

[54] **METHOD FOR CLEANING PLATE-SHAPED OBJECTS**

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[51] **Int. Cl.²** **B08B 1/02**;

[58] **Field of Search** ..134/6, 9, 25 A, 32, 15, 134/34; 15/77, 21D, 102, 3.15

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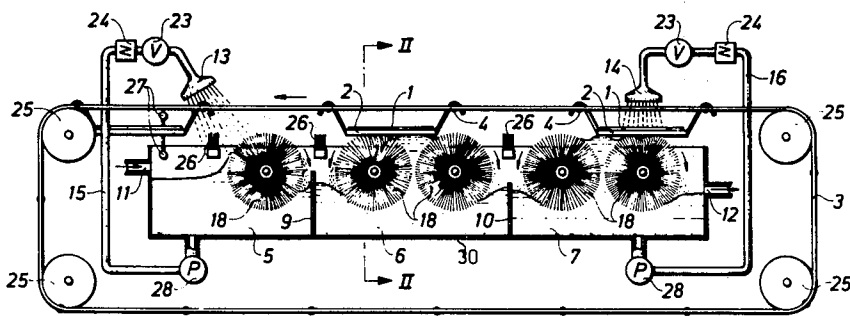
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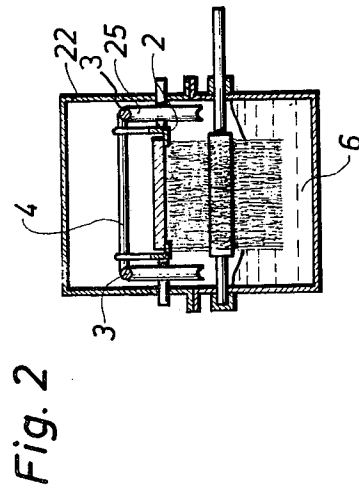
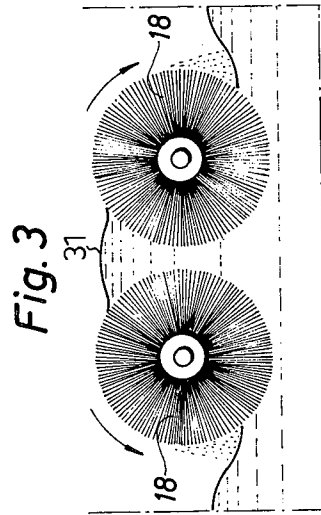
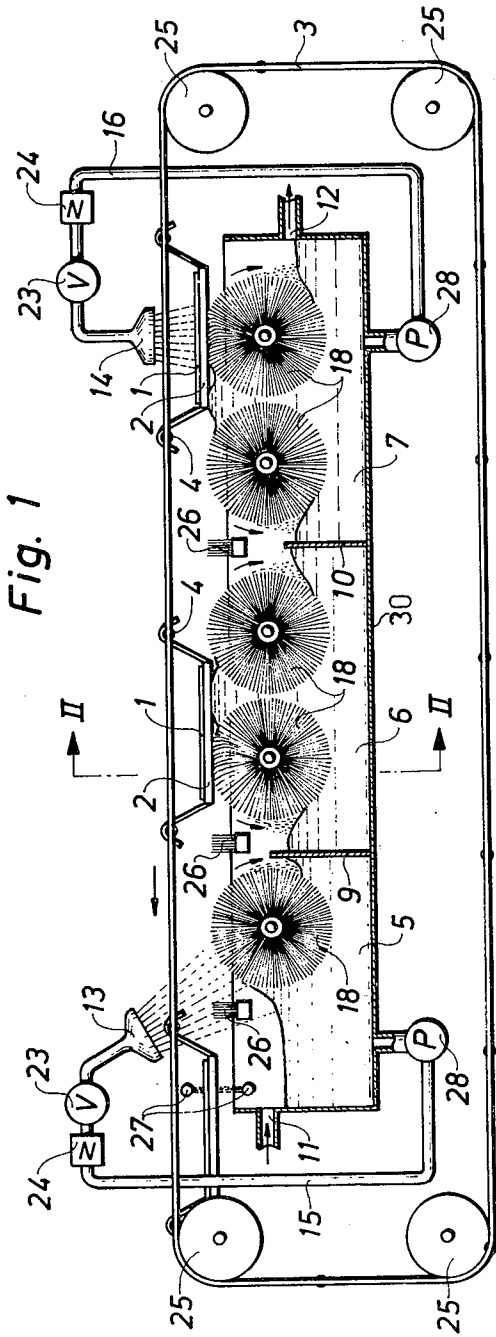
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[57] **ABSTRACT**

In cleaning plate-shaped objects a tub is filled with a cleaning liquid and contains a plurality of troughs mounting brushes for cleaning the objects. At least some of the brushes are arranged in pairs, with each brush of a pair rotating in the opposite direction. The plate-shaped objects are conveyed across and above the tub and the brushes are arranged so that the periphery of each brush extends above the top of the tub and contacts the objects to clean them. By rotating each brush of a pair in opposite directions, a meniscus of cleaning liquid is formed between them that contacts the objects and aids in cleaning them.

2 Claims, 3 Drawing Figures





METHOD FOR CLEANING PLATE-SHAPED OBJECTS

SUMMARY OF THE INVENTION

The present invention relates to a method and apparatus for cleaning plate-shaped objects which are conveyed along a path. The plate-shaped objects to be cleaned are, preferably, plates or cards with printed circuits on them. The circuit elements comprise electronic elements, such as transistors, which are soldered to the plate or card. After soldering these elements, the plate or card must be cleaned, and the present invention does this in an advantageous and efficient manner.

The invention comprises a tub filled with a cleaning liquid which mounts a series of brushes. The brushes are arranged so that at least some of them form pairs parallel to each other. The brushes of the pairs are rotated in opposite directions so that a liquid meniscus rises between them.

The tub of the present invention is divided into a number of troughs which mount at least one brush, but no more than a pair of brushes. The troughs are formed by providing the tub with spillways of different height. The brushes, coming into contact with both the cleaning liquid and plate-shaped objects, effectively clean the objects as they are conveyed.

The plate-shaped objects are conveyed by a pair of chains, parallel to each other, which mount baskets having open bottoms for receiving the objects. As the objects are transported across the tub, they come into contact with the brushes which clean them.

Additional cleaning is achieved by providing spray nozzles at each end of the tub that spray the side of the plate-shaped objects remote from the brushes with the cleaning liquid.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE INVENTION

FIG. 1 is a longitudinal sectional view of the cleaning apparatus of the present invention;

FIG. 2 is a sectional view taken along II — II in FIG. 1; and

FIG. 3 is a schematic view of the pumping action of a pair of brushes of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Plate-shaped objects 1, e.g. printed circuit cards, are conveyed across and above a tub 30 filled with a cleaning liquid, e.g. tetrachloroethylene. The plate-shaped objects 1 are placed in baskets 2 having open bottoms so that the objects lay flat in the open bottoms. The baskets 2 have a bottom frame formed of L sections arranged to fit the dimensions of the particular plate or card to be cleaned. The baskets 2 are suspended from two parallel endless conveyor chains or belts 3 which are interconnected by rods 4 suitably spaced and which suspend the baskets 2 between the conveyor chains. The chains 3 are deflected by pulleys 25 which are spaced about the tub 30, and which are driven in the

direction indicated in FIG. 1 by any conventional drive means (not shown).

The tub 30 is divided into three troughs 5, 6, 7, which receive the cleaning liquid. The troughs are separated by spillways 9, 10, spillway 9 being of a greater height than spillway 10 so that the cleaning liquid may flow from trough 5 to trough 6, but not vice versa.

The cleaning liquid is supplied to the tub 30 by an inlet 11 arranged at one end of the trough 5. The liquid is supplied to the trough in any conventional manner and the manner of supply forms no part of this invention. The cleaning liquid enters the trough 5 via inlet 11 and progresses through the tub in the direction opposite to the path of travel of plate-shaped objects 1. An outlet 12 is arranged at the downstream end of trough 7 which allows the cleaning liquid to exit from the tub. Outlet 12 is situated in the tub at a height lower than inlet 11 to assure discharge of the liquid.

The troughs 5, 6, 7 mount a plurality of brushes 18. The first trough 5, in the direction of the cleaning liquid flow, mounts one brush which rotates in the direction indicated in FIG. 1. Each of the following troughs 6, 7 mount a pair of brushes with one brush of the pair rotating in a direction opposite to that of the other brush, as indicated by arrows in FIG. 1.

The brushes 18 are mounted in the troughs with their axis of rotation parallel and at such a height so as to contact the cleaning liquid and plate-shaped objects 1. The periphery of each brush extends above the walls of the trough so as to come into contact with the path of travel of the objects 1. By rotating each brush of a pair in opposite directions, a pumping action forms a meniscus 31 between them which contacts the face of the objects 1 and aids in cleaning. Since both the brushes 18 and the meniscus 31 contact the objects 1, a thorough and effective cleaning is attained.

Spray nozzle 13 is arranged above the trough 5 and conveying chains 3, and between the two chains 3. Nozzle 13 is inclined with respect to the direction of transport so that the side or upwardly directed face of the objects 1 remote from brushes 18 may also be cleaned.

At the opposite end of the tub 30 another nozzle 14 is arranged above the trough 7 and conveying chains 3, and between the two chains 3. Nozzle 14, however, is not inclined relative to the direction of transport, rather it is directed downwardly of the objects.

Nozzles 13 and 14 spray cleaning liquid received from the troughs 5 and 7, respectively. The pump 28 supplies the liquid to the nozzles 13, 14 via pipes 15, 16 respectively. A central valve 23 and magnetic valve 24 of conventional type are provided to control the amount of spray from nozzles 13, 14.

At the front or upstream end of each trough relative to the direction of flow of the cleaning liquid, a wiping brush 26 is mounted which contacts the plate-shaped objects 1 after having been cleaned by the brushes in the troughs. Wiping brushes 26 prevent the cleaning liquid from being carried from one trough to the next and prepare the objects 1 for the next stage of treatment.

At the exit end of trough 5 for the objects, air knife 27 is mounted for drying the objects 1 before they are removed from the baskets 2.

A hood 22 is also provided for each of the troughs 5, 6, 7, which prevents the cleaning liquid from evaporating into the premises where the apparatus is located.

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The brushes 18 of the invention may be made of any suitable material such as horsehair, pigs' bristle, or the like.

The conveying means of the present invention may comprise two facing U-shaped bars constituting a guide for the plate-shaped objects, which are driven along the channel formed by the U-shaped bars by, for example, dogs in a conveyor chain. It is also possible to have any desired number of troughs and brushes and/or pairs of brushes in the apparatus of the present invention.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A method of cleaning plate-shaped objects by moving the objects past a tub containing a cleaning liquid and having a plurality of brushes mounted therein, comprising conveying the plate-shaped objects across and above the tub, serially arranging the brushes

in the tub along the path of movement of the objects with at least certain of the brushes disposed in pairs and partially immersed in the cleaning liquid, positioning the periphery of the brushes above the top of the tub so as to come into contact with the plate-shaped objects, and rotating one brush of a pair in the opposite direction as the rotation of the other brush of the pair, so as to form a meniscus therebetween contacting the surface of the object being cleaned.

2. The method according to claim 1, further comprising, dividing the tub into a plurality of troughs each mounting at least one brush, spraying the plate-shaped objects with cleaning liquid from the troughs at the beginning and end of the path of movement of the objects above the tub so that the spray contacts the opposite side of the object from the sides contacted by the brushes, and drying the plate-shaped objects after the completion of their paths of movement over the tub.

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