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

(11) Publication number: **0 251 780**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87305827.5**

(22) Date of filing: **01.07.87**

(51) Int. Cl.4: **B 44 C 1/17**
B 65 C 9/25

(30) Priority: **02.07.86 GB 8616177**

(43) Date of publication of application:
07.01.88 Bulletin 88/01

(84) Designated Contracting States:
CH DE FR GB IT LI SE

(71) Applicant: **SERVICE (ENGINEERS) LIMITED**
Leek New Road
Cobridge Stoke-on-Trent, ST6 2LB (GB)

(72) Inventor: **Pass, Peter Allan**
8 Milford Avenue
Werrington Stoke-on-Trent (GB)

(74) Representative: **Russell, Paul Sidney et al**
Barker, Brettell & Duncan 138 Hagley Road Edgbaston
Birmingham B16 9PW (GB)

(54) Applying designs from heat-release transfers by means of a transfer pad.

(57) Design layers from heat-release transfers are applied to surfaces of articles of ceramic ware (W) utilising a deformable transfer pad (18). The surface of the transfer pad is heated by bringing together the pad and a pad-heating platen 12, whose surface is maintained at a suitable elevated temperature, and separating the pad and the surface after a suitable heating period. A heat-release transfer (T) is presented on a presenting platen (10), with at least the adhesive between the design layer and the backing sheet of the transfer not yet activated, and the heated pad pressed against the transfer on the platen. The pad is maintained pressed against the transfer for sufficient time for heat from the pad to activate the adhesive of the transfer, and the pad is then raised from the platen with the design layer of the transfer attached to the surface of the pad and with the backing sheet remaining on the platen. The pad bearing the design layer is then pressed against an article to be decorated (W) on a ware support (22) to apply the design layer to the surface of the article.

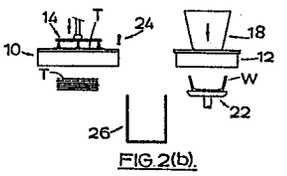

FIG.2(b).

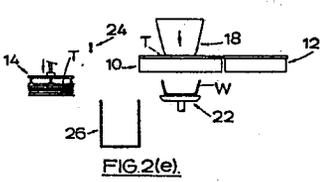

FIG.2(e).

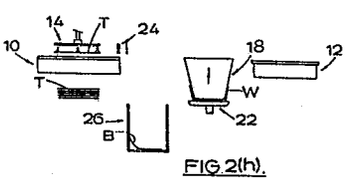

FIG.2(h).

EP 0 251 780 A1

Description

APPLYING DESIGNS FROM HEAT-RELEASE TRANSFERS BY MEANS OF A TRANSFER PAD

This invention relates to the decoration or other marking of articles by applying design layers from heat-release transfers to surfaces of the articles by means of a deformable transfer pad.

For example in decorating industrially produced ceramic tableware, the use of transfers has long been one of the decorating techniques available where suitable. Such transfers comprise a thin film-like design layer which is separable from a backing sheet which supports it prior to use. The design layer is secured to the backing sheet, in manufacture of the transfer, by some form of adhesive material which can be activated in use to permit separation. Furthermore, an adhesive layer may be provided covering the design layer. Depending upon the type of transfer, the design layer may be adhered to an article by activated adhesive provided on one side or the other of the design layer.

Known constructions of such transfers involve a wide variety of combinations of adhesive layers and types of adhesive material employed. However, the present invention relates solely to the use of such transfers in which heat-activatable adhesive material is used to attach the design layer to the backing sheet prior to use, and to enable temporary attachment to a transfer pad (as hereinafter explained), and such transfers are referred to herein as heat-release transfers.

For applying the design layers from heat-release transfers to curved surfaces of articles, there have been various proposals to make use of a deformable pad to carry the design layer from the backing sheet and apply it to the article. Such a pad can suitably be of a silicone rubber material and be shaped to present a domed working surface, similar to pads well known in applying decorative colour to articles in off-set printing of ceramic tableware.

An early proposal of this kind is set out in U.K. patent specification No. 1 388 029. The method there described involves heating the transfer to activate the adhesive materials of the transfer, and thereafter pressing the pad against the transfer to take up the design layer from the backing sheet. Although no specific mention is made of this, it would seem by implication that radiant heaters are meant to be used for heating the decal, reference being made to removal of the heat source prior to the transfer pad being brought down against the activated transfer.

More recent proposals are made in European patent specification No. 0 055 395 A1. That disclosure relates principally to a particular construction of heat release transfer, but several apparatuses are also described as suitable for use in applying the transfers. In each of those apparatuses the method proposed for heating the transfer is by means of a hot platen on which the transfer is supported prior to and during take-up of the design layer by the transfer pad. In this specification the suggestion is made that the pad may be heated, and there is a reference to the possibility of the pad alone being heated. However, there is no further elaboration of this suggestion and no apparatus is described in which the pad is heated at all.

A further recent disclosure in this field is that of U.S. Patent No. 4 511 425. This is concerned with labelling containers. Once again, the adhesive layers of the transfers are activated by heat from a hot platen on which the transfers are presented to the transfer pad. In this proposal the transfer pad is heated in addition to the platen (though to a lower temperature than the platen) in order to maintain the activated adhesive tacky during carriage of the design layer from its backing sheet to a container to be labelled. Various ways of heating the pad internally are described, and it is also suggested that the pad might be heated by radiant heaters. Furthermore it is mentioned that the pad might be heated by pressing it periodically against the hot label-heating platen, though the rider is added that "the use of an additional (internal) heating element is generally preferred since it affords a greater degree of temperature control and is a more reliable method of maintaining the pad at the required temperature levels".

All of those documents are principally or exclusively concerned with processes in which a heat-release transfer is activated by heating on a support surface prior to application of the transfer pad to take up the design layer from the backing sheet. Where in European specification No. 0 055 395 it is suggested in passing that the pad may be heated instead, nothing further is said to suggest that there could in fact be an advantage from effecting the process in that way, and there is no supporting description of performance of such a method to encourage use of such a process.

We have found that advantage can be gained from presenting the transfer to the pad unactivated (which is to say with at least the adhesive layer between the design layer and the backing sheet unactivated, and so the transfer structure still coherent) and utilising heat from the pad to activate the adhesive. In particular the following disadvantages can be avoided, which may result from adhesive between the design layer and the backing sheet being in a fluid condition when the transfer pad is applied:

(i) As the usual domed form of pad is pressed against the transfer, the centre of the pad touches the transfer first. The area of contact then gradually increases around that centre as pressure between the pad and the transfer-supporting platen is increased, to cause the pad to spread out over the whole of the area of the design layer. Such outwards spread of pressure tends to cause spreading of fluid adhesive material between the design layer and the backing sheet, resulting in a non-uniform distribution of the adhesive across the design layer.

(ii) Because the film-like design layer is supported by a fluid base of adhesive, distor-

tions (e.g. stretching) of the design layer may occur as the spreading pad pressure is applied.

(iii) An excessive amount of the fluid adhesive material may become absorbed by the backing sheet, therefore leaving too little on the design layer for reliable adhesion subsequently to an article.

We have also found, however, that the manner in which the pad is heated can be very important for reliable performance of a process in which heat from the pad is relied upon to activate the transfer. The provision of heating elements embedded in the pad (as encouraged by U.S. Patent No. 4 511 425) can have the undesirable consequence of affecting the physical behaviour of the pad. Radiant heating of the pad tends to require very careful setting up, if a uniform heating of the pad surface is to be achieved, and tends to require rearrangement each time the pad form is changed to suit different forms of articles to be decorated.

It is an object of the present invention to provide an improved method of decorating or otherwise marking articles using heat-release transfers.

In one of its aspects the invention provides a method of applying a design layer from a heat-release transfer to a surface of an article utilising a deformable transfer pad, the method comprising heating the surface of the transfer pad by bringing together the pad and a pad-heating surface at a suitable elevated temperature and separating the pad and the surface after a suitable heating period, pressing together the heated pad and a heat-release transfer presented on a platen with at least the adhesive between the design layer and the backing sheet of the transfer not yet activated and maintaining the pad pressed against the transfer for sufficient time for heat from the pad to activate the adhesive of the transfer, separating the pad and the platen with the design layer of the transfer attached to the surface of the pad and with the backing sheet remaining on the platen, pressing together the pad and an article to be decorated to apply the design layer to the surface of the article, and separating the pad and the article leaving the design layer adhered to the article.

In another of its aspects the invention provides apparatus suitable for use in applying a design layer from a heat-release transfer to a surface of an article in performance of a method as set out in the last preceding paragraph, the apparatus comprising a deformable transfer pad, pad-heating means presenting a pad-heating surface, heating means arranged to heat the pad-heating means to maintain the pad-heating surface at an elevated temperature, a transfer-presenting platen, an article support, and mounting means supporting the pad, the pad-heating means, the platen and the article support and enabling relative movements of approach and separation to be effected:

(i) between the pad and the pad-heating surface and enabling the pad and the surface to be pressed together;

(ii) between the pad and the transfer-presenting platen and enabling the pad and a transfer on the platen to be pressed together; and

(iii) between the pad and the article support and enabling the pad and an article mounted on the support to be pressed together.

The pad-heating surface can be a flat surface of a heated plate against which the pad is pressed to spread a working area of the surface of the pad over the plate. The plate can conveniently be maintained at a substantially constant temperature by means of thermostatically-controlled electrical heating elements heating the plate conductively.

The temperature of the transfer-presenting platen may be above ambient temperature in continuing performance of the method; each time the hot pad engages a transfer on the platen some heat will be transferred into the platen. However, a rise in temperature of the platen need not be detrimental to the process, provided it is not such that a significant heating effect on the transfers occurs; what matters principally is that in performance of the method the transfers do not become heated by the platen sufficiently for their adhesive to be activated, and the transfers so to lose their structural coherence, prior to being engaged by the pad.

Prior to performance of the method in production, it may be desirable to heat the pad for some time in an oven, in order to get the material of the pad warmed right through, before relying on the pad-heating surface to maintain the necessary surface temperature.

The precise temperatures involved in performance of the method will, of course, be determined not least by the physical characteristics of the transfers being used.

There now follows a description, to be read with reference to the accompanying drawings, of a method and apparatus for performance of the method which illustrate the invention by way of example.

In the accompanying drawings:-

Figure 1 is a diagrammatic illustration of principal components of the apparatus; and

Figures 2(a) to 2(i) illustrate successive steps in performance of the method using the apparatus.

Apparatus suitable for use in decorating articles of ceramic ware using heat-release transfers in a repetitive production process comprises (Figure 1) a horizontally-reciprocable transfer-presenting platen 10, a horizontally-reciprocable pad-heating platen 12, a vertically-reciprocable transfer-placing head 14, a cassette 16 for a stack of transfers T to be taken up one at a time by the placing head 14, a vertically-reciprocable transfer pad 18, and a ware-presenting turntable 20 comprising a plurality of circumferentially-spaced ware supports 22. The apparatus comprises also a vertically-reciprocable brush 24 which in a lowered position is arranged to sweep the surface of the presenting platen 10, as the latter moves therebeneath, and a collecting bin 26 to collect waste backing sheets B (Figures 2(f) to 2(i)) swept from the platen 10 by the brush 24.

Components of mounting means of the apparatus, supporting the transfer pad 18 and the placing head 14 for their vertical movements, are indicated at 19 and 15, respectively, in Figure 1. The mounting

means comprises also a vertical shaft 21 supporting the turntable 20 for rotational indexing movements of the turntable to present the ware supports 22 in turn beneath the transfer pad 18. The presenting platen 10 and the heating platen 12 are mounted in common on a horizontal slideway 11 of the mounting means, and the apparatus comprises operating means (not shown but of a conventional kind) for effecting required independent movements of them along the slideway. Likewise, the apparatus comprises operating means of a conventional kind for effecting vertical reciprocation of the placing head 14 and of the transfer pad 18, and indexing of the turntable 20. Actuation of the various operating means in timed sequence, in a continuously repeated operating cycle, is controlled automatically by the apparatus in a conventional manner.

The presenting platen 10 comprises a smooth and flat horizontal top surface. In continuous use of the apparatus, as described hereinafter, the pad 18 is maintained hot and the metal presenting platen 10 becomes incidentally warmed from repeated brief engagements by the pad. Simply to ease the starting of operations with the apparatus, when the hot pad would be unduly chilled by a platen at ambient temperature, electric heating elements (not shown) are built into the platen so that the platen can be warmed initially. Once operation of the apparatus is under way, the heating elements are switched off.

A flat pad-heating surface presented by the heating platen 12 is, on the other hand, maintained hot throughout use by conductive heating from thermostatically-controlled electrical heating elements 13 within the platen.

The transfer-placing head 14 comprises a plurality of suckers whereby the surface of a transfer T can be gripped for lifting by the head from the cassette 16. Vacuum applied to the suckers for that operation can be released to allow the transfer to be put down on to the top surface of the presenting platen 10. The presenting platen 10 is arranged with airways leading to perforations in its top surface, allowing vacuum to be applied by the apparatus to hold the transfer backing sheet down to the surface of the platen when required during operation.

The transfer pad 18 is of a suitably resiliently deformable silicone rubber material, and is shaped to present (facing downwardly) a domed working area of its surface. The precise pad shape is selected to suit the surface contours of the ware to be decorated.

Before starting operation of the apparatus it is as well to pre-heat the transfer pad 18, for example in an oven, to get its mass of material warmed through. That having been done and the pad mounted in the apparatus, the presenting platen 10 having been warmed to avoid undue chilling of the pad, and there being a stack of transfers T in the cassette 16 and articles of ware W (Figures 2) ready for decoration, operation of the apparatus in continuously repeated operating cycles can proceed. Starting at a suitable point for descriptive purposes, one complete cycle of operation will now be described.

With reference to Figure 2(a), the placing head 14 is seen to be gripping a transfer T in a raised position in registry above the presenting platen 10. An article of ware W is mounted on one of the ware supports 22 in registry beneath the transfer pad 18. The pad 18 is in a raised position. Also positioned beneath the transfer pad 18, above the article W on the ware support, is the heating platen 12. The brush 24 is also in a raised position, so as to be well clear of the top surface of the presenting platen 10.

Figure 2(b) shows the placing head 14 lowered to position the transfer T (with its design layer D uppermost) on the presenting platen 10. The transfer pad 18 is shown lowered and pressed against the heating platen 12; the pad and the heating platen are pressed together sufficiently for the whole working area of the pad to be spread over the surface of the platen.

The pad 18 is maintained pressed against the heating platen for a suitable length of time. That heating period depends upon many different factors, and will usually have to be determined by experiment in each case. However, in one example of the process the platen surface is maintained at a temperature of about 180°C and the pad heating period is approximately two seconds in order to restore the pad surface temperature from around 105°C to around 125°C, the required decal-activating temperature in that case being 115°C.

The transfer T having been placed on to the presenting platen 10, and suction being applied through the perforated top surface of the platen to hold the transfer in position, the placing head 14 is raised from the platen when its suction grip on the transfer has been released. This is illustrated in Figure 2(C) which shows also the transfer pad 18 having been raised from the heating platen 12 after the required heating period.

The presenting platen is next moved horizontally to bring the transfer T on its top surface into registry beneath the transfer pad 18 (Figure 2(d)). The heating platen 12 is displaced to one side.

The transfer pad 18 is now brought down and the heated working area of its surface spread over and pressed against the so-far unactivated transfer. This is illustrated in Figure 2(e). By this time, following the figures given as an example in the last preceding paragraph but two, the pad surface is at a temperature of around 115°C. Heated by the pad to such a temperature, adhesive layers of the transfer between the design layer and the pad and between the design layer and the backing sheet become activated; the previously substantially solid adhesive layers become softened and attain tacky fluid conditions. The adhesive materials are such that the design layer D adheres more strongly to the transfer pad than to the backing sheet B, so that upon the pad being raised (Figure 2(f)) the design layer D is taken up by the pad from the backing sheet. Such behaviour of the transfer is, of course, in itself known in the art.

As shown in Figures 2(e) and 2(f), the placing head 14 is operated to take up a next transfer T from the cassette 16 whilst the transfer pad is being operated to take up the design layer from the transfer on the presenting platen 10.

In the next stage, illustrated by Figure 2 (g), the

brush 24 is lowered and the presenting platen 10 moved away from under the pad 18, back into position beneath the reloaded placing head 14 to receive the next transfer T. As the platen 10 moves beneath the brush 24, the brush sweeps the waste backing sheet B from its surface into the collecting bin 26; suction holding the sheet to the platen surface is temporarily released to enable it to be swept off.

The brush is next raised clear of the presenting platen surface (Figure 2(h)) and the transfer pad 18 bearing the design layer D on its surface is brought down to press together the pad and the article of ware W, in registry therebeneath, to apply the design layer D to the surface of the article. The design layer adheres preferentially to the article rather than to the pad so that when the pad is next raised (Figure 2(i)) it leaves the design layer on the article. The heating platen 12 is then moved into position beneath the pad for a next cycle of operation to begin.

Once a steady state has been established in continuous operation of the apparatus, the pad is reliably heated by the heating platen 12 to ensure uniform heating of the pad surface and presentation at a suitable temperature for activation of the transfer adhesives. A change of pad, to suit a different form of ware to be decorated, presents no difficulty as regards the heating platen, a suitable platen temperature and pad-heating period being readily established empirically.

Claims

1. A method of applying a design layer from a heat-release transfer (T) to a surface of an article (W) to be decorated, in which a deformable transfer pad (18) is used to take up the design layer from the backing sheet of the heat-activated transfer and to apply the design layer to the article, the method comprising pressing together the pad and a platen (10) on which the transfer is presented, separating the pad and the platen with the design layer of the transfer attached to the surface of the pad and with the backing sheet remaining on the platen, pressing together the pad and the article to be decorated to apply the design layer to the surface of the article, and separating the pad and the article leaving the design layer adhered to the article, characterised in that the heat required to activate the transfer is taken from the pad, the method comprising heating the surface of the pad by bringing together the pad and a pad-heating surface (12) at a suitable elevated temperature and separating the pad and the surface after a suitable heating period, pressing together the pad and the transfer on the platen with at least the adhesive between the design layer and the backing sheet of the transfer not yet activated, and maintaining the pad pressed against the transfer for sufficient time for heat from the pad to activate the adhesive of the transfer before separating the pad and the platen with the design layer attached to the pad.

2. Apparatus suitable for use in applying a design layer from a heat-release transfer (T) to a surface of an article (W) in performance of a method according to claim 1, the apparatus comprising a deformable transfer pad (18), a transfer-presenting platen (10), an article support (22), and mounting means (19, 11, 21) supporting the pad, the platen and the article support, characterised in that the apparatus comprises also pad-heating means (12) presenting a pad-heating surface and heating means (13) arranged to heat the pad-heating means to maintain the pad-heating surface at an elevated temperature, the mounting means (11) supporting also he pad-heating means (12) and enabling relative movements of approach and separation to be effected

(i) between the pad (18) and the pad-heating surface (12) and enabling the pad and the surface to be pressed together;

(ii) between the pad (18) and the transfer-presenting platen (10) and enabling the pad and a transfer (T) on the platen to be pressed together; and

(iii) between the pad (18) and the article support (22) and enabling the pad and an article (W) mounted on the support to be pressed together.

3. Apparatus according to claim 2 characterised in that the transfer-presenting platen (10) is flat and the pad-heating means (12) presents a flat pad-heating surface.

4. Apparatus according to either of claims 2 and 3 characterised in that the transfer pad (18) is supported by the mounting means (19) for vertical movements towards and away from the pad-heating means (12), the platen (10) and the article support (22) in turn, and the pad-heating means (12) and the transfer-presenting platen (10) are supported for horizontal movements positioning them in turn beneath the pad for engagement by the pad.

5. Apparatus according to claim 4 characterised in that the transfer-presenting platen (10) is supported for movements between a position beneath transfer-placing means (14) of the apparatus whereby a transfer (T) can be placed on the platen and a position beneath the pad (18) to which the pad can descend to be pressed against the transfer on the platen.

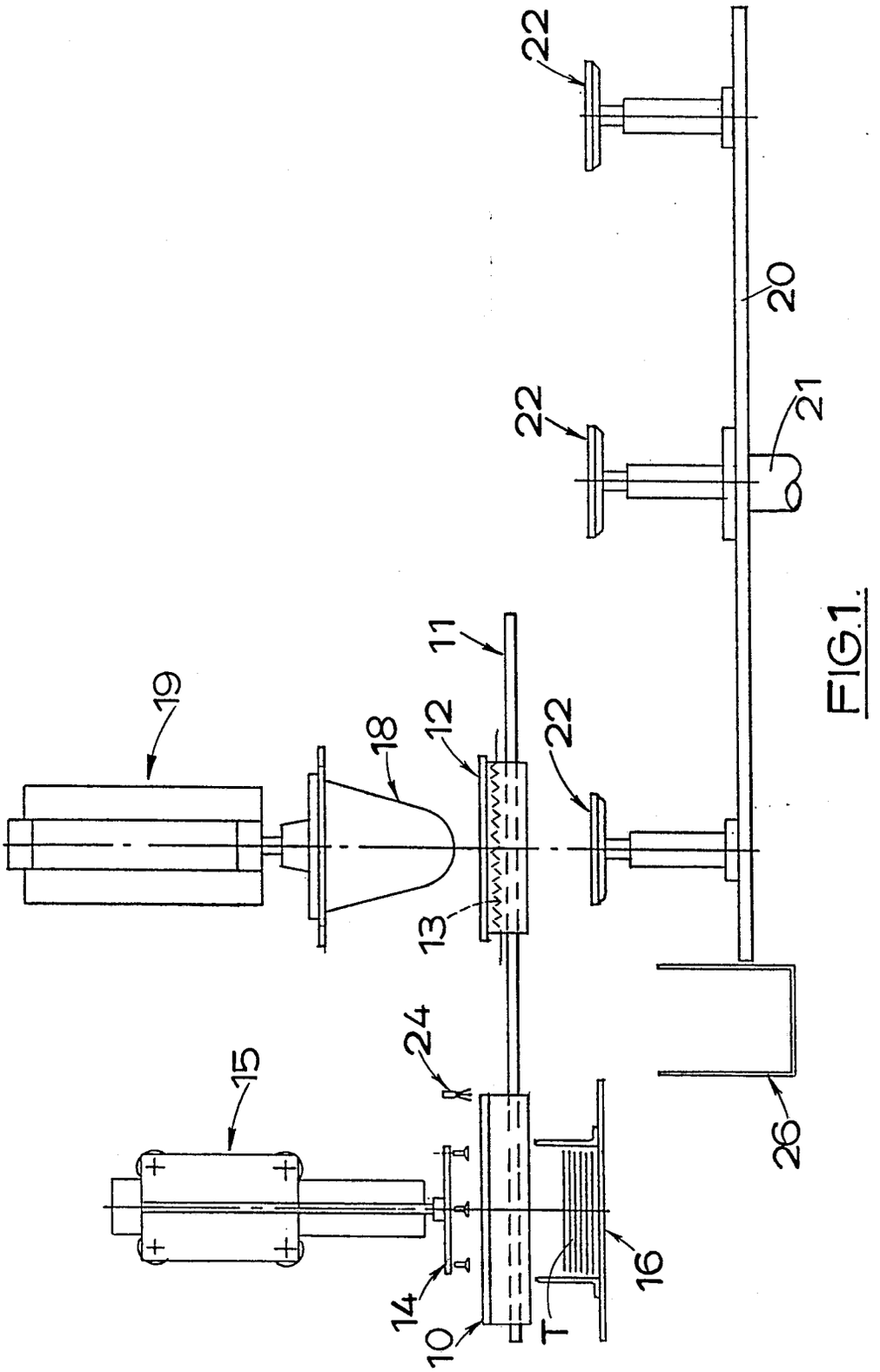

FIG.1.

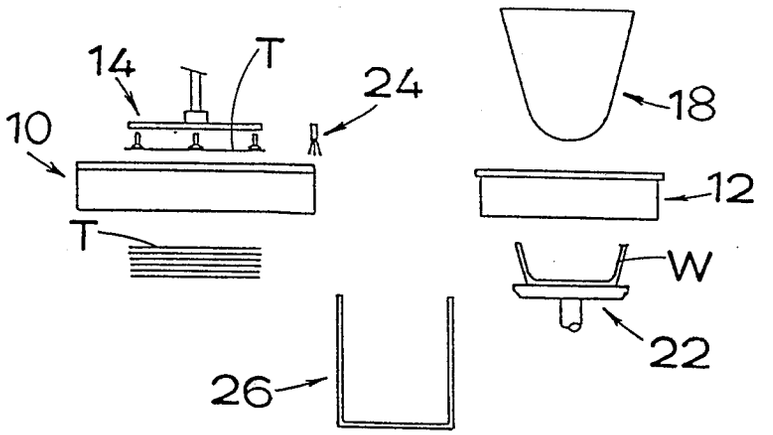

FIG. 2(a).

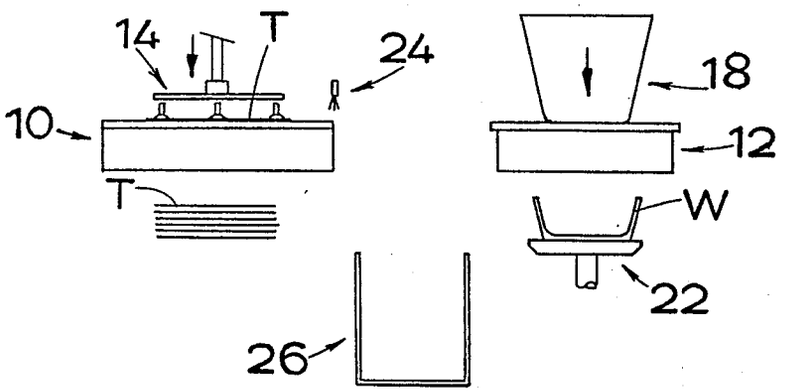

FIG. 2(b).

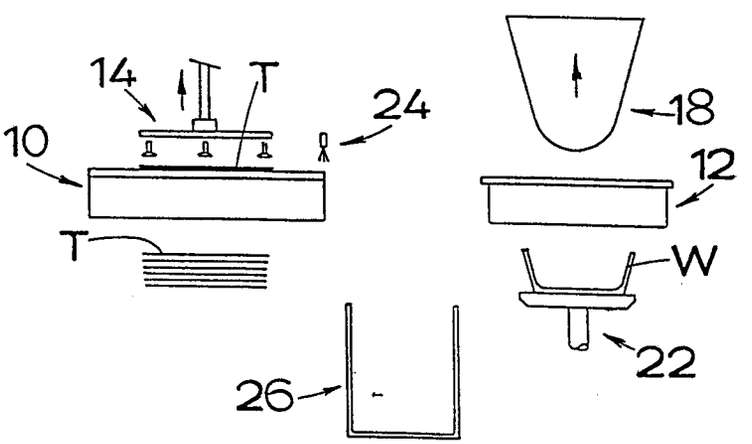

FIG. 2(c).

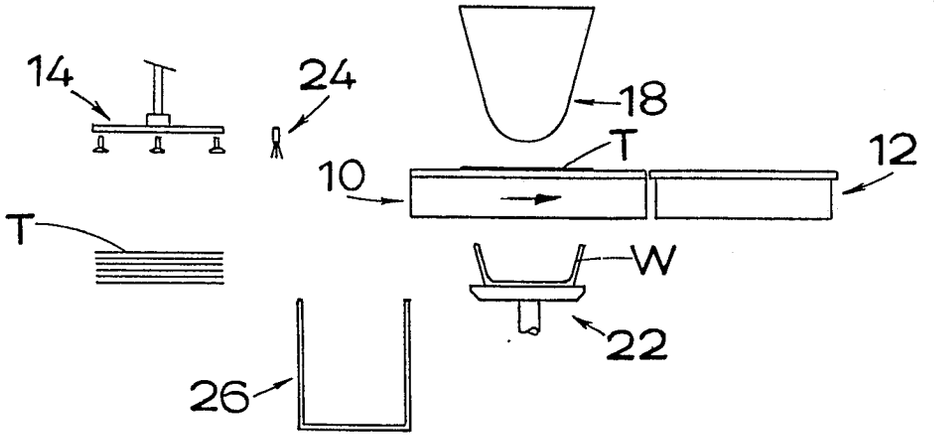

FIG.2(d).

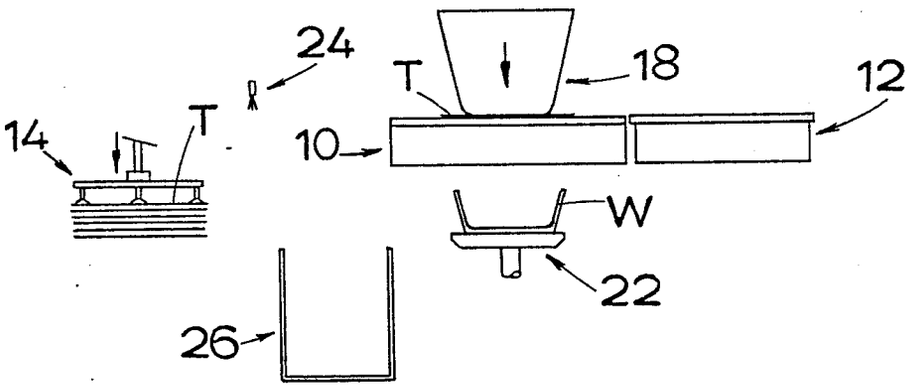

FIG.2(e).

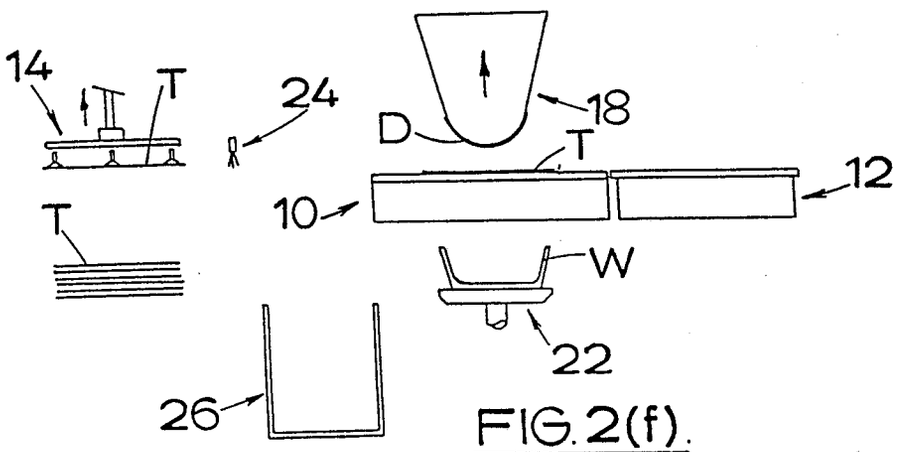

FIG.2(f).

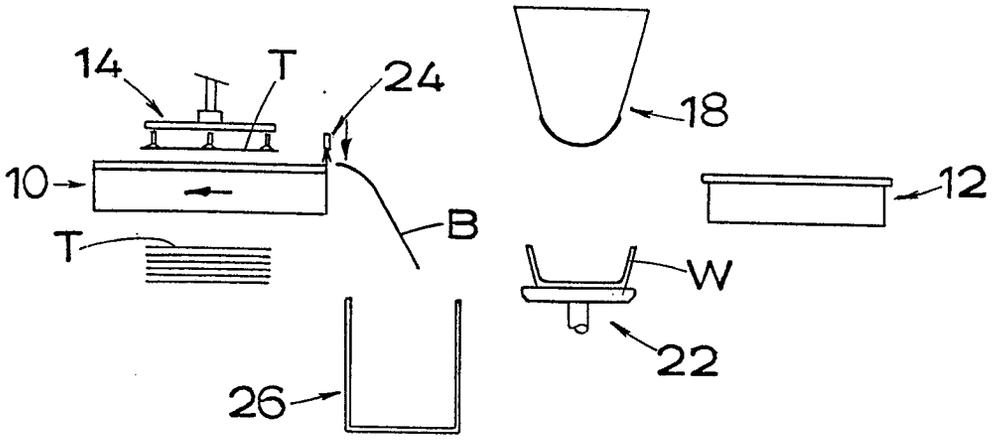

FIG.2(g).

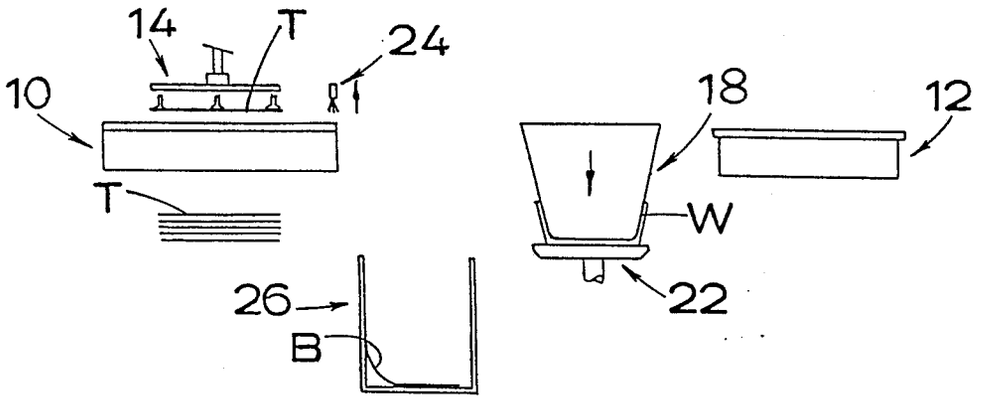

FIG.2(h).

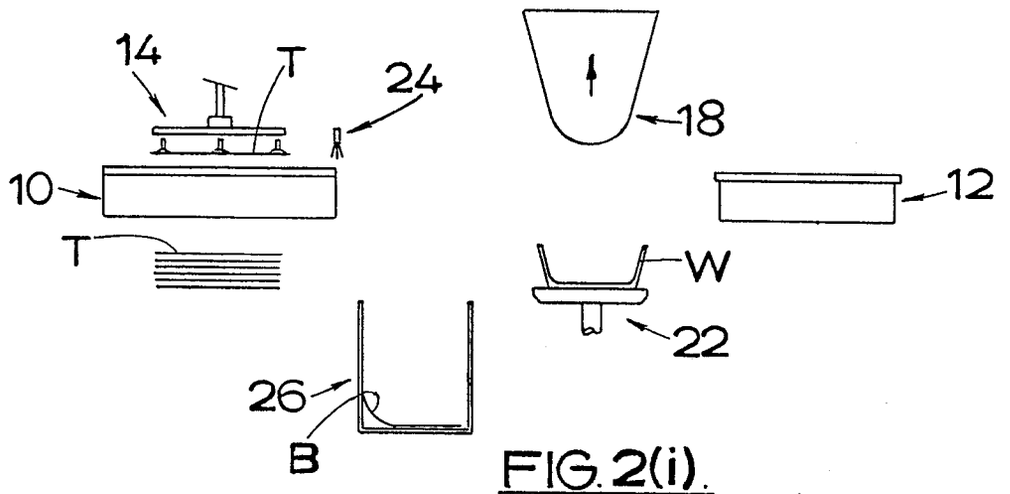

FIG.2(i).

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 87 30 5827

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)
A	US-A-4 392 905 (BOYD et al.) * Abstract; column 4, lines 10-54 * ---	1,2	B 44 C 1/17 B 65 C 9/25
D,A	US-A-4 511 425 (BOYD et al.) * Abstract; column 8, lines 54-58 * ---	1,2	
A	EP-A-0 200 285 (ROYAL DOULTON (U.K) LTD) * Claims 1,4,5,6 * -----	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 44 C
B 65 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	04-09-1987	MCCONNELL C.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