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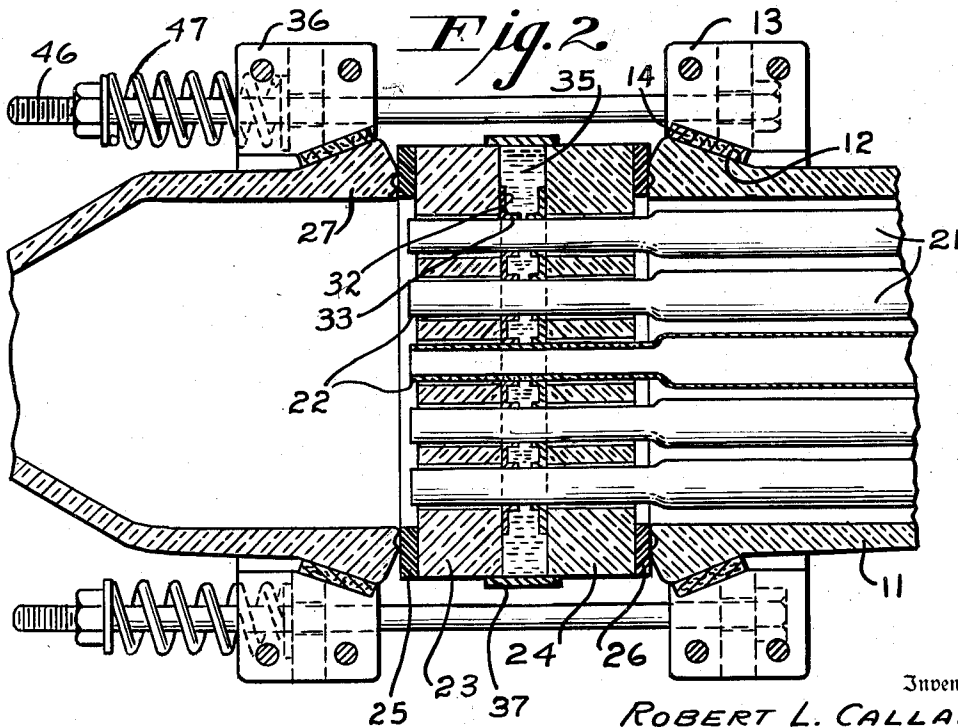
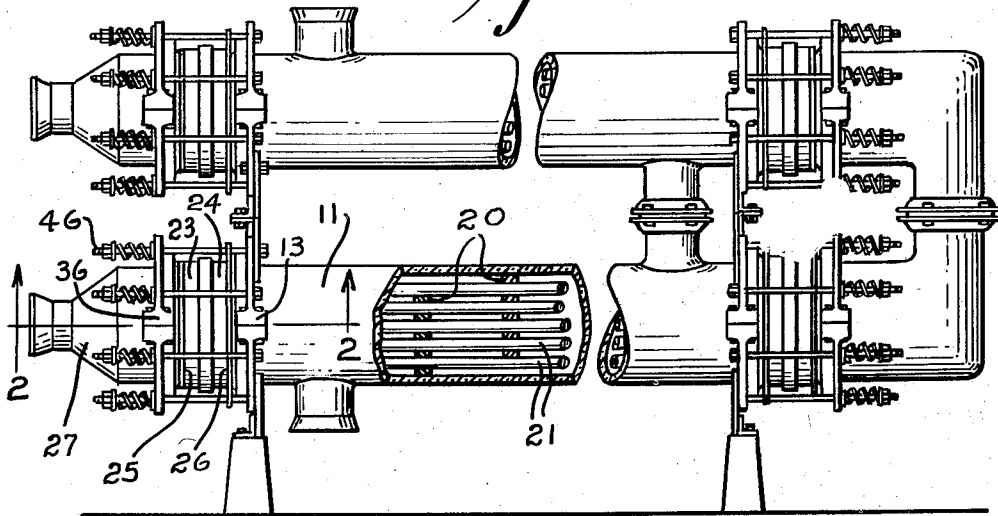
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HEAT EXCHANGER

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Fig. 1



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2,859,948

HEAT EXCHANGER

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The present invention relates in general to fluid seals and more particularly to heat exchangers, of the shell and tube type provided with fluid seals embodying the invention.

According to the invention, as applied to a shell and tube type of heat exchanger unit, the tubular shell near each end opening is provided with a lateral branch surrounding a side opening. The wall surrounding the opening in each instance has exterior surfaces which flare in a conventional fashion to facilitate, with the aid of suitable fittings, the ready clamping of the unit to another in either a vertical or horizontal stack. Fluid seals bridge the spaces surrounding the usual tubes extending through the shell and in communication with the shell interior, from communication with shell end members in communication with such tubes. Each fluid seal includes a pair of spaced aperture plates, of glass or other highly corrosion resistant ceramic material, clamped between an end of the shell and an adjoining shell end member and through which the tubes occupying the shell freely pass. Such tubes in the region between such plates are surrounded by tubular wall portions of high durometer polytetrafluoroethylene sealing members which are non-sticky and therefore readily slidable with respect to the engaged tube wall, shell and plate surfaces during contraction and expansion of the shell and tubes as occurs in ordinary use. Moreover, they are inert to most corrosive fluids and capable of safely withstanding temperatures up to 500° F. Such members are held in sealing engagement with the wall areas of the tubes surrounded and with the plates through which they pass by hydraulic pressure applied to their opposite surfaces. Such pressure is applied, by displacement of a plastic body or a body of low durometer material such as silicone base synthetic rubber confined within the remainder of the space between such plates, and compressed therebetween as they are clamped between a shell end and a shell end member. The above rubber, while less inert to corrosive materials than polytetrafluoroethylene, is likewise unaffected by prolonged exposure to temperatures up to 500° F.

A further feature of the invention is the employment of tubes that are thick-walled in their end regions, so as to enable them to withstand the compression thereabout resulting from the clamping of the parts to one another, but which are thin-walled within the shell body for highest possible heat transfer efficiency.

For a better understanding of the invention reference is made to the accompanying drawing in which:

Fig. 1 is a side elevation of a heat exchanger embody-

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ing the invention and in which two shell units are shown stacked horizontally, and part of one unit being shown in section.

Fig. 2 is an enlarged sectional view of a unit fragment taken on line 2-2 of Fig. 1.

In detail, each unit of an assembly comprises a glass shell 11 having end openings bordered with a wall whose exterior surface 12 is outwardly flared toward the end to form a seat for a clamping member such as 13 provided with a suitable glass engaging cushion 14. A plurality of glass tubes such as 21 occupy shell 11 and have reduced diameter thick-wall portions such as 22 projecting through the open ends thereof. Desirably such tubes are in part supported at intervals along their length by suitably perforated baffles 20. As will be noted from Fig. 1 such baffles are arranged in the shell in a manner to provide an undulating cross flow of fluid passing through the shell about the tubes.

The end portions such as 22 of the tubes 21 pass through aligned apertures in spaced plates 23 and 24 arranged between polytetrafluoroethylene gaskets 26 and 25 adjacent the ends of shell 11 and a shell end member such as 27. Arranged between plates 23 and 24 are fluid sealing members each having disc portions such as 32 surrounding tubular portions such as 33 closely fitted about the tube portions such as 22 and with their disc portions arranged against the opposing surfaces of the respective plates so as to bridge the passage spaces remaining between the tubes and such plates. The remaining space between plates 23 and 24 is filled with a low durometer rubbery body 35 confined therein by a metal band or clamp such as 37 bridging the outer confines of the space between such plates and slidably fitted thereabout. Accordingly, when an end of a pipe or shell 11 and a shell end member such as 27 are clamped against the described assembly including plates 23 and 24, as is done through the medium of clamping member 13, a similar member 36 and a number of bolts such as 46 and springs such as 47, the body 35 of low durometer liquid is displaced under the compression of such springs against the high durometer member portions such as 32 and 33, which are in turn snugly pressed against the surrounded tube ends 22 and against the adjacent plates. Such high durometer members accordingly maintain the spaces surrounding the respective tubes sealed while allowing freedom of relative movement of the respective parts during temperature changes of the structure that occur in the usual course of its use.

As will be understood, although the seals as illustrated and described bridge spaces surrounding tubes passing through plates, the provision of seals between adjoining elements of any desired shape is within the concept of the invention. As will be appreciated it is only necessary that a sealing strip of high durometer material bridge the line of juncture of such elements, to back up such material with a confined liquid body of a low durometer material and to provide facilities for suitably compressing the liquid body against the sealing strip.

What is claimed is:

1. An assembly which includes a tubular shell having a tubular body passing therethrough, a fluid tight closure for the shell end surrounding the tubular body, said closure including a pair of similar spaced rigid plates extending transversely of an end of the shell and having

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aligned passages through which an end region of said tubular body freely passes, rubbery sealing discs of high durometer material each having a tubular portion occupying the space between said rigid plates and whose passage is closely confined about said tubular body and occupies the space between said plates and whose disc portions bridge the spaces around the rigid plate passages through which the tubular body is passed, an end-
 5 less band bridging the outer confines of the space between such plates, a body of relatively low durometer material occupying the remainder of the space between
 10 said plates, and a single means for urging said plates toward one another and toward the adjacent shell end whereby the body of low durometer material displaces the relatively high durometer material members into
 15 intimate fluid sealing engagement with the surrounded wall portions of the tubular body and with the engaged surfaces of said rigid plates respectively.

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2. An assembly such as defined by claim 1 wherein the wall thickness of the tubular body is greatest in the end regions thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

1,412,056	Hughes et al.	Apr. 11, 1922
1,575,497	Meschke	Mar. 2, 1926
2,196,683	Pickstone	Apr. 9, 1940
2,313,308	Allen	Mar. 9, 1943
2,467,312	Jack	Apr. 12, 1949
2,504,496	Carter	Apr. 18, 1950

FOREIGN PATENTS

406,584	Great Britain	Mar. 1, 1934
821,798	Germany	Nov. 19, 1951