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(71) Applicant: **NORSK HYDRO ASA**
0240 Oslo (NO)

(72) Inventor: **Vestergaard, Bjorn**
6200 Aabenraa (DK)

(74) Representative: **Bleukx, Luc**
Norsk Hydro Technology B.V.,
Avenue Marcel Thiry 83
1200 Brussels (BE)

(54) Process of making a fluid flow tube with varying cross section

(57) A process for making a fluid tube (10) with a varying cross section comprising extruding a tube with a constant cross section, positioning the extruded tube in a die having substantially the cross section of the outer wall of the end tube and increasing the pressure inside the extruded tube, thereby deforming the tube, so that its outer wall confirms to the die form. The tube is a multiport extruded tube, in which the partition walls (16,17) are provided with at least one portion (19) with reduced thickness, the partition walls being broken during expansion.

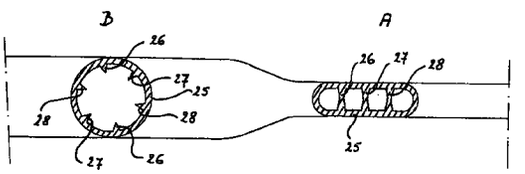

FIG. 4

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Description

The invention relates to a process for making a fluid flow tube with varying cross section.
Such a process is known from US-A-3.625.257.

In this patent specification there is described a process wherein a tube is extruded with a constant cross section and provided with one or more longitudinally extending partitions dividing the tube into a plurality of flow passages. In order to provide a fitting with enlarged circular cross section, the partitions are split at an end portion of the tube and the tube end reshaped into a circular cross section.

The process as described in said US-specification is restricted to the reshaping of the end portion of the tube as it is necessary to have access to the partitions to be slit. Practically it is nearly impossible to slit the partitions in intermediate portions without damaging the partitions in the end portions. This is especially true for tubes with small flowing channels, as it is impossible to introduce the necessary tools.

It is an object of the invention to provide a process for making a fluid flow tube with varying cross section, which makes it possible to produce tubes with widely varying configurations, especially with intermediate portions having a larger cross section than the portions which are closer to the ends of the tube.

This object is achieved by extruding a tube with a constant cross section, positioning the tube in a die having substantially the cross section of the outer wall of the end tube and increasing the pressure inside the tube, thereby deforming the tube so that its outer wall confirms to the die form.

By using this process it is possible to produce tubes with varying cross section, wherein the position of the portions with a cross section deviating from the original cross section can be freely chosen and is completely defined by the die form. Moreover it becomes possible to design the die in such a way that the shape of the cross section of each portion with modified cross section can be defined by the die shape.

Other features and advantages of the invention will be apparent from the following description, reference being made to the annexed drawings, in which :

Fig. 1 is a cross section of a multiport extruded tube prior to be reshaped and reformed according to the invention.

Fig. 2 is a cross section (enlarged scale) of a partition wall of the tube of Fig. 1.

Fig. 3 is a cross section (enlarged scale) of a modified shape of a partition wall of the tube of Fig. 1.

Fig. 4 is a schematic representation of a tube with a deformed portion, showing the cross section of an original portion and a deformed portion end.

Fig. 5, 6, 7 show the different steps of making a tube according to the invention.

In the embodiment illustrated in Figs. 1 - 4 the fluid flow tube 10 of generally oval cross section has parallel top 11 and bottom 12 webs with the interior being separated into a number of parallel fluid flow passages 13, 14 and 15 by a pair of spaced longitudinal dividing walls or partitions 16 and 17. The partitions 16 and 17 can have the form shown in cross section in Fig. 2 and 3 or similar. In fig. 2 the partition has the shape of two truncated cones fixed to each other by their shortest edges. In this way the partitions 16 and 17 have a central section 19 with a reduced thickness offer a reduced strength and thereby allowing the partition 16 or 17 to be broken more easily when an increasing pressure is applied to the interior of the flow channels. At the same time the flow channels in the undeformed position of the tube are still separated from each other thereby offering the well known advantage of the so called multiport extrusion tubes.

The partition 16 shown in fig. 3 has a modified cross section. Both sides of the central section 19 are provided with a notch like saving 20 and 21, thereby providing a portion with reduced strength. In this way it is achieved that upon applying pressure the partitions 16 and 17 will preferably split at the portions with reduced strength.

In fig. 4 is shown part of a multiport extrusion tube 25.
The tube 25 as extruded is shown in cross section in the right hand section A of this figure, wherein the partitions 26, 27, 28 are still in their original form and shape. In the left hand section B of fig. 4 is shown the tube after being expanded by increasing the pressure internally. As shown the partitions 26, 27 and 28 have been broken in the central portion and each half partition is still extending into the interior of the tube 25. These protrusions are still contributing in the heat exchanging process between the fluid and the wall of the tube 25, as they increase the contact surface with the fluid.

In Fig. 5 - 7 is shown a practical application of the process. A tube 35 has been made by means of an extrusion process and thereupon been reshaped to the form shown in fig. 5. This form corresponds to the form the tube must have in its final application, in this case an evaporator provided with a suction accumulator. It could also be a condenser with a receiver. The tube may be of the type of a multiport extruded tube, but any other tube is also possible.

In Fig. 6 the tube of Fig. 5 has been positioned with a die 36 shown in cross section. The die 36 consists of two portions, each provided with savings which are mirror-image of each other, the savings corresponding to the final form the tube 35 must take. In this case the savings in the die are very closely fitting to the serpentine bent portion of the tube, but at the portion 37 of the tube

35 there is a more spacious saving 38, giving some freedom of movement to the tube.

After positioning the tube 35 into one part of the die 36 and closing the die by bringing together its two portions, pressure is applied to the interior of the tube. If needed the die may be preheated and/or heated while the increased pressure is applied. If sufficient pressure is applied the tube portion 37 will be expanded in order to confirm itself to the wall of the die at that location, as shown in fig. 7. After removing the pressure from the interior of the tube and if needed cooling of the tube, the tube with its expanded portion can be removed from the die and further processed to its final application. In order to avoid further deformation each and of the tube can be clamped during the expansion process.

It may be obvious that the invention is not restricted to the embodiment shown and described. More especially it is possible to use the invention with other type of tubes, such a s tubes without partitions or other cross sections.

Although the tube may be made of different materials, either metal or plastics or any other material capable of maintaining its shape after controlled deformation, the invention is preferably applied with tubes made of aluminum or aluminum alloy.

Claims

1. A process for making a fluid flow tube with a varying cross section comprising extruding a tube with a constant cross section, positioning the extruded tube in a die having substantially the cross section of the outer wall of the end tube and increasing the pressure inside the extruded tube, thereby deforming the tube, so that its outer wall confirms to the die form.

2. A process according to claim 1, wherein the tube is heated at least during deformation.

3. A process according to claim 1 or 2, wherein the extended tube is provided with at least an internal partition wall defining several flowing channels with the tube, and that at the locations where the extruded tube is expanded said wall is broken.

4. A process according to claim 3, wherein the internal wall is provided with a portion with smaller cross section.

5. A process according to claim 4, wherein said portion with smaller cross is a portion provided with notch-like saving or savings.

6. A process according to any one of claims 3 - 5, wherein the extruded tube is a multiport extruded tube.

7. A process according to any one of claims 1 - 6, wherein the extruded tube is made of aluminum or aluminium alloy.

8. Heat exchanger comprising a tube like part having at least one portion with enlarged cross section, to be used e.g. as suction accumulator, condenser or the like, wherein the tube like part is obtained by a process according to any one of claims 1 - 7.

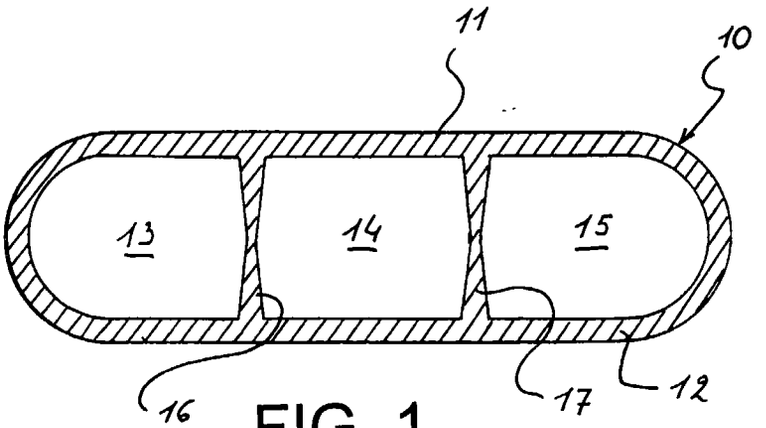

FIG. 1

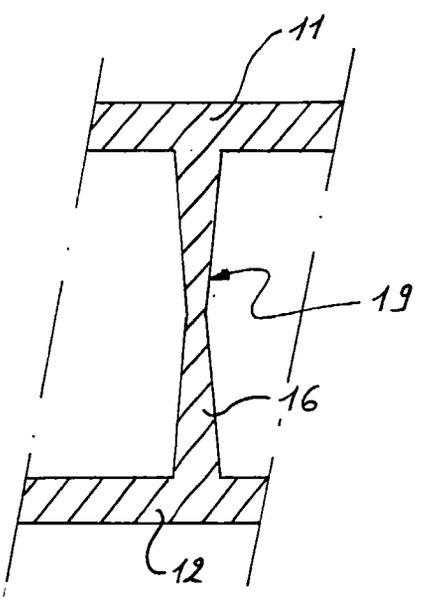

FIG. 2

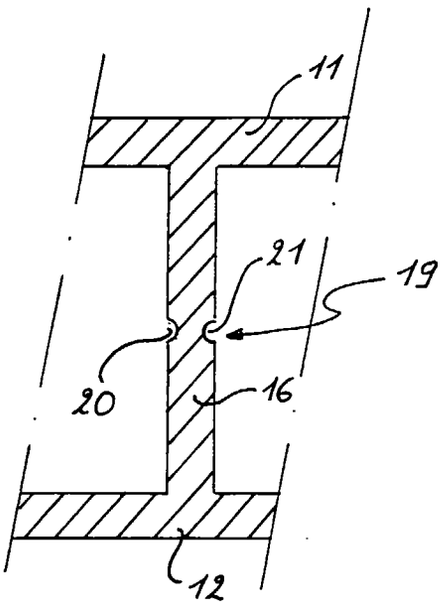

FIG. 3

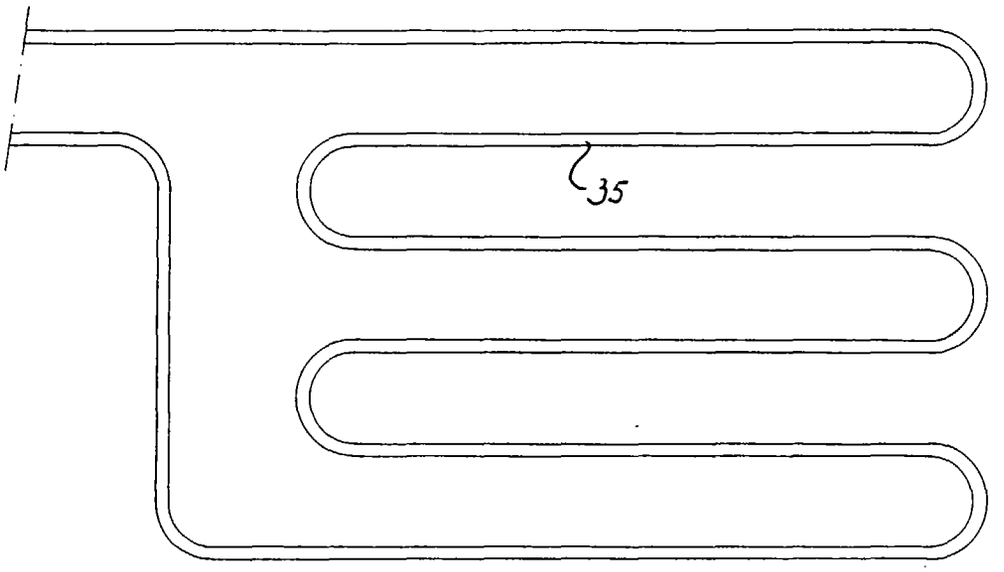

FIG. 5

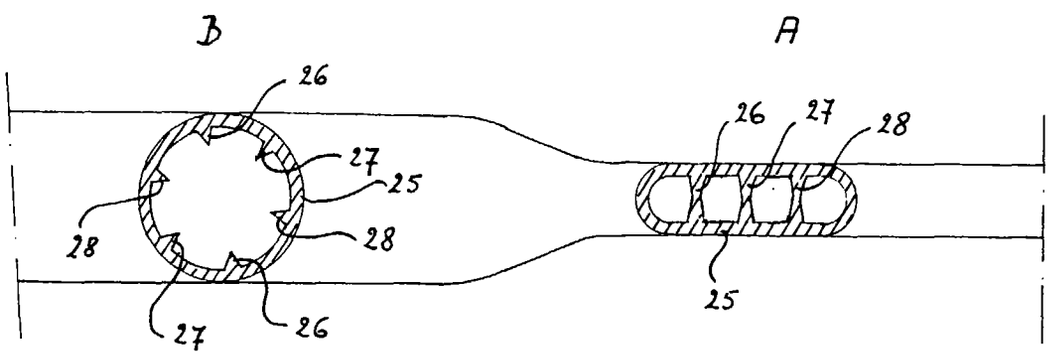

FIG. 4

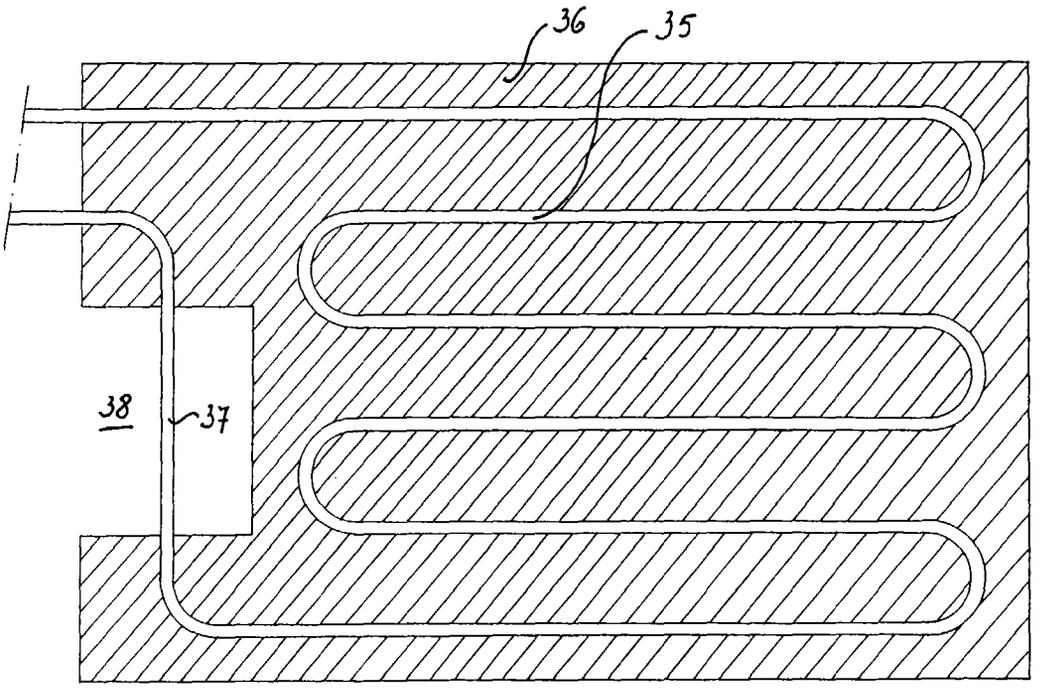

FIG. 6

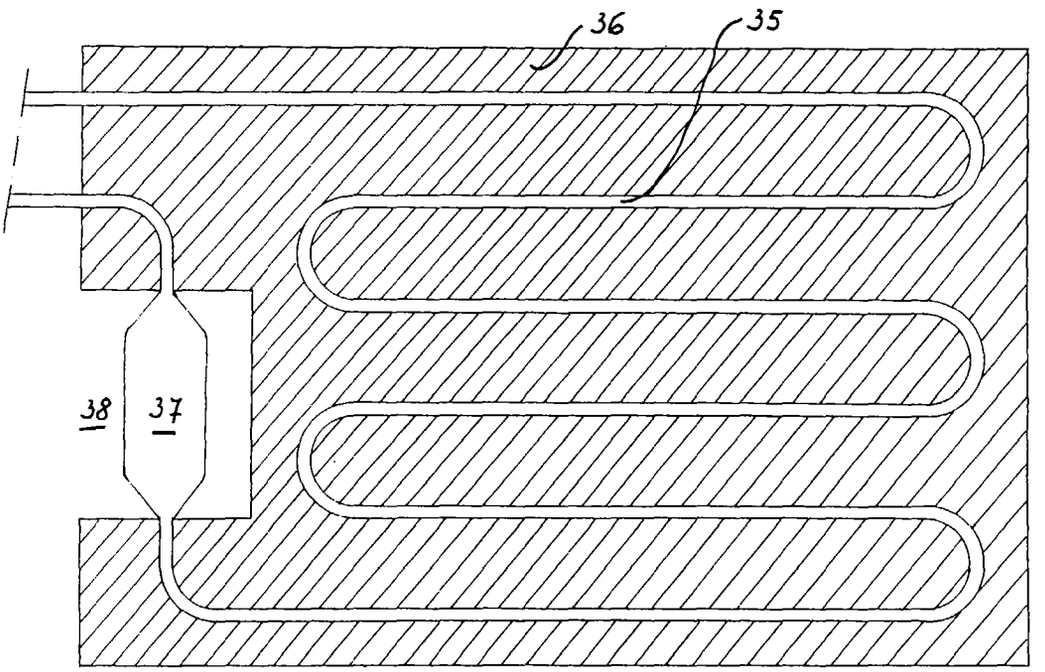

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0712

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	DE-A-44 25 984 (BAYERISCHE MOTOREN WERKE AG ;YMOS AG IND PRODUKTE (DE)) 25 January 1996	1,2,8	B21D26/02 B21C37/16
A	* the whole document *	3,6,7	
A	PATENT ABSTRACTS OF JAPAN vol. 015, no. 155 (M-1104), 18 April 1991 & JP-A-03 027833 (SHOWA ALUM CORP), 6 February 1991, * abstract *	4-7	
A	JP-A-03 027 833 (SHOWA ALUM CORP) 6 February 1991 * figures *	4-7	
A	US-A-4 580 324 (LASKA STANLEY T) 8 April 1986		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B21D B21C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 July 1996	Ris, M

CATEGORY OF CITED DOCUMENTS

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