

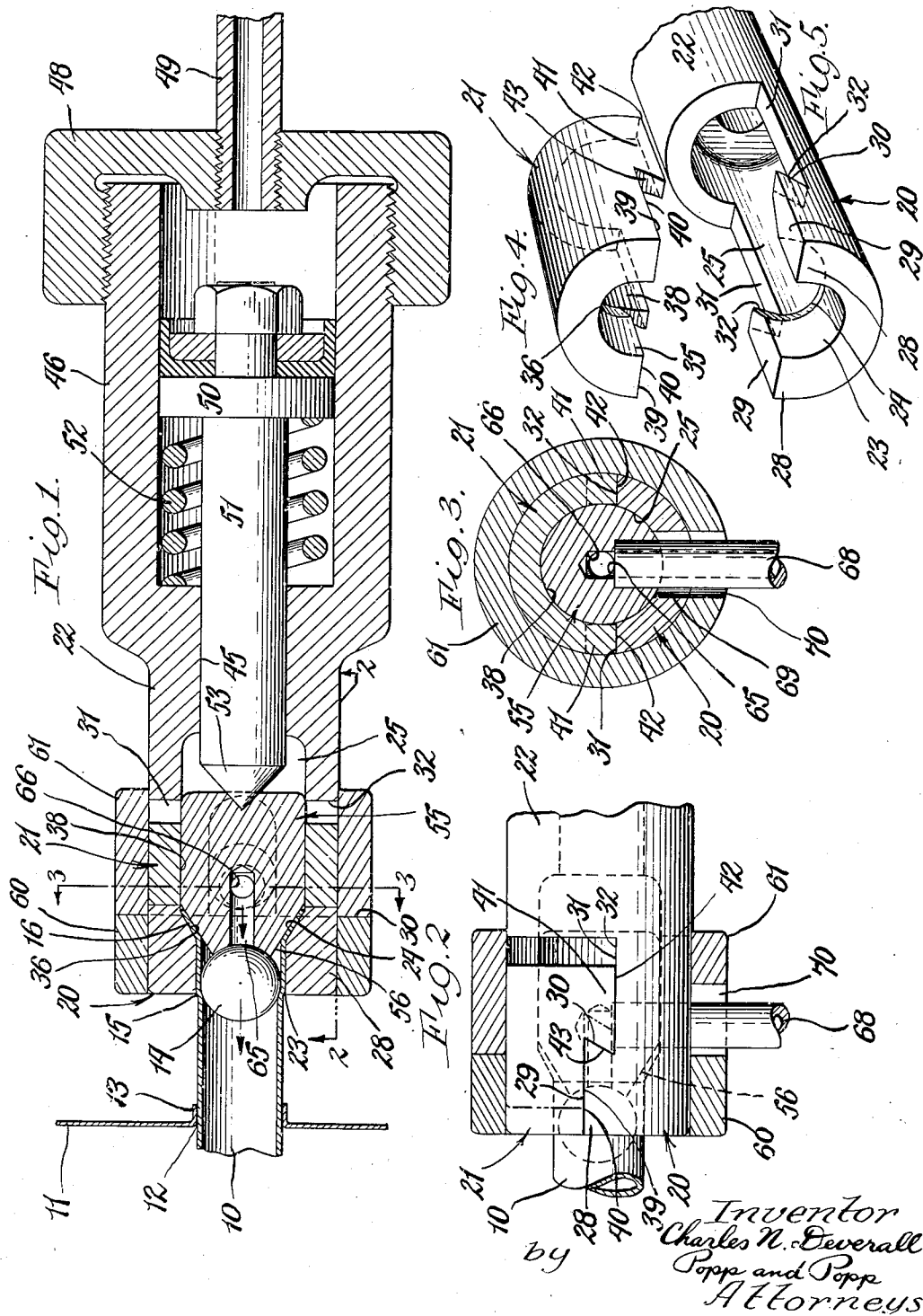
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HOLDER FOR THE ENDS OF TUBES

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HOLDER FOR THE ENDS OF TUBES

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This invention relates to a holder for the ends of tubes and more particularly to such a holder which can be quickly applied to and released from the end of a tube to clamp the same and through which fluid pressure can be applied to the interior of the tube for expanding the tube.

In the manufacture of extended surface heating and cooling coils fins are provided on the exterior of the tubes of the coils to provide the extended surface. In the form of such extended surface coils to which the present invention particularly relates the fins are in the form of sheet metal plates having a plurality of registering holes therein. These plates are arranged in spaced relation with their holes in register, a plurality of tubes being then inserted through the registering holes. It is then necessary, in order to secure good thermal contact between each of the tubes and the fins, to expand the tubes. This is done, in the use of the present invention, by driving a ball, under fluid pressure, through the tube, this ball being oversize so as to progressively expand the diameter of the tube in order to tightly seize each of the surrounding fins.

It is apparent that in such expansion of the tubes comparatively high fluid pressures must be employed and hence the end of the tube from which the ball is driven must be firmly clamped by a holder. It is further apparent that such a holder must have a leak-tight seal with the end of the tube since otherwise the pressure medium, which is preferably a liquid, would escape. It is also apparent that such a holder must be readily and easily applied to and removed from the tube end since otherwise other methods of driving the ball through the tube would be less costly.

It is accordingly one of the objects of the present invention to provide a holder for the ends of tubes which is relatively light in weight and readily portable so that it can readily be brought into position to be applied to the end of a tube.

It is a further object of the invention to provide such a holder which can be quickly applied to and removed from the end of the tube.

Another object of the invention is to provide such a holder which firmly clamps the end of the tube so that there is no danger of accidental release thereof, or of the leakage of fluid because of the high pressures which are necessarily applied through the holder to the interior of the tube.

Another aim of the invention is to provide such a holder through which a high pressure medium is introduced into the end of the tube.

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Another aim of the invention is to provide such a holder which can be clamped and released hydraulically or by any other fluid pressure medium.

Another object is to provide such a holder which is simple in construction and which will stand up under conditions of severe and constant use without getting out of order or requiring repairs.

Other objects and advantages will appear from the following description and drawings in which:

Fig. 1 is a vertical longitudinal section through a holder for the ends of the tubes embodying my invention and showing the same applied to the end of a tube for the purpose of expanding the tube into firm engagement with a fin thereof.

Fig. 2 is a fragmentary sectional view similar to Fig. 1 but showing the clamp body members in elevation.

Fig. 3 is a vertical transverse section, taken on line 3—3, Fig. 1.

Figs. 4 and 5 are perspective views, Fig. 5 being fragmentary, of the mating clamp body members and showing the manner in which they can be brought together to engage the tube end.

In the drawings the numeral 10 represents the tube to which the holder embodying the invention is applied, this tube being shown as having loosely assembled thereon a fin 11, this fin having an opening 12 loosely receiving the tube 10 and this opening being surrounded by a thimble 13 formed integrally with the fin 11. In order to provide good thermal contact between the tube 10 and the thimble 13, the tube 10 is expanded so as to tightly engage this thimble. For this purpose a metal ball 14 is shown as driven through the tube, this metal ball being of larger diameter than the inside diameter of the tube so that upon being forced through the tube it expands the same. To initially position the ball 14 the end of the tube is slightly expanded, as indicated at 15, so as to form a pocket in the end of the tube into which the ball 14 is manually placed. In addition, the end of the tube is flared outwardly, as indicated at 16.

The holder embodying the present invention comprises two semicylindrical, mating, clamp body members 20 and 21 which are separable from each other and are brought together to engage the exterior of the tube 10 around the enlargement 15 and flare 16 thereof. The clamping body member 20 is formed as the forward extension of a cylindrical neck 22 and is of semicylindrical form having a semicylindrical seat 23 at its forward end adapted to fit the enlarge-

ment 15 of the tube 10 and having a semicircular conical seat 24 adapted to fit the flare 16 of the tube 10 and having an internal semicylindrical face 25 of larger diameter than the semicylindrical face 23, the semicircular conical face 24 being interposed between the semicircular faces 23 and 25. That portion of the clamping body member 20 which forms the semicylindrical seat 23 and circular conical seat 24 is extended upwardly to provide a pair of lugs 28 at the forward end of this clamping body member. These lugs extend above the axis of the holder and are provided with coplanar flat faces 29 which are parallel with this axis and these lugs are also provided with undercut rear faces 30. Between the cylindrical part 22 and the lugs 28 the clamping body member 20 is provided with recessed coplanar flat faces 31 which are in the plane of the axis of the holder, and this recess being indicated at 32.

The companion clamping body member 21 is of semicylindrical form having a semicylindrical seat 35 at its forward end adapted to fit the enlargement 15 of the tube 10 and having a semicircular conical seat 36 adapted to fit the flare 16 of the tube 10 and having an internal semicylindrical face 38 of larger diameter than the semicylindrical face 35, the semicircular conical face 36 being interposed between the semicircular faces 35 and 38. That portion of the clamping body member 21 which forms the semicylindrical seat 35 and circular conical seat 36 is formed to provide a pair of flat coplanar faces 39 which fit the faces 29 of the lugs 28 and these faces provide a recess 40 provided by a pair of lugs 41 at the rear of the body member 21. When the clamping body members 20 and 21 are fitted together the under faces 42 of the lugs 41 fit the faces 31 of the recess 30 and the forward face 43 of each of these lugs 42 is inclined to fit the undercut face 30 of the corresponding lug 28. Each recess 32 is of greater axial extent than the axial dimension of each lug 41 so that the lugs 41 can be fitted in these recesses 32 and the clamping body member 21 then moved forwardly to engage the inclined faces 43 with the inclined faces 30, in which position the semicylindrical faces 23 and 35 and the semicircular conical faces 24 and 36 are in register to fit the enlarged and flared end 15, 16 of the tube 10. The cylindrical neck 22 of the clamping body member 20 is provided with an axial bore 45 and is also enlarged to provide a cylinder 46, the outer end of which is closed by a removable end head 48 carrying a pressure line 49 through which fluid under pressure is introduced into the corresponding end of the cylinder 46. In this cylinder 46 is arranged a piston 50 having a piston rod 51 slidingly mounted in the bore 45 and a return spring 52 is arranged in the cylinder 46 so as to return the piston 50 to the right hand position as viewed in Fig. 1 when the pressure applied to the piston through the line 49 is relieved. The forward end 53 of the piston rod 51 is shown as being of conical form and engages the rear end of a cylindrical plug indicated generally at 55. This plug is slidingly fitted in the cylinder provided by the semicylindrical faces 25 and 38 of the clamping body members 20 and 21, respectively. This plug is of conical form at its forward end, as indicated at 56, so as to fit the flare 16 of the tube 10 and clamp this tube firmly against the semicircular conical faces 24 and 36 of the clamping body members 20 and 21, respectively. The plug is moved into clamping engagement with the flare

16 of the tube 10 by the piston rod 51 through pressure exerted through line 49 against its piston 50.

In so clamping the flared end 16 of the tube 10 the clamping body members 20 and 21 must, of course, be held together and for this purpose a ring 60 and sleeve 61 embrace the external cylindrical surfaces of these clamping body members 20 and 21. The sleeve 61 is movable rearwardly on the cylindrical neck 22 to permit of freeing the clamping body member 21 from the clamping body member 20 and the ring 60 is removable from these clamping body members so as to permit them to be separated. When the ring 60 and sleeve 61 are in operative position, as shown in Figs. 1 and 2, the clamping body members 20 and 21 are held against such separation by this ring 60 and sleeve 61.

Fluid pressure, preferably in the form of a liquid, is applied against the ball 14 to drive it through the tube 10 and for this purpose the cylindrical plug is provided with an axial bore 65 extending partway from the end facing the ball 14 and joining a radial bore 66 having a pipe connection 68. This pipe connection extends through an axial slot 69 provided in the clamping body member 20 and also with an axially extending notch 70 provided at one end of the sleeve 61. The purpose of these slots is to permit of axial movement of the cylindrical plug 55, this also requiring the axial movement of the fluid pressure supply pipe 68 in these slots 69 and 70.

The device forming the subject of this invention can very easily be applied to and removed from the enlarged and flared end 15 and 16 of the tube 10 to drive the ball 14 through the tube 10 under hydraulic pressure applied through the device. Thus, assuming the parts to be disassembled with the ring 60 hung on the end of the tube 10 and the cylindrical plug 55 and sleeve 61 backed away toward the right, as viewed in Fig. 1, the clamping body members 20 and 21 are loosely assembled around the end of the tube 10 at a small distance along the tube so that the flare 16 of the tube is disposed in the cylindrical chamber provided by the faces 25 and 38 of the clamping body members. In so assembling the two clamping body members 20 and 21 the faces 29 are engaged with the faces 39 thereof and the faces 31 are engaged with the faces 42 thereof. The two clamping body members are then slid axially relatively to each other so as to bring the undercut faces 30 into engagement with the faces 43 thereof, this bringing the semicylindrical faces 23 and 35 into register with each other and also bringing the semicircular conical faces 25 and 36 into register with each other. The assembled body members are then moved axially so that the semicircular conical faces 24 and 36 engage with the flare 16 of the tube. The ring 60 is then slipped over the ends of the assembled clamping body members 20, 21 and the sleeve 61 is slid along the cylindrical neck 22, to the left as viewed in Fig. 1, to embrace the assembled clamping body members 20 and 21.

Pressure is then applied through the line 49 against the piston 50, this driving the piston rod 51 and cylindrical plug 55 against the resistance of the return spring 52 and driving the conical face 56 of the plug 55 into engagement with the inside of the flare 16 of the tube. This clamps this flare 16 of the tube firmly between the cylindrical plug 55 and the semicircular conical faces 24 and 36 of the clamping body members 20 and 21. In this movement of the cylindrical plug 55

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its pressure supply pipe 68 moves in the axial slots 69 and 70 provided, respectively, in the clamping body member 20 and sleeve 61.

Fluid pressure, preferably a liquid, is then supplied through the pipe 68 and bores 66 and 65 of the cylindrical plug 55, this discharging into the end of the tube 10. This pressure drives the ball 14 along the tube 10 thereby progressively expanding this tube into tight engagement and thermal contact with the thimbles 13 of the successive fins 11. This ball is ejected through the opposite open end of the tube 16. Upon completion of this operation the fluid pressure supply through the pipes 68 and 49 is cut off and hence return spring 52 drives the piston 50 to the right, as viewed in Fig. 1, thereby to free the cylindrical plug 55 from clamping engagement with the flare 16 of the tube. The operator then slips the sleeve 61 back on the cylindrical neck 22 and slides the ring 60 off the end of the device onto the projecting end of the tube 10. The assembled clamping body members 20, 21 are then moved a short distance to the left, as viewed in Fig. 1, this permitting the clamping member 21 to be moved axially to the right so as to free its undercuts 43 from the undercuts 30 of the clamping body member 20. When this is done the clamping body members 20 and 21 can be removed radially from each other so as to completely free the end of the tube 16.

From the foregoing it will be seen that the present invention provides a holder for the ends of tubes which securely clamps the end of the tube and permits fluid pressure to be applied through the holder into the tube to expand the same. It will further be seen that the holder can be quickly applied to and removed from the tube so as to facilitate the expanding operation and that it is simple and positive in its operation.

I claim as my invention:

1. A holder for the flared ends of tubes being expanded, comprising a two part clamping body split axially and internally formed to fit that side of the flare on said tube which forms a continuation of the external surface thereof and also formed with an internal chamber at the opposite side of said flare, means releasably holding said parts of said clamping body together, a plug in said chamber and having a conical end adapted to seat against the opposite side of said flare, means for moving said plug axially relative

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to said clamping body into and out of engagement with said flare, and means for introducing fluid under pressure through said plug into said tube to expand the tube comprising a bore extending from the conical end of said plug to one side thereof, and a fluid pressure supply pipe connected with said one side of said plug in communication with said bore and arranged in an axial slot provided in said clamping body.

2. A holder for the flared ends of tubes being expanded, comprising a two part cylindrical clamping body split axially and internally formed to fit that side of the flare on said tube which forms a continuation of the external surface thereof and also formed with an internal chamber at the opposite side of said flare, a plug in said chamber and having a conical end adapted to seat against the opposite side of said flare, means for moving said plug axially into and out of engagement with said flare, means releasably holding said parts of said clamping body together, comprising a ring engageable with the external surface of said clamping body and removable axially therefrom, and means for introducing fluid under pressure through the plug into said tube to expand the tube, comprising a bore extending from the conical end of said plug to one side thereof, and a fluid pressure supply pipe connected with said one side of said bore and arranged in an axial slot provided in said clamping body and an axial notch provided in one end of said ring.

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