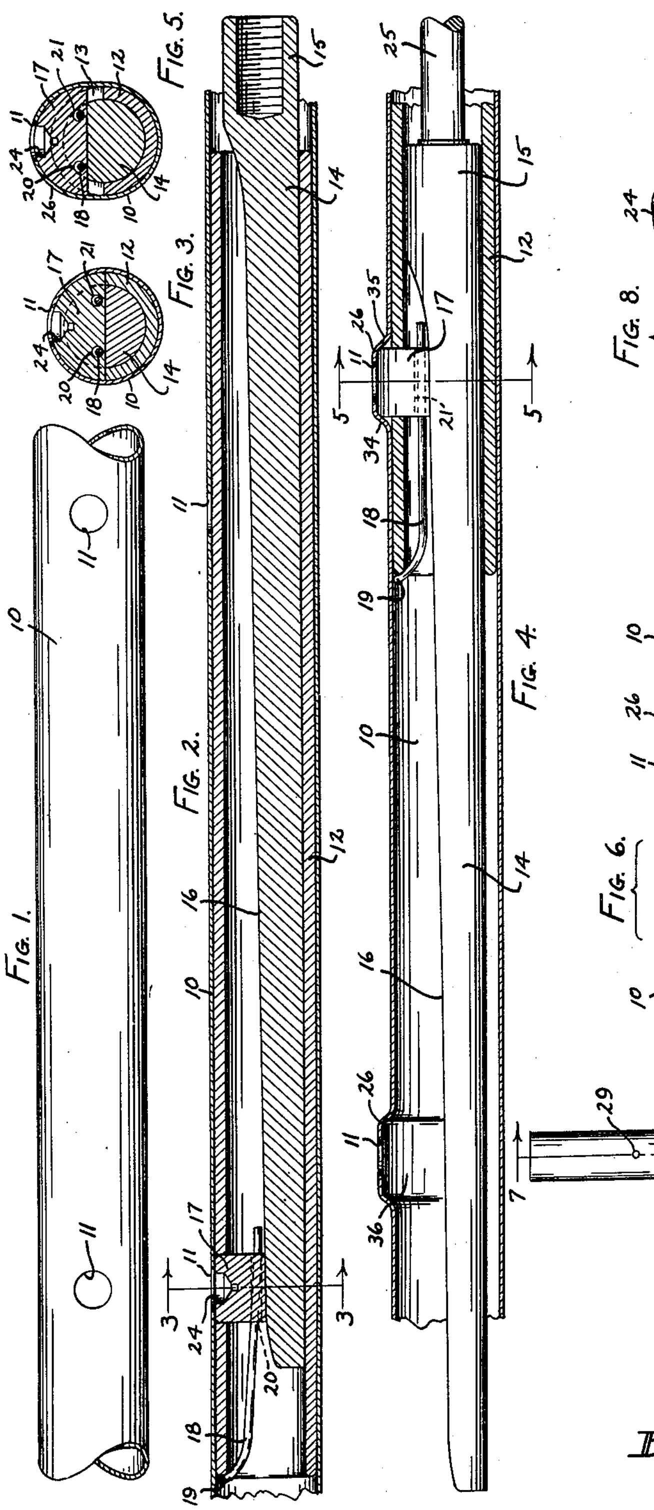
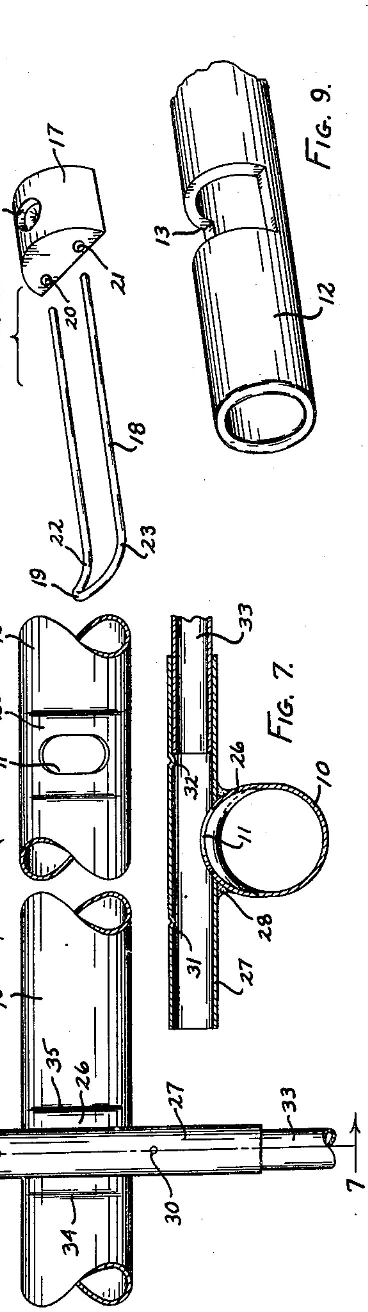
Jan. 23, 1951 J. L. BRADFIELD 2,538,859

TUBE CROSS CONNECTION

Filed June 3, 1947 2 Sheets-Sheet 1





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TUBE CROSS CONNECTION

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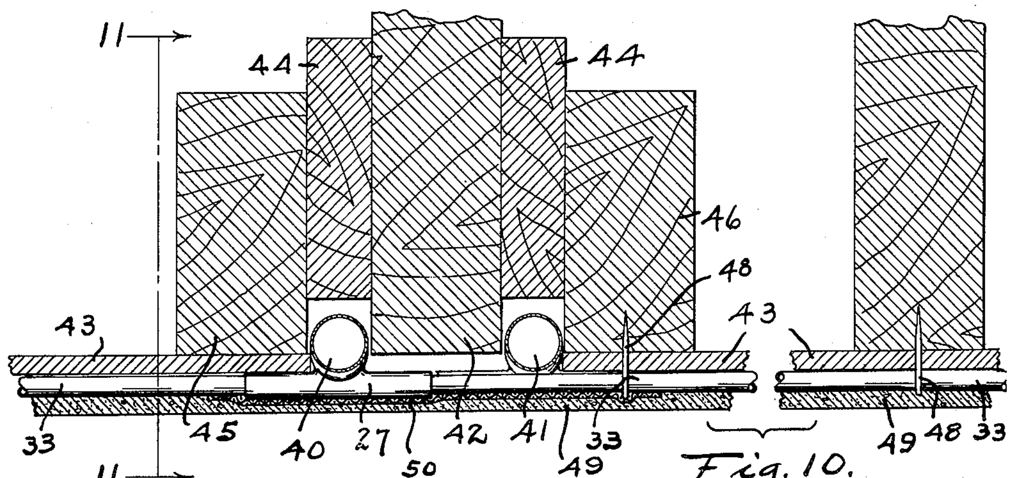
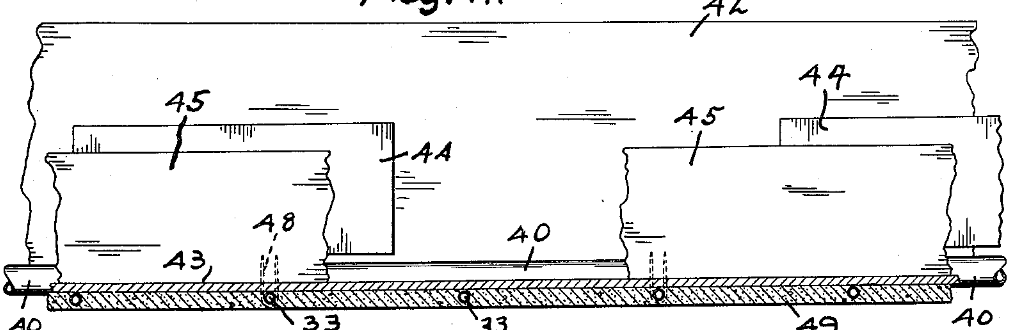


Fig. 10.

Fig. 11.



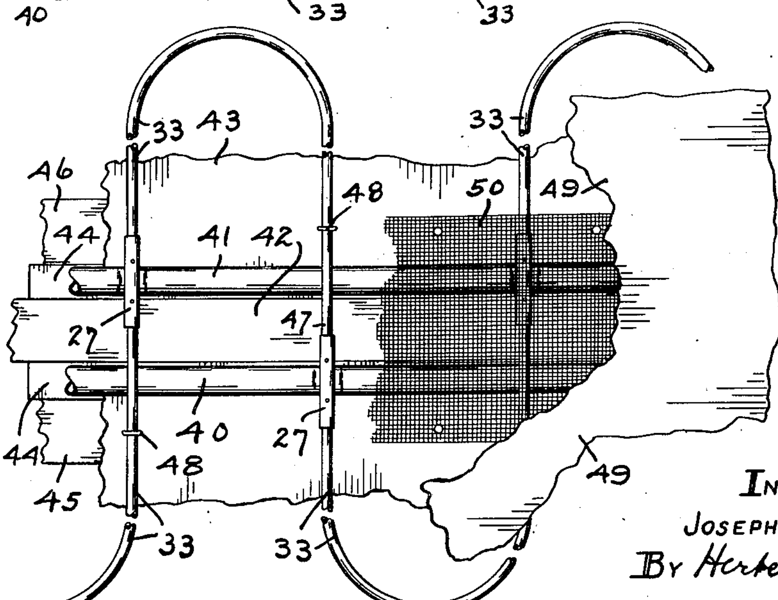


Fig. 12.

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TUBE CROSS CONNECTION

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2 Claims. (Cl. 285—106)

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This invention relates to a radiant heating system and to the method or the process of making lateral flow line connections with supply and return flow lines. A primary object of the invention is to provide a mechanical combination of supply and return flow lines from and to which are connected loops of laterally extending lines, connected to those supply and return flow lines in a manner permitting the lateral lines to be imbedded in the plaster of a ceiling or panels and the like; permitting the lateral loop ends to pass under one of the flow lines without increasing the normal thickness of the plaster or causing a bend in that passing portion; and more importantly permitting the positioning of the supply and return flow lines entirely above the plaster to prevent any appreciable direct conduction of heat primarily from the supply line to the plaster.

In the system herein described, a fluid is circulated through a supply line from a heat source and returned back to that source through a return flow line. A plurality of loops, preferably of such material as copper, extend laterally from these two flow pipes which are normally positioned centrally across the panel from which the heat is to be radiated. These loops have one end connected to the supply line and the other end to the return line. The connections between the loops in these lines are extremely important in the present invention in order, not only to permit one end portion of a loop passing across one flow line to the other without a downward bend, but also to have the axes of these loops so positioned that the supply and return lines are spaced entirely thereabove so as to locate those lines up out of the plaster.

There may be as many as thirty or more lateral loops connected in parallel to the supply and return lines for one room. Heretofore it has been common practice to bury not only these lateral lines or loops in the plaster, but also to bury those supply and return lines. This resulted in a very marked drop in temperature of the fluid between the inlet end and the far end across a room in the supply line due to exchange of heat by conduction loss to the plaster. This resulted in serious temperature shading across the room in the lateral lines because the remote lines along the supply line were receiving cooler fluid than those at the near end of the supply line. Copper is a notoriously known good conductor and one of the primary objects of this invention is to prevent, or at least remove, most of the possibility of that conduction loss of heat from the supply and return lines in order to prevent that

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temperature shading across the panel of the radiated loops.

In the construction herein shown and described the supply line as well as the return line is above the lower face of the ceiling lath and therefore is out of contact with the plaster therebelow. The supply and return lines thus exposed above the plaster may be covered with suitable heat insulating material. The result is that there is practically no drop in the temperature of the fluid as it is flowed through the supply line resulting in fluid entering all of the lateral loops or lines at practically the same temperature.

Furthermore, it has also been found necessary to make a fitting or cross connection with these supply and return flow lines which will have such a form that there will be no murmuring or rippling noises arising from flow of the water in these supply lines as the water travels across these connections. Normally, cross connections with the supply and flow return lines are made at frequent intervals therealong, such for example, as spacings on the order of from six to nine inches apart. This means that there are a large number of cross connections required to install a complete radiant system. Therefore, it is necessary that these connections be made not only exceedingly durable in respect to possible leakage, but that they be made in the most inexpensive manner as well as be made to permit quick connections therewith at the ceiling level with the ends of the lateral pipes or tubes, these cross connections being sufficiently substantial to permit the insertion of the ends of the tube within the connections for soldering or brazing. Preferably the material used in the type of heating herein indicated consists of copper tubing.

An important object of the invention is to provide supply and return flow tubes with multiple outlets over which cross tubes are secured in position in such manner that the cross tube diameter is substantially tangential to the diameter of the flow tube and the flow tube is sufficiently offset or bulged about its opening into the cross tube to permit the cross tube to be saddled across the flow tube and yet maintain the relative position thereof as indicated. A still further important object of the invention is to provide a method for quickly and safely forming the bulged zones in the flow tube and at the same time forming elliptical or elongated openings through that bulged zone.

These and many other objects and advantages will become apparent to those versed in the art in the following description of one particular form of the invention as illustrated in the accompanying drawing in which:

Fig. 1 is a view or bottom plan of a length of a flow tube initially drilled at cross connection spacings;

Fig. 2, a view in central longitudinal section through the flow tube with a bulge forming tool therewithin;

Fig. 3, a view in transverse section on the line 3—3 in Fig. 2;

Fig. 4, a view in central longitudinal section through a length of the flow tube with the tool therewithin and bulged zones formed;

Fig. 5, a view in transverse section on the line 5—5 in Fig. 4;

Fig. 6, a view in bottom plan view of the flow tube with the bulge formed and a cross tube connector across one bulge;

Fig. 7, a view in transverse section on the line 7—7 in Fig. 6;

Fig. 8, a detail in perspective of the tool expanding member;

Fig. 9, a view in perspective of the end portion of the outer shell of the tool;

Fig. 10 is a detail in section of a fragmentary portion of a ceiling construction to which the invention is applied;

Fig. 11, a section on the line 11—11 in Fig. 10; and

Fig. 12, a view from the under side of a fragmentary portion of the ceiling with a portion of plaster removed.

Referring to the drawing in which like characters of reference indicate like parts, a flow tube 10 made of copper is drilled at the desired cross connection locations to form the circular holes 11 therein. It is understood of course, that the length of the tube 10 may be made to be that which can be conveniently handled. For example, a length of six feet may be employed without difficulty in the forming of the cross connections.

I provide a tool which has a tubular shell or sleeve 12 with an external diameter sufficiently less than the internal diameter of the tube 10 to permit the sleeve 12 to be inserted within the tube 10 with a free, sliding fit. Toward one end of the shell 12, Fig. 9, a window 13 is cut across the shell 12 down to about the diametrical plane. Within the shell 12 is inserted a cam or wedge member 14. This member 14 has a cylindrical head 15 of a diameter to produce a sliding fit between it and the inside of the shell 12. From this head 15, the member 14 slopes by a flat face 16 gradually downwardly to terminate substantially within the diametrical plane of the head 15. The under side of the member 14 is curved to conform with the inside curvature of the shell 12. A block 17 substantially semi-cylindrical in shape, Fig. 8, is provided to have a length slightly less than the length of the window 13 so that the block 17 may be slidingly entered between the ends of that window across the shell 12 to have the under face of the block 17 rest by its outer end portions across the shell wall portions defining the longitudinal ends of the window 13. When the block 17 is thus positioned its curved surface is of the same curvature as that of the outer face of the shell 12. A keeper 18, Fig. 8, generally in the shape of a hairpin, has its outer looped end 19 preferably secured to the outer end of the shell 12 in any suitable manner such as by brazing, to have the keeper 18 extend within the shell 12 and enter by its two prongs loosely within spaced apart holes 20 and 21 drilled longitudinally through the block 17 near its base. To facilitate the mounting of the keeper 18 and to have its prong normally parallel with the axis of the shell 12, the keeper is provided with bends 22 and 23 adjacent the outer looped end so that the end 19 may be curved around upwardly against the outer end of the shell 12. Preferably for locating purposes the top side of the black 17 is provided with a bore 24 equal in diameter to or slightly less than the diameter of the holes 11.

The shell 12 with the block 17 mounted thereon as above indicated is inserted into the tube 10, and as indicated in Fig. 2, the bore 24 of the block 17 is centered under a tube hole 11, a left hand hole in the present showing. Then the cam member or bar 14 is entered in the shell 12 to have its thinner end carried under the block 17. Pressure is applied to the bar head 15 by any suitable means such as through a rod 25, Fig. 4, operated by a hydraulic cylinder (not shown) and the bar 14 is forced longitudinally along within the shell 12 (the shell 12 remaining stationary relative to the tube 10) whereby the block 17 is forced laterally against the limited area of the tube 10 which is exposed over the block 17. As indicated in Fig. 4, in reference to the right hand hole 11, the block 17 will stretch the wall of the tube 10 to form the bulge 26. Upon stretching the tube wall to form this extended bulge 26 the hole 11 assumes the generally elliptical shape as indicated in Fig. 6 which is the final desired shape of this hole 11. This operation of forming a bulge 26 about each hole 11 and the production of the elliptical shape of the hole is repeated at the position of each hole 11 along the tube 10. A cross tube 27 of much smaller diameter than that of the flow tube 10 is cut away on one side by any suitable means such as by a circular milling cutter to a sufficient depth to permit the connector tube 27 to fit across the bulge 26 and have the margin of the opening in it fit around the margin of the hole 11, Fig. 7. The depth of the cut into the connector tube 27 is made to be such that the under side of the connector tube 27, Fig. 7, is tangential to the outer side of the flow tube 10 between bulges 26. The connector 27 is brazed in position across the hole 11 to fix it and to seal the joint therearound against leakage, a fillet 28 being preferably run around the joint to reinforce the connection.

The connector tube 27 is initially provided with spaced apart prick punchings 29 and 30 to form the rounded projections 31 and 32 within the bore of the tube. These projections 31 and 32 serve as limiting stops against which the end of the lateral radiating tube 33 may be abutted when that end is inserted within the connector tube 27. These ends are sweated to the connector tubes 27 for leak-proof connections.

In the process of forming the bulges 26 it is to be noted that the tube wall is stretched primarily laterally to leave rather short fillets 34 and 35 across the tube 10. The pockets 36, Fig. 4, formed inside of the tube 10 inside of each of the bulges 26 are normally on the under side of the tube 10 when the installation is made. These pockets 36 are sufficient to set up the desired resistance to flow longitudinally of the tube 10 to induce lateral flow through the connector tube 27, and yet the shape is such that no sound is evident in the installation. It is understood of course, that in the radiating heat installation, water is circulating throughout the various pipes or tubes to maintain the fluid therewithin at the required temperature.

Now referring to Figs. 10–12, the supply and return flow lines 40 and 41 respectively each constituting lengths of the tubing 10 above described with the connector tubes 27 mounted thereon, are placed along the sides of the lower portion of a joist 42. In the form herein shown, the plaster backing is shown to be the now customarily employed plaster board 43. At the joist 42 along which the lines 40 and 41 are positioned, Fig. 10, a spacing strip or as herein shown, a plurality of spacing blocks 44 are secured to both sides of the joist 42, the thicknesses of these blocks 44 being close to but slightly larger than the diameter of the lines 40 and 41. Then across these blocks 44 are fixed, one on each side of the joist 42, the plaster board nailing or securing strips 45 and 46. This plaster board 43 is secured to the under sides of the strips 45 and 46 to terminate at their inner opposing edges to permit insertion of these lines 40 and 41 along the sides of the joist 42 and within the strips 45 and 46. Then the tubing 33 has one end secured in a connector tube 27 on the line 41 for example, Fig. 12, and is carried out across the ceiling and looped around to come back by its other end 47 to cross under the line 41 and fit in the connector tube 27 on the flow line 40. This looped arrangement of the tube 33 is carried directly against the plaster board 43 and secured in position by any suitable manner such as by staples 48, this securing means likewise retaining the lines 40 and 41 in their positions along the joist 42.

A six inch wide strip of metal screen 50 or plaster lath having openings therethrough limited in size to allow only sufficient plaster to flow therethrough to clinch on the top side, is placed over the pipes 40 and 41 and tacked along its edges to the strips 45 and 46, Figs. 10 and 12. Then, when the plaster 49 is applied, the screen 50, being spaced from the board 43 by the undersides of the tubes 27, the plaster 49 will be withheld entirely from contact with the pipes 40 and 41, while the tubes 33 will be embedded in the plaster 49 on each side of the screen 50. In this respect, reference is made to my prior Patent No. 2,338,090, issued January 4, 1944.

Thus it is to be seen that while the radiating tubes 33 are imbedded in the plaster 49, they pass under the flow lines 40 and 41 without having to be bent thereunder in order to reach the connector tubes on the other line. Also by reason of the lines 40 and 41 further being spaced through the connector tubes 27 as above indicated these lines 40 and 41 are removed from the plaster 49 so that conduction loss from those tubes is negligible. The space between the strips 45 and 46 may be filled in with suitable insulating material over the lines 40 and 41, or they may be left open as indicated in the drawing.

While I have herein shown and described my invention in the one particular form, it is obvious that many structural variations may be employed without departing from the sprit of the invention and I therefore do not desire to be limited to that precise form beyond the limitations which may be imposed by the following claims.

I claim:

1. A tube cross connection comprising a tube with an outwardly localized bulged zone of the tube wall; said zone having a hole therethrough elongated transversely of the tube and generally elliptical in contour; and a connector tube of less diameter than that of said first tube and having an arcuate opening along one side, the chordal length of which opening is substantially equal to the major length of said zone hole, said connector tube being positioned transversely across said first tube to have its opening coincide with said hole; and means securing the two tubes one to the other; the said connector tube being approximately tangential to said first tube.

2. A tube cross connection comprising a header tube; a localized outwardly bulged integral zone of the wall of the tube having a substantially elliptical hole therethrough and having its major axis transversely disposed across the zone; said zone being exteriorly convexly curved transversely of the tube; a cross tube having a substantially elliptical hole therethrough with its major axis parallel to its longitudinal axis, the over-all length of the cross tube hole being approximately equal to that of said header tube hole, said cross tube being positioned transversely across said zone whereby the margins of both of said holes substantially coincide; and a brazed connection between said two tubes around said holes forming a fluid tight joint between the tubes; said zone having its outer wall spaced from the axis of the header tube to locate the axis of said cross tube that distance from said header tube axis substantially equal to the radius of the external surface of the header tube plus the radius of the external surface of the cross tube.

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