Feb. 28, 1961 D. I. CROPP ET AL 2,973,289

METHOD FOR CLEANING ARTICLES OF MANUFACTURE

Filed Jan. 26, 1959

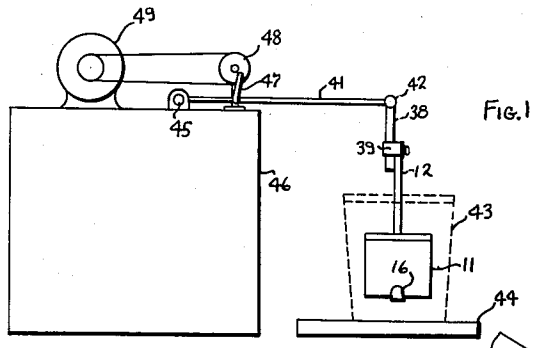


FIG. 1

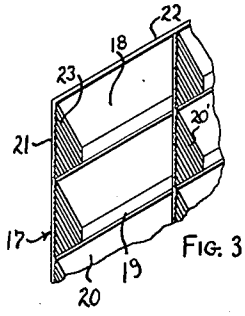


FIG. 3

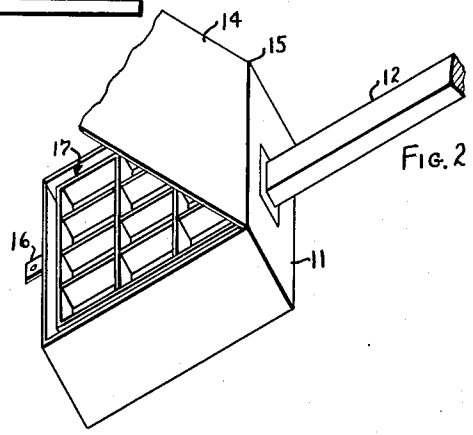


FIG. 2

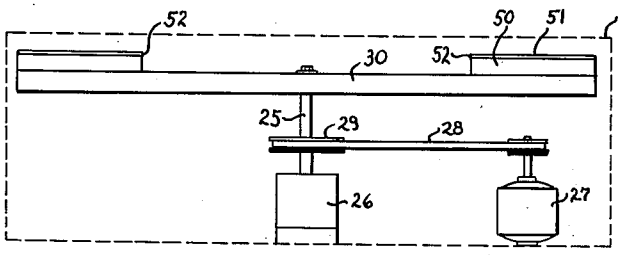


FIG. 4

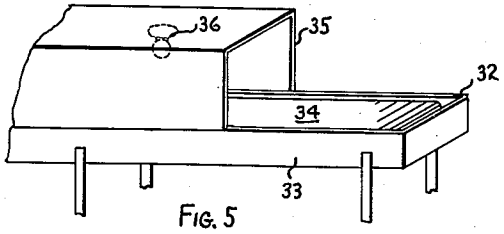


FIG. 5

INVENTORS

DAVID I. CROPP
CHALMER C. JORDAN
ROBERT W. LINGO

By Charles A. Lorenchuk
ATTORNEY

United States Patent Office 2,973,289 Patented Feb. 28, 1961

2,973,289

METHOD FOR CLEANING ARTICLES OF MANUFACTURE

David I. Cropp, R.D. 2, Meadville, Pa.; Chalmer C. Jordan, Box 188, Saegertown, Pa.; and Robert W. Lingo, R.D. 6, Meadville, Pa.

Filed Jan. 26, 1959, Ser. No. 788,842

11 Claims. (Cl. 134—23)

This invention relates to cleaning machines and processes and, more particularly, to machines for cleaning transistors and parts thereof during the manufacturing process.

In the manufacture of transistors, it is common practice to manufacture subassemblies of the transistors and to hermetically seal segments of dumit wires into the ends of glass tubes. Dumit wires used are made up of a nickel iron core about .0185 inch in diameter and of fifty-two percent nickel and forty-eight percent iron with a brass shield, approximately .0002 inch thick, around the core and a copper sheet .0001 inch thick around the brass shield. The copper oxide formed in the process of hermetically sealing the dumit wires to the glass is extremely difficult to remove from the inside of the glass tube and processes for removing it proposed to date have been unsuccessful.

It is, accordingly, an object of the present invention to provide a process for cleaning transistors during the manufacturing process.

Another object of the invention is to provide an improved process for cleaning articles of manufacture.

A further object of this invention is to provide a process for cleaning transistors which is simple, economical to carry out, and simple and efficient in operation.

With the above and other objects in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawing and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawing:

Fig. 1 is a side view of a transistor cleaning apparatus comprising one of the rinsing actions to be used in the process disclosed herein;

Fig. 2 is an isometric view of the nylon transistor tray container inside one of the rinsing boxes used in the process of cleansing the transistors;

Fig. 3 is an enlarged broken isometric view of the trays used for containing the transistors during the washing process;

Fig. 4 is a view of the centrifuge mechanism for spinning the water out of the transistors; and

Fig. 5 is a view of the drying mechanism for use in the process.

Now with more specific reference to the drawing, transistor trays 17 are made of molded nylon or other suitable plastic having bottoms 19, compartments 18, partitions 20, end walls 21, and side walls 22, all integrally molded together. Spaced grooves 23 are formed on the outer ends of the inside surfaces of the ends of partitions 20' and the end walls 21 and the grooves 23 receive the ends of the transistors when the transistor trays 17 thereof are being spun by the centrifuge for drying. Also, they help to hold the transistors separated during the washing processes.

Rinsing boxes 11 are supported on the ends of arms 12 and are welded thereon. The rinsing boxes 11 have a cover 14 hinged at 15 and a lock 16 is provided to hold the cover 14 in closed positon. The transistor trays 17 fit into the rinsing boxes 11 and contain transistors made up of small glass tubes having a wire hermetically sealed therein. The transistors are received in the compartments 18 of the transistor trays 17.

The mechanism shown in Fig. 1 is provided for the purpose of washing the transistors. The transistor trays 17 are contained in the rinsing boxes 11. The arms 12 of the rinsing boxes 11 are supported on short arms 38 by means of clamps 39. The arms 38 are fixed to an arm 41 at 42 and liquid containers 43 are, in effect, large open topped cans and are supported on a base 44. The arm 41 is swingably connected at 45 to a frame 46 and a pitman arm 47 is connected to a wheel 48 and to the arm 41 so that as the wheel 48 is rotated by a motor 49, the pitman arm 47 will swing the arm 41 up and down on the pivot 45 and thereby move the rinsing box 11 up and down rapidly in the liquid container 43.

A series of approximately eight of the mechanisms shown in Fig. 1 will be provided with separate containers 43. Some of the containers 43 will contain de-ionized water and some will contain plain clear water. The first container 43 in the row will be empty as the acid is sealed inside the rinsing box 11.

The centrifuge mechanism shown in Fig. 4 is made up of a casing 24 which is of any suitable rugged material such as steel which may be closed to house the spinning mechanism. An arm 30 is supported on a central shaft 25 which is in turn supported in a bearing 26 firmly attached to the casing 24 and supported on the floor. A motor 27 is supported on the casing 24 and drives a belt 28 which in turn drives a pulley 29 keyed to the shaft 25. The arm 30 is fixed to the shaft 25 and has boxes 50 on the end thereof to receive the transistor trays 17 supported thereon so that as the motor 27 drives the shaft 25, the arm 30 is rotated at a rapid rate and the arm 30 swings the boxes 50 with the transistors in the transistor trays 17. The boxes 50 have lids 51 hinged at 52. The water therein is removed by centrifugal force of the rotating movement thereof.

In Fig. 5, a drying apparatus 32 is shown having a chamber 35 having an inlet and an outlet through which the transistor trays 17 are passed. A frame 33 with a belt 34 is driven at a constant speed. The belt 34 presents a supporting surface and is carried through the chamber 35. Infrared bulbs 36 are supported on the top of the apparatus 32. The bulbs 36 radiate heat downward on the belt 34. The heat is absorbed by the transistors supported on the belt 34 and the moisture is thereby evaporated therefrom. Air is circulated through the drying apparatus 32 toward both the inlet and the outlet to carry away the moisture.

The device shown in Fig. 5 will preferably have ten two hundred seventy-five watt infrared bulbs 36 supported therein and it will be approximately ten feet long and eighteen inches wide.

The mixture of water and equal parts of ammonium chloride and hydrochloric acid, utilizing half acid mixture and half clear water will be put into the transistor trays 17 shown in Fig. 3 and they will be placed in the rinsing boxes 11 and the cover 14 sealed to the tray 17 by means of a sheet of rubber or the like. Then the rinsing boxes 11 will be attached to the arms 38 and the container 43 moved up and down at the rate of approximately four hundred fifty strokes per minute in the container 43. This operation is carried out for a period of three minutes in the first stage. The cover 14 on the rinsing boxes 11 will seal the acid in the tray 17. The acid is discarded after each tray 17 of transistors is washed in it.

After the transistors have been washed in the acid and the acid emptied therefrom, the rinsing box **11** is attached to the arm **38** over a container **43** having clear water therein and the motor **49** is operated for a period of five minutes to wash the acid off of the parts in the water in the container **43**. Then the tray **17** is put in a third container **43** and again moved up and down by the arm **41** for a period of five minutes. The tray **17** is then put on the box **50** on the centrifuge shown in Fig. 4 and spun for a period of two minutes. The tray **17** is then put back into a box **11** attached to the arm **41** and put into de-ionized water in the container **43** and the operation is repeated, putting the transistors through three containers such as the container **43** having ionized water and allowed then to be oscillated by the motor **49** for a period of two minutes in each container **43**. The de-ionization of the water can be done with de-ionization equipment familiar to those skilled in the art. The transistor tray **17** is then replaced in the box **50** on the centrifuge cylinder shown in Fig. 4 and spun and then it is put through the drying apparatus **32** shown in Fig. 5 for a period of approximately twenty-five minutes to thoroughly dry the parts. The parts of the transistor may then be shipped in the trays **17**.

The foregoing specification sets forth the invention in its prefererd practical forms but the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A process for cleaning articles of manufacture comprising disposing said articles in a holder containing an aqueous solution of hydrochloric acid and ammonium chloride, sealing said holder, agitating said articles in said solution, emptying said solution from said holder, disposing said holder with said articles therein in clear water with said clear water in engagemnet with said articles, agitating said holder, drying said articles, disposing said holder in de-ionized water, agitating said articles and said holder, and drying said articles.

2. The process recited in claim 1 wherein said articles are washed in a second bath of clear water after said first bath.

3. The process recited in claim 2 wherein said articles are dried after being disposed in said clear water by means of a centrifuge.

4. The process recited in claim 3 wherein parts of said articles are hollow cylindrical in shape and the longitudinal axis of each said article is held parallel to the radius of rotation of said centrifuge.

5. The process recited in claim 4 wherein said articles are agitated in said de-ionized water in a path parallel to the longitudinal axes of said articles.

6. The process recited in claim 5 wherein said articles are passed successively through at least two separate de-ionized water baths.

7. The process recited in claim 6 wherein said articles are passed successively through four said baths of de-ionized water.

8. A process of cleaning articles of manufacture, including hollow cylindrical members, comprising supporting said articles in a holder, said articles being supported with the longitudinal axes of said cylindrical members parallel to each other, filling said holder approximately half full of an aqueous solution of hydrochloric acid and ammonium chloride, sealing said holder, agitating said holder in a path parallel to the longitudinal axes of said articles, removing said acid, agitating said articles in a clear water bath, removing said water by means of a centrifuge, agitating said articles in de-ionized water, drying said articles by means of a centrifuge with the longitudinal axes of said articles parallel to the radius of said centrifuge, and drying said articles in said holder by exposing them to infrared heat.

9. The process recited in claim 8 wherein said articles are agitated in two separate said clear water baths.

10. The process recited in claim 9 wherein said articles are agitated in four said de-ionized water baths.

11. The process recited in claim 10 wherein said articles are kept in said holder throughout said process.

No references cited.