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CLOSING ENDS OF METAL TUBES

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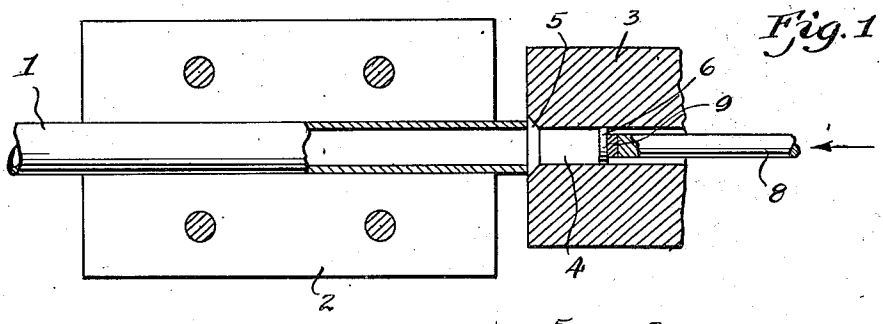


Fig. 1

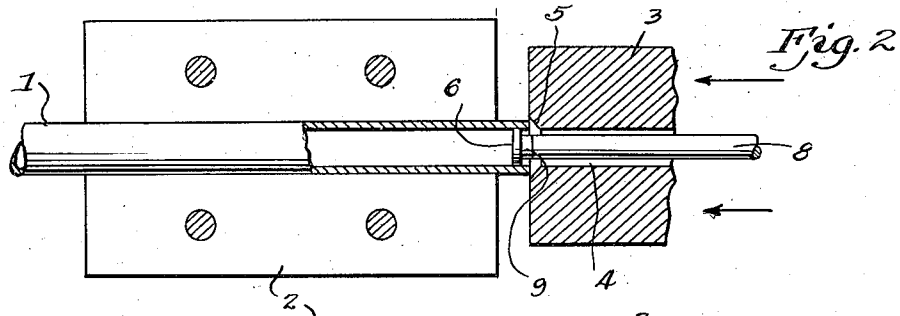


Fig. 2

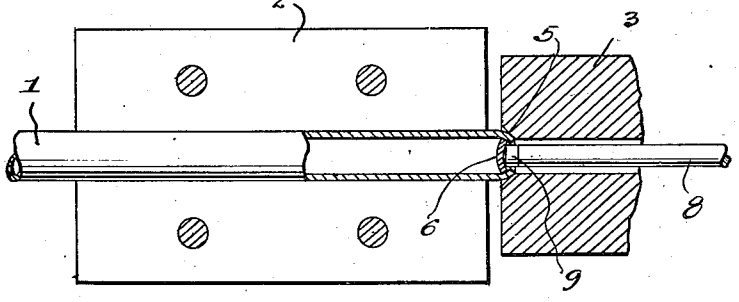


Fig. 3

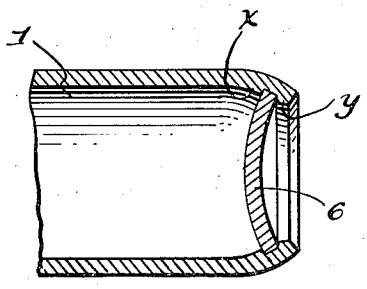


Fig. 4

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CLOSING ENDS OF METAL TUBES

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3 Claims. (Cl. 29—148.2)

This invention relates to the closing or sealing of the ends of metal tubes.

The principal object of the invention is to provide a novel structure for closing or sealing the end of a metal tube and a method in which all operations are performed on the tube at the end to be sealed and without requiring the insertion of an instrument or tool from the opposite end of the tube.

The structure of the invention is one which may be employed for a number of purposes. For example, the structure may be used on tubing which is to be used with refrigeration equipment, and the length of tube with its sealed ends may be shaped and fashioned into the desired coils or shapes and the final steps may be that of opening the tube ends and charging the same with refrigerant. Thus the interior of the tube is kept clean and devoid from a collection of extraneous material. Another place of use is in bombs or explosive shells where a closed tube is used for ignition purposes.

The structure and the method are disclosed in the accompanying drawing wherein

Fig. 1 is a view illustrating the tube and sealing element associated with diagrammatically illustrated apparatus for performing the method.

Fig. 2 is a view similar to Fig. 1 showing the sealing element inserted in the end of the tube.

Fig. 3 is a view showing the final step of swaging the end of the tube for sealing purposes.

Fig. 4 is an enlarged cross sectional view showing the sealed end of the tube and illustrating how the metal flows.

In disclosing the invention both as to method and structure, it appears to be most expedient to proceed in the order of the steps of the process. In Fig. 1, the tube is illustrated at 1 while a holder or clamping device for the tube is illustrated at 2. This clamping device may be made in any suitable way to be opened and closed so that a length of tube may be placed therein, and then gripped and held in position. A swaging tool is illustrated at 3, and it is provided with a bore 4 therethrough, one end of which has an outward flare as at 5. A sealing member is illustrated at 6, and this is in the form of a metal disc. A feeding plunger for the disc is illustrated at 8, and for the purpose of holding the disc it may have a magnetic tip 9.

In sealing a tube, one end of the length of tube is placed in the holder 2 with its end abutting against the swaging tool substantially as illustrated in Fig. 1. The feed plunger is retracted so that a sealing disc may be placed thereon and magnetically held, and then the plunger advances the disc into the tube as substantially illustrated in Fig. 2. Insofar as the method is concerned, the movement of the feeding plunger and the opening and closing of the holding device and the placing of the tube therein, may be done by hand or by suitable mechanical means.

The disc preferably has a snug fit with the interior of the tube so that it is more or less held positioned frictionally as well as magnetically. Now, as shown in Fig. 3, the swaging tool 3 is advanced toward the end of the tube and the inclined walls 5 engage the end of the tube to swage the same and thus contract the end of the tube as substantially illustrated in Figs. 3 and 4. This gives the end of the tube a sort of tapered formation. The disc is originally positioned so that it is subjected to the pressure of the swaging tool. Furthermore, the metal of the tube is swaged to an extent such that the sealing disc is subjected peripherally to pressure and deformed. As illustrated in Fig. 4, the sealing disc is deformed into a concavo-convex formation with the convexity facing inwardly of the tube and the concavity facing outwardly. The disc is thus deformed with its concavity facing outwardly apparently because the forces applied to the disc are greater in the region adjacent the side which becomes concave than in the region adjacent the side which becomes convex. The metal in the tube wall at the swaged end, being forced into a smaller radius, is caused to flow with the result that the wall becomes thickened. Yet the disc offers a substantial resistance to deformation. As a result, the metal in the wall of the tube flows over or into overlapping relationship with the peripheral edges of the disc as illustrated at X and Y.

The structure, accordingly, is one capable of withstanding substantial internal pressures. The method is preferably performed with the metals in a cold condition, that is to say, at room temperature, but the engagement at the interfaces between the tube wall and the disc is such as to withstand large internal pressure without leakage. Where conditions of use require, it is, of course, within the invention to so unite the disc and tube wall at the seam by molten sealing metal as for example, by the application of solder or brazing metal.

I claim:

1. The method of closing the end of a metal tube which comprises, placing a substantially flat metal disc having a diameter substantially cor-

responding to the internal diameter of the tube within the end of the tube in a position so that the end of the tube projects beyond the disc, subjecting the projecting end of the tube and the portion thereof surrounding the disc to external pressure with the tube and disc in a cold state to reduce the projecting end of the tube to an internal diameter less than the diameter of the disc and to deform the disc into a concavo-convex formation with the concavity thereof facing outwardly and to cause the metal of the tube wall to thicken and flow over the peripheral edges of the disc.

2. The method of closing the end of a metal tube which comprises, placing a substantially flat metal disc having a diameter substantially corresponding to the internal diameter of the tube within the end of the tube in a position so that the end of the tube projects beyond the disc, applying swaging forces to the projecting end of the tube and to the portion thereof surrounding the disc with the tube and disc in a cold state to deform the disc into concavo-convex formation with the concavity facing outwardly, to reduce the projecting end of the tube to an internal diameter less than that of the deformed disc and to cause the metal of the tube wall to thicken and flow over the peripheral edges of the disc.

3. The method of closing the end of a metal tube which comprises, placing a substantially flat metal disc having a diameter substantially corresponding to the internal diameter of the tube within the end of the tube in a position so that the end of the tube projects beyond the disc, holding the tube in a fixed position, swaging the end of the tube by advancing a swaging tool axially of the tube and into swaging engagement with the end of the tube with the tube and disc in a cold state to reduce the projecting end of the tube to an internal diameter less than the diameter of the disc and to partially collapse the disc into concavo-convex form with its concavity facing outwardly and to cause the metal of the tube wall to thicken and flow over the peripheral edges of the disc.

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