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(54) **Water-gas heat exchanger, in particular for centralized heating systems and sanitary water systems.**

(57) There is disclosed a water-gas heat exchanger, in particular for centralized heating systems and sanitary water systems, comprising a composite structure including a plurality of pipes (16,18,22,24) and component parts, effective to allow for the pipes to exchange heat with an outside gaseous fluid, the pipes defining two discrete coils one whereof is provided for heating purposes and the other whereof is provided for supplying sanitary drinkable water.

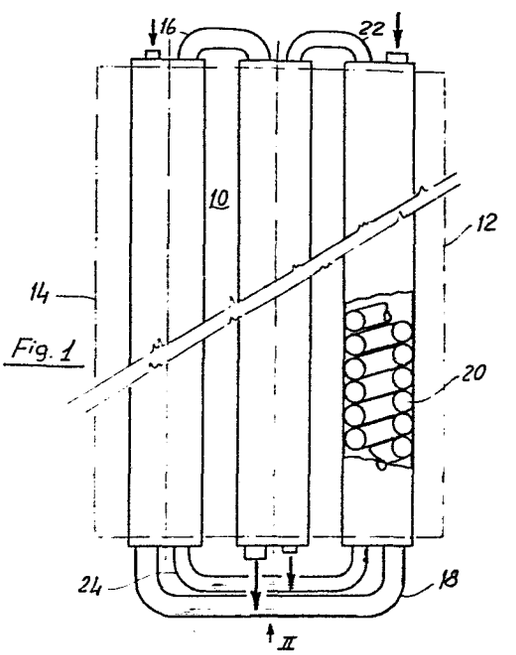

Fig. 1

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COMPLETE DOCUMENT

The present invention relates to a so-called heat exchanger effective to transmit heat from a gaseous fluid to a liquid.

More specifically the present invention relates to the thermal exchange medium proper of a heating boiler, preferably of the centralized type, and/or for producing "sanitary water ", that is drinkable hot water. In other words the heat exchanger according to the invention is provided for association with ducts and other metal or metal alloy conveying systems effective to preserve the drinkability properties of the conveyed water.

The system therewith the subject heat exchanger is associated will be used, for example, in homes, offices and the like.

As it is known, in such a heat exchanger, the thermal power is exploited contained in a gaseous stream, such as a gas produced by the combustion products of a burner, or the heat directly produced by the flame of said burner, in order to heat water to be circulated through radiating members effective to provide heat to the environment.

Also known is the fact that the mentioned heat exchangers are used for heating the water supplied by the available supplying system, or any other suitable source, which water may also be used for drinking purposes and accordingly must have precise drinkability properties, at least for the portion thereof being circulated through the heat exchanger.

According to an important, though not critical,

characteristic of the invention, it is characterized in that the heat exchanger is so designed and arranged as to provide an optimal compromise between the high thermal conductivity of the structural materials, preferably copper, and the cost of the materials themselves. A satisfactory achieving of that compromise is an essential parameter for the industrial making and operation of the heat exchanger.

The heat exchanger according to the present invention is essentially characterized by the provision and arrangement, as is will be illustrated in a more detailed way thereinafter and as it is clearly shown in the accompanying drawing, of a plurality of pipes of copper or any other suitable materials, which pipes comprise preferably parallel pipe lengths lying on at least two substantially horizontal planes. The mentioned pipe lengths are effective to jointly form a circuit and are series coupled to one another.

With the mentioned pipes are associated, in a thermal exchcanging relationship, fins or heat releasing equivalent means, also made of copper or any other thermally conducting suitable material, said heat releasing means being provided with shapes and/or thicknesses which have been suitably designed to provide the most satisfactory results.

According to an important feature of the invention, the mentioned fins are formed by pressing a high thermal conductivity sheet metal (made of copper, iron or other suitable materials) and comprise hole formations effective to facilitate the assembl-

ing of the heat exchanger component parts to form a structural unit, which will be thereinafter called "pack" provided for forming the heat exchanger proper.

The mentioned fins are preferably "packaged" on the pipes by means of suitable holes formed in said fins, and they are made rigid with said pipes by means of known soldering methods, or they are mechanically locked to said pipes by riveting or permanent swaging methods, effective to provide the desired coupling at the desired positions along the extension of said pipes, in such a way as to assure an optimal heat exchange relationship.

During the installation, the pack is preferably arranged in a horizontal attitude above a heat source, in particular "ramps" or sets of small flames as emitted from a plurality of gaseous fuel emitting nozzles, as thereinabove indicated.

The fluid to be heated (for example water) is caused to flow inside said pipes, whereas on the outside, that is between the pipes and the fin gap, the hot gas produced by the burner system is caused to pass in such a way as to release heat both to the pipes and to the fins, to provide the desired exchange of the thermal energy.

Preferably the mentioned fins are so designed and arranged as to satisfactorily pick up the gas heat and transmit it to said pipes and accordingly to the fluid conveyed therethrough.

In addition to the above disclosed choice of the fins, which has been specifically designed and experimentally tested, the configuration and spacing of said fins have been so designed as to provide a very small resistance against the flowing of the gaseous fluid, jointly to a more efficient thermal exchange.

According to a further important characteristic of the invention, inside the mentioned pipes a coil is arranged, which is welded thereto, provided for conveying the sanitary water which is heated by the boiler water and by the heat transmitted because of the direct contact between the outer pipe and the coil. Accordingly the mentioned coil must be produced starting from a material having in combination the thermal conductivity and sanitary properties as specified for the so-called "hydraulic-sanitary" apparatus, since the water passing through the coil will also be used for alimentary purposes.

The above and other features of the present invention, jointly to the advantages provided thereby, will become more apparent thereinafter from the following description, with reference to the accompanying drawing, where:

fig.1 is a general view of the heat exchanger according to the present invention, illustrating partially broken away component parts of the heat exchanger itself, in order to better show the combination of the pipes; it should be noted that the size of the heat exchanger may be different from the size illustrated

in order to optimally fit it to the available space and/or to the constructional and operating requirements of the heat exchanger itself,and

fig.2 illustrates that same heat exchanger as taken in the direction indicated at -II- in figure 1.

With reference to the figures of the drawing,the heat exchanger comprises a composite structure,therein fins are provided,generally indicated at 10 and extending,in the main plane of the heat exchanger,through the space defined by the dash-dot outline,in particular defined by the base lines 12 and 14 of fig.2.

The shape of the outline or contour of the mentioned fins 10 is shown in fig.2,therein are also indicated,by way of example,some numerical values of the preferred size for the mentioned fins 10.

That same composite structure critically comprises a multiple coil,comprising an outer component part of greater diameter,a portion whereof is defined by partially rectilinear and partially curved lengths,the mentioned components parts being indicated at 16 and 18.

More specifically the mentioned coil,made from a copper tubular member,defines the circuit of the boiler liquid and has the shape shown in fig.2. Parts of the mentioned coil,indicated at 20,are also shown in fig.1,the coil being welded,on its outer circumpherence,to the pipe encompassing it;as it is shown the mentioned parts 20 are coupled in series relationship in the mentioned outer lengths and are effective to operate as a turbolator only during the

heating step.The component parts of the coil including the parts 20,22 and 23 jointly form or define the sanitary water circuit.The mentioned fins 10, preferably made of copper and under the above indicated conditions,have a suitable thickness effective to provide a high efficiency of the heat exchanger. The size parameters for the mentioned fins may be as follows:

thickness	from 0.5 to 0.7 mm
fin to fin spacing	" 3.5 to 4 mm

The mentioned size preferred values have been found to be an optimal compromise between the heat absorption and the free passage of the combustion gaseous products to discharge to the outside,through chimneys or the like evacuating means.

It should be apparent that the principle of the present invention may be extended to the heat exchanging assemblies effective to provide equal or equivalent usefulness,depending on the industrial making requirements,as well as on economical requirements, such as the cost of copper or stainless steel for making the heat exchanger.

C L A I M S

1- Water-gas heat exchanger, in particular for centralized heating and hot sanitary water supplying systems, characterized in that it comprises a combination composite structure, including a plurality of pipes(16,18,22,24) and members effective to allow for said pipes to exchange heat with an outside gaseous fluid.

2- A heat exchanger according to claim 1, characterized in that said plurality of pipes defines two discrete coils, one whereof is used for heating purposes and the other whereof is used for supplying drinkable hot water.

3- A heat exchanger according to claims 1 or 2, characterized in that at least a portion of said pipes is made from copper.

4- A heat exchanger according to one or more of claims 1 to 3, characterized in that said composite structure comprises a plurality of fins (10) for transmitting the heat of an outside gaseous fluid.

5- A heat exchanger according to claim 4, characterized in that said composite structure is made in the form of a pack forming the heat exchanger proper.

6- A heat exchanger according to claim 5, characterized in that in said pack said fins (10) are structurally associated with said pipes, in a thermal transmission relationship.

7- A heat exchanger according to claim 6, characterized in that said pipes and fins are mutually coupled by means of welding methods.

8- A heat exchanger according to claim 7, characterized in that said coupling is carried out by means of soldering methods.

9- A heat exchanger according to claim 4, characterized in that said fins (10) are made by means of metal sheet shearing or pressing methods.

10-A heat exchanger according to claim 4, characterized in that said fins are made rigid with said pipes by mechanical means such as riveting or permanent swaging.

11-A heat exchanger according to claim 4 and any preceding claims, characterized in that said fins have a thickness from 0.5 to 0.7 mm.

12-A heat exchanger according to claim 5 and any preceding claims, characterized in that in said pack formed by said composite structure, the spacing

between adjoining fins is from 3.5 to 4 mm, thereby assuring an optimal heat absorption and combustion product releasing.

13- A heat exchanger according to claim 2 and any preceding claims, characterized in that one of said discrete coils comprises component members effective to define the sanitary water circuit.

14- A heat exchanger according to claim 13, characterized in that the sanitary water coil comprises inner parts and tubular component members included in the heating water coil.

15- A heat exchanger according to claim 14, characterized in that said inner parts are so arranged and designed as to be effective to act as a "turbulator" during the heating step.

16- A heat exchanger according to any preceding claims, characterized in that it is provided with a homogeneous heat exchange surface obtained by soldering said fins and pipes and said pipes and sanitary coil and effective to be used both for heating and sanitary water producing purposes.

17- A heat exchanger for heating and sanitary water systems, according to any preceding claims and

substantially as disclosed and illustrated for the intended objects.

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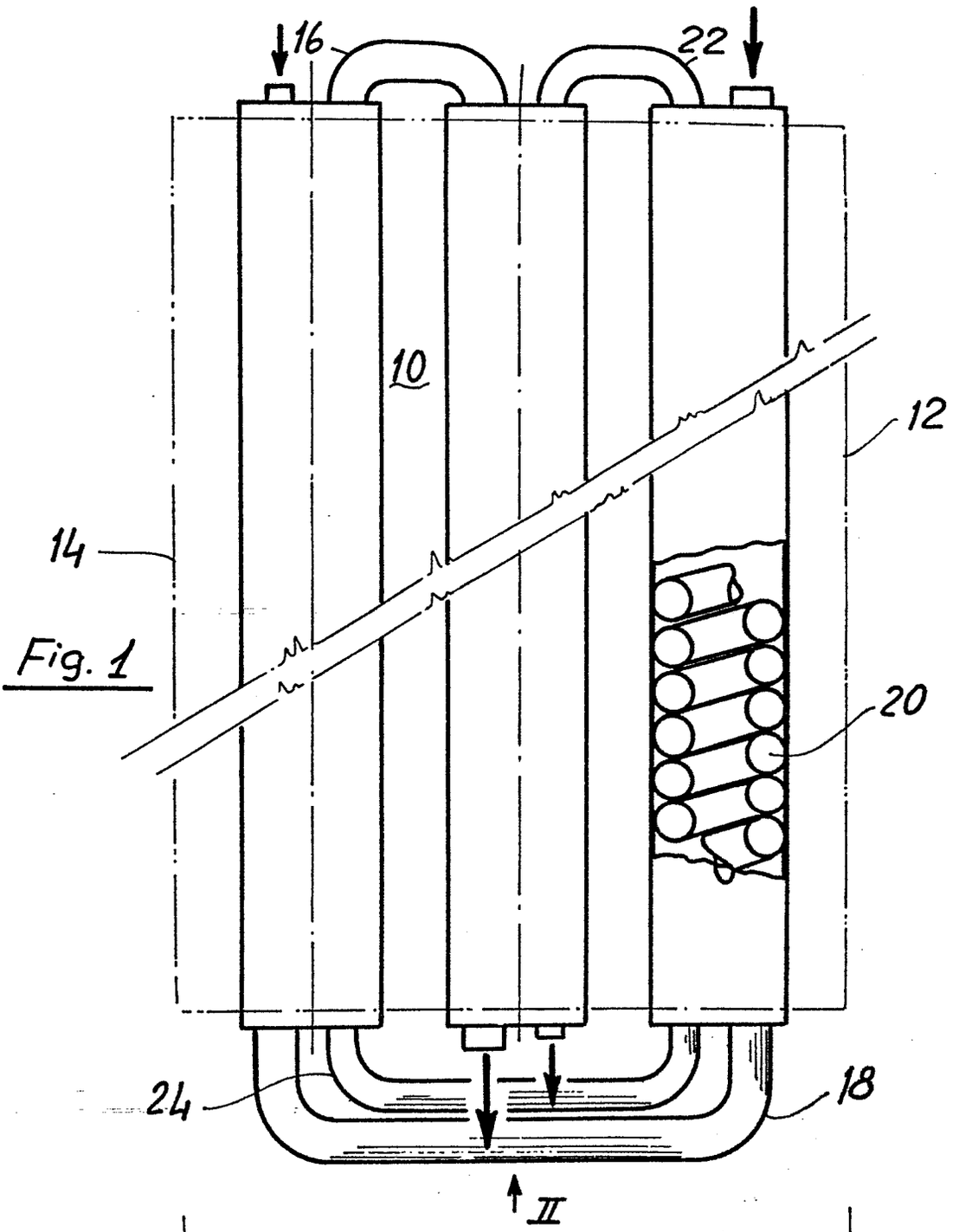

Fig. 1

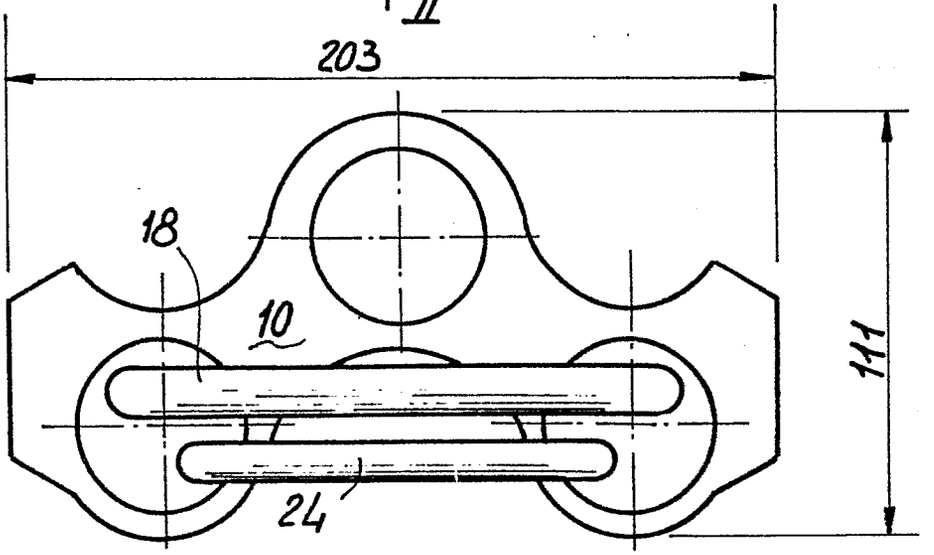

Fig. 2