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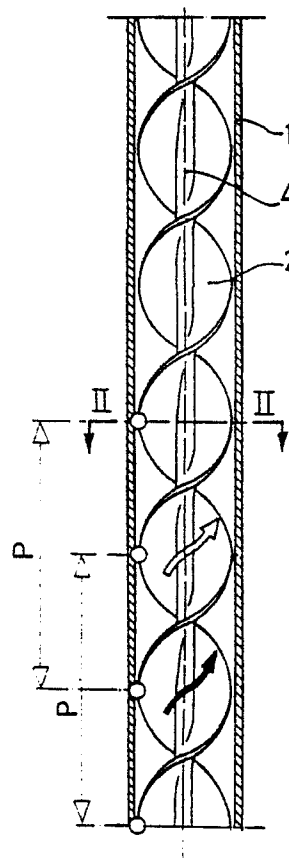
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54 **Turbulence device for heat exchanger tubes.**

57 A turbulence device for heat exchangers, comprising a lengthened and flexible element (2) made of synthetic material having, at least, three helices (5, 6, 7), whose cross section has a star shape of as many points as helices.

FIG.1



EP 0 257 220 A1

AN IMPROVED TURBULENCE DEVICE FOR HEAT EXCHANGER TUBES

SPECIFICATION

This patent refers to an improved turbulence device of the type associated with the tubing utilized in heat exchangers for the purpose of improving their operational characteristics and the thermal efficiency of the fluid circulation along the said tubing.

As is currently known, the thermal efficiency of some types of heat exchanger is greatly influenced by the time period during which the fluid remains in contact with the walls of the containing vessel and in such cases it is the practice to insert within the tube a helicoidal member which is formed by twisting a rectangular strip of a material which has physical properties that will not be affected by the presence of the circulating fluid.

This helicoidal member causes a turbulence in the circulating fluid which causes an increase in the time during which the fluid remains within the tube and introduces a tendency for the fluid layers to be projected against the tube walls thus lengthening the trajectory of the flow and consequently the residual time period of the fluid in the tube once again, this resulting in an improvement in the heat transfer efficiency of the system.

The improvement in the transfer efficiency in heat exchanger tubes has been achieved in the current state of the art by fitting an element of helicoidal configuration having two wings or vanes into the interior of the tube. The improved device described herein consists equally of an element having the same pitch as that of the currently known two wing helicoidal components but having at least three wings or vanes each forming a helix thus increasing the turbulence and the number of turns in contact with the internal walls of the tube and providing an increase in the annular sections impeding the direct flow of the fluid along the tube. The effect of this being to improve the thermal and hydraulic efficiency of the assembly.

The improved turbulence device as described herein can be made from a synthetic material such as a plastic, using mass production automatic machinery and the resulting product can be automatically inserted into the heat exchanger tube with a consequent reduction in cost and an improvement in quality and handling facility.

To assist the description there are attached to this specification drawings which illustrate by way of a non-limitative example one embodiment of the improved heat exchanger tube turbulence device in accordance with the principles of the claims.

In the drawings:

Figure 1 shows a central longitudinal cross-section of a tube fitted with a turbulence device consisting of two wings and two helices from among the various types available and made from a rectangular strip while Figure 2 shows five variations of the assembly taken on a transverse cross-section along the plane II - II.

Figure 3 shows one example of the improved device as described in this Patent and having three wings with the transverse cross-section being Y or lambda shaped as in Figure 4, from the plane IV - IV of Figure 3. The device may also have a three or more-than-three pointed star form.

Figure 5 shows a length of the tube having fitted therein a turbulence device as is described herein while Figure 6 shows a cross-section of the novel assembly taken on the plane VI - VI of Figure 5.

Figure 7 is a schematic comparison between the known turbulence device as described in Figure 1 and the device object of this patent showing that the number of contact areas of equal pitch is greater in the latter.

The numbers on the drawings correspond to the references given below.

The thermal efficiency of a heat exchanger is a function, among other parameters, of the contact made by the circulating fluid with the tube wall and hence of the residual time of the fluid within the interior of the tube and thus the transfer of part of the fluid's heat to the walls of the said containing tube.

In the case of relatively low density fluids the efficiency is increased by inserting in the tube which is of circular section and contains the fluid a component as described above. If the passage of the fluid through the tube is linear in the absence of any turbulence producing element the time during which the fluid occupies the tube is minimal, the fluid moving unimpeded along the tube path.

With the placing of an obstacle of the type described and currently known, the trajectory is diverted into a helicoidal path with a resulting increase in the contact time. Nevertheless there is a leakage between the walls of the tube and the edges of the turbulence device helix. To reduce this leakage without increasing the length of the tubing, the present invention provides for the fitting of a turbulence device having three or more wings determining three or more helices which, at the same pitch provide a greater number of impeding sections to direct flow and a division of the flow which then circulates in a number of flow passages equivalent to the number of wings of the device.

The tube -1-shown in Figure 1 is carrying a fluid vertically upwards and to increase the efficiency it is fitted with the turbulence component -2-, comprising two undefined helices at a pitch suitably selected to suit the characteristics of the fluid process in question. 5

Figure 2 shows five possible sections of the component from figure 1, as currently known each being of the configuration arising from the shape of the helix wing resulting from the individual method of manufacture. 10

Resulting from the arrangement shown, of the component -2-, there is a turbulence in a longitudinal direction.

Figures 3 and 4 also illustrate a helicoidal component with three wings defining a Y or lambda shaped cross-section, consisting in effect of three simple juxtaposed helices -5-, -6-, and -7-of which the pitch -P-is the same as that of the known device illustrated in figures 1 and 2. The wavelength, so to speak, or the distance between the node points coincident with the cylinder walls is taken as between the points on each of the salient parts of the particular section. 15 20

Figure 5 shows the turbulence component in accordance with this invention fitted within a tube -8-and making contact with the internal walls at the extreme edges of the helix wings as shown in Figure 6. 25

The three helices making up this novel turbulence device are indicated in the above drawings by means of three different styles of arrow. The device may be fitted within the tube by automatic means, the tube lengths being selected to suit the specific application for which they are destined. 30 35

Anything not affecting the essentiality of this device as described or altering, modifying or changing the same is a variable for purposes of the Patent. 40

Claims

1.-Improved turbulence device for heat exchangers, characterized essentially in that it comprises the manufacture of a lengthened and flexible element made of synthetic material having, at least, three helices, whose cross section has a star shape of as many points as helices. 45 50

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FIG.1

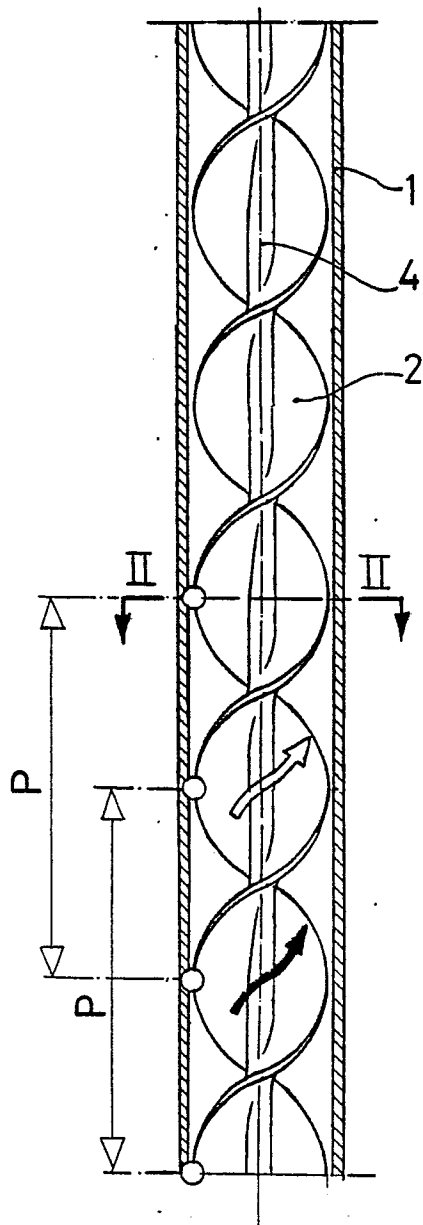


FIG.2

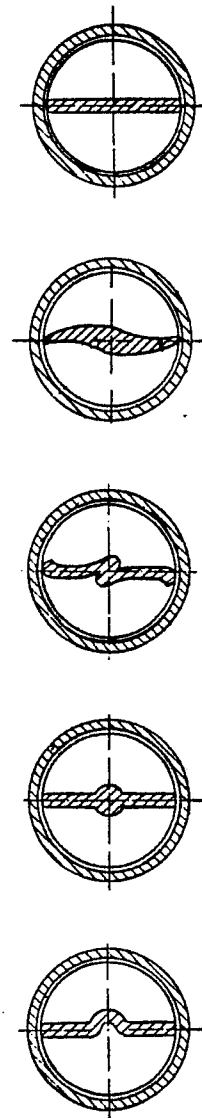


FIG. 3

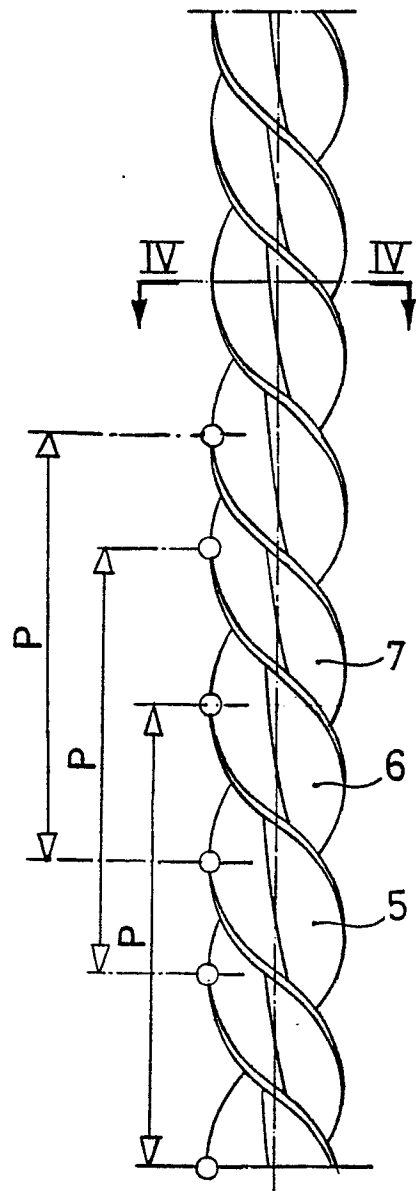


FIG. 4

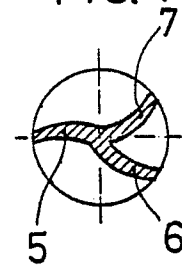


FIG.5

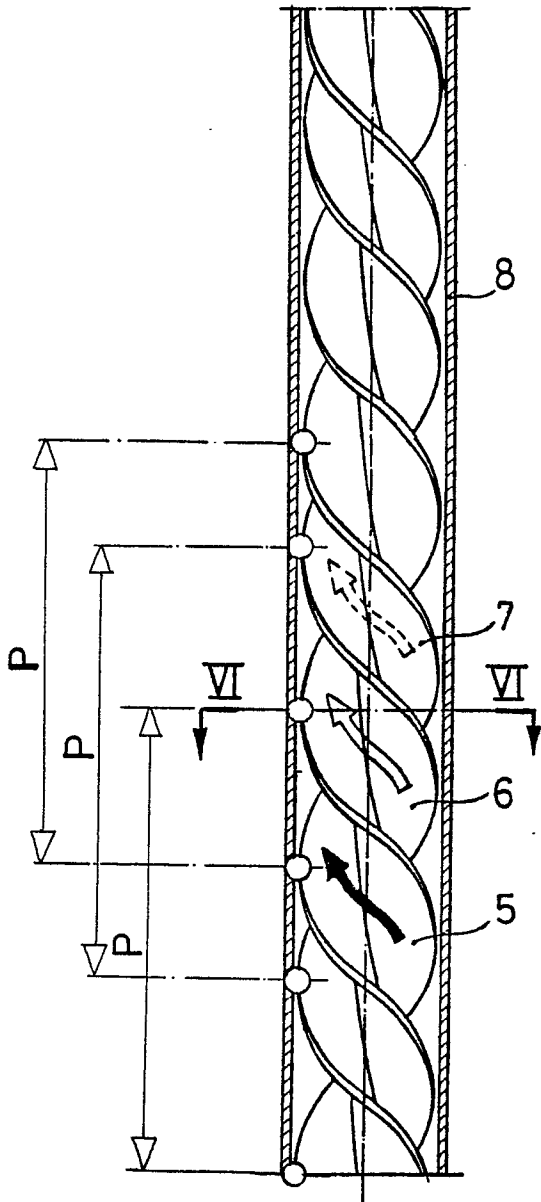


FIG.6

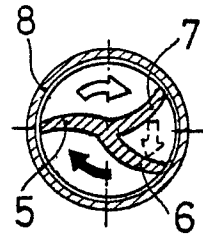
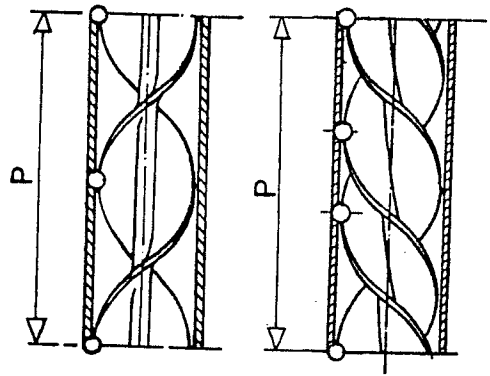


FIG.7





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.4)
X	EP-A-0 072 996 (ICHIZO) * Whole document *	1	F 28 F 13/12

X	EP-A-0 077 130 (ICHIZO) * Page 6, lines 2-6; figure 2 *	1	

			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			F 28 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27-10-1987	Examiner SMETS E.D.C.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		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	