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TUBE COUPLING FOR HEAT EXCHANGER AND THE LIKE

Filed Feb. 12, 1960

2 Sheets-Sheet 1

FIG. 1

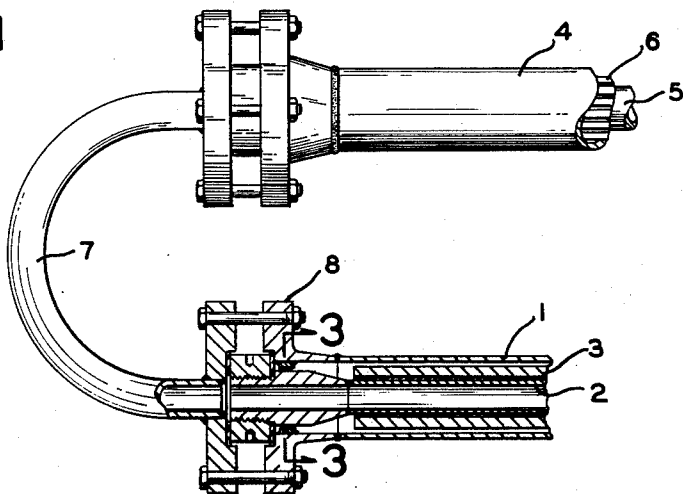


FIG. 2

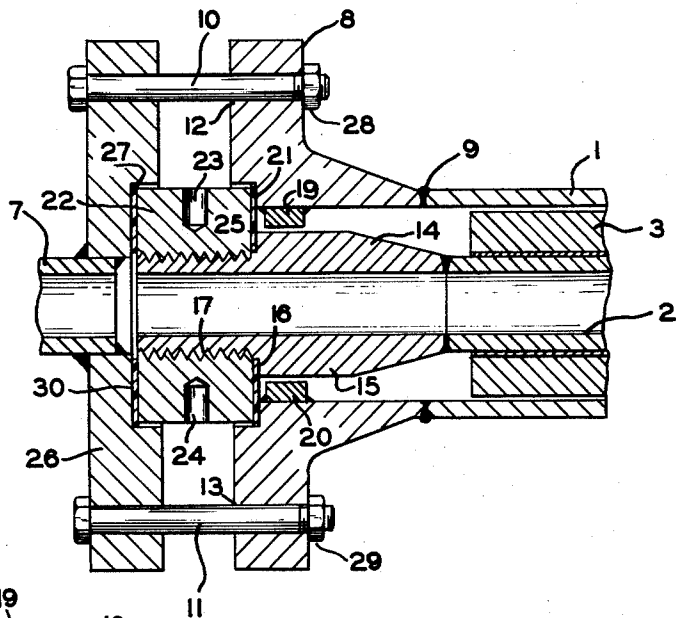
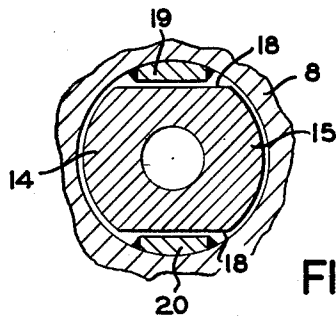


FIG. 3

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FIG. 4

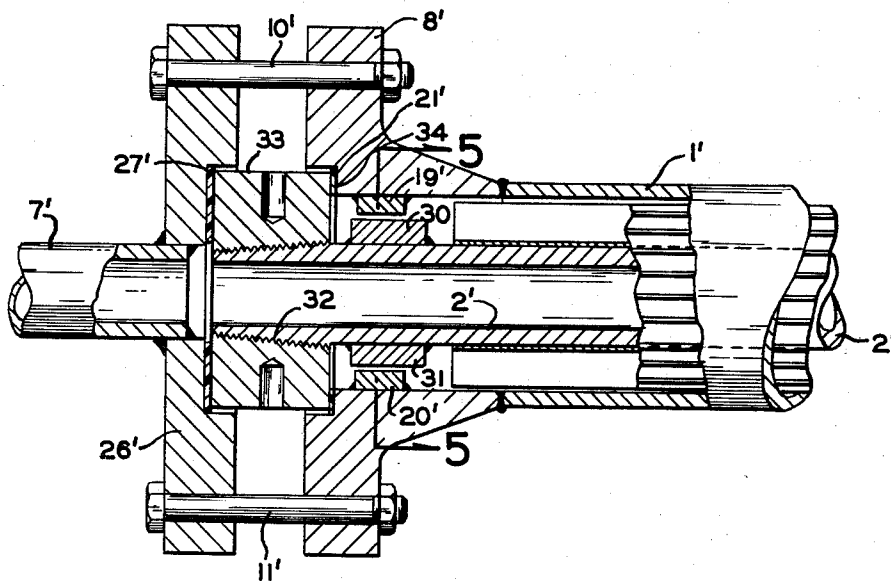
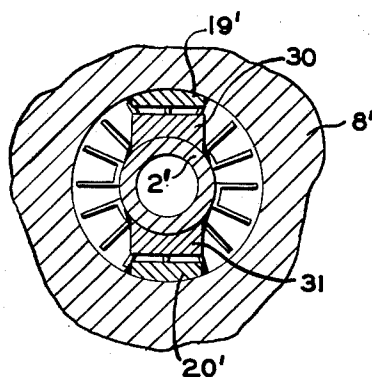


FIG. 5

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TUBE COUPLING FOR HEAT EXCHANGER
AND THE LIKE

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1 Claim. (Cl. 285—133)

This invention relates to means for forming a connection to an encased tube where the end of the casing at the joint must be sealed, as for example, in coupling head ends of hairpin heat exchanger sections.

A sectional heat exchanger of the type referred to comprises a considerable number of units or sections each including a hairpin tube and an enclosing shell, with the sections arranged in banks and the like and the tubes interconnected at their head ends for continuity by removable bridge or jumper tubes. This construction is of course well-known and further includes separate and simple shell to shell connections of lateral nature among the several sections, that is, from one section laterally to the next adjacent, which are not involved in the present improvements. The latter are, as indicated, concerned in such an embodiment with the coupling of the inter-section tubes in such manner as to seal both the shell side and the tube side at each joint.

It is a principal object of the invention to provide the type of sealed tube coupling desired in such a heat exchanger, and in other assemblies of similar nature, by means of structure which is mechanically simpler than prior assemblies provided for the purpose with which I am familiar. Such simplification, provided without impairment of efficiency, reduces the number of components required for the assembly, whereby the same is more economical to produce and more easily utilized.

With further regard to the heat exchanger use as representative, normal maintenance of such an exchanger involves regular removal of the head end connections for inspection and cleaning of the tubes and the like, so that the facility with which the couples can be made and opened is a factor of importance, and it is another primary object of the present invention to provide a tube coupling of this character which is quick-opening or such that the necessary manual operations thereon can readily be performed.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claim, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawings:

FIG. 1 is a fragmented and partially sectioned elevation of two exchanger sections interconnected by means of couplings in accordance with the present invention;

FIG. 2 shows the section coupling of FIG. 1 on an enlarged scale;

FIG. 3 is a fragmentary sectional view taken substantially on the line 3—3 in FIG. 1;

FIG. 4 is a sectional view similar to FIG. 2 but illustrating another form of the invention; and

FIG. 5 is a fragmentary sectional view taken substantially on the line 5—5 in FIG. 4.

Referring now to the drawings in detail, FIG. 1 shows one end of a conventional heat exchanger section, which

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may be of hairpin type, comprising an outer shell 1 and an exchanger tube 2 in spaced relation therewithin, the latter having longitudinal heat-dissipating fins 3 about its periphery. Reference numerals 4, 5 and 6 designate, respectively, the same components of a further exchanger section, the tube 5 of which is to be connected to the tube 2 of the first-mentioned section.

The U-shaped external tube 7 is employed for such connection and removably attached at its ends to the exchanger tubes by the new couplings, which further seal the sides or ends of the respectively associated outer shells 1 and 4. Since the couplings are the same at each end, it will suffice to described only one in detail.

As better shown in FIG. 2, a stationary side flange member 8 is welded, at 9, to the end of the shell 1, such shell or casing flange having the same inside diameter as the shell 1 over an axial portion. The outwardly directed end portion is either fully annular or formed with a series of circumferentially spaced lugs at its outer periphery for reception of a plurality of axially extending bolts two of which are shown at 10 and 11 as extending respectively through openings 12 and 13 provided therefor in the shell flange 8.

An extension 14 is welded to the end of the exchanger tube 2 and projects beyond the outer face of the shell flange. Such extension has an enlarged axial portion 15 terminating in an intermediate radial wall 16, and the extension outwardly of such wall is of reduced diameter and externally threaded, as shown at 17. As most clearly illustrated in FIG. 3, the enlarged portion 15 of the extension is provided with flat opposed surfaces 18, and blocks 19 and 20 are welded to the inner wall of the shell flange 8 in closed spaced opposition to the extension surfaces 18. It will be clear that this arrangement precludes significant relative rotation of the shell and tube assemblies for a reason which will later become apparent.

The outer or end face of the shell flange 8 is relieved about its center opening to form a recessed annular seat 21 which is, in the illustrated assembly, substantially planar with the radial surface 16 of the tube extension 14. A cylindrical and fairly heavy nut 22 is threaded on the outer end of the extension 14 with its inner end or face commonly opposed to seat 21 and the radial surface 16. A flat annular gasket 25 is inserted between this end of the nut and the two such surfaces opposed thereto, and the nut is tightened thereagainst, for example, by means of a wrench having lugs engageable in diametrically opposite peripheral openings 23 and 24 in the nut, to seal both the shell and tube sides. It will be clear that the single gasket shown could, if desired, be replaced with two separate seals respectively against the surfaces 16 and 21 and commonly engaged by this end of the nut.

The connector tube 7 has a stationary side flange 26 welded on its end and this flange is approximately of the same size and shape as the shell or casing flange 8. The inner face of the tube flange 26 has an inner relief forming a radial seat 27 of the same outer diameter as the seat 21 in the shell flange 8, and it will be seen that the connecting bolts, such as 10 and 11, are passed through openings in the tube flange 26 and through the respectively aligned openings in the shell flange 8, with nuts, such as shown at 28 and 29, on the bolt ends behind the latter flange. The outer end of the nut 22 is opposed to the seat 27 in the tube flange and a second flat annular gasket 30 is interposed between the two. Accordingly, the bolts are effective to draw the tube flange toward the shell flange to compress the gasket 30 and thus seal the end of the coupled tube 7. The gaskets may of course be made of any appropriate material, including soft metal.

It will also be clear that if the tube 2 is not positively restrained against movement within its shell 1,

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the nut 22 will effectively draw the tube end into proper position, and tightening of the connecting bolts will compress both gaskets for the described sealing.

The modified coupling shown in FIG. 4 differs from the first-described form primarily with regard to the exchanger tube seal. Primed reference numerals have been used in this view to designate those components previously described, and this expedient further shows the differences in the two types of coupling to be localized at the end of the finned tube 2'. Such tube here extends with the same wall thickness through the major extent of the axial portion of the shell flange 8' or approximately to the plane of the seat 21' provided in such flange.

Key blocks 30 and 31 are welded to the outside of the tube 2' respectively opposed to the chordal blocks 19' and 20' at the inner wall of the shell flange, this assembly providing the desired locking of the shell and tube assemblies against significant relative rotation. The outer end portion of the tube 2', projecting beyond the plane of the shell flange seat 21', is provided with a tapered external thread, as shown at 32, and a nut 33 having a corresponding internal thread is engaged thereon, such nut otherwise being similar to the nut 22 used in the first embodiment of the coupling. A gasket 34 is positioned between the seat 21' and the opposed end of the nut 33, with this gasket being of a width approximately the same as that of the seat.

Accordingly, the gasket 34 provides the desired seal between the nut and the shell side flange 8', while the seal of the end of the exchanger tube 2' is provided by the tapered-thread wedging of the nut on the end of such tube. If desired, a sealing compound can be applied to the tapered thread.

The mechanical structure will be seen to be substantially the same in both cases, and the manual operations involved in making and opening the tube connection the same. The tightening of the nut is obviously a simple operation, and there is only one series of bolts for actuation by the workman, as contrasted with prior assemblies wherein the shell side and tube side seals are physically separated in such manner as to require two pairs of flanges each with a series of connecting bolts. The overall length of the new coupling is relatively reduced and there is obviously no problem of convenient access to the elements which must be manipulated by hand tools.

While the illustrated embodiments both employ a cylindrical nut and recessed seats for the flange gaskets, such seats can be relatively raised and a hexagonal nut employed with the same facility and sealing action.

Other modes of applying the principle of the invention may be employed, change being made as regards the de-

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tails described, provided the features stated in the following claim or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

5 In combination, a first tube having a casing concentrically spaced thereabout and a second tube, a coupling for connecting said first tube to said second tube and sealing the end of said casing at said coupling comprising a casing flange provided on said end of said casing to be sealed, a threaded extension on the end of said first tube which projects beyond the end face of said casing flange, a radial enlargement on the end of said first tube having a radial gasket retaining surface adjacent the threaded portion thereof, a recessed annular portion on the end face of said casing flange having a radially extending bottom wall intersecting an inner wall of a passage through said casing flange, a nut on said threaded extension opposed at its inner face to said bottom wall of said recessed annular portion and said radial gasket retaining surface on said radial enlargement, said radial gasket retaining surface on said radial enlargement being in the same radial plane as said bottom wall of said recessed annular portion on the end face of said casing flange thus both cooperating with the inner face of said nut, a gasket interposed between the inner face of said nut and the radial wall of said recessed annular portion of said casing flange and the coplanar radial gasket retaining surface on said first tube, said nut and thus said gasket closing the annular space between said first tube and said casing, chordal surfaces on said radial enlargement cooperating with chordal surfaces on said casing operative to preclude substantial relative rotation of said first tube and said casing, said radial gasket retaining surface otherwise abutting through said gasket substantially all of the exposed inner face of said nut between said first tube and said casing, a tube flange on the end of said second tube to be coupled opposed to the outer face of said nut, a further gasket between said tube flange and nut, and fastener means interconnecting said casing and tube flanges operative to draw the two axially toward one another.

References Cited in the file of this patent

UNITED STATES PATENTS

45	1,512,219	Goosman	Oct. 21, 1924
	2,211,173	Shaffer	Aug. 13, 1940
	2,520,755	Brown	Aug. 29, 1950
	2,695,182	Folz	Nov. 23, 1954
50	2,745,689	Balint	May 15, 1956
	3,002,769	Deubler et al.	Oct. 3, 1961