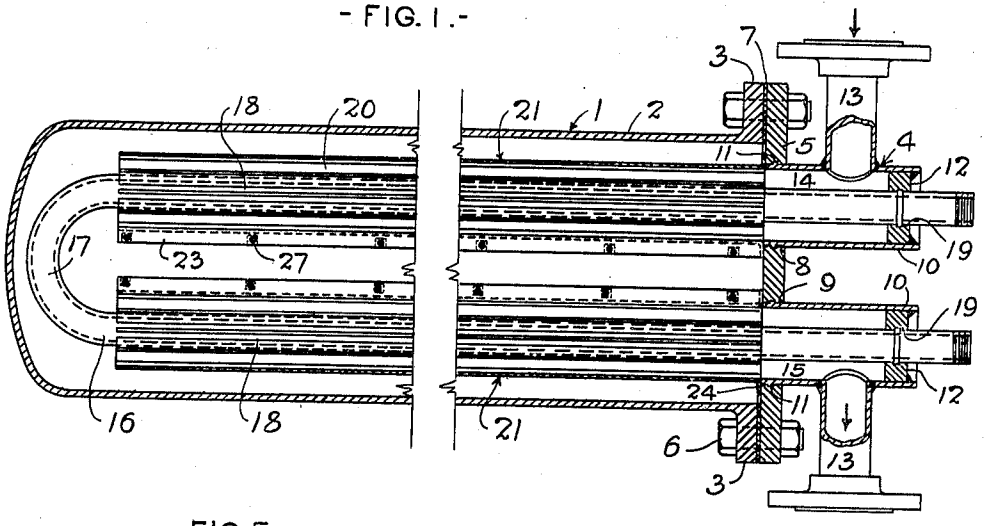
April 4, 1944. A. Y. GUNTER 2,346,104

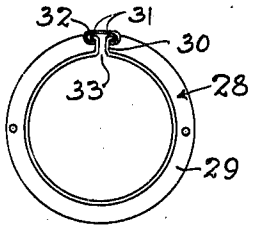
HEAT EXCHANGER

Filed April 4, 1942

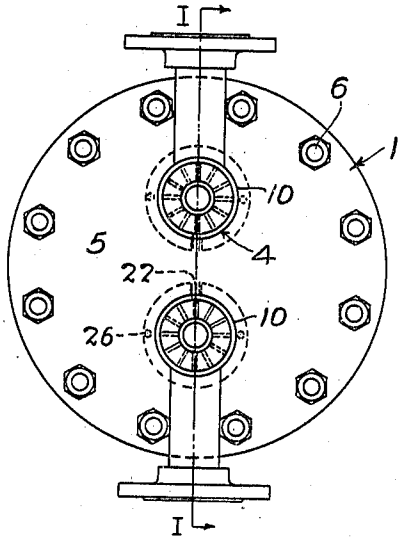
- FIG. 1.-



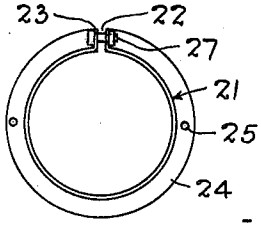
- FIG. 5.-



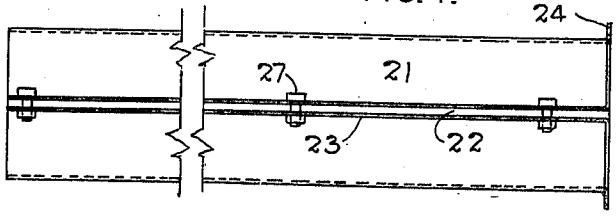
- FIG. 2.-



- FIG. 3.-



- FIG. 4.-



INVENTOR
Addison Y. Gunter
By Samuel C. Yeaton Jr.
ATTORNEY

Patented Apr. 4, 1944 2,346,104

UNITED STATES PATENT OFFICE

2,346,104

HEAT EXCHANGER

Addison Y. Gunter, Larchmont, N. Y., assignor to American Locomotive Company, New York, N. Y., a corporation of New York

Application April 4, 1942, Serial No. 437,632

1 Claim. (Cl. 257—239)

This invention relates to heat exchangers, and more particularly to a removable tube-embracing sleeve therefor.

The object of the present invention is to provide, in a heat exchanger, a tube-embracing sleeve having a longitudinal slit permitting the passage therethrough of the tube.

Referring to the drawing forming a part of this application, Figure 1 is a view of a heat exchanger embodying the present invention taken on the line I—I of Fig. 2, parts being shown in full and parts being broken away, the heat exchanger being shown aforeshortened; Fig. 2 is an end view of the heat exchanger as viewed from the right of Fig. 1; Fig. 3 is an end view of a sleeve shown in Figs. 1 and 2 as viewed from the left of Fig. 1; Fig. 4 is a foreshortened plan view of the sleeve of Fig. 3; and Fig. 5 is a view similar to Fig. 3 but showing a modified form of sleeve.

The heat exchanger, indicated generally by the reference numeral 1, includes a shell 2 open at its forward end and closed at its rear end and having an external orificed bolting flange 3 at its forward end. A header 4 closes the forward end of the shell, the header having a tube sheet 5 secured to the flange 3 by bolts 6, a gasket 7 being provided between the flange and tube sheet, sealing the shell.

The tube sheet is provided with openings 8 and 9. A tubular pipe section 10 is expanded into each of the openings 8 and 9 and extends forwardly therefrom, the expanded joint being made fluid tight by a tongue and groove connection 11. The forward end of each section 10 is closed by an orificed disc 12 which is welded thereto. A pipe fitting 13 is secured to the side wall of each section 10 and opens thereinto. One section 10 forms a header inlet and the other section a header outlet. In the present instance it is contemplated that the section 10 secured in opening 8 form the inlet and it therefore provides an inlet chamber 14. Similarly section 10 secured in opening 9 provides an outlet chamber 15.

A U-tube 16 is disposed in the shell 2 with its U-bend 17 at the rear end of the shell and its straight legs 18 extending forwardly therefrom through sections 10, through the orifices in the discs 12, and forwardly therefrom to the exterior of the exchanger, the forward ends of the legs being threaded. An expanded tongue and groove connection 19 of each leg in its disc 12 is provided, preventing escape of fluid therethrough from the chambers 14 and 15. The legs within the shell are provided with external fins 20.

The type of heat exchanger shown and described forms no part of the present invention, and is by way of example only. The present invention resides in the sleeves, later to be referred to, which coact with the exchanger tubes, and these sleeves have application to other heat exchangers than that shown in the drawing.

Disposed in the shell are sleeves 21, one embracing each leg 18, these sleeves augmenting flow of shell fluid through the fin area of the tubes in accordance with usual practice. The shell fluid from chamber 14 flows through the adjacent sleeve 21 and into shell 2, the rear end of this sleeve 21 opening directly into the shell. The fluid leaves the shell through the other sleeve 21 which is also open directly into the shell at its rear end and which directs the fluid into the outlet chamber 15.

It is desirable to employ removable sleeves so that the fin area of the tubes can be cleaned and inspected when necessary. This is especially true when the fin tubes are permanently secured to the header as in the instant exchanger. Sleeve 21 is therefore made of sheet metal rolled into shape and is provided with a slit 22. In its simplest form the sleeve may be merely a rolled flat piece of sheet iron which, due to its own resiliency, would tightly embrace the fins of the tube. It is not necessary that the edges of the slit come in contact as the same fluid is in the sleeve and shell and some leakage of fluid through the slit has no ill effect, both shell and sleeves being filled with the fluid. The edges of the slit could also overlap if desired. However a more desirable sleeve is provided by the construction shown in Figs. 1 to 4 of the drawing. Here the sleeve is made by rolling sheet metal, and substantially radial longitudinal flanges 23 are provided at the edges of the slit, and a circumferential flange 24 is provided at one end of the sleeve, namely the end adjacent the tube sheet 5. The flange 24 has perforations 25 for screws 26 which removably secure the sleeve to the tube sheet 5. The perforations 25 may be elongated if desired. Flanges 23 are also perforated for bolts 27. Flanges 23 and 24 are preferably but not necessarily formed integral with the sleeve. For instance the flange 24 may be of angle iron ring shape and detachably screwed to the sleeve permitting removal of the sleeve.

To assemble a sleeve 21 with a leg 18 it is

merely necessary to open the slit sufficiently to pass it over the U-bend 17 and to move the sleeve longitudinally along the adjacent leg 18. Sleeve 21 may be smaller in diameter than the fin diameter so that bolts 27 may be tightened to snugly draw the sleeve around the fins. Sleeve 21 may be made of a size to completely close the slit or to leave it open as shown in drawing. The screws 26 securing the sleeve to the tube sheet prevent axial movement of the sleeve. However flange 24 may be done away with if desired, and the pressure fit produced by bolts 27 relied upon to prevent such axial movement of the sleeve.

While it is contemplated that sleeve 21 will tightly embrace the fins it may however loosely embrace them or even embrace them in slightly spaced relation, in which case flange 24 would act as a base for the sleeve, holding it in correct position and preventing axial movement.

A modified form of sleeve is shown in Fig. 5. This sleeve, indicated by the reference numeral 28, has a flange 29 similar to flange 24 and similar remarks apply thereto, and outwardly extending flanges 30, similar to flanges 23 except that they are not perforated, and furthermore has lips 31 extending laterally outward from the edges of flanges 30. These lips are engaged by a clamp 32, as is clearly shown in Fig. 5. Clamp 32 is made from a flat strip of sheet metal with the end portions bent over upon themselves to form slots which engage the lips 31. Clamp 32 may be made as one single long clamp or as several short spaced clamps. When such clamp or clamps are employed it is contemplated that a slit 33 will be provided. However, in general, clamp 32 acts similarly to bolts 27 and the foregoing remarks made with relation to sleeve 21 apply similarly to sleeve 28.

In the exchanger shown in Fig. 1 when it is desired to remove the sleeves, shell 2 is first removed from the header and then sleeves 21 are slid axially off the legs, the slits being open sufficiently to pass over the bend 17 as aforesaid, the screws 26 and the bolts 27, if employed, being first removed. The slits are therefore appropriately shown opposed to each other in line with the U-bend. However, if desired, the slits may be open sufficiently to remove the sleeves in a direction perpendicular to the axis of the legs, i. e., directly over the legs instead of the U-bends. Thus the sleeves are adaptable for use where axial movement is impossible, as for instance where straight tubes instead of U-tubes are employed, in which instance there is a tube sheet at each end of the tubes. If desired the sleeves may be made in two pieces, thereby having two slits. This will facilitate perpendicular removal especially where the shell contains a bank of legs or tubes.

While the foregoing description has been in relation to a U-tube it will be understood that the sleeves have application equally as well to straight tubes. Also the sleeves can be used with finless tubes.

While there have been hereinbefore described approved embodiments of this invention, it will be understood that many and various changes and modifications in form, arrangement of parts and details of construction may be made thereto without departing from the spirit of the invention, and that all such changes and modifications as fall within the scope of the appended claim are contemplated as a part of this invention.

The invention claimed and desired to be secured by Letters Patent is:

A heat exchanger comprising a shell open at one end; a header detachably secured to said shell, closing said end and having two separate compartments opening into said shell, provided one with an inlet and the other with an outlet, and each having an orificed outer end wall; a sleeve disposed over each of said compartment openings provided with a flange at the end thereof adjacent said opening, removably secured to said header, said sleeve extending from its said flange partly through said shell longitudinally thereof, and open at its opposite end to said shell, said shell, compartments and sleeves providing a chamber for a fluid; a U-tube for another fluid having its U-bend disposed in said shell beyond said opposite ends of said sleeves, and having its legs extending one through each of said sleeves and through the correlated compartment and said end wall orifice thereof to the exterior and permanently secured to said end wall whereby said header and U-tube provide a unit, each said sleeve being provided with a slit extending throughout its entire length and through said flange, said slit being openable to permit the passage therethrough of said tube, each said sleeve further having oppositely disposed outwardly extending flanges adjacent each edge of said slit; and removable means engaging said oppositely disposed flanges holding the opposite edges of said slit together.

ADDISON Y. GUNTER.