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METHOD OF MANUFACTURING A REGENERATOR OF THE TYPE USED IN HOT-GAS RECIPROCATING ENGINES

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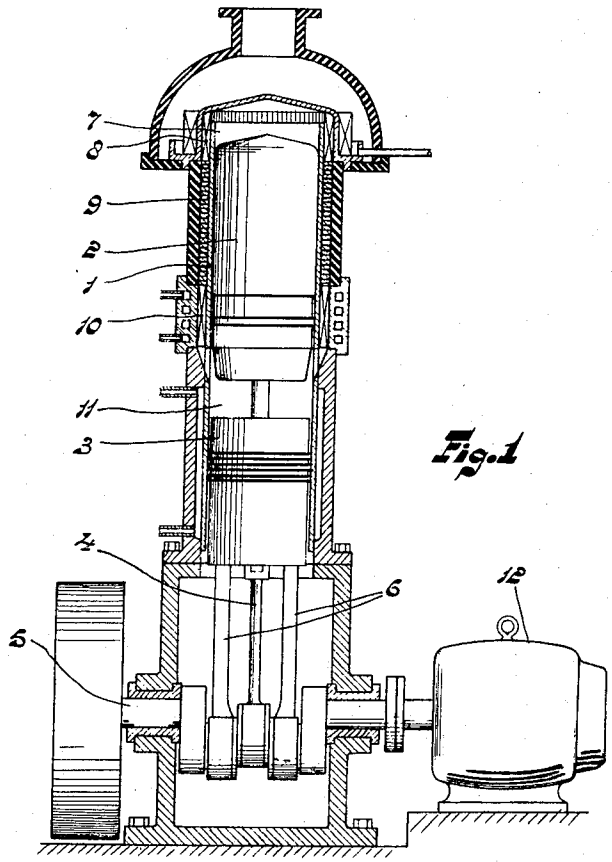


Fig. 1



Fig. 2

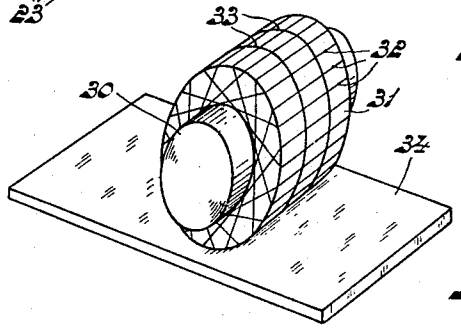


Fig. 3

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METHOD OF MANUFACTURING A REGENERATOR OF THE TYPE USED IN HOT-GAS RECIPROCATING ENGINES

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The invention relates to a method of manufacturing a regenerator for use in a hot-gas reciprocating engine, this regenerator comprising a housing and a filling contained therein. If reference is made here to a hot-gas reciprocating engine, this term is to be understood to mean a hot-gas reciprocating motor, a refrigerator operating on the reversed hot-gas reciprocating motor principle or a heat pump.

Regenerators comprising a housing and a filling contained therein are known. The filling used in these known regenerators is, as a rule, made of metal wire, more particularly of metal gauze. This material forms a resilient mass which, after having been introduced into the regenerator housing, engages the wall of the housing with some amount of tension. Consequently, in these known regenerators, a satisfactory contact between the filling and the wall of the housing was ensured.

By experiments with hot-gas reciprocating engines it has been found that the output obtainable from a regenerator of the aforesaid kind was lower than could be expected theoretically. This phenomenon could not be accounted for until I found that in spite of the fact that the filling of the regenerator engages the walls of the housing with a certain amount of tension, this filling is blown off the wall of the housing when the gas flows through the regenerator. The aforesaid reduction in output is due to this phenomenon.

I have already proposed the securing of the regenerator filling to the wall of the regenerator housing, for example, by sticking or soldering, however, I have devised another method of obviating the harmful effects described above. Thus, according to the invention, the filling is embedded in a plurality of superposed annular rings over at least part of its contact surface during the manufacture of this wall.

The aforesaid method is preferably carried out in a regenerator built up from layers of metal gauze.

A regenerator constructed in accordance with this method has the feature that one wall of the regenerator space consists of elements, the filling, or at least part thereof, being clamped between the intermediate walls of the elements, and the elements being secured to one another.

A further embodiment of the invention is applied to a regenerator consisting of a plurality of layers arranged transversely to the main passage of the medium across the regenerators, these layers having a thickness of not more than 200 μ, each layer is secured between rings, and the rings being secured to one another.

In a further embodiment of the invention, in which the wall of the regenerator consists of rings, these rings are made of metal and secured to one another by means of synthetic resin. If, however, the rings are made of a thermoplastic substance, it will be possible, in a further embodiment of the invention, to secure the rings to one another by heating.

In a further embodiment of the invention the housing

of the regenerator is made of a hardened, plastic substance, in which the filling is embedded locally, i.e. at its circumference.

In order that the invention may be readily carried into effect, it will now be described in detail with reference to the accompanying drawing in which:

Fig. 1 shows a hot-gas reciprocating engine provided with a regenerator according to the invention;

Fig. 2 is a longitudinal sectional view of part of the ring-shaped regenerator shown in Fig. 1 taken approximately in the middle thereof and

Fig. 3 is a sectional view of a regenerator showing a second embodiment.

In the hot-gas reciprocating engine shown in Fig. 1, a cold-gas refrigerator, is constructed in this case as a displacer-piston apparatus. In the cylinder **1** are adapted to reciprocate a displacer **2** and a piston **3** with constant phase difference. The displacer **2** is coupled through a connecting-rod mechanism **4** with a crank of a crank shaft **5** and the piston **3** is coupled by means of connecting rods **6** with cranks of the same crank shaft **5**. The space **7** over the displacer **2** is the freezing space, which communicates through a freezer **8**, a regenerator **9** and a cooler **10** with the space **11** between the displacer **2** and the piston **3**. The latter space is the so-called cooled space. The refrigerator is driven by an electric motor **12**.

The regenerator is constructed in the form described above and a few embodiments will be explained more fully with reference to Figs. 2 and 3.

Referring now to Fig. 2 in particular, the outer wall of the housing of the regenerator is built up from a plurality of rings **21** and the inner wall is composed of a plurality of rings **22**, so that in this embodiment as in the embodiment shown in Fig. 1 an annular regenerator space is obtained. The rings **21** and **22** are made of a thermoplastic substance and have a thickness of 50 μ. Between the rings is provided an annular strip of wire gauze **23**, also having a thickness of 50 μ. The rings of thermoplastic substance and the gauze rings are stacked, as is shown in Fig. 2, after which the rings of thermoplastic substance are secured to one another by heating, so that together they form the wall of the regenerator. As is evident from Fig. 2, the filling is embedded only locally, i.e. at its periphery in the walls of the housing. The regenerator thus formed may be incorporated as a unit in a hot-gas reciprocating engine.

A metal may be used for the rings **21** and **22** instead of using a thermoplastic substance, for example, synthetic resin. These rings may be secured to one another either by a welding method or by adhering them by means of synthetic resin.

Fig. 3 shows another embodiment of my invention in which a regenerator is wound about a core **30**. This regenerator may be made of a so-called crinkling wire. After the regenerator filling **31** has been coiled, it is held by the wires **32** and **33**. The coil thus formed is rolled over a layer of heated thermoplastic substance **34**, for example, a thermoplastic synthetic resin in a manner such that a wall is formed on the outer surface of the filling, in which the wires of the regenerator filling are embedded. After the core **30** has been removed, a layer of thermoplastic material may be provided on the inner periphery, so that during the manufacture of the wall the filling is embedded also at the inner circumference.

In the aforesaid embodiments annular regenerators are used. However, the method according to the invention may also be carried out for regenerators shaped in the form of cylinders, which may, for example, be obtained by using circular gauze pieces (Fig. 2), embedded at the periphery, so that a circular inner wall as is formed by the rings **22** in Fig. 2 is not provided.

While I have shown and described the preferred em-

bodiment of my invention, it will be understood that the latter may be embodied otherwise than as herein specifically illustrated or described and that in the illustrated embodiment certain changes in the details of construction and in the arrangement of parts may be made without departing from the underlying idea or principle of the invention within the scope of the appended claims.

What I claim is:

1. A method of manufacturing a regenerator of the type used in hot-gas reciprocating engines comprising building the regenerator wall from a plurality of aligned superposed annular rings constituted of thermoplastic material, placing an annular wire gauze element between adjacent superposed rings and substantially perpendicular to said regenerator wall, and heating said annular rings together at the peripheries of said annular rings to thereby form an integral wall with said annular wire gauze elements locally embedded therein in an arrangement of superposed, spaced annular wire gauze elements.

2. A method of manufacturing a regenerator of the type used in hot-gas reciprocating engines comprising

building the regenerator wall from a plurality of superposed thermoplastic annular rings having a thickness of no more than 50 microns, placing an annular wire gauze element between adjacent superposed rings and substantially perpendicular to said regenerator wall, the thickness of each of said annular wire gauze elements being substantially equal to the thickness of an adjacent annular ring, and heating said annular rings together at the peripheries thereof to thereby form an integral wall with said annular wire gauze elements locally embedded therein in an arrangement of superposed, spaced strips of annular wire gauze elements.

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