March 29, 1966 D. A. COBB 3,242,977

ROTARY HEAT EXCHANGER DRUM CONSTRUCTION

Original Filed Nov. 15, 1961

Fig. 1.

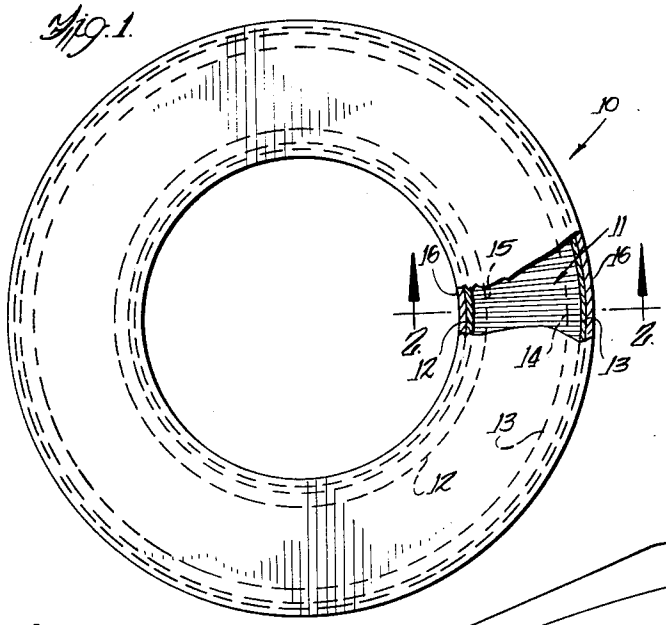


Fig. 2.

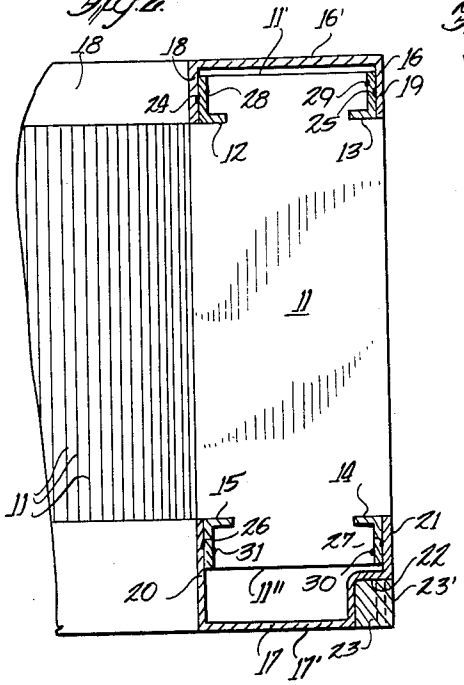


Fig. 3.

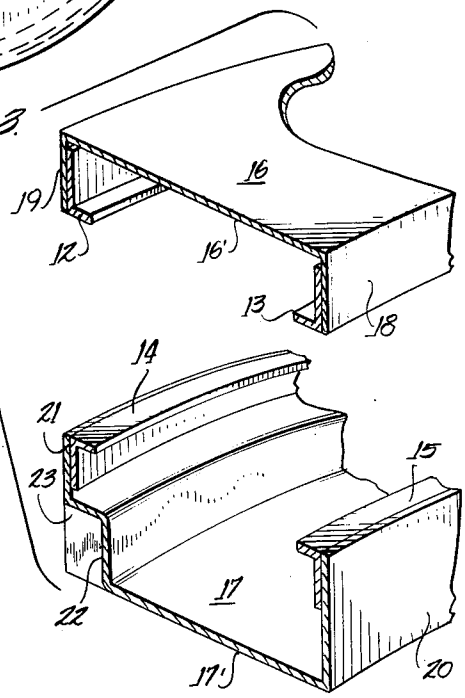
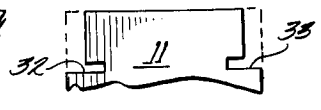


Fig. 4.



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ROTARY HEAT EXCHANGER DRUM CONSTRUCTION

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Original application Nov. 15, 1961, Ser. No. 152,500, now Patent No. 3,213,526, dated Oct. 26, 1965. Divided and this application Apr. 30, 1965, Ser. No. 461,573

1 Claim. (Cl. 165—10)

This invention relates to the construction of a rotatable rigid drum for a rotary heat exchanger. More in particular this invention relates to the construction of a rotatable heat exchanger drum wherein the matrix may be secured with formed sheet metal parts in welded relation. This application is divided from copending application, Serial No. 152,500 filed November 15, 1961, now Patent No. 3,213,526.

In the prior art the matrix plates or elements of a rotatable heat exchanger drum are usually secured to a cage. These cages usually comprise a pair of machined annular rings secured in axial spaced relation by a plurality of longitudinally extending machined spacer bars. After positioning the matrix elements the spacer bars and annular rings are secured rigidly together by screws and the like. The cost of these machined parts and securing means therefor together with the labor time required for assembly is very expensive. In order to reduce substantially the cost of constructing a rotary heat exchanger drum, this invention contemplates employing formed sheet metal parts in the manner hereinafter described which when spot welded, such as brazing, forms a rigid drum structure. It is therefore a prime object of this invention to provide a rotatable drum construction for a heat exchanger employing annular elements connected together and secured to the matrix in rigid relation.

A further important object of this invention is to provide a drum construction according to the preceding object wherein the annular elements may be constructed of pre-formed sheet metal.

These and other desirable and important objects inherent in and encompassed by the invention will be more readily understood from the ensuing description, the appended claims and the annexed drawings wherein:

FIGURE 1 is a top view, partly broken away and partly in section illustrating the assembled rotary heat exchanger drum of this invention;

FIG. 2 is a sectional view, partly broken away, taken on line 2—2 of FIGURE 1 showing construction details of the assembled drum;

FIGURE 3 is a perspective view, partly in section and partly broken away, illustrating the arrangement of the elements in assembled form but omitting the matrix; and

FIGURE 4 is a side view, partly broken away of a matrix plate showing the grooves therein positioned to receive the annular elements.

With continued reference to the drawings the rotary drum construction of this invention is indicated generally by the numeral **10** including a series of plates or matrix elements **11** positioned side-by-side in circumferentially spaced relation as is evident from FIGURES 1 and 2. This permits fluid flow through the matrix in a radial direction but not in a circumferential direction. The matrix elements **11** per se are conventional as a heat exchange media except for certain cut-away portions or grooves necessary for the construction and assembly of the drum of the present invention.

Referring now to FIGURES 2 and 3 it will be seen that there is provided four annular rings **12, 13, 14** and **15**, each of L-shaped cross-section. The inner rings **12** and **15** are of lesser diameter than the outer rings **13** and **14**. Rings **12** and **13** are disposed in concentric relation and

the rings **14** and **15** likewise. Ring **12** is positioned in axial spaced relation with respect to ring **15**. Similarly ring **13** is positioned in axial spaced relation with respect to ring **14** as shown.

An upper closure member **16** is provided having an annular face portion **16'** with downwardly extending flanges **18** and **19**. A lower closure member **17** is also provided and positioned in axially spaced opposed relation with respect to the upper closure member **16** as shown. The lower closure member **17** is provided with upwardly extending flanges **20** and **21** integrally connected to the annular face portion **17'** as best shown in FIGURE 3. The lower closure member **17** is also provided with an annular shaped recess **22** having a rectangular cross-section. The purpose of the recess **22** is to accommodate a ring gear **23** having outwardly extending teeth **23'**. The ring gear **23** is secured rigidly to the lower closure member **17** by conventional means such as by press-fitting, welding or brazing. The gear **23** is for driving rotatably the drum **10** under power in a conventional manner.

At this point it will be observed that the annular rings **12, 13, 14** and **15** as well as the closure members **16** and **17** may be formed from sheet metal in a conventional manner such as by punch and die means which is an important feature of this invention as the cost thereof is relatively inexpensive when compared with machined drum cages heretofore known.

The individual elements **11** comprising the matrix are flat plates as may be evident from the drawings. Flat plates as a heat exchange media for drums of rotary heat exchangers disposed in the manner shown in the drawings herein are per se known as previously mentioned. The only departure herein is that the upper and lower end portions must be provided with specific cut-aways or grooves for receiving the rings **12, 13, 14** and **15** as evident from FIGURE 2. Referring to FIGURE 4 each matrix plate **11** is originally of rectangular shape as shown in full and dotted lines. The dotted position is removed, such as by a punching operation, to form grooves **32** and **33** as shown which permits reception of rings **12** and **13**, respectively, and flanges **18** and **19**, respectively, of the upper closure member **16** as shown best in FIGURE 2. In a similar manner the lower end portion of each matrix element **11** is grooved to receive rings **14** and **15** and the flanges **21** and **20**, respectively as shown in FIGURE 2. Of course it should be understood that other types of conventional matrices may be employed as well as the type of matrix described herein such as a wire mesh matrix.

The method of assembling the drum **10** employing the above described components will now be described.

First the rings **12, 13, 14** and **15** are positioned in the relation to each other as shown in FIGURES 2 and 3. This is accomplished by means of a suitable clamping fixture (not shown). There are numerous means known in the art for accomplishing this and hence unnecessary to describe any here.

Next the matrix elements **11** are inserted, one by one, and shifted circumferentially to pack them in side-by-side contiguous relation until the required number of plates **11** have been inserted. When the plates **11** are thus packed contiguously there will be sufficient space to insert the final plate. Each plate **11** is inserted by revolving it perhaps 90° on its vertical axis and placing it between rings **14** and **15** and between rings **12** and **13**. Thereafter the plate is rotated about its vertical axis until positioned as shown in FIGURE 2. Alternately, one or more of the rings **12, 13, 14** and **15** may be split to permit insertion of the plates **11** and after all plates **11** have been inserted the ring or rings are welded to unite the split.

After all of the required number of matrix elements **11** have been inserted as described above, the elements **11** are circumferentially spaced apart uniformly as evident from FIGURES 1 and 2. One way of spacing the elements **11** uniformly is to insert a spacer plate between each pair of matrix elements **11** and temporarily leaving them inserted.

Next each matrix element **11** is welded to at least one of the rings **12, 13, 14** and **15** to prevent circumferential shifting during operational use of the drum **10**. As shown in FIGURE 2 each matrix element **11** is spot welded to each of the four rings **12, 13, 14** and **15** at **28, 29, 30** and **31** respectively as illustrated in FIGURE 2. Thereafter the spacer plates and fixture employed for circumferentially spacing uniformly the matrix elements **11** and positioning of the rings **12, 13, 14** and **15** are removed.

The upper closure member **16** is then positioned so that by axial movement thereof the flanges **18** and **19** thereof slide over the rings **12** and **13**, respectively to the position shown in FIGURE 2. In a similar manner the closure member **17** with its affixed ring gear **23** is positioned so that axial movement thereof the flanges **20** and **21** slide over the rings **15** and **14**, respectively, to the positions shown in FIGURE 2. Thereafter the rings **12, 13, 14** and **15** are spot welded to the members **16** and **17** at **24, 25, 27** and **26**, respectively, as shown in FIGURE 2. Thus the closure members **16** and **17**, rings **12, 13, 14** and **15**, and matrix elements are secured together in rigid relation to form the drum **10**.

From the foregoing it can be seen all of the components except the ring gear comprising the drum **10** may be fabricated from sheet metal cut and preformed by means of conventional punch and die operations, and forming operations. The preformed components are then assembled in accordance with that described herein to form the drum **10**.

Having thus described a preferred embodiment of the invention it can now be seen that the objects of the invention have been fully achieved and it must be understood that changes and modifications may be made which do not depart from the spirit of the invention nor from the scope thereof as defined in the appended claim.

What is claimed is:

A rotary heat exchanger drum construction assembly comprising, in combination,

(a) a first annular inner ring having an L-shaped cross-section,

(b) a second annular inner ring having an L-shaped cross-section positioned opposedly in axial spaced relation with respect to said first annular inner ring,

(c) a first annular outer ring having an L-shaped cross-section disposed in concentric opposed relation with respect to said first annular inner ring,

(d) a second annular outer ring having an L-shaped cross-section disposed in concentric opposed relation with respect to said second annular inner ring,

(e) a plurality of heat transfer flat matrix elements rigidly disposed between said annular inner rings and said annular outer rings in circumferentially spaced uniform side-by-side relation,

(f) each of said heat transfer flat matrix elements having radially disposed first grooves on one end portion thereof positioned in receiving relation with said first annular rings,

(g) each of said heat transfer flat matrix elements having radially disposed second grooves on the other end portion thereof positioned in receiving relation with said second annular rings,

(h) an annular shaped upper closure member having axial downwardly extending flanges positioned in rigidly connected relation with said first annular rings,

(i) an annular shaped lower closure member having axial upwardly extending flanges positioned in rigidly connected relation with said second annular rings

whereby a rigid drum assembly is formed.

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