June 11, 1946. C. E. HANSEN 2,401,930

ARTICLE TREATING APPARATUS

Filed April 28, 1944 2 Sheets-Sheet 1

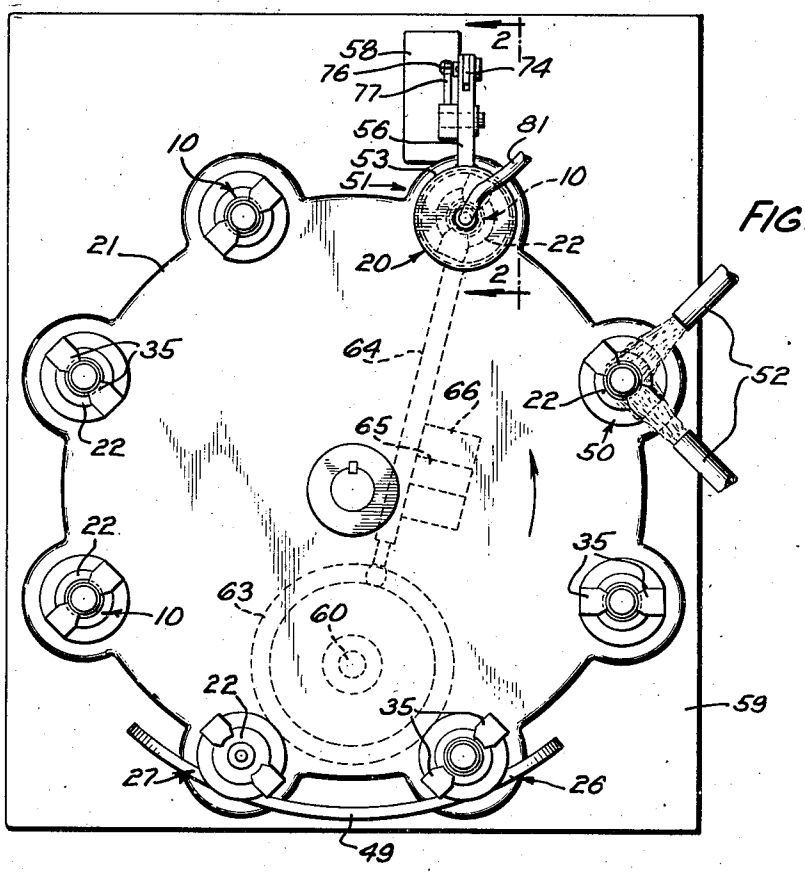


FIG. 1

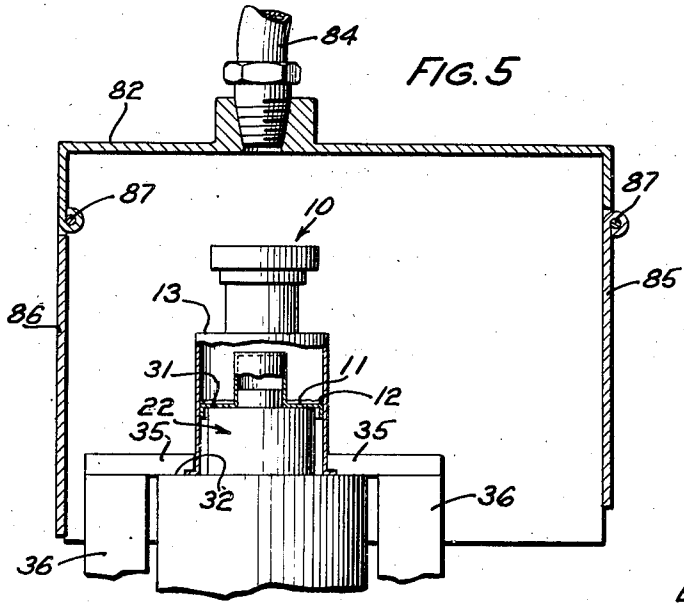
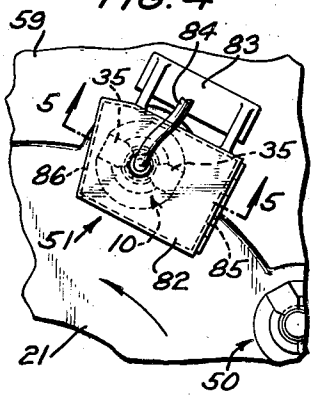


FIG. 5

FIG. 4



INVENTOR
C. E. HANSEN
BY Harry R. Dufft
ATTORNEY

June 11, 1946. C. E. HANSEN 2,401,930

ARTICLE TREATING APPARATUS

Filed April 28, 1944 2 Sheets-Sheet 2

FIG. 2

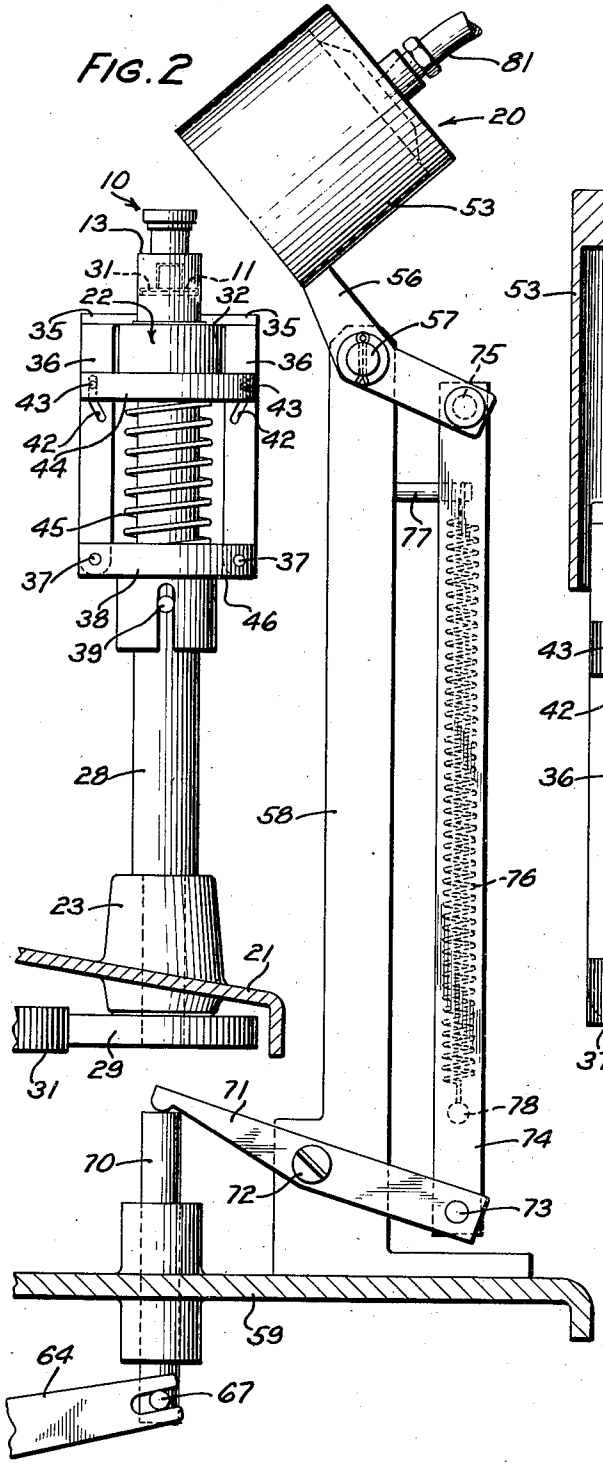
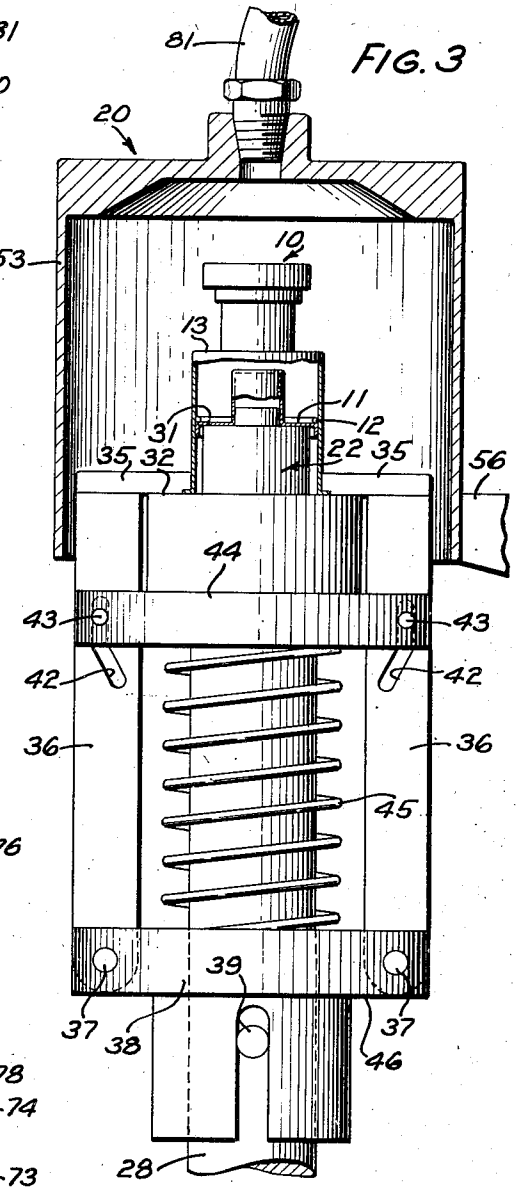


FIG. 3



INVENTOR
C. E. HANSEN
BY Harry R. Dunfee
ATTORNEY

Patented June 11, 1946

2,401,930

UNITED STATES PATENT OFFICE

2,401,930

ARTICLE TREATING APPARATUS

Carl E. Hansen, Chicago, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application April 28, 1944, Serial No. 533,229

7 Claims. (Cl. 113—59)

1

This invention relates to article treating apparatus and more particularly to apparatus for treating articles for preventing oxidation thereof during partial cooling after being heated to a high temperature.

The invention has been found particularly useful in a sealing-in operation on metal type vacuum tubes, as effected on an intermittently operated automatic machine. Heretofore, in the manufacture of such tubes, during which a metal envelope is sealed by solder to another metal portion of the tube, by the application of a high temperature flame to the envelope, the practice has been in some instances, upon completing the sealing-in operation and the cooling of the tube parts and their removal from the machine, to manually wire-brush the tube parts to remove the coating of scale or oxide formed thereon. This operation is expensive, tedious and quite unsatisfactory.

An object of the present invention is to provide a simple and practicable arrangement and apparatus for use on the above type of machine for preventing the forming of scale or oxide on the hereinbefore-mentioned envelopes during the manufacture of vacuum tubes.

In accordance with the above object, this invention contemplates, in one embodiment thereof, as applied to the above-referred-to type of machine, an apparatus at one of the index stations which comprises an inverted pivotally mounted cup-shaped member, to the upper end wall of which is connected a supply of illuminating gas, which is continually slowly burning therein. As each vacuum tube part, with its envelope sealed thereto, after leaving an index station where it was subjected to a high temperature flame stops under the cup-shaped member at the deoxidizing station, it is automatically lowered to surround the heated envelope with the flame therein, which is of a much lower temperature than that of the flame previously applied thereto in the sealing-in operation. Thus, the oxygen surrounding the heated envelope is consumed by the flame while the part is cooling and the formation of a coating of scale or oxide thereon is substantially prevented.

An alternative embodiment of the apparatus comprises a fixed inverted cup-shaped member at the deoxidizing station connected to an illuminating gas supply in the manner of the above-described movable member and provided with hinged doors at opposite sides thereof, which are opened by the advancing tube, the first door closing after the tube is within the member and

2

the second door being opened by the tube advancing from the member and, thereafter, it moves back to its closed position.

Other objects and advantages of this invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings, in which

Fig. 1 is a plan view of an intermittently operated automatic sealing-in machine embodying the features of the invention, showing the deoxidizing member in its lowered operative position;

Fig. 2 is an enlarged fragmentary elevational view, partly in section, taken substantially on the line 2—2 of Fig. 1, the deoxidizing member being shown in its upper inoperative position;

Fig. 3 is an enlarged fragmentary view similar to Fig. 2, partly in section, the deoxidizing member being shown in its lowered operative position;

Fig. 4 is a fragmentary plan view similar to Fig. 1 showing an alternative embodiment of the deoxidizing member; and

Fig. 5 is an enlarged fragmentary vertical section taken on the line 5—5 of Fig. 4.

Although not limited thereto, the apparatus embodying the features of the invention may be employed to advantage for sealing metal parts of a metal vacuum tube, indicated in general at 10 (Figs. 2 and 3). As shown in Fig. 3, such parts may comprise a metal shell 11, to which is circularly joined or sealed, by means of a ring of solder 12, a surrounding inverted circular cup-like metal envelope 13 of varying diameter.

Referring to the drawings in detail and particularly to Figs. 1 and 2, one embodiment of the invention, indicated in general at 20, is preferably mounted on an intermittently operated automatic machine, which is basically a Charles Eisler type sealing machine, such as is disclosed in U. S. Patent No. 2,063,235 of December 8, 1936. Such an automatic machine includes a rotatable turret or carrier 21 carrying a plurality of circularly arranged devices or heads 22 rotatably mounted in bearings 23 adjacent the periphery of the carrier, for supporting the vacuum tube parts during the heating, sealing, deoxidizing and cooling thereof. Any suitable mechanism (not shown) may be provided for effecting an intermittent rotary motion to the carrier 21, whereby the several devices 22 are advanced, step by step, past operators located at certain positions around the carrier to load the parts 11 and 13 on the device and remove the completed assemblage therefrom. Mechanism is also included in the ma-

chine whereby during the intermittent advance of the devices 22 with the carrier 21 and during each dwell period except at loading and removal stations indicated at 26 and 27, respectively, the devices are continuously rotated about their own axes.

The details of the referred-to mechanisms of the machine on which the devices 22 are mounted have been omitted from this disclosure for the sake of simplicity, since a full disclosure thereof is not essential to a complete understanding of the present invention.

Each of the devices 22 (Fig. 2) comprises a shouldered non-reciprocatory shaft 28 rotatably journalled in the bearing 23 and having fixed thereto at its lower end a friction gear 29. The gear 29 meshes with a driving friction gear 31, shown fragmentarily, which is constantly driven in the operation of the machine except during the dwell periods of the device 22 at the loading and removal stations. An upper end face 31 of the shaft 28 serves as a seat for the tube shell 11 and an annular face 32 on the shaft provides a seat for the tube envelope 13. A pair of diametrically opposite rockable clamping fingers 35 are fixed to the upper ends of members 36 pivoted at their lower ends, as indicated at 37, to slotted portions of a flanged collar 38 connected to the rotary non-reciprocatory shaft 28 by a pin and slot connection 39, whereby the collar 38 may slide up and down on the shaft simultaneously with its rotation therewith. Intermediate their ends, the members 36 are formed with cam slots 42, through which extend pins 43 secured in an enlargement 44 of the shaft 28. A compression spring 45, having its opposite ends abutting the collar 38 and the enlargement 44 of the shaft 28 normally maintains the collar 38 in its lowered position, as shown in Figs. 2 and 3, in which position the rockable clamping fingers 35 are in their operative positions, holding a tube envelope 13 on its seat 32. In the bodily rotation of the device 22 with the rotating carrier 21 in the direction of the arrow (Fig. 1), and in timed relation to its arrival at the removal station 27, a lower annular face 46 of the collar 38 rides up a stationary arc-shaped cam member 49 extending between the removal and loading stations 27 and 26, respectively. Thus, cam member 49 causes the collar 38 to be elevated and through the cam slots 42 and pins 43, the clamping fingers 35 are moved upward and outward to release the sealed tube assemblage for removal from the device 22. Upon reloading, the device 22 with the tube parts 11 and 13 and the solder ring 12 at the station 26 and its advance therefrom, the face 46 of the collar 38 rides off the cam member 49, whereupon the clamping fingers 35 are caused to move downward and inward to the positions shown in Figs. 2 and 3 to clamp the tube parts to the device. At a station 50 in advance of a deoxidizing station 51 are arranged gas burners 52, the high temperature flames from which, when the device 22 is stopped thereat, are played upon the peripheral face of the rotating tube envelope 13, particularly at the point where the solder ring 12 is located, and thus the solder ring melts and the tube shell 11 and envelope 13 are sealed together.

At the station 51 is arranged the deoxidizing apparatus 20, which comprises an inverted cup-shaped member 53 having a radially extending integral angular shaped arm 56, which is pivoted intermediate its ends at 57, to a standard 58 secured to the upper face of a stationary frame 59 of the sealing-in machine. The member 53 is so arranged relative to the station 51 that upon pivotal movement from its inoperative position (Fig. 2) to its operative position (Fig. 3), it will completely and freely surround the tube envelope 13 carried by the device 22 when it is advanced and stops at the station. In order that the cup-shaped member 53 may be automatically moved to such operative position in timed relation to the arrival of the tube envelope 13 at the station 51, a vertical shaft 60 of the machine operating at a fixed position, shown in dotted outline in Fig. 1, carries a circular cam member having a suitably shaped cam face 63 on which constantly rides one end of a lever 64 pivoted at 65 to a stationary portion 66 of the machine. The opposite end of the lever 64 is pivotally connected at 67 (Fig. 2) to a reciprocable plunger shaft 70 axially aligned with the station 51 and having a bearing in the frame 59. Engaging the upper end of the shaft 70 is one end of a lever 71 pivoted at 72 to the standard 58, the opposite end of the lever being pivoted at 73 to one end of a link 74, which is pivoted at 75 to the outer end 56 of the cup-shaped member 53. A tension spring 76 connected at opposite ends to pins 77 and 78 fixed to the standard 58 and link 74 is effective to maintain the lever 71 in constant engagement with the reciprocable plunger shaft 70 and thus as the shaft is lowered through the cooperating rotating cam face 63 and the lever 64, the latter being connected to the shaft, the link 74 is raised, as viewed in Fig. 1, and the cup-shaped member 53 rocked about its pivot 57 and lowered to the position shown in Fig. 3. In the same manner as the shaft 70 is raised, the cup-shaped member 53 will be moved from its operated position (Fig. 3) to its inoperated position (Fig. 2).

To the upper end wall of the cup-shaped member 53 and communicating with the interior thereof is connected a flexible tube 81 for supplying, from a source not shown, a suitable inflammable gas which, in the operation of the sealing-in machine, is continually in flame and completely filling the interior of the member 53, such flame being of relatively low temperature compared to that provided by the gas burners 52. The gas used may be ordinary illuminating gas and it burns only as it escapes from the tube 81 into the inverted member 53 and mixes with the air. Thus, noxious gases are prevented from entering the room and a deoxidizing atmosphere is provided within the inverted member.

In the operation of the intermittently operated automatic machine of the type referred to hereinbefore, and to which the described deoxidizing device 20 of this invention is applied, each tube part carrying device 22 intermittently advances from the removal station 27 and dwells at the loading station 26 for a predetermined period, during which the tube parts 11 and 13 and the ring of solder 12 are assembled in the manner previously described thereon and as the device advances from the station 26, the tube envelope 13 is automatically clamped in position thereon by the fingers 35 in the manner previously described and caused to rotate about its own axis. As each rotating tube assemblage dwells at the heating station 50 for a predetermined period, the tube envelope 13 is subjected, in the desired area, to high temperature gas flames from the burners 52 sufficient to melt the ring of solder 12 and thus seal the tube envelope to the tube shell 11. Thereafter, the heated tube parts are advanced to and dwell at the deoxidizing sta-

tion 51. In timed relation thereto, the rotating shaft 60 carrying the cam face 63 causes the plunger shaft 70 to be lowered and through the spring 76 the cup-shaped member 53 with the low temperature flame therein is automatically lowered to the position shown in Fig. 3 to completely surround the rotating and heated tube parts. After the tube parts have been in the presence of the flame at the station 51 for a predetermined period, the cup-shaped member 53 is automatically elevated to the position shown in Fig. 2 by the action of the cam face 63 on the plunger shaft 70, which is raised, and the device 22 is then advanced toward the removal station 27.

Immediately upon leaving the heating station 50 and while at the station 51, it will be understood that the tube parts begin to cool in the presence of the surrounding low temperature flame which consumes all oxygen during such cooling and thus substantially prevents the forming of a coating of scale or oxide upon the surfaces of the tube parts. In their subsequent intermittent advance to the removal station 27, further cooling of the parts takes place.

An alternative embodiment of a deoxidizing device, effective in a manner similar to the above described deoxidizing device, is shown in Figs. 4 and 5, which comprises a stationary inverted irregular shaped hood 82 arranged at the station 51 and secured to a standard 83, in turn fixed to the machine frame 59. The interior of the hood 82 is supplied through a tube 84 with an inflammable gas, which is continually in flame to surround the tube parts as they dwell at the station 51. Opposite ends of the hood 82 are provided with swinging doors 85 and 86 horizontally hinged, as indicated at 87 (Fig. 5) to permit the entrance and exit of the device 22 with the tube parts into and from the hood. The entering heated tube parts engage the door 85 and swing it inwardly and as the tube parts come to a stop, the door swings back to its closed position. Upon leaving the hood 82, after being subjected to the deoxidizing flame therein, the tube parts engage the door 86 and swing it outwardly and as the tube parts disengage the door, it swings back to its closed position.

What is claimed is:

1. An apparatus for sealing one metal part to another comprising means for applying a high temperature directly to one of the parts to seal the parts, a movable carrier for advancing the assembled parts to said temperature applying means, inverted suspended hollow means spaced from said carrier and adapted to receive the parts upon advance of said carrier thereto, and means for supplying an inflammable gas to the interior of said hollow means for enveloping the parts in a flame of a low temperature during cooling of the parts effective to substantially prevent the forming of oxide on the parts.

2. An apparatus for sealing one metal part to another comprising means for applying a high temperature directly to one of the parts to seal the parts, a bodily movable rotatable carrier for advancing the assembled parts to said temperature applying means and rotating them thereat, a movable inverted hollow means suspended and mounted for movement from an inoperative to an operative position for receiving the parts upon advance of said carrier into alignment therewith, means for supplying an inflammable gas to the interior of said hollow means for enveloping the parts in a flame of a low temperature during cooling of the part effective to substantially prevent the forming of oxide on the parts, and means for actuating said hollow means.

3. An apparatus for treating metal parts comprising a movable carrier for parts, means for moving said carrier, a plurality of work stations along the path of said carrier, means for heating the parts to a high temperature at one of said stations, suspended movable hollow means spaced from said carrier at a subsequent station for receiving the parts when aligned therewith, means for supplying a deoxidizing atmosphere to the interior of said hollow means to envelope the parts, and means controlled by the movement of said carrier for actuating said hollow means.

4. An apparatus for treating metal parts comprising a movable carrier for parts, means for moving said carrier, a plurality of work stations along the path of said carrier, means for heating the parts to a high temperature at one of said stations, suspended movable hollow means spaced from said carrier at a subsequent station for receiving the parts when aligned therewith, means for supplying a deoxidizing atmosphere to the interior of said hollow means to envelope the parts, and means operable in timed relation to the arrival of the heated parts at said subsequent station for actuating said hollow means.

5. An apparatus for sealing metal parts comprising a movable carrier for parts, means for moving said carrier, a plurality of work stations along the path of said carrier, means for heating the parts to a high temperature at one of said stations, a pivotal inverted hollow means at a subsequent station adapted to be moved to surround the parts when aligned therewith, means connected to said hollow means for continuously supplying an inflammable gas to the interior thereof for enveloping the parts in a slowly burning flame of a low temperature to substantially prevent the forming of oxide on the parts, and means controlled by the movement of said carrier for actuating said hollow means.

6. An apparatus for treating metal parts comprising an intermittently movable carrier for parts, means for moving said carrier, a plurality of work stations along the path of said carrier, means for heating the parts to a high temperature at one of said stations, a pivotal inverted cup-shaped member spaced from said carrier at a subsequent station adapted to be rocked to surround the parts when aligned therewith, means for supplying a deoxidizing atmosphere to the interior of said member to envelope the parts, and means operable in timed relation to the arrival of the heated parts at said subsequent station for actuating said cup-shaped member.

7. An apparatus for treating metal parts comprising a movable carrier for parts, a plurality of work stations along the path of said carrier, means for heating the parts to a high temperature at one of said stations, a suspended stationary inverted hollow member spaced from said carrier at a subsequent station having openings in opposite ends for the entrance and exit of the parts in the advance of said carrier, closure elements in said openings for normally closing said openings actuated by the engagement of the parts therewith in entering and leaving said member, and means for supplying a deoxidizing atmosphere to the interior of said member to envelope the parts.

CARL E. HANSEN.