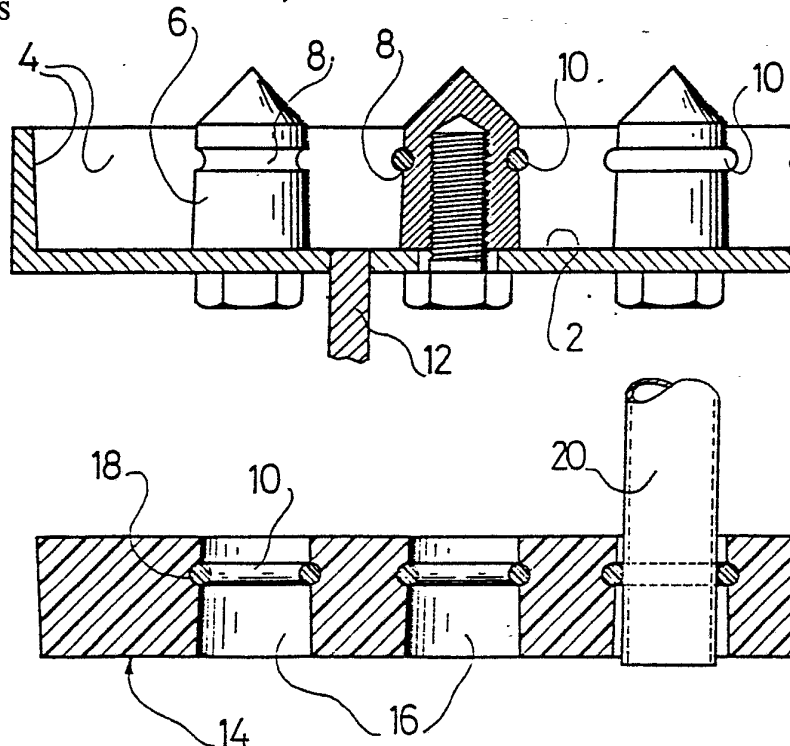




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<p>(21) International Application Number: PCT/DK81/00112 (22) International Filing Date: 7 December 1981 (07.12.81) (31) Priority Application Number: 5236/80 (32) Priority Date: 9 December 1980 (09.12.80) (33) Priority Country: DK</p> <p>(71) Applicant (for all designated States except US): BRDR. SKOV VENTILATION OG ELEKTRONIK A/S [DK/DK]; Hedelund 4, Glyngøre, DK-7870 Roslev (DK).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): SKOV, Kjeld [DK/DK]; Østergaard Hovedgaard, Aasted, DK-7870 Roslev (DK).</p>		<p>(74) Agent: K. SKÖTT-JENSEN; Lemmingvej 225, DK-8361 Hasselager (DK).</p> <p>(81) Designated States: AT (European patent), CH (European patent), DE, DE (Utility model), DE (European patent), FI, FR (European patent), GB, GB (European patent), JP, LU (European patent), NL, NL (European patent), NO, SE, SE (European patent), US.</p> <p>Published With international search report.</p>

(54) Title: A METHOD OF MANUFACTURING A MULTI TUBE HOLDER PLATE ELEMENT E. G. FOR HEAT EXCHANGERS



(57) Abstract

In many heat exchangers is used a system of a large number of glass tubes, which are endwise connected with opposed holder plates, and it is hereby a problem to achieve an easy mounting of the tubes and at the same time a sealed, but non-stiff connection between the tube ends and the holder plates. According to the invention an advantageous connection is achieved by producing the holder plates as moulded elements (14), e.g. made of an artificial resin, with the use of a mould having a plurality of upstanding core stubs (6) each provided with a seat groove (8) for an O-ring (10). Prior to the moulding operation an O-ring (10) is mounted on each of the stubs (6), and by the moulding operation corresponding seat grooves (18) will be formed in the moulded member. When the moulded member (14) is rejected from the mould the O-rings (10) will remain in the moulded seat grooves and thus be drawn off the stubs (6), whereafter the moulded member (14) is immediately usable for receiving tube ends (20) through the moulded holes (16) and their associated O-rings (10).

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A method of manufacturing a multi tube holder plate element, e.g. for heat exchangers.

The present invention relates to a method of manufacturing a plate element having a plurality of holes for sealingly receiving respective tubes or tube ends, particularly for use in heat exchangers of the type
5 comprising a plurality of glass tubes mounted between opposed holding walls. It is well known that a quite effective type of heat exchanger is produceable by mounting a plurality of parallel glass tubes between two opposed holding walls of a heat exchanger chamber,
10 and in that connection it is an almost traditional problem how to work out the sealed connection between the tube ends and the holding walls in or adjacent the respective holes therein. For various reasons it is in practice preferred that the tube ends be held
15 inside the holes, i.e. by the tube ends being received in the holes rather than abutting their edge portions axially. The tube ends must not be entirely rigidly held, but the known solutions of this holding problem are rather expensive..

20 It is the purpose of the invention to provide a holding arrangement which is well suited for the purpose and even cheap and easy to provide in a running production.

The invention is based on a moulding technique,
25 whereby the holder plate is produced by moulding. This has previously been suggested, but without real success. The characterizing features of the invention are that the holding plate is moulded in a mould provided with core stubs at the places where the holes are desired,
30 and that an O-ring or a similar resilient sealing ring is placed in a seat groove on each core stub in such a

manner that by the moulding process the moulding material is shaped with the corresponding holes, in the walls of which there will automatically be formed a seat groove for the O-ring as projecting partially from the core
5 stub surface, whereafter upon the setting of the moulding material the core stubs are retracted so as to leave the O-rings located in the moulded seat grooves. Since the rings were originally slightly projecting into the seat grooves of the core stubs they will, upon the de-
10 moulding, be correspondingly projecting inwardly from the walls of the holes, and when the holes are shaped with a diameter only slightly larger than the exterior tube diameter, then the tubes will be mountable in an ideal manner, namely held sealingly and safely by means
15 of the O-rings, and yet not in any stiff manner.

In the following the invention is described in more detail with reference to the drawing, in which:-

Fig. 1 is a perspective view of a corner section of a mould for the production of a holder plate accord-
20 ing to the invention,

Fig. 2 is a sectional view thereof, and

Fig. 3 is a corresponding sectional view of a holder plate as produced in the mould.

The mould shown in Figs. 1 and 2 has a mould bottom
25 2 with upright lateral edges 4 and a plurality of core stubs 4, which are conically converging upwardly from the mould bottom 2. Typically the mould may be adapted for the production of holder plates having a surface area of some 50x60 cm and having 400-500 holes, i.e.
30 the mould has a corresponding number of core stubs 6 for forming the holes, these being adapted to receive the ends of glass tubes having an exterior diameter of 15 mm. The stubs 6 are provided with annular seat grooves 8 for O-rings 10, and prior to each mould
35 operation an O-ring 10 is placed in the seat groove 8 of each of the stubs 6.

Thereafter a suitable moulding material is poured into the mould, preferably a two component artificial resin compound, if desired with a reinforcing fibre material mixed into the compound or placed in the mould
5 prior to the moulding operation.

When the moulding compound has set the moulded member is caused to be released from the mould by means of suitable ejectors as shown at 12 in Fig. 2, and the moulded and released member 14 will hereby, as
10 shown in Fig. 3, be provided with holes 16 corresponding to the stubs 6, these holes by the very moulding process being shaped with seat grooves 18 for the O-rings 10. It is experienced in practice that the seat grooves 18 by the rejection of the moulded member 14
15 from the mould will bring along the O-rings 10, i.e. without these remaining on the stubs 6. This effect is presumably due to the fact that the moulded seat grooves 18 for the O-rings will automatically fit completely against the outside of the O-rings, while the ring fit
20 against the bottom of the stub grooves 8 will be less perfect. Besides it will of course be important that the O-rings are sufficiently resilient or compressible to allow for their material to be compressed radially by the rejection of the moulded member 14, since other-
25 wise the O-rings by the said rejection would be influenced by forces seeking to cut them along a diametrical plane as seen in each cross section of the rings. Moreover the cross section of the grooves 8 should be arched along less than 180° , e.g. some 140° , and the
30 grooves should be prepared so as to closely fit the O-rings in order to prevent the moulding material from entering any space between the groove and the ring.

For facilitating the rejection of the moulded member the portions of the stubs 6 which are located
35 above the grooves 8 may be prepared with a conicity smaller than that of the stub portions underneath the

grooves.

When the holder plate is moulded from e.g. a glass fibre reinforced artificial resin a certain moulding shrinkage should be aforesaid, and a.o. for this reason
5 it may be preferable that the seat grooves 8 on the stubs 6 exert a slight expanding effect on the O-rings.

As shown in the right hand side of Fig. 3 the moulded member 14 will be immediately ready to receive the ends of tubes 20, with which it is adapted to be
10 used. When the tubes in hundreds are to be mounted between two parallel plate members 14 for use in a heat exchanger housing it will be practical to mount the tubes one by one by pushing them through the respective holes in one of the plate members, because it will be
15 very difficult to mount the other plate member upon all the tubes being premounted as shown in Fig. 3.

CLAIM:

A method of manufacturing a plate element having one or more holes for receiving tubes or tube ends in a sealed manner, particularly for use in heat exchangers of the type comprising a plurality of glass tubes mounted between opposed holding plate elements, characterized in that the plate element (14) is produced by moulding in a mould provided with hole forming core stubs (6) showing annular seat grooves (8) for O-rings (10) which, when premounted on said stubs (6), are preferably projecting from the stub surface by more than half their cross section, such that the moulded member (14) when rejected from the mould will bring along the O-rings (10), which are thereafter projecting inwardly from the inner surfaces of the holes (16) as provided in the moulded member (14) by the said stubs (6).

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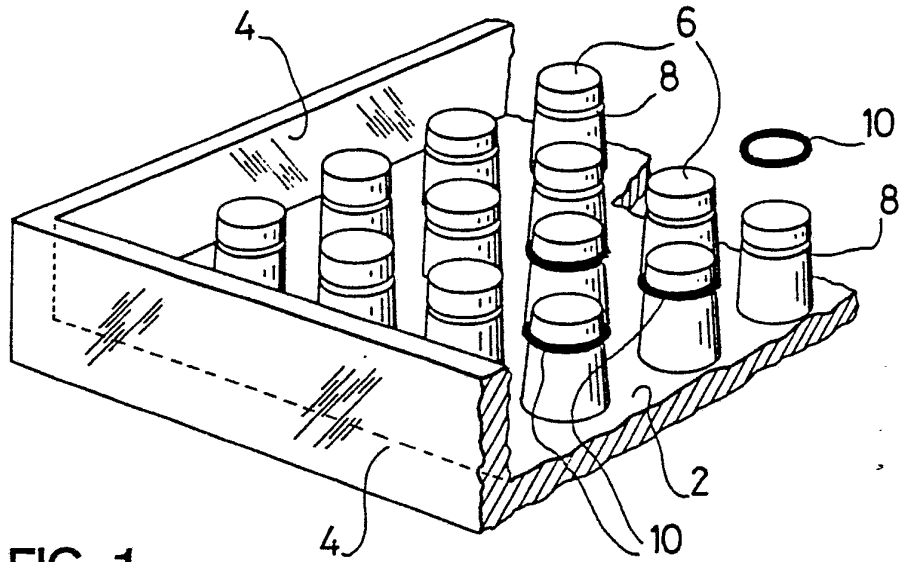


FIG. 1

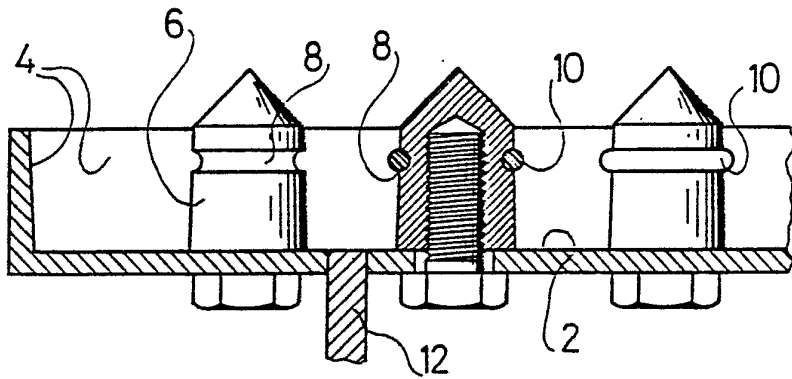


FIG. 2

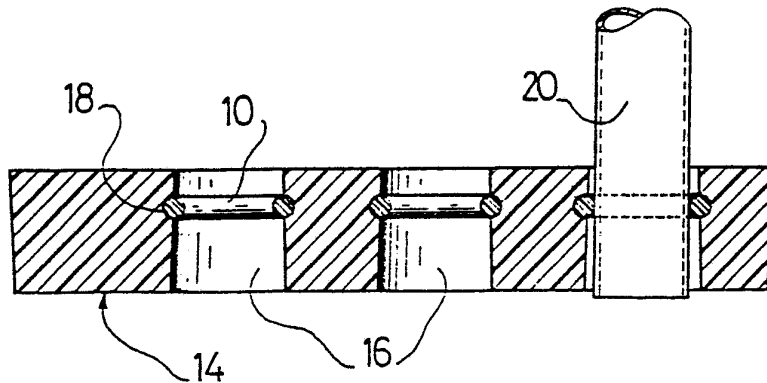
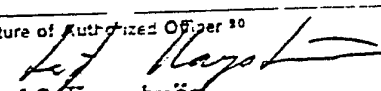


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No. PCT/DK81/00112

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC ³		
B 23 P 15/26, F 28 F 9/04		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
IPC 3	B 23 P 15/26, F 28 F 1/00, 9/00-08, 9/14, 21/00, 21/06	
US C1	29/157.3; 113/118; 165/177, 178	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category ⁶	Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X	GB, A, 1 525 641 (ROUSSELIH, DAMOIS) 20 September 1978	
A	GB, A, 1 465 732 (CARL-ZEISS-STIFTUNG) 2 March 1977	
A	GB, A, 1 151 233 (R C BRAIN) 7 May 1969	
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IV. CERTIFICATION		
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