

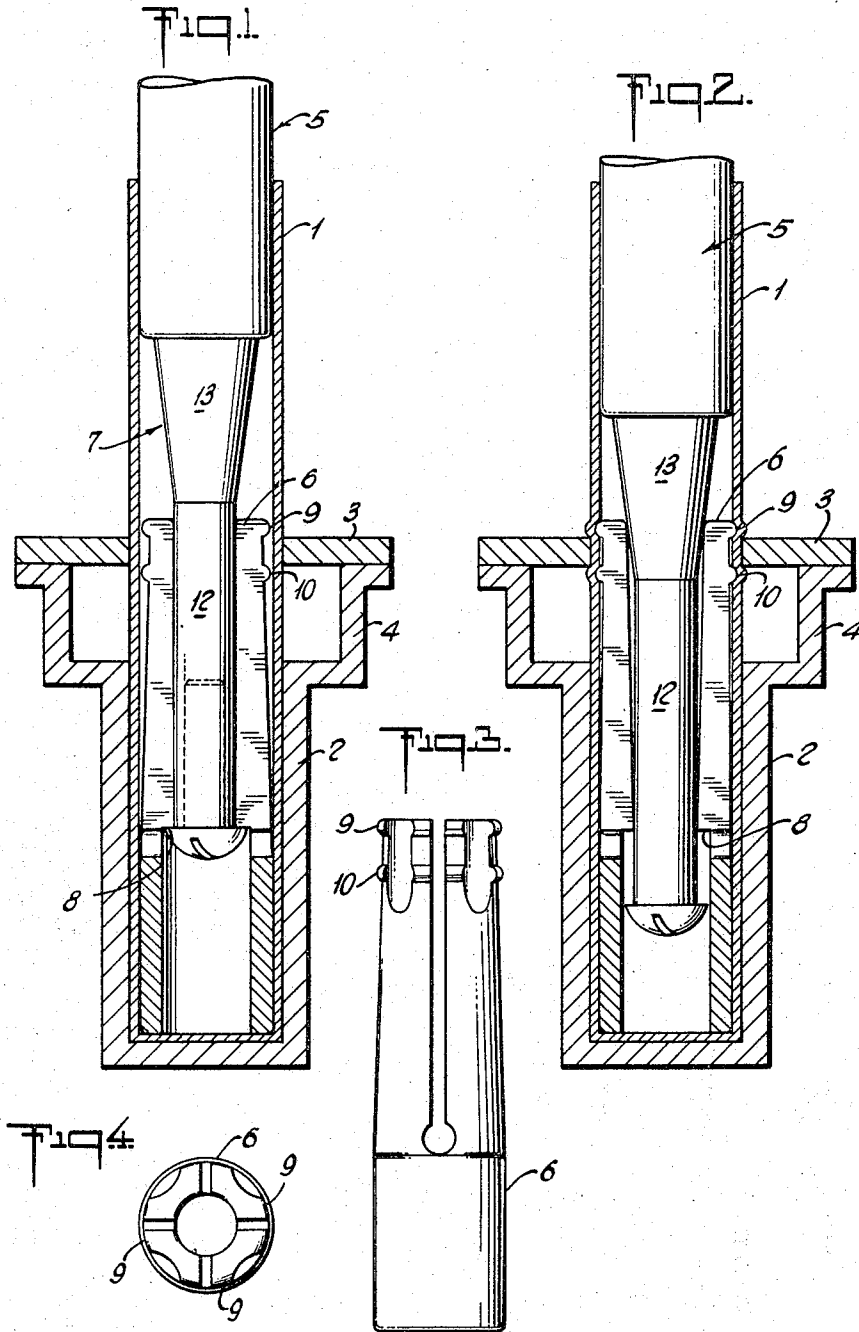
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APPARATUS FOR AFFIXING A FLANGE TO A TUBE

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1

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APPARATUS FOR AFFIXING A FLANGE TO A TUBE

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2 Claims. (Cl. 29—243.52)

This is a division of application Ser. No. 316,613, filed Oct. 16, 1963, now abandoned.

This invention relates to a method and apparatus for affixing a flange to a tube. More specifically, the invention is directed to techniques for affixing a flange to a tube without causing a reduction to the internal diameter of the tube.

In Patent No. 3,037,800, assigned to Murray Manufacturing Corporation, techniques are described for affixing a flange to one end of a tube. The tube and flange described in that patent and the tube and flange described and claimed in the instant application are for use with an electromagnetic circuit breaker. In the circuit breaker, the tube is hydraulically filled and hermetically sealed.

The internal dimensions of the tube are critical because a magnetic pole piece travels axially within the tube during operation of the circuit breaker.

In the aforementioned patent, the external flange is affixed to the circumferential area adjacent the closed end of the tube. The flange is staked to the tube by deforming a portion of the flange close to the tube, so as to displace part of the flange material into the wall of the tube. A slug is located internally of the tube adjacent the flange and wedged in place. Although the invention described in the aforementioned patent is generally satisfactory, it is limited to an assembly where the flange is affixed at the closed end of the tube.

Accordingly, it is the object of this invention to provide a technique for affixing a flange to a tube anywhere along its perimeter and without the requirement of a slug on the inside of the tube.

It is a further object of the invention to provide a technique for affixing a flange to a tube without causing any reduction in the internal diameter of the tube.

In accordance with an aspect of the invention, the flange is located a desired distance from one end of the tube which may be either the open or closed end. The flange is an annular member closely surrounding the circumference of the tube. An expansible punch is inserted into the tube and has a die portion shaped to form rims on opposite sides of the flange; the rims are sufficient to stake the flange to the tube. The punch is expanded to produce the rims and then collapsed and removed from the tube.

The above mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a cross-sectional view showing the tube, punch and flange prior to the expansion of the punch;

FIG. 2 is a similar view showing the punch in the expanded condition;

FIG. 3 is a side view of the punch; and

FIG. 4 is a top view of the punch.

Referring first to FIG. 1, there is illustrated a tube 1, preferably made of brass or other suitable malleable material. The tube 1 is located preferably automatically within a tube holder 2, which is designed to support the tube during the staking of the flange to the tube.

2

The flange 3, preferably made of steel, is an annular member having a diametral opening just slightly greater than the external diameter of the tube 1. The flange is positioned around the tube and is supported by the arms 4 of the tube holder 2. The location of the flange on the tube is predetermined, and by the length of the tube holder is selected accordingly.

The flange 3 is staked to the tube 1 by means of a punch 5. The punch comprises an expansible body portion 6 and an actuating rod 7 which produces the desired expansion.

The expansible body portion is shown in detail in FIGS. 3 and 4 and is in the form of a hollow cylinder slotted longitudinally at quadrant intervals to provide the desired expansibility. As shown in the drawing, the punch body 6 is hollow and the lower portion of the punch body is formed with an enlarged bore which joins the upper hollow portion of the punch; the openings are joined by a ledge 8.

The upper face of the punch body 6 is in the form of a die containing pairs of axially spaced projections 9 and 10. When the punch is fully inserted into the tube 1 so that the bottom of the punch comes to rest on the base of the tube, or equivalent support if the tube is open ended, the pairs of projections 9, 10 are located approximately in line with the upper and lower faces of the flange, respectively. The space between the projections 9 and 10 is approximately equal to the thickness of the flange 3.

The punch body is expanded by the actuating rod 7, which comprises a cylindrical portion 12 having an external diameter less than the internal diameter of the punch body 6. The length of the cylindrical rod 12 is approximately equal to the length of the hollow portion of the punch body, as shown in FIG. 1. The cylindrical rod 12 is integral with or connected to a tapered rod 13 whose diameter gradually increases to a dimension sufficient to produce the desired expansion of the punch.

In the unactuated condition, as shown in FIG. 1, the cylindrical rod 12 is inserted in the punch body 6. The staking is produced by actuating the rod in the downward direction, as shown in FIG. 2, so that, the tapered portion 13 enters into the hollow portion of the punch body 6. The die face is gradually extended and the projections 9 and 10 are forced radially outwardly to form rims on opposite sides of the flange faces.

The actuating rod 5 is coupled to the punch body 6 very simply by means of a screw which has a head engaging the ledge 8 between the different sized openings in the punch body 6. The coupling, therefore, permits axial freedom of the actuating rod in the downward direction, as shown in FIG. 2. The enlarged bore diameter is, of course, greater than the diameter of the screw head.

Upon withdrawal of the actuating rod 5, the expansible body collapses to its normal diameter upon removal of the tapered arm 13. Further withdrawal of the arm 5 causes the screw head to engage the ledge 8 and carry with it the punch body 6. The tube and flange are thus staked together and the assembly is removed from the tube holder 2.

It is apparent from the foregoing description that the invention is relatively simple, requiring only a few parts, and is capable of producing the desired staking without reducing the internal diameter of the tube.

While the foregoing description sets forth the principles of the invention in connection with specific apparatus, it is to be understood that this description is made only by way of example and not as a limitation of the scope of the invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. Apparatus for affixing an external flange to a metal tube, comprising an expansible punch having an external diameter slightly less than the inside diameter of said tube, whereby the punch may be inserted into said tube, one end of said punch being in the form of a die and having axially spaced projections, the axial separation between said projections being approximately equal to the thickness of said flange, said punch being in the form of a tube, the upper portion of which is longitudinally slotted to provide radial expansibility, tubular means having means associated therewith for engaging said punch and said tube end, for locating said flange around said tube a given distance from the end of the tube and for limiting the movement of said punch during the expansion thereof, the flange fitting snugly around said tube, and punch expanding means attached to said punch capable of expanding said die to cause said projections to deform the tube metal outwardly and thereby staking said flange, said punch expanding means comprising a rod, a first portion of said rod being located inside the slotted portion of said punch when said punch is in the unexpanded condition, a second portion of said rod being tapered to produce the desired expansion when the tapered portion is

inserted into said punch, and means coupling an end of said rod to said punch with freedom of axial movement of said rod in the punch expanding direction, but engaging said punch when it is desired to remove said punch from the tube.

2. The apparatus according to claim 1, wherein said punch is provided with an enlarged radial bore at the end opposite the die, the length of said bore being greater than the length of said tapered portion of said rod, and said coupling means comprises a member attached to the end of said first portion of said rod and extending into said enlarged bore and having a radial width greater than the internal diameter of said tube, whereby the rod may be moved axially into said bore, but upon withdrawal said member engages the ledge between the bore and tube diameter and the rod carries said punch with it.

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