



European Patent Office



EP 0 857 516 A2

(12)

(51) Int. Cl.⁶: **B05C 3/10**

(22) Date of filing: 10.02.1998

(74) Representative:
Symes, Christopher A.
FORRESTER & BOEHMERT
Franz-Joseph-Strasse 38
80801 München (DE)

(71) Applicant:
Protective Finishing Group Limited
Redditch, Worcestershire B98 7TH (GB)

(57) Apparatus (10) for coating articles (28), comprising a support structure (11), a container (23) to contain the articles (28), container support means (21), and means (16a) to rotate the container, wherein resilient means (17) are provided to connect the container support means (21) to the support structure (11). The resilient means (17) preferably comprise metal coil springs, such that any wobble or other undesired vibrations caused by rotation of the container (23), conveniently a metal basket are absorbed by the coil springs (17), such that the basket, whilst rotating at high speed, exhibits a high degree of stability, in a manner similar to that of a gyroscope.



Description

This invention relates to apparatus for coating articles, primarily but not exclusively, to apparatus for coating metal articles, and to a method of coating articles. Although the term "metal" will be used henceforth, it should be understood that the term is intended to encompass other materials.

Several techniques presently exist by which metal articles may be coated, with paint, varnish, corrosion resistant formulations and the like, such techniques including dipping, spraying, powder coating, and electroplating.

Such techniques generally impart an acceptable coating to the articles, but a preferred technique has been found to be centrifugal coating, whereby the articles to be coated are placed in a rotatable container such as a perforated basket, a coating material such as paint is applied to the articles, by dipping the basket and articles into a paint reservoir, and the basket is then removed from the paint reservoir and rotated at high speed about a generally vertical axis to remove excess paint from the articles and to ensure that a generally uniform thickness of paint is applied thereto.

The articles are often relatively heavy, and it is often the case that when loaded the distribution of articles therein will be uneven. When the basket is rotated about a vertical axis at high speed, which may exceed 2500 rpm, significant "wobble" may exist, putting considerable strain on a mounting to which an upper part of the basket is secured.

In order to ensure that the rotating basket does not become detached from the mounting during rotation of the basket, it has hitherto been necessary to hold the mounting in a very rigid manner, requiring the use of strong and heavy material about the mounting.

However, significant stress may still be imparted to parts of the apparatus, presenting a risk of failure, which if occurring during high speed rotation of the basket, may have serious implications.

It is one of the various objects of the present invention to provide improved apparatus for coating articles which overcomes or reduces the problems above.

According to one aspect of the invention, there is provided apparatus for coating articles, comprising a support structure, a container to contain the articles, container support means and means to rotate the container wherein resilient means are provided to connect the container support means to the support structure.

Preferably, the container support means is connected to or forms part of drive means associated with the means to rotate the container.

Preferably, the container support means comprises a plate like member on which the means to rotate the container and its drive means are mounted.

The resilient means preferably comprises a coil spring, one end of which is attached to the container support means, the other end of which is attached to the

support structure, which may be in the form of a frame assembly, support beam, or the other suitable construction.

Preferably, more than one resilient means is provided, and conveniently, four coil springs may be provided in a generally cruciform arrangement, and lying in a generally horizontal plane, by which the container support means is mounted to the support. The springs are preferably metallic but may equally be formed from other suitable materials, such as plastics materials, if desired.

The means to rotate the container preferably comprises a motor, and conveniently, comprises an air motor, driven by compressed air. The air motor preferably connected to a compressed air source by a flexible hose. The motor is preferably generally vertically oriented, such that a drive shaft rotated by the motor extends generally vertically, and downwardly, from the motor towards the container.

There may also be provided guide members, integral with or secured to the container support means through which the drive shaft from the motor passes.

Preferably, the guide members comprise a first part, which in use is firmly secured to the drive shaft and a second part, relative to which the first part may rotate, such that in use, the weight of the container attached to a lower part of the drive shaft is at least partly supported by the guide members, rather than by the motor alone.

Conveniently, the guide members comprise plunger blocks.

The container is preferably in the form of a basket, by which it is meant that the container comprises a plurality of apertures in at least the side thereof, and conveniently also in the base, the motor being connected to the container by means of the rotatable drive shaft.

The shaft may comprise a hook at the lower end thereof, which hook in use engages with a receiving formation located on an upper part of the container such as an inverted U-shaped arm or carrying handle.

According to a further aspect of the invention, there is provided a hook, comprising a channel adapted to receive part of an article to be held by the hook, the channel comprising a first part having a first width, and a second part, having a second width, wherein the second width is greater than the first width.

The first part may be generally straight, such that the first part comprises generally parallel extending inner side walls, whereas the second part may be generally circular in cross section, such that the diameter of the cross section is greater than the shortest distance between the inner side walls of the first part.

By providing a second part of greater width than the first part, the hook is effectively provided with shoulder formations, which restrict upward movement of the article, relative to the hook.

The hook preferably comprises a recess in the first part, and conveniently, the hook comprises a recess in each side wall of the first part.

Preferably, the hook is cut from steel plate, conveniently of approximately 1-1.5 cm thickness.

The apparatus preferably also comprises a reservoir adapted to contain a liquid with which the articles are to be coated.

The reservoir is preferably located generally beneath the container, and there is preferably provided means to induce generally vertical relative movement between the reservoir and the container.

The means may comprise a moveable platform, hoist, table or the like, whereby the reservoir, containing the required liquid, may be raised up to a point at which the liquid contained therein comes into contact with the articles in the container, thus applying the liquid to the articles. The platform or hoist may be raised/lowered by any convenient means, although preferably, hydraulic means is utilised.

Alternatively, the apparatus may comprise means to lower the container towards the reservoir below, and to subsequently raise the container prior to commencement rotation thereof. Again, such means is preferably hydraulic.

According to a still further aspect of the invention, there is provided a method of coating articles comprising placing the articles in a container, applying liquid to the articles, rotating the container to remove excess liquid from the articles, and placing the articles in a heated environment, wherein the articles remain in the container when placed in the heated environment.

The heated environment is preferably provided by an oven, conveniently an airless oven.

The liquid may comprise paint, a corrosion resistant formulation, or other metal protective composition, such as are used during centrifugal coating of articles.

If desired, the coating and heating operations may be repeated.

According to yet still further aspect of the invention, there is provided apparatus for coating articles, comprising coating means, whereby liquid is applied to articles in a container, heating means, whereby heat is imparted to the articles in the container, and conveying means whereby the container is conveyed from the coating means to the heating means.

The coating means preferably comprises centrifugal coating apparatus, conveniently such as that described in relation to the first aspect of the invention.

The conveying means may comprise a conveyor belt arrangement, but preferably, comprises a chain conveyor having attached thereto a plurality of engaging formations such as hooks, to which upper parts of the containers may be attached.

Preferably, the conveying means extends into the heating means.

Thus, the chain conveyor may be in the form of a loop, whereby containers containing articles may be attached to the chain at a position adjacent the coating means, transported via the chain to an into the heating means, and subsequently returned from the heating

means to the coating means.

Thus, if desired, the coating and heating operation may be repeated.

Of course, the containers and articles may be removed from the chain shortly after the heating operation if no further coating is required.

The invention will now be described with reference to the accompanying drawings, wherein:

FIGURE 1 is a perspective view of a preferred embodiment of one aspect of the invention, FIGURE 2 is a side view of part of the assembly shown in Figure 1, with a modified hook, and FIGURE 3 is a schematic view of a preferred embodiment of a further aspect of the invention.

Referring first to Figure 1, a centrifugal coating assembly generally indicated at 10 is shown comprising a support structure in the form of an overhead frame assembly 11 consisting of beams 12, 13, 14 and 15, located generally centrally of which is an air motor 16, attached to a container support plate 21, which is suspended between the beams by four metal coil springs 17. The air motor 16 is connected to a source of compressed air 16a by a flexible hose 16b.

The plate 21 is connected to the springs through nylon bushes (not shown).

Connected to a lower portion of the air motor 16 is a drive shaft 18, which passes through plummer blocks 19 and 20 which are connected to the support plate 21, the plummer blocks serving to restrict sideways movement of the shaft 18 during rotation thereof, and to take a large portion of the weight of the container attached to the shaft 18.

The lower end of the shaft 18 is provided with an upturned hook 22 to which, in use, is connected a basket 23 having a handle 24 under which the hook passes.

There is provided beneath the basket a paint bath 25 containing paint 26, the bath being provided on a moveable platform 27, which may be raised or lowered in a conventional manner by use of hydraulic or pneumatic arrangement.

Thus, in use, articles 28 to be coated are placed within the basket, the basket is then attached to the hook 22 of the rod 18, and the moveable platform 27 is raised so that the articles become submersed in the paint 26. The moveable platform is then lowered, excess paint being allowed to drip back into the bath 25 through apertures in the base of the basket 23.

The bath is lowered to a height at which the basket is no longer in contact with the paint 26, but at which the side walls of the bath extend above the level of the articles 28 contained within the basket.

The basket is then rotated at high speed, for example, 2500 rpm, to remove excess paint from the articles, which allows a generally uniform coating of paint on the articles to be obtained, in conventional manner.

Since the basket may be unevenly loaded with arti-

cles, the basket is subjected to uneven downwardly extending forces, which when the basket is rotated, can cause significant wobble to occur to the basket, and thus to the shaft and air motor, which has hitherto been overcome by rigidly mounting the motor assembly to the frame assembly 11.

However, it has been found by the applicants that by resiliently mounting the container support assembly to the frame, conveniently using a support plate such as that shown at 21, any wobble or other undesired vibrations are absorbed by the coil springs, and the basket, while rotating at high speed, exhibits a high degree of lateral stability, in a manner similar to that of a gyroscope.

Referring now to Figure 2, part of the assembly shown in Figure 1 is shown in side view. The air motor 16 is mounted to the support plate 21 by a generally L-shaped foot 60, the lower part of which is attached to the plate by screws 61 and 62.

As shown in Figure 2, the drive shaft 18 may be connected to the air motor via a universal joint 63, which conveniently is a rubber, or other flexible universal joint.

The hook 22 is generally of U-shaped construction, comprising a top 64 and U arms 65 and 66. A channel 67 extending into the hook, has an inlet 68 and a seat 69 which in use is occupied by an arm of the container which is supported by the hook. The generally vertically orientated part of the channel 67 comprises inner side walls 70 and 71, which extend generally parallel to each other. The seat 69 is part circular in cross section, the diameter thereof being greater than the distance between the parallel extending side walls 70 and 71. Furthermore, there is provided a recess 73 in the side wall 70.

It has been found by the applicants that the provision of a seat having a circular cross section whose dimension exceeds the distance between the parallel extending side walls of the channel reduces the tendency of a container or other construction, attached to the hook by an arm passing through the channel of the hook, to become detached, when the hook is rotated at relatively high speed about a generally vertical axis. The reason for this is thought to be that when the hook begins to rotate, the arm of the container held by the hook, which passes through the bottom of the channel 69, and which arm has a diameter less than the diameter of the second part of the channel, twists out of alignment with the channel.

Since the arm of the container is thus not in the line of sight of the channel, upward movement of the arm relative to the hook is restricted, and the applicants have found that over a prolonged period of use, the arm beds into the base of the channel 69. Furthermore, when an unevenly loaded basket is attached to the hook, the arm of the basket passing through the channel 69 will tend to lie to one side of the axis A. When the hook is rotated about the axis A, the centrifugal force applied to the container biases the container firmly

towards the side of the axis. Thus, there is effectively provided a shoulder 74 or 75, depending on the weighting of the container, which restricts upward movement of the arm relative to the hook.

Should however the arm slip past the shoulder 74 or 75, the recess 73 catches the arm and restricts further upward movement.

It will be appreciated that whilst the recess 73 in the drawing is shown on the left hand side of the hook, there may in practice also be provided a corresponding recess on the other side of the hook.

Referring now to Figure 3, a coating assembly 50 is shown, which includes a centrifugal coating arrangement such as, for example, that described in relation to Figures 1 and 2. Once the centrifugal process has been completed, the baskets 23 are transferred to a chain conveyor arrangement 51, which carries the baskets towards and into an airless oven 52 through an entrance 53, in which oven the paint is at least partially dried. The baskets exit the oven through an exit 54, and are then transferred back towards the coating assembly 50, where the process may be repeated if required.

By drying the articles in the baskets, rather than by removing the articles from the basket prior to the drying operation, and thus removing the necessity of transferring the articles to a conventional working tray, which is subsequently put into the oven, it has been found that significantly less scratch marks are imparted to the articles, thus providing a superior finish to the articles over previously known techniques. Of course, some 'bare' areas may exist on the articles, corresponding to areas of contact between the articles when the paint is first applied. However, by agitation of the articles after the drying process and subsequently repeating the process, which effectively removes the possibility of the articles touching one another at the same areas, articles having a very high quality appearance may be obtained.

In a preferred arrangement, there may be provided in the coating assembly 50, more than one centrifugal assemblies of the type generally shown at 10 in Figure 1, and conveniently, there may be provided three such centrifugal assemblies, thus enabling a greater number of articles to be coated in a given time.

The centrifugal assemblies may be connected to a common source of comprises air, but preferably, each is independently controlled such that the containers associated therewith may be caused to rotate at different speeds, which may be desirable in view of differing articles contained therein, or differing compositions to be applied to the articles.

Further more, the complete centrifugal coating process is preferably automated such that by operation of a single switch which is spaced from the coating assembly 50, the moveable platform 27, on which rests the paint bath 25 is first raised so as to submerge the container and articles in the paint 26, maintained at the raised height for a sufficient time for paint to be imparted to the articles (approximately 2 seconds has been found

to be sufficient), and subsequently lowered to a position at which the basket no longer contacts the paint but at which the side walls of the paint bath extend above the level of the articles contained within the basket.

The automated procedure is then such that rotation of the baskets commences, continues for a present length of time, and then ceases.

The procedure may also involve the raising and lowering of a safety screen located towards the front of the centrifugal assembly, such that during rotation of the baskets, an operator is shielded from any articles which may conceivably be ejected from the baskets, or, in the event of failure of the basket or drive shaft, from any other parts which may be ejected from the assembly at high speeds.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. Apparatus (10) for coating articles (28), comprising a support structure (11), a container (23) to contain the articles (28), container support means (21) and means (16a) to rotate the container; characterised in that resilient means (17) are provided to connect the container support means (21) to the support structure (11).
2. Apparatus according to Claim 1 wherein the resilient means (17) comprises a coil spring (17).
3. Apparatus according to Claim 2 wherein four coil springs (17) are provided in a generally cruciform arrangement.
4. Apparatus according to any one of the preceding Claims wherein the means to rotate the container comprises an air motor (16).
5. Apparatus according to Claim 5 wherein the air motor (16) is generally vertically orientated.
6. Apparatus according to Claim 4 or Claim 5 comprising guide members (19,20), integral with or secured to the container support means (21), and through which a drive shaft (18) extending from the motor (16) may pass.
7. Apparatus according to Claim 6 wherein the guide members (19, 20) comprise a first part, which in use is firmly secured to the drive shaft (18), and a second part which is integral with or secured to the container support means (21), and relative to which the first part may rotate.
8. Apparatus according to Claim 6 or Claim 7 wherein the guide members (19, 20) comprise plumber blocks.
9. A hook (22) comprising a channel (67) adapted to receive part of an article to be held by the hook, the channel (67) comprising a first part (70, 71) having a first width, and a second part (69), having a second width, wherein the second width is greater than the first width.
10. A hook (22) according to Claim 9 wherein the first part comprises generally parallel extending inner side walls (70, 71), and wherein the second part (69) is generally circular in cross-section, the diameter of the second part (69) being greater than the distance between the side walls (70, 71) of the first part.
11. A hook (22) according to Claim 9 or Claim 10 comprising a recess (73) in the first part.
12. A method of coating articles (28) comprising placing the articles in a container (23), applying liquid (26) to the articles (28), rotating the container (23) to remove excess liquid from the articles (28), and placing the articles in a heated environment (52), wherein the articles (28) remain in the container (23) when placed in the heated environment (52).
13. Apparatus for coating articles (28), comprising coating means (10) whereby liquid (26) is applied to articles in a container (23), heating means (52) whereby heat is imparted to the articles (28) in the container (23), and conveying means (51) whereby the container (23) is conveyed from the coating means (10) to the heating means (52).

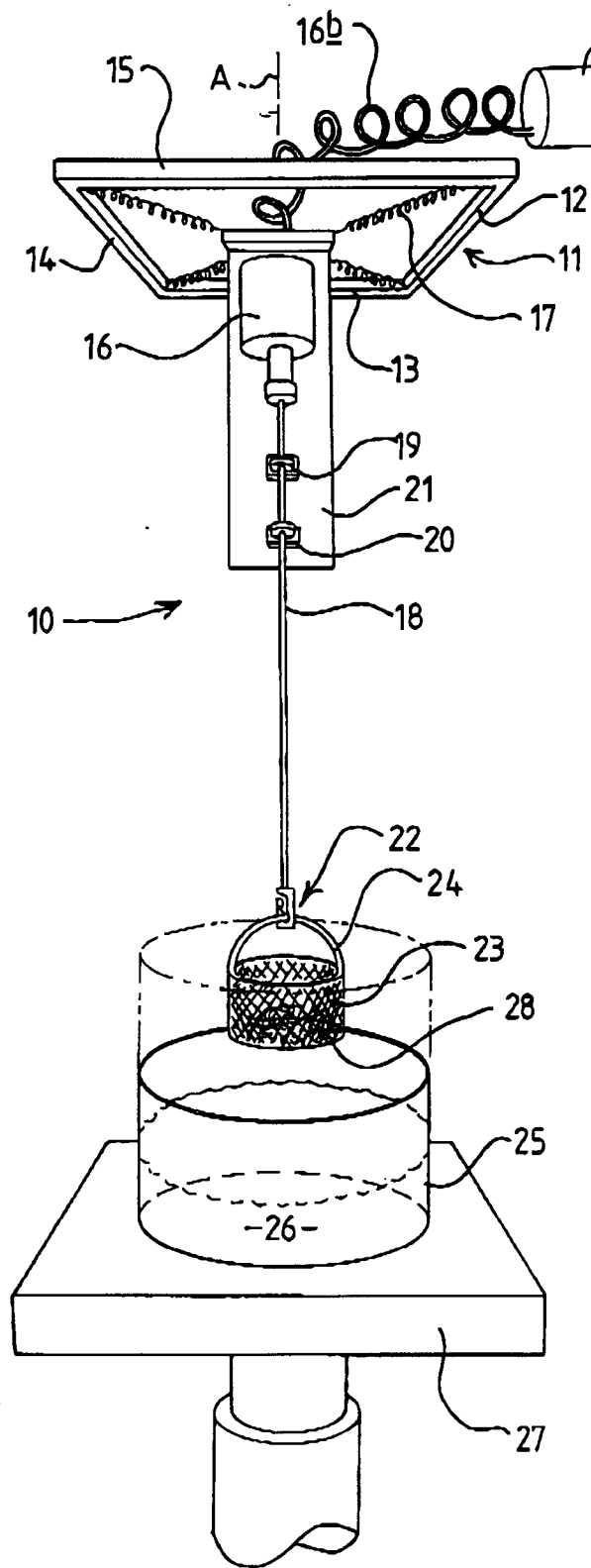


FIG 1

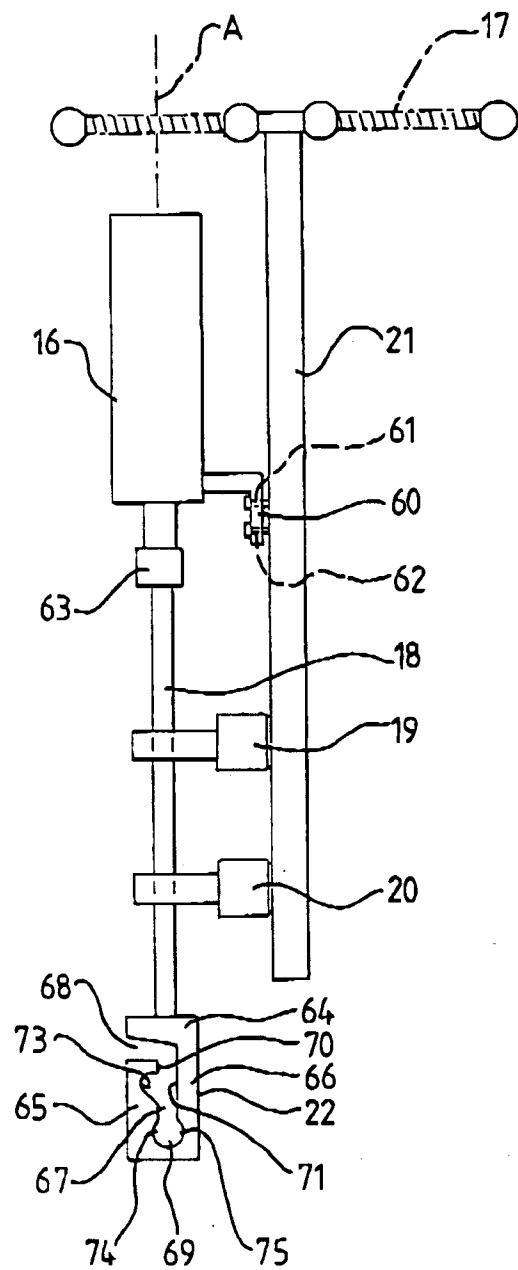


FIG 2

FIG 3

