Jan. 16, 1951 R. KOCH 2,538,571

METHOD AND APPARATUS FOR SEALING CAPILLARY TUBES

Filed April 9, 1949

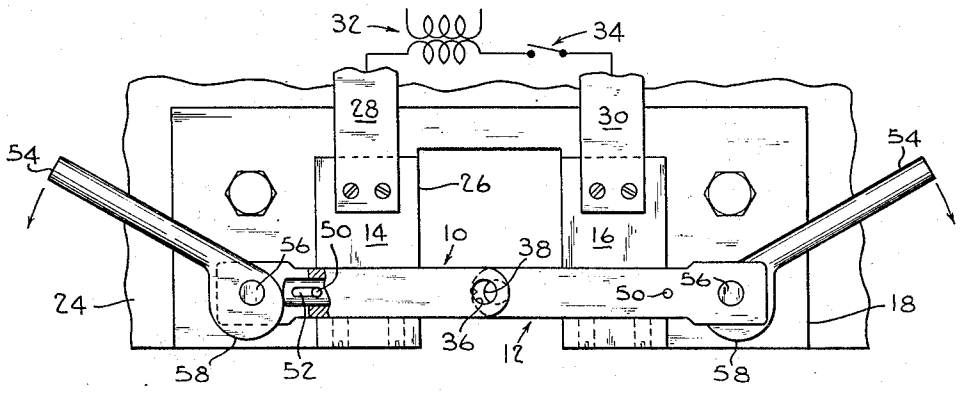


FIG. 1

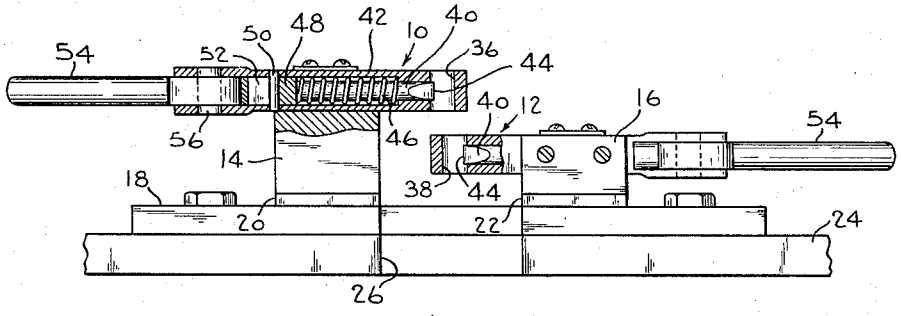


FIG. 2

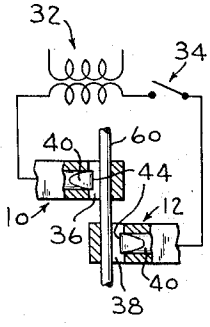


FIG. 3

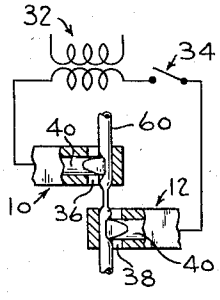


FIG. 4

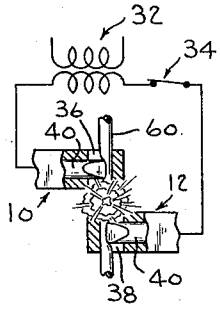


FIG. 5

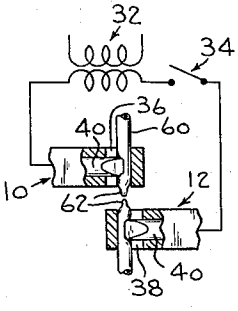


FIG. 6

INVENTOR.

RUDOLF KOCH

BY John W. Michael

ATTORNEY.

Patented Jan. 16, 1951 2,538,571

UNITED STATES PATENT OFFICE

2,538,571

METHOD AND APPARATUS FOR SEALING CAPILLARY TUBES

Rudolf Koch, Milwaukee, Wis., assignor to Automatic Products Company, Milwaukee, Wis., a corporation of Wisconsin

Application April 9, 1949, Serial No. 86,451

7 Claims. (Cl. 219—4)

1

This invention relates to a method and apparatus for burning off or hermetically sealing a capillary tube.

The sealing of copper and other metallic capillary charging tubes has heretofore been a tedious and expensive process. The conventional practice has been to crimp the tube after the system has been charged to form a temporary seal. Flux is then applied to the end of the tube and the tube soldered. In addition to being a process involving a lot of handling and requiring great care, the results obtained were often unsatisfactory due to minute leaks.

The principal object of this invention is to provide apparatus for rapidly sealing capillary tubes.

Another object is to provide apparatus for sealing capillary tubes in a simple manner while consistently obtaining a high quality of work.

Another object is to provide a process for greatly simplifying the method and reducing the cost of sealing capillary tubes.

Still another object is to provide a new process for closing off capillary tubes.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as will obvious modifications of the single embodiment of the apparatus shown in the drawings, in which:

Fig. 1 is a top plan view of the apparatus employed in this invention;

Fig. 2 is a front elevation of Fig. 1 with parts broken away; and

Figs. 3, 4, 5 and 6 illustrate the operation of this apparatus and the steps employed in the process for burning off the capillary tube.

Referring to the drawings in detail, two vertically staggered crimping tools 10, 12 are mounted in blocks 14, 16, respectively mounted on and insulated from base plate 18 by means of insulating blocks 20, 22. Plate 18 in turn may be mounted on a suitable work bench 24 which may be provided with a convenient rectangular cut 26 permitting access to the underside of the lower crimping tool 12. Bus bars 28, 30, in circuit with the secondary of stepdown transformer 32 and a foot or hand operated switch 34, are connected to blocks 14, 16, respectively. Therefore, with the use of metallic blocks and crimping tools the circuit may be closed when the gap between the tools is bridged.

As is clear in the drawings, the vertically spaced crimping tools are provided with holes 36, 38 adapted to receive a capillary tube 60 and having their centers horizontally displaced so

2

the tube will be substantially vertical when contacting the outer portion of the wall of each hole, as illustrated in Fig. 3. The holes could, however, be coaxial since the usual capillary tube is readily bent as desired. The vertical distance between the pinch-off tools is sufficient to permit pliers to be inserted between the pinch-off tools to flatten the capillary tube for a purpose which will be explained hereinafter.

A reciprocable plunger 40 is mounted within the casing 42 of each crimping tool and has a nose 44 adapted to bear against the wall of the capillary tube. The plunger 40 is biased outwardly by means of spring 46 bearing against shoulder 48 on the plunger and is guided by pin 50 projecting through slot 52 in the outer end of the plunger to maintain the nose in a vertical position. Rotation of the manually operated handles 54 about pin 56 will cause cam surface 58 to bear against the end of the plunger to force the plunger into engagement with the wall of the capillary tube to collapse or crimp the tube. Crimping in this manner serves both to seal the fluid in the system from the heat of the welding operation and to establish good electrical contact with the tube.

Sealing or burning off the capillary tube with this apparatus is a simple, rapid process. After the particular system has been charged, the capillary tube may be crimped to form a temporary seal. The end of the tube is inserted through each of the holes 36, 38 in crimping tools 10, 12. The lower handle 54 is then rotated in the direction indicated by the arrow to crimp tube 60 as indicated in Fig. 4. Pliers are now utilized to flatten the tube between the pinch-off tools (Fig. 4) and the upper crimping tool is operated. When switch 34 is closed to complete the circuit (Fig. 5) the tube is melted between the pinch-off tools, as indicated in Fig. 6, and the melted tube ends 62, 62 are welded. About 500 amperes at 6 volts has proven highly successful in obtaining a clean, rapid weld.

The simplicity of this method will be appreciated when compared to the tedious processes heretofore employed. The weld thus obtained is uniform and of very high quality, while former processes frequently failed to seal the system. Experimentation has indicated that in most cases it is desirable to flatten the tube between the pinch-off tools by means of pliers or other mechanism as indicated in Fig. 4 in order to obtain a seal of uniform high quality since the gases in the tube expand and cause the weld to blow out. When working with tubing having

a very small inside diameter, however, satisfactory results may sometimes be obtained without flattening the tube prior to welding.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. The method of hermetically sealing a capillary tube, comprising the steps of, collapsing a portion of the wall of said tube until juxtaposed interior surfaces are in contact, establishing electrical contact at axially spaced positions on either side of said portion, and passing an electric current between said positions to melt said portion.

2. The method of hermetically sealing a capillary tube, comprising the steps of, crimping said tube at two axially spaced points, and passing an electric current between said points to melt and weld the tube.

3. The method of hermetically sealing a capillary tube, comprising the steps of, collapsing a portion of the wall of the tube until juxtaposed interior surfaces are in contact, crimping the tube at axially spaced points on each side of the collapsed portion, and passing an electric current between said points to melt said collapsed portion.

4. Apparatus for hermetically sealing a capillary tube comprising, spaced crimping tools adapted to receive a capillary tube and crimp the tube at spaced points, an electric circuit connecting said crimping tools to a source of electric potential and including a switch, said switch being operable when closed to permit passage of electric current through the tube between said points to melt the tube between said points, the melted metal coalescing to seal the end of each section of the capillary tube so melted.

5. A device for hermetically sealing a capillary tube having a portion of the tube wall collapsed to bring juxtaposed interior surfaces into contact comprising, an electric circuit including a current source, means for establishing electric contact with said tube on each side of said collapsed portion, means for temporarily sealing said tube on each side of said collapsed portion,

and switch means included in said circuit for permitting current flow through said tube between said electric contacts to melt the tube at said collapsed portion when the switch is closed.

6. A device for sealing capillary tubes, comprising, a pair of crimping tools, an aperture in each of said tools, said apertures being generally axially aligned and being adapted to receive a capillary tube, means associated with each of said tools to crimp a portion of the capillary tube passing through the corresponding hole, circuit means for connecting said tools with a source of electrical energy so current may be passed through said tube between the crimped portions, said circuit means including a switch.

7. A device for sealing capillary tubes, comprising, a pair of crimping tools each of which include a hole and a generally reciprocal plunger, said holes being generally aligned so a tube may be passed through both holes, each of said plungers being generally diametrically movable into and out of their corresponding holes and being adapted to abut and crimp a tube passing through the hole, means for reciprocating said plungers in said tools, circuit means for connecting said plungers to a source of electrical energy and including a switch for completing the circuit to pass current through the tube between the tools.

RUDOLF KOCH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,259,271	Murray	Mar. 12, 1918
1,296,780	Dyer	Mar. 11, 1919
1,339,417	Pierce	May 11, 1920
2,056,398	Herzog	Oct. 6, 1936
2,057,969	Payson et al.	Oct. 20, 1936
2,132,071	Johnson	Oct. 4, 1938
2,174,906	Wagner	Oct. 3, 1939
2,202,580	Hahn	May 28, 1940
2,264,817	Uhler	Dec. 21, 1941

FOREIGN PATENTS

Number	Country	Date
490,586	Great Britain	Aug. 17, 1938