United States Patent

[11] **3,548,158**

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[54] **HEAT TRANSFER DEVICE**
7 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **219/530,** 219/535, 219/540; 138/33, 138/112; 165/184
[51] **Int. Cl.** **H05b 3/06**
[50] **Field of Search** ..... 219/530, 540, 535—537, 301, 365; 174/47; 165/1, 183—184, 164, 172; 29/157.3; 138/27, 33, 38X, 111—112

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ABSTRACT: A heat transfer assembly for heat transfer between two conduits which are in peripheral contact, one conduit being adapted to take heat from the other, and a heat transfer material between and in contact with peripheral surfaces of the conduits which are out of contact with each other. The heat transfer material may be a sheet wound about the conduits or metal foil spirally wound about the conduits.

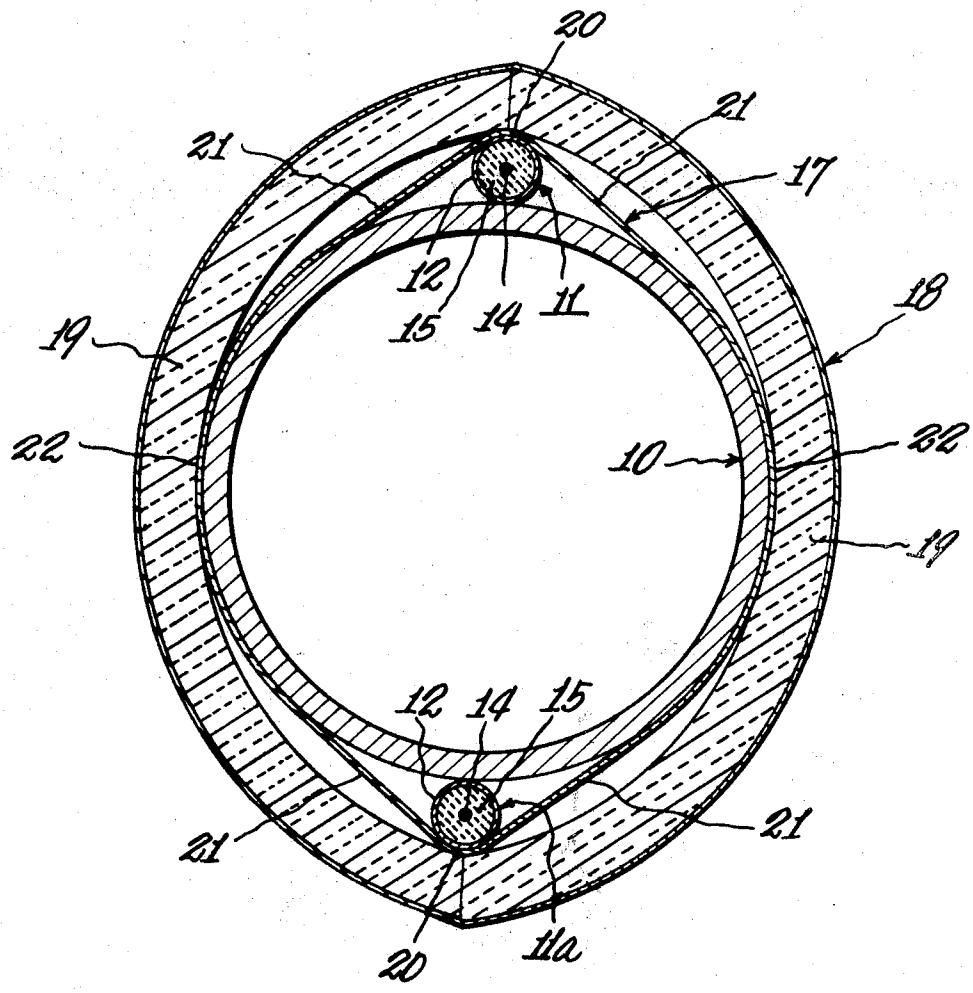


FIG. 1.

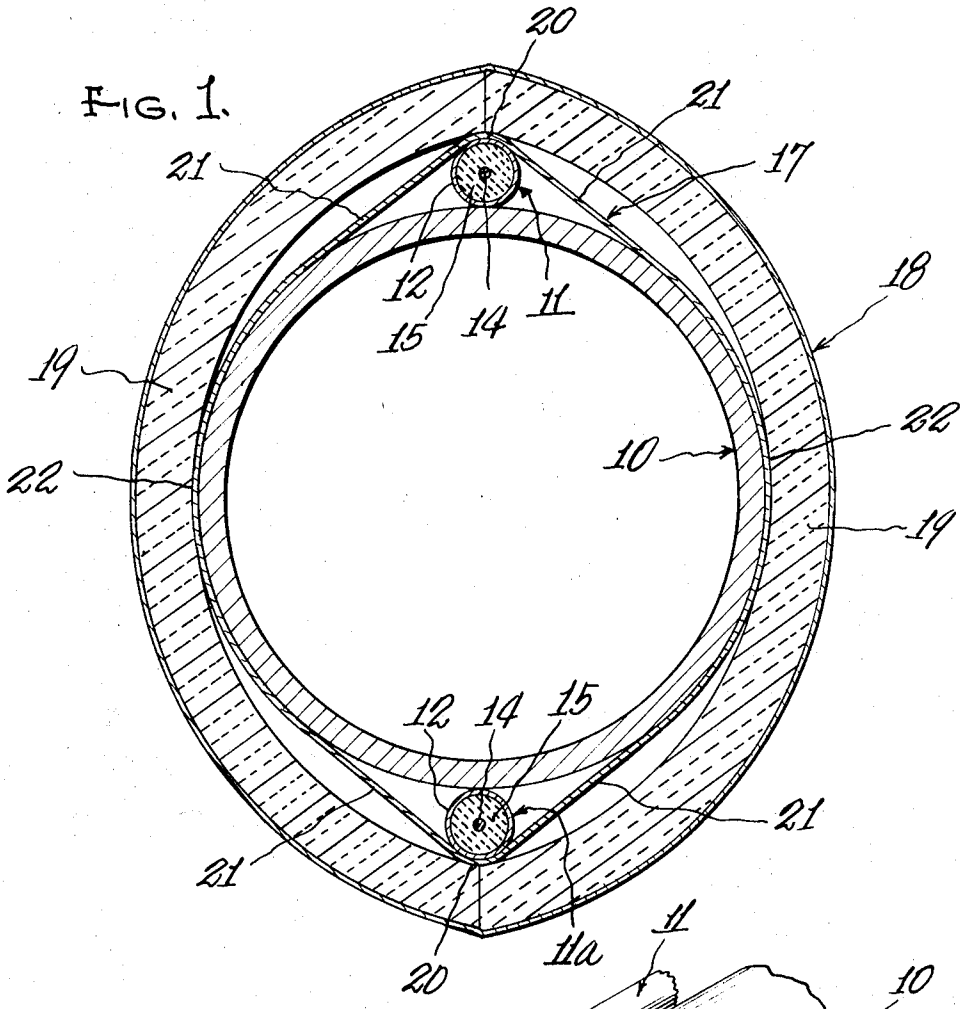
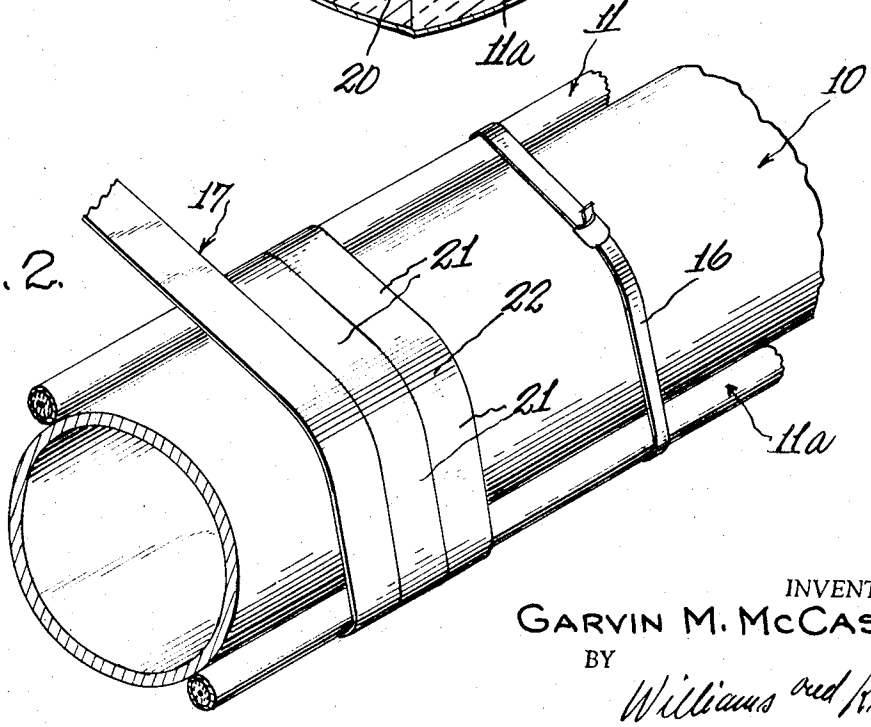


FIG. 2.



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HEAT TRANSFER DEVICE

BACKGROUND AND SUMMARY

There are many applications where two conduits are disposed in peripheral contact so that one takes heat from the other. Such peripheral contact limits the surface engagement between the conduits substantially to a line along the intercontact and this limited surface engagement has caused problems. The problems become more acute when one of the conduits is an electric heating element, since the limited surface engagement requires the heater to be of a high wattage; otherwise heat transfer would require an undesirable length of time. Further, since the heat is conducted along a line contact, the heat is not evenly distributed to the heated conduit and the heater may develop hotspots or oxidize to interrupt or impair its operation.

It is an object of my invention to improve heat transfer between two conduits having peripheral intercontact by disposing heat transfer material between and in contact with peripheral surfaces of the conduits which are out of contact. This enables a lower wattage electric heater to be used, thereby not only conserving power but also increasing efficiency.

DESCRIPTION OF DRAWING

In the drawing accompanying this specification and forming a part of this application, there is shown, for purpose of illustration, an embodiment which my invention may assume, and in this drawing:

FIG. 1 is a section through a heat transfer assembly, illustrating an embodiment of my invention; and

FIG. 2 is a perspective view showing a step in the method of assembly.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawing, the heat transfer assembly comprises conduits **10** and **11**, **11***a*, which are in peripheral intercontact. The diameter of the conduit **10** may be large, small or the same as the diameter of the conduits **11**, **11***a*, and contains a substance to be heated. One or more conduits **11** may be used, and in the present embodiment, the conduits are shown as electric heating elements comprising an elongated metal sheath **12** in which is disposed a heating resistor **14** which is electrically insulated from the sheath by highly compacted mineral insulating material **15**.

As best seen in FIG. 2, the conduits **11**, **11***a* are disposed longitudinally of the conduit **10** in peripheral intercontact, and may be held to the conduit in any desired manner, such as by strapping **16** at spaced places. Up to this point, the assembly method is conventional, and it will be appreciated that the conduits have substantially line contact, assuming that they interengage throughout their coextensive lengths. Such line contact limits the heat-conducting surface between the conduits and thus seriously impairs efficiency of the heat transfer device.

To improve heat transfer between the conduits **10** and **11**, **11***a*, I propose to dispose a heat transfer material between and in contact with the peripheral surfaces of the conduits which are out of contact with each other to additionally transfer heat between the conduits. Such material may be in sheet form and wound about the conduits, and it is presently preferred to wind a strip of metal foil **17** in spiral fashion about the conduits, as seen in FIG. 2, with adjoining convolutions overlapping slightly. Tape (not shown) may be used to hold the end of the wound foil in place. The foil may be coated on its inside surface with a high temperature epoxy to restrict galvanic action, or the foil, conduits and strapping may be formed of compatible metals to restrict such action.

To reduce heat losses, it is preferable to dispose insulating material **18** about the foil-enclosed conduits, and such insulation may take any suitable form, such as preformed halves **19–19** of fiber glass with a backing sheet of aluminum or the like.

As seen in FIG. **1**, the foil **17** passes over those portions **20** of the periphery of the conduits **11**, **11***a* which are opposed to the line of contact with the conduit **10**, and conduct heat from the sheaths of the heaters **11**, **11***a* through spans **21** to portions **22** of the conduit **10**. It will be appreciated that the foil engages the peripheries of the conduits **10** and **11**, **11***a* with more than a line contact because it is wrapped thereabout, and therefore materially assists in even heat transfer from the heaters **11**, **11***a* to the conduit **10**.

I claim:

1. A heat transfer assembly, comprising a metal tube adapted to contain a substance to be heated, an electric heating element having a tubular metal sheath in peripheral contact with the exterior of said metal tube to transfer heat from said element to said tube, and an imperforate metallic banding of good thermal conductivity peripherally around encompassing said tube and said sheath and in contact therewith said banding comprising a plurality of side-by-side portions each transverse of and in peripheral contact with said tube and said sheath at surfaces thereof which are spaced from their peripheral interengagement, the adjoining margins of said portions being in touching engagement with each other and in thermal conducting engagement whereby an unbroken heat transfer covering is provided about said tube and said element to additionally transfer heat therebetween without endangering said heating element to development of localized hotspots at portions along its heating extent.

2. The construction of claim **1** wherein said banding is in the form of long imperforate metal strip which is helically wound about tube and the sheath of said heating element, the helical winding disposing adjoining margins of adjoining laps in interengagement.

3. The construction of claim **2** wherein said strip is a metal foil, and adjoining margins are in overlapped relation.

4. The construction of claim **1** wherein the inner surface of said banding is coated with a substance to restrict galvanic action.

5. The construction of claim **1** wherein said tube, the sheath of said heating element and said foil are formed of compatible materials which restrict galvanic action.

6. The method of improving heat transfer between a metal tube adapted to contain a substance to adjoining margins of the laps in overlapping relation. heated, and an electric heating element having a metal sheath in peripheral contact with the exterior surface of said tube to provide a first path of good thermal conductivity therebetween, the improvement of providing a second path of good thermal conductivity between said tube and said sheath without endangering said heating element to localized hotspots throughout its heating extent, comprising disposing an imperforate metallic banding of good thermal conductivity peripherally around said tube and sheath and in contact therewith with portions of said banding in side-by-side touching engagement with each other and in thermal conducting relation with said tube and sheath at surfaces spaced from their peripheral interengagement, and holding adjoining margins of said portions in thermal conducting relation.

7. The method of claim **6** including helically winding said banding about said tube and sheath with adjoining margins of the laps in overlapping relation.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,548,158 Dated December 15, 1970

Inventor(s) Garvin M. McCaskill

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, lines 49 and 50, cancel "adjoining margins of the laps in overlapping relation heated," and insert -- be heated, --.

Signed and sealed this 9th day of March 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR
Commissioner of Patents