(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 160 362**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **85301549.3**

(22) Date of filing: **06.03.85**

(51) Int. Cl.⁴: **B 08 B 3/04**
C 23 G 5/04

(30) Priority: **13.03.84 GB 8406536**
29.10.84 GB 8427274

(43) Date of publication of application:
06.11.85 Bulletin 85/45

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: **Pattison, Henry Michael**
132, King Cross Road
Halifax West Yorkshire HX1 3JZ(GB)

(72) Inventor: **Pattison, Henry Michael**
132, King Cross Road
Halifax West Yorkshire HX1 3JZ(GB)

(74) Representative: **Stanley, David William et al,**
APPLEYARD LEES & CO. 15 Clare Road Halifax
West Yorkshire HX1 2HY(GB)

(54) Cleaning plants.

(57) A cleaning plant (1) comprises four baths (B1 to B4) and an entry/exit station (2), which are spaced at regular angular intervals (72°) around a circular path, in the manner of a carousel. A transporter (6) is adapted to transport basket carriers (9) successively through the baths (B1 to B4), and from and to the entry/exit station (2). To this end, a central piston (7), which supports the basket carriers (9), may move up and down and rotate.

The baskets (9) carry, for example, machined parts which are cleaned in solvent in the baths (B1 to B4). Drip trays (D1 to D3) are placed between the baths, to catch drips of solvent from the baskets, as they are moved around the plant. At least one of the drip trays (30) has an inclined portion (31), such that drips of solvent may be returned into one of the baths (B1 to B4), rather than evaporating.

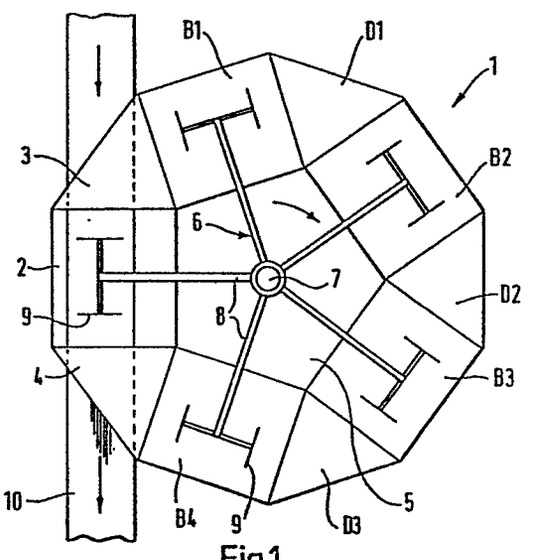

Fig.1.

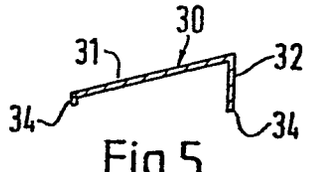

Fig.5.

EP 0 160 362 A1

0160362

CLEANING PLANTS

This invention relates to cleaning plants, and is concerned particularly although not exclusively with cleaning plants which are adapted to clean machined parts in solvent.

Cleaning plants are known in which articles to be cleaned are immersed in successive baths of solvent. Usually, a transport means performs an automatic cycle, to transport such articles between the baths. Usually, the transport means is so arranged that, after each immersion, the respective article is suspended above the bath from which it has emerged, to enable any drips to return into the bath. Flat drip trays are provided between the baths, to catch any drips of excess solvent, which is then usually allowed to evaporate.

It will be appreciated that, in such an arrangement, the cycle time (and therefore the efficiency) of the plant is limited to some extent by the dwell time for which an article must be suspended over a bath, after immersion. Also, evaporation of solvent from the flat drip trays leads to further expense, either in loss of solvent altogether, or costs in running a reclamation plant for the solvent.

The present invention aims to provide cleaning plants which may be improved in this respect.

According to one aspect of the present invention, there is provided a cleaning plant comprising:

a plurality of baths adapted to contain solvent;

transport means adapted to receive articles to be cleaned and to transport them successively through the baths; and

at least one drip tray which is disposed between two of the baths and is adapted to catch any drips of solvent from an article being transported between the baths, the drip tray being inclined to the horizontal so as to direct any drips of solvent thereon into a receptacle for the solvent.

It may be appreciated that, in such a cleaning plant, the dwell time of an article over a bath, after its immersion therein, may be reduced relative to present practice, as the inclined drip tray serves to catch and redirect into said receptacle any drips of solvent from the article.

Preferably, the receptacle comprises one of the two baths adjacent the drip tray. The drip tray may have two inclined portions, each inclined towards a respective one of the two adjacent baths. Alternatively, the drip tray may be inclined towards only one of the two adjacent baths. In this latter case, said one bath is preferably upstream of the drip tray, with respect to a feed path of the transport means.

The drip tray is preferably formed with drainage channels. It may advantageously be made of stainless steel.

The drip tray may be formed along at least one lower edge with a plurality of recesses arranged to receive securing bolts or the like. Said recesses may open downwardly, such that the drip tray may be positioned simply over existing bolts.

The baths of the cleaning plant may be disposed on a curved path, along which the transport means is arranged to transport articles to be cleaned. The curved path may be a circular path.

An entry and/or exit station may be disposed on the said curved path, with the transport means adapted to pick up articles to be cleaned and/or to set down articles after cleaning at said entry and/or exit station.

The cleaning plant may include conveyor means for conveying articles towards and/or away from the cleaning plant.

In another aspect, the invention provides a cleaning process comprising the steps of transporting an article successively through the baths of a cleaning plant in accordance with the first aspect of the invention, and allowing solvent to drip from the article onto said drip tray as it is transported between the two adjacent baths, such that the solvent is directed into said receptacle.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawing, in which:

Figure 1 is a plan view of a cleaning plant;

Figure 2 is a plan view of a drip tray for use with the cleaning plant;

Figure 3 is a side view of the drip tray;

Figure 4 shows a cross-section of the drip tray on the line IV-IV of Figure 2; and

Figure 5 is a view similar to Figure 4, but showing the cross-section of an alternative drip tray.

Figure 1 is a diagrammatic representation of a cleaning plant which is made by Techno Chemie AG of Zurich, and is known as a "Carousel" cleaning plant.

The cleaning plant 1 comprises four baths B1 to B4 and an entry/exit station 2, which are spaced at regular angular intervals (72^{o}) around a circular path, in the manner of a carousel.

A drip tray D1 is disposed between the two adjacent baths B1 and B2. In plan view, the drip tray D1 is triangular, and it may conveniently be secured to the baths B1 and B2 by means of bolts which pass through flanges in lower edges of the drip tray D1, and engage in tapped holes in the sides of the baths B1 and B2. Similarly, a drip tray D2 is positioned between the two baths B2 and B3, and a further drip tray D3 is positioned between the two baths B3 and B4. Infill panels 3 and 4 are disposed between the entry/exit station 2 and the first and fourth baths B1, B4 respectively. The infill panels 3 and 4 are, in plan, of similar shape to the drip trays but, as will become apparent from the following description, do not themselves have to serve as drip trays, in use. A conveyor belt 10 serves to convey articles to be cleaned, towards and away from the entry/exit station 2.

In the centre of the cleaning plant 1 there is defined a space 5 in which there is disposed a transporter 6. This comprises a central piston 7 from which there radiate five arms 8, at 72^{o} intervals. A

basket carrier 9 depends from the outer end of each arm 8.

Briefly, operation of the illustrated cleaning plant 1 is as follows.

Firstly, the baths B1 to B4 are filled with solvent. Typically, they may contain perchloroethylene (e.g. "PERKLONE" - Registered Trade Mark, as sold by I.C.I. Chemicals Limited). In the first path B1, the perchloroethylene solvent may be heated to 60°F-90°F, for example. In the second and third baths B2 and B3, the solvent may be cold. In the fourth bath B4, the temperature of the solvent may be elevated e.g. at 120°F, and there may in fact be relatively little solvent in this bath.

A basket of machined parts ready to be cleaned is loaded onto the conveyor 10, upstream of the entry/exit station 2. The piston 7 is lowered, such that the respective basket carrier 9 is disposed at a predetermined height above the conveyor belt 10. The conveyor belt 10 is then operated, to bring the basket of machined parts into the entry/exit station, where it engages with the respective basket carrier 9. The conveyor 10 is then stopped.

The piston 7 is then raised, and the various basket carriers 9 maintained at a semi-elevated position for a predetermined dwell time. After this, the piston 7 is raised to a maximum elevated position and then rotated clockwise (as illustrated in Figure 1 by the arrow), so that each arm 8 and its respective basket carrier 9 becomes positioned over the successive station. In the case of the basket carrier 9 that was initially in the entry/exit station 2, this is now moved to a position above the first bath B1.

The piston 7 is then lowered to its lowermost position, immersing the respective basket of machined parts into the first bath B1. It remains there for a predetermined time, during which the piston 7 may move up and down to agitate the basket of parts within the hot solvent. At the end of the predetermined time, the piston 7 then raises again to its semi-elevated position, and remains stationary for the aforementioned dwell time. During this time, any solvent may drip off the basket of parts which is suspended over the bath B1, and back into the bath.

The piston 7 is then raised to its maximum height and rotated through 72°, so that the basket of parts which was previously immersed in bath B1 is now positioned over bath B2. The sequence of movements of the piston 7 is then repeated, such that the basket of parts is immersed and agitated in the second bath B2, to effect a primary rinsing operation. It will readily be appreciated that, in a similar way, the basket of parts successively undergoes a second rinsing operation in the third bath B3, and a final drying operation in the fourth bath B4. After this, the basket of parts is returned to the entry/exit station. After the piston has been lowered to place the basket of parts onto the conveyor 10, the conveyor is then caused to move, to take the basket of cleaned parts away from the cleaning plant.

Thus, the cleaning plant 1 operates continuously such that, at any one time, there is a basket of parts immersed in each one of the four baths B1 to B4, and a further basket of parts either entering or exiting from the station 2.

In the conventional apparatus, each of the drip trays D1 to D3 is flat. The predetermined dwell time,

for which a respective basket is suspended over each of the baths B1 to B3 in particular, is so chosen that dripping of solvent from the basket is substantially finished, before the piston 7 is rotated. Any occasional drips of excess solvent which fall on the drip trays D1 to D3 evaporate. Thus, the rate at which the plant 1 may operate is limited to some degree by the fairly significant dwell time that is required, to ensure that dripping of solvent is substantially finished before rotation of the piston 7.

It will be appreciated that the solvent that is used in the cleaning plant 1 is hazardous to operators, and that the plant 1 is therefore necessarily enclosed within its own housing. A certain amount of the solvent will be continuously evaporating, and this is withdrawn from the main enclosure by means of an extraction fan, and reclaimed for subsequent use, through a reclamation plant, including stills, pumps, etc. Although such reclamation avoids direct loss of the solvent, it will be appreciated that it involves a certain amount of running costs.

To improve upon the conventional arrangement of the cleaning plant 1, each of the drip trays D1 to D3 is of the form of the drip tray 20 which is shown in Figures 2 to 4. The drip tray 20 is of triangular form in plan view, as is illustrated in Figure 1. However, as will be seen with particular reference to Figures 3 and 4, the drip tray 20 comprises two oppositely inclined portions 21, which meet at an apex ridge 22. A plurality of drainage channels 23 are formed in each of the inclined portions 21. Along the lower edge 24 of each portion 21 there is formed a series of part circular recesses 25, each of which is open downwardly.

Thus, an existing conventional cleaning plant 1 which has a general form as illustrated in Figure 1 may be converted for use in accordance with the invention, simply by adopting a respective drip tray 20 for each of the drip trays D1 to D3. In a particularly convenient arrangement, existing securing bolts for conventional flat drip trays may be slackened, and the new drip trays 20 fitted directly over the conventional flat drip trays, such that each recess 25 fits over a respective one of the securing bolts. Upon retightening the securing bolts, each drip tray 20 is secured in place.

Thus, in use, each of the drip trays 20 is adapted to catch any drips of solvent which may fall from the basket of machined parts, as it is transported between two adjacent baths. Thus, the drip tray D1, when constructed as shown in Figures 2 to 4, is arranged to catch drips of solvent and direct them either into the first bath B1 or the second bath B2.

This arrangement means that the dwell time of the basket over the respective baths may be significantly reduced. If the solvent continues to drip from one of the baskets as it is transported from one of the baths to the next, then the solvent is simply caught by the drip tray beneath it, and directed back into an adjacent path. In consequence, the cycle time of the cleaning plant 1 may be significanty reduced, leading to greater efficiency and therefore reduced operating costs. This is particularly important in view of the fact that the cleaning plant 1 is typically arranged to be run continuously. If it is able to clean a significantly increased number of articles during the working day, then this may effectively reduce capital investment in such cleaning plants.

Another advantage is that, because the drip trays 20 are adapted to return solvent directly to adjacent baths, there is less likelihood of solvent evaporating. This means that the solvent returned from the drip trays may be used immediately, rather than having to be reclaimed in the reclamation plant, at some appreciable cost.

It will be appreciated that, when a basket is travelling from one bath to the next, it may be desired to minimise the amount of returned solvent being directed into the succeeding bath. This may particularly be the case in respect of the first bath B1, which is naturally the dirtiest bath. It may be undesirable to have a significant amount of relatively dirty solvent from the first bath B1 dripping into the succeeding rinsing bath B2.

Therefore, an alternative drip tray 30 may be used, as shown in Figure 5. This is generally similar to the drip tray 20 of Figures 2 to 4, but it will be seen that it has only one inclined portion 31, and a vertical side wall 32. The lower edges 34 of the inclined portion 31 and the vertical wall 32 may be provided with recesses 25 as shown in Figures 2 to 4, and the inclined portion 31 may be provided with drainage channels such as 23, generally as illustrated in Figures 2 to 4. However, when the drip tray 30 is positioned between the first and second bath B1, B2, it will return any drips of solvent falling from a passing basket only into the first bath B1, rather than into the rinsing bath B2.

It will be appreciated that, the higher the apex ridge 22 of the drip trays 20 or 30, and the steeper the incline of the inclined portions 21, 31, the faster solvent will return to the adjacent baths. Thus, the piston 7 should raise to as great a height as possible,

so that the drip trays 20, 30 may be as tall as possible. If necessary, this may be achieved by raising the roof of the enclosure within which the cleaning plant 1 is housed.

As an alternative to the illustrated arrangement, the drip trays 20, 30 may be arranged to direct collected solvent to an additional receptacle, rather than directly back into the respective baths.

As another alternative, the drip trays 20, 30 may be free standing on existing drip trays and/or the sides of the adjacent baths.

Although the apex ridge 22 is shown in Figure 3 as itself inclined, the inclined portions 21, 31 of the drip trays 20, 30 may be so contoured that the apex ridge 22 is of substantially constant height - i.e. substantially horizontal.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification and/or drawings, or to any novel one, or any novel combination, of the steps of any method or process disclosed herein.

CLAIMS:

1. A cleaning plant (1) comprising:

a plurality of baths (B1 to B4) adapted to contain solvent;

transport means (6) adapted to receive articles to be cleaned and to transport them successively through the baths (B1 to B4); and

at least one drip tray (D1 to D3) which is disposed between two of the baths (B1 to B4) and is adapted to catch any drips of solvent from an article being transported between the baths, characterised in that the drip tray (30) is inclined to the horizontal so as to direct any drips of solvent thereon into a receptacle for the solvent.

2. A cleaning plant according to Claim 1, wherein said receptacle comprises one of the two baths adjacent the drip tray.

3. A cleaning plant according to Claim 2, wherein the drip tray has two inclined portions, each inclined towards a respective one of the two adjacent baths.

4. A cleaning plant according to Claim 2, wherein the drip tray is inclined towards one only of the two adjacent baths.

5. A cleaning plant according to Claim 4, wherein said one bath is upstream of the drip tray, with respect to a feed path of the transport means.

6. A cleaning plant according to any preceding claim, wherein the drip tray is formed with drainage channels.

7. A cleaning plant according to any preceding claim, wherein the drip tray is formed along at least one lower edge with a plurality of recesses arranged to receive securing bolts.

8. A cleaning plant according to Claim 7, wherein said recesses are open downwardly.

9. A cleaning plant according to any preceding claim, wherein said baths are disposed on a curved path, along which the transport means is arranged to transport articles to be cleaned.

10. A cleaning plant according to Claim 9, wherein said curved path is a circular path.

11. A cleaning plant according to Claim 10 or 11, wherein an entry and/or exit station is disposed on said curved path, and the transport means is adapted to pick up articles to be cleaned and/or to set down articles after cleaning at said entry and/or exit station.

12. A cleaning plant according to any preceding claim, including conveyor means for conveying articles towards and/or away from the cleaning plant.

13. A cleaning process comprising the steps of transporting an article successively through the baths of a cleaning plant according to any preceding claim, and allowing solvent to drip from the article onto said drip tray as it is transported between the two adjacent baths, such that the solvent is directed into said receptacle.

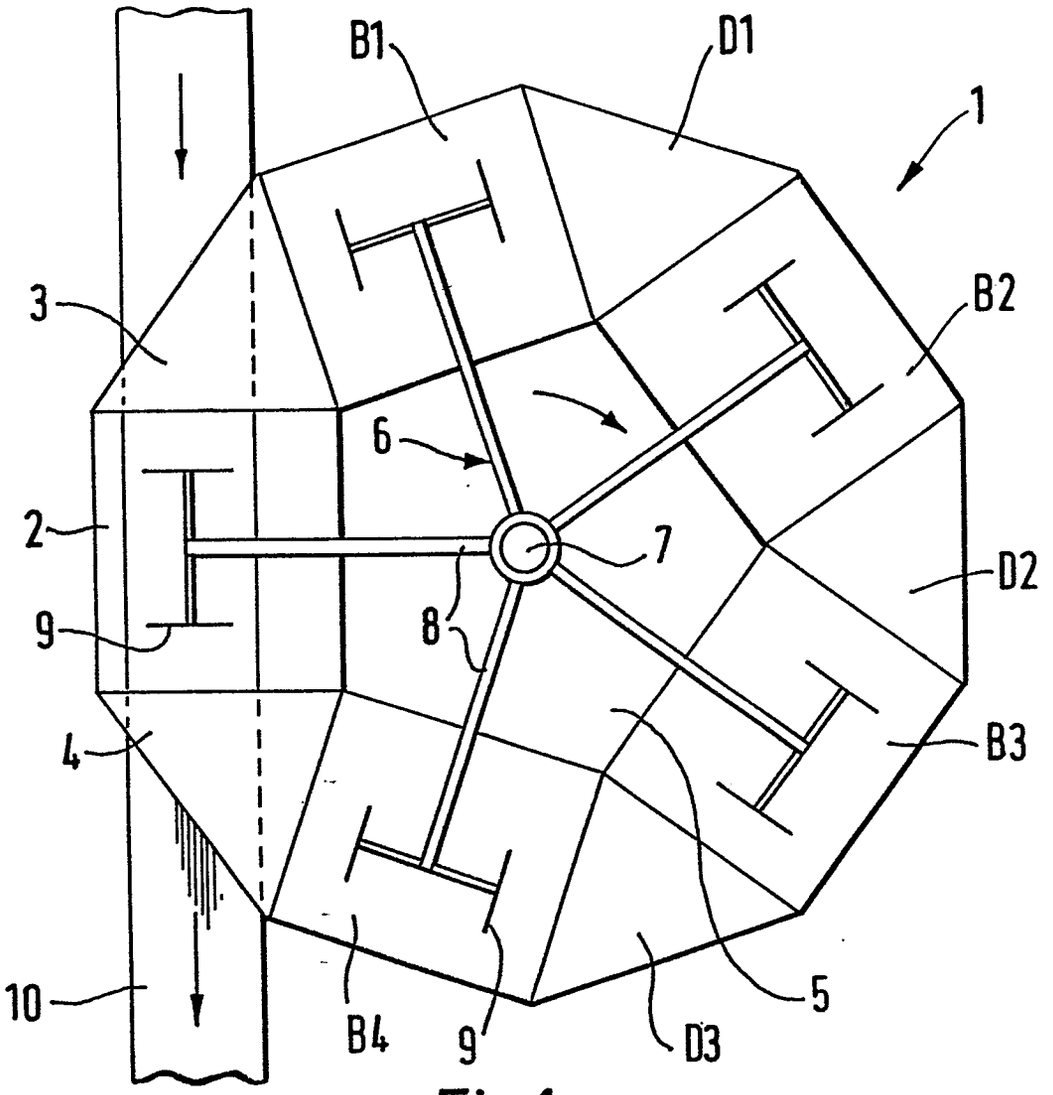

Fig.1.

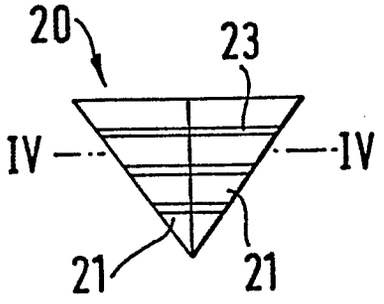

Fig.2.

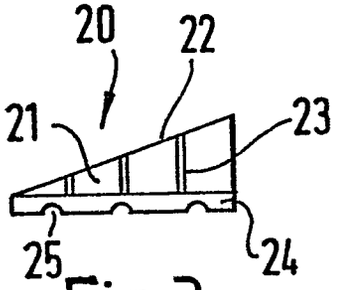

Fig.3.

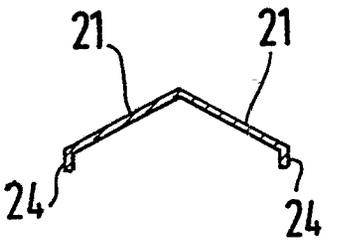

Fig.4.

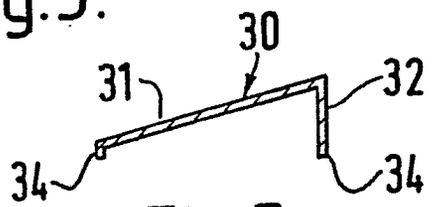

Fig.5.

European Patent Office

EUROPEAN SEARCH REPORT

0160362
Application number

EP 85 30 1549

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
X	FR-A-2 452 529 (LANGBEIN) * Claims 1,5; figures 1,2 *	1,9-13	B 08 B 3/04 C 23 G 5/04
A	FR-A-1 214 210 (MAESTRELLI)		
A	DE-C- 746 954 (HUMMEL)		
A	US-A-3 970 560 (METZGER)		

TECHNICAL FIELDS SEARCHED (Int Cl 4)

B 08 B
C 23 G
B 65 G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28-06-1985	DE SCHEPPER H.P.H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503. 03.82