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The interchanger battery with flippers

Eugenia Adriana Rîbu
University of Craiova- Faculty of Mechanics,
e-mail**:** **ginaribu@yahoo.com**

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Abstract. The batteries with flippers are the compact fated interchanger in special his heating of large used-up refrigeration in the frigorific his plant of air-conditioning, but and as the his blast-heating apparatus radiators for cars.

1. Introduction

In a intake interchanger, in the absence of the deposits, appear three thermic which resistors causes the global spare coefficient of heat: The thermic fluid resistor of the mayor, determinates of the coefficient from this fluid to the spare surface of heat, the thermic fluid secondary resistor, determinates of the coefficient from exteriorly spare of this fluid heat and the thermic resistor wall, in most many cases this weight from trace be negligible. In the cases when one of the thermic agents is an which liquids is warmed or is cooled anaphase his with change of phase, and another agent of transfer of thermic heat is a gas, the difference between the convective coefficients is of one or else many order of size, the global coefficient of transfer of heat be caused the practice except of minim coefficient of convection, the one on the part of the gas.

For the improvement global coefficient of transfer of heat is shall operated is about coefficient of convection through the zoom of the turbulence and the perturbation of the boundary layer, is about spare surface of heat through this extension on the fluid part with minim coefficient of convection(of the gas). This expand is achieved with help of the flippers.

2. Constructive features

For the characterization extensive surfaces I can envisage else many criterii among which and form pipe of base.

The basic pipe can have the section: Roundly, elliptically, his pay in form of drop.

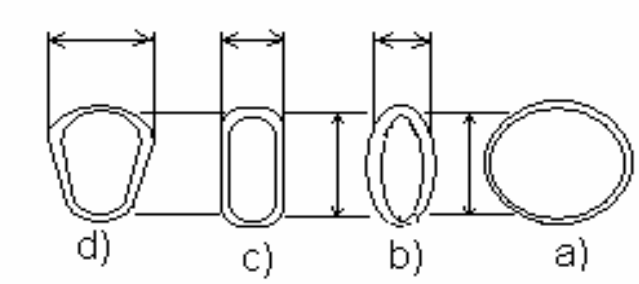

Fig. 1 *Guys Of section for the basic pipes*

Most prevalent form is one round, this having most reduced the cost. The others guys of tubes assures a toughness enlarge and miss else a little of pressure to the flow of the gas. They are only that else loves and the fixation of the nervures on them is else

difficult. In the figure 2 am presented some constructive details ale of the batteries with flippers.

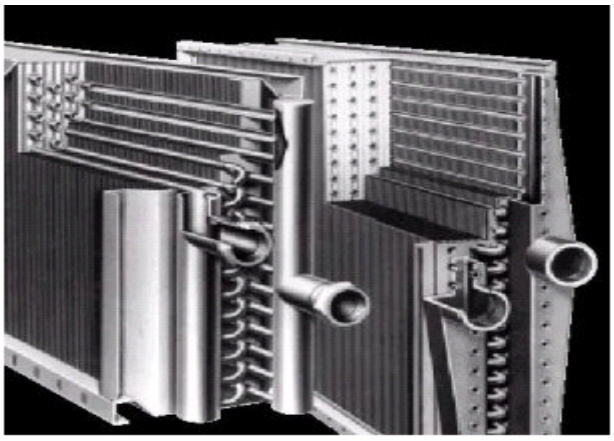

Fig. 2 *Constructive details of the batteries with flippers*

The physical which parameters abscess define in the sight effectuation of thermic calculi and aerodynamic these ale interchanger am: the plebeian number of pipes on the vertical, the plebeian number of pipes on the horizontal line, the surface total of thermic transfer, the report among the extrados and the surface interior, The surface frontal in the sense of flow the air, the surface free of flow the air.

In the sight anticorrosive average protection in which shall operate these apparatus(the air, the marine air, the air from diverse local), is achieved diverse guys of coverings:

Galvanize - used in the case pipes and the nervures from steels in the sight protection against the rustiness through covering zincky and assuring of a thermic very good contact;

Ematare - used in the case pipes and the nervures from copper, for these covering with resins poliuretanice.

After setting, the batteries are submissive of hydraulic samples of tightness, and then I am dry and dehydrated, loaded with azotes to low pressure, closed and kept in the sight delivery.

The pipes are achieved in principle from same material and one from the interchanger's multitubulare, but prevail the steel and the copper. The tendency last years in these building apparatus is of is reduced the more how much the diameter pipes, in the aim of the improvement of global coefficient of thermic reduced, changeable table and the charge of coolant, on the background of global cost for the pipes from steels, the clear width is round of 20 mm, and for one from copper, the minimum diameter is round of 910 mm. The thickness pipes are relative little, for steels round of 1 mm, and for actually copper below 0, 5 mm. In defended against this used-up guys as the his vaporizers condensers, therefore in which is achieved the change state of aggregate, is utilized frequently special pipes, of the guy who presented in the paragraph to the interchangers multitubulare.

For the disposition pipes adopted the in generally one from one two variants presented the in the figure 3: In equilateral triangles (in chess) and in squares (in corridor). Disposes pipes after equilateral triangles assure a coefficient of thermic better transfer but with loss of pressure the big maul, in while dispose in squares assure a thermic less transfer's formant, but characterized through loss of pressure the reduced maul.

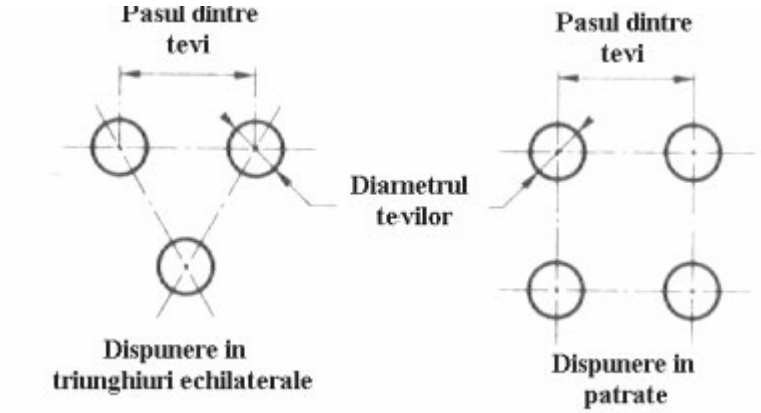

Fig. 3 *Dispose the pipes in grapple flippers*

The named nervures to these buildings and his flippers contiguous nervures, I can achieve from steels, his aluminum copper. Most dense used-up by-path the combinations: Pipes from steels and flippers from hotels and pipes from copper and flippers from aluminum. The maul is possible and combinations as the: Pipes from steels and flippers from aluminum, pipes from copper and flippers from his copper pipes from nirostas and flippers from nirostas. In the figure 4 am presented sectional two pipes on which were fixed contiguous lamellar nervures.

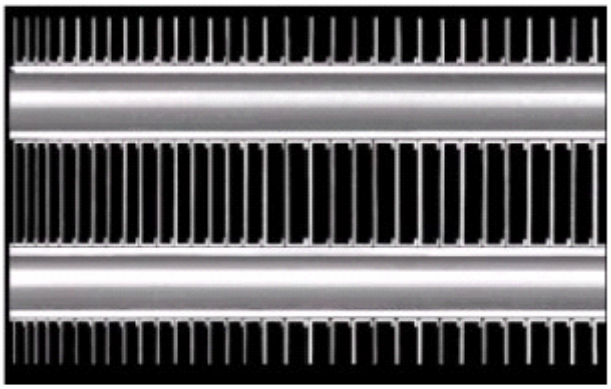

Fig. 4 *Pipes with lamellar nervures*

Most prevalent guys of flippers are presented in fig. 5 And in fig. 6: Nervures The contiguous plans and convolute nervures. Efficiencies mica the nervures is with as much else hello with how much.

The material from which by-paths made has a conductibility mica a maul hello(this breeds the in order in order: Nirosta, steel, aluminum, copper), the height of the nervures is else reduced, the thickness of the nervures is elder, the contact with the basic pipes is better.

At large in, pipes from steels with the diameter of cca. 20 mm, the height of the nervures is of 25…30 mm, and the thickness of 0, 3… 0, 4 mm, in while for the thin pipes from copper, the height of the nervures is of 10…20 mm, and these thickness is of 0, 1… 0, 3mm.

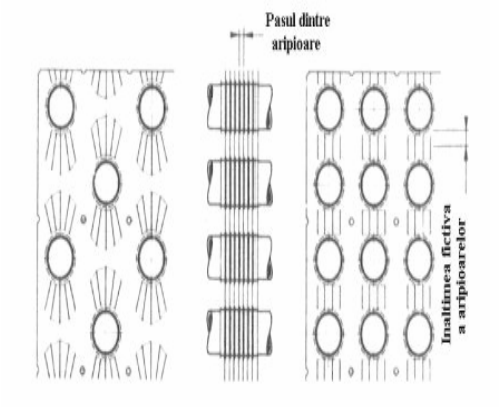

Fig. 5 Continual flat nervures

Two geometric important features ale of the nervures of this guys are step that is distance among axle two consecutive nervures the and the distance among two nervures, that is distances among the flanks opposed two consecutive nervures. For condensers, minimum step accepts is of cca. 2 Mm, and for vaporizers is of cca. 4 Mm. In the case industrial vaporizers from steels with massive snowy deposits, step among nervures can come up to cca. 30 Mm.

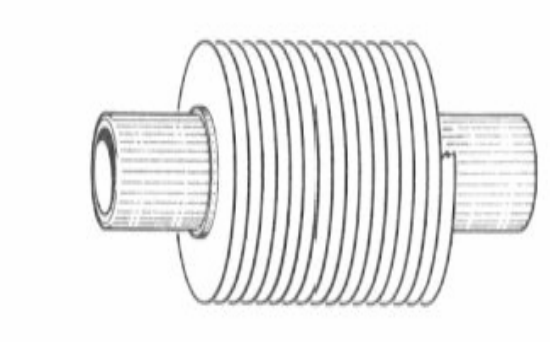

Fig. 6. *Convolute nervures*

The nervures the contiguous plans is achieved through punched alone crossing so that to resulted and the boards for fixation on the pipe, the ebullators(the forms from the lateral surfaces) and the orifices of relief, represented the in these figure 6 nervures is mounted in parcels of nervures, on named devices combs, carry to assure desirable step. Follows the setting pipes in the holes realized in nervures.

3. The thermal peculiarities calculus of the batteries with flippers

In the batteries with flippers the fluid flow is in current criss-cross. In the case of the apparatus with a plebeian paucity of, for the calculus of average difference of temperature is necessary the of a intake supplementary which correctness to consider the fluid which circulation circulates through pipes on the many maul roads. For the thermic calculus is can utilized the method, principal problem be the determination coefficient of convection on the part of the flippers. The big constructive these diversity, as well as the taking in consider of a possible condensations humidity from air in the case of this refrigeration, does difficult the of a determination valid relations for a number of constructive solutions.

In the case of the batteries with contiguous flippers law, with more of three rows of pipes, for the calculus the coefficient of convection on the part with flippers are can utilized the relations:

- In the case of dry flippers:

$$j = 0.053\left(\frac{S_2}{S_1}\right)^{-0.24} \mathrm{Re}_{D_h}{}^{-0.18}$$

$$f = 0.589\left(\frac{S_2}{S_1}\right)^{-0.28} \mathrm{Re}_{D_h} - 0.27$$

- in the case of damp flippers:

$$j_w = 0.0025\, j^{-0.94}\left(\frac{s}{e}\right)^{1.15} \mathrm{Re}_{D_h}{}^{-0.92}$$

$$f_w = 0.318\, f^{-0.04}\left(\frac{s}{e}\right)^{0.4} \mathrm{Re}_{D_h}{}^{-0.42}$$

where: j, j_w- factors Colburn factors for the dry flippers, respectively damp $\left(j = St\,\mathrm{Pr}^{2/3}\right)$; St- Stanton criterion $\left(St = Nu/(\mathrm{Re}\,\mathrm{Pr})\right)$; D_h-the hydraulic diameter of the channel $\left(D_h = 4A_mL/S_2\right)$; S_2, S_1 – the spare surface of heat respective total pipes of base(fig.); A_m-the minimum section of flow through battery; L- the depth of the battery(in the sense of flow); s- step between two flippers neighbors; e- the thickness of the flippers; Re_{D_h}-the criterion Reynolds calculating with the hydraulic diameter and the speed sectional minimum of flow; f, f_w-the friction coefficients for the dry flippers, respectively damp.

For the corrugated flippers with the geometry presented in fig. 7 for the calculus coefficient of convection is can used:

$$Nu = 0.5Gz^{0.86}A^{0.11}B^{-0.09}C^{0.12}D^{-0.34}$$
$$Nu = 0.83Gz^{0.76}A^{0.13}B^{-0.16}C^{0.25}D^{-0.43}$$

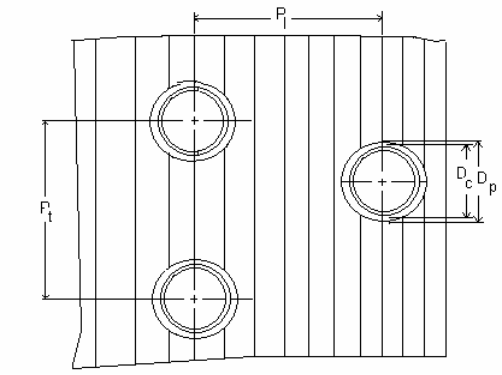

Fig. 7. *The geometry of corrugated flippers*

Where: $Gz = \mathrm{Re}\,\mathrm{Pr}\,D_h/L$ Is his Graetz criterion;

$A = P_t/D_c$ - the report Between transversal step of pipes and the exterior diameter of the collar from pipes;

$B = s / D_c$ - the report Between step between two adjacent flippers and exterior diameter of the collar from pipes;

$C = s_d / P_l$ -the report Between the height crispations and longitudinal step among pipes;

$D = 2s_p / P_l$ - the report Between step crispation and longitudinal step among pipes.

The relations shows a growth a coefficient of convection a date with the growth of the step between flippers diminish step of crispation.

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