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(71) Applicant: **D'ARCY POLYCHROME LIMITED** [NZ/NZ]; 24 Balfour Road, Auckland 1052 (NZ).

(72) Inventors: **LACY, Rachel D'Arcy**; 28 Gibraltar Crescent, Parnell, Auckland, 1052 (NZ). **LACY, Nigel**; 28 Gibraltar Crescent, Parnell, Auckland, 1052 (NZ). **SLACK, Kristian Hugh Darcy**; 5 Ropiha Street, Fitzroy, New Plymouth, 4312 (NZ). **McLELLAN, Jamie Sinclair**; 47 Keppell Street, Arch Hill, Auckland, 1021 (NZ). **HINKLEY, Simon Francis Robert**; 35 Maungaraki Road, Korokoro, Lower Hutt (NZ).

(74) Agents: **ELLIS | TERRY** et al.; P.O.Box 10932, The Terrace, Wellington, 6143 (NZ).

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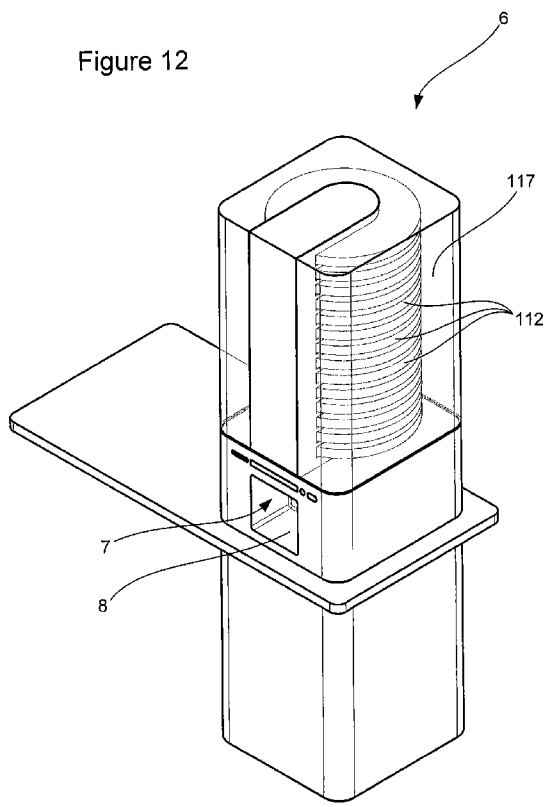
[Continued on next page]

(54) Title: DRY COLOUR SYSTEMS AND METHODS

Figure 12



(57) Abstract: A dry pigment paint system includes dry pigment doses that may be used alone or combined with other dry pigment doses to provide a desired colour when dispersed in a paint base. The system may use a plurality of dry pigment formulations, with each dry pigment formulation consisting of one or more dry pigments, generally a plurality of dry pigments. Each dry pigment dose may include a single dry pigment formulation. Each does may be a tablet, capsule or sachet. Various dose forms and dispensing systems are disclosed.

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DRY COLOUR SYSTEMS AND METHODS

FIELD OF THE INVENTION

The invention relates to the colouring of base paint and/or other materials using dry colorants, particularly but not exclusively at the point of sale or point of use, and related colouring materials, systems and methods.

BACKGROUND TO THE INVENTION

A number of methods have been devised to apply colour or tints to paint. Typically, multiple pigments are separately added to a paint base at either a central location by the paint manufacturer or at the point of sale by a paint retailer to achieve a predetermined paint colour. Both of these approaches have significant limitations.

In the central production model the range of colours is typically limited due to economies of scale, meaning there is little scope for bespoke or low-volume colour production, and logistics of stock holding and transport of the factory-coloured paint limits the practical delivery of a full colour range.

Retail-tinted paint systems rely on human control or a mix of computer control and human programming to accurately tint paints from a low number of separate, single liquid pigments. Each pigment has to be carefully dosed volumetrically by a complex machine in the retail environment by semi-skilled operators according to a formulation provided by the pigment manufacturer, posing a risk of mis-tinting. Further, liquid pigments typically utilise Volatile Organic Compounds (VOCs), have a propensity to dry and clog the dosing machine, and require mechanical mixing in-store.

A further disadvantage of both central production and retail colouring is limited access to design-led colour palettes and the need to engage with the physical paint retail channel.

Dry pigment systems have been developed for paint that can be easily dispersed using minimal mechanical intervention. These pigments are called Easily Dispersed or ED pigments and have been successfully used in the central production of paints and the tinting of concrete at the point of use. The opportunity to use ED pigments at the point of sale of paint has been identified and a number of systems for formulating mixtures of ED pigments at the point of sale have been explored. For example, US7311223 and US7134573 describe systems for point of sale dispensing of dry pigments. As ED pigments are particularly concentrated they require very accurate formulation (weighing) which has resulted in proposed retail machines that require very high levels of accuracy and calibration. However, in practice these systems have been impractical and further compromised the quality of the tinted paint, suffering from the same accuracy and user skill problems as do point of sale systems for dispensing liquid colorants. Further, the range of ED pigments is limited, further limiting the potential of retail systems.

As an alternative to incumbent processes, packaging of pigments, including ED pigments, for small volume paint requirements has been proposed. U.S. Patent Publication US 2007/0221531 discloses dissolvable packets containing a predefined quantity of dry powder dispersible pigments that, when added to a predetermined volume of a compatible liquid coating, dissolves in the container to tint the coating. U.S. Patent Publication US 2007/0266901 discloses encapsulated colorants provided as a system and kit, wherein the encapsulating layer is in the form of a sealed pouch that contains the tinting material. Multiple pouches, each having different tinting materials, may be combined to provide a colour range of up to about 150 different colours or shades. The pouches are packaged in a moisture resistant package or container. U.S. Patent Publication US 2008/0060553 discloses pressing single pigment preparations to form dispersible single pigment preparations in the

form of pellets or tablets. Pigment portions are marketed in different portion amounts, providing more or less intensive base colours, which may then be mixed with other pigments.

A limitation on the use of commercially-available ED pigments is the limited colour range available in this format. Further, where sold as a final pigment mixture, the different ED dry pigments are mixed in the carrier (pouch / pack / tablet), which does not produce a colour indicative of the final paint colour, making the package less attractive / suitable for display and unsuitable for visual matching or checking with a required colour, prior to mixing into the paint.

NZ207217 proposes a solid paint concentrate including a pigment or mixture of pigments. A final paint colour may be reached by selecting a number of pigment concentrates corresponding to the desired colour. While overcoming some of the limitations of existing systems through the use of a solid, pre-manufactured paint concentrate the prior art tablet systems do not overcome the limitations of the retail environment with respect to mis-tinting risk. Further, the tablet formulations disclosed in the prior art do not disperse effectively without the use of a retail mechanical mixer, thus limiting the sale of colour outside the paint retail channel.

Reference to any prior art in this specification does not constitute an admission that such prior art forms part of the common general knowledge.

It is an object of the invention to provide improved methods, paint colorants, paint systems and/or dispensing systems that address one or more of the above problems. In particular, it would be desirable to separate the final paint colour from technical inaccuracies and user skill at the point of sale. It would also be desirable in some (but not all) applications to allow the sale of colour to be separate from the sale of base paint, enabling consumer access to bespoke colours and the procurement of colour through non-traditional sales channels separate from the base paint.

Each object is to be read disjunctively with the alternative object of at least providing the public with a useful choice.

SUMMARY OF THE INVENTION

In one aspect the invention provides a dry pigment paint system including: a plurality of dry pigment doses, each dry pigment dose comprising grains or particles of one of a plurality of dry pigment formulations, each dry pigment formulation consisting of one or more dry pigments; and one or more liquid paint bases; wherein a set of dry pigment doses selected from the plurality of dry pigment doses provides a defined paint colour when dispersed in a paint base.

In this aspect the grains or particles of dry pigment formulation are formed into a dry pigment dose. This is distinct from formation of grains of unprocessed dry pigments and subsequent mixing of those grains to build up a desired colour profile.

Preferably at least some of the dry pigment formulations each include a plurality of dry pigments.

Preferably each dry pigment formulation includes a plurality of dry pigments.

Preferably each dry pigment dose is a tablet.

Alternatively each dry pigment dose is a capsule.

Optionally, each dry pigment dose may further include one or more: dispersants, disintegrating agents, fillers, surfactants and/or tableting aids.

Preferably each dry pigment dose includes a predetermined amount of dry pigment formulation.

Preferably the paint system includes between 8 and 32 dry pigment formulations and the same number of dry pigment dose types, each type including dry pigment doses of a single formulation. More preferably the paint system includes between 8 and 24 dry pigment formulations and the same number of dry pigment dose types, each type including dry pigment doses of a single formulation. Still more preferably the paint system includes 16 dry pigment formulations and 16 dry pigment dose types, each type including dry pigment doses of a single formulation.

Preferably the paint system includes one or more paint bases.

In a second aspect the invention provides a dry pigment production method including: producing a plurality of dry pigment doses, each dry pigment dose comprising grains or particles of one of a plurality of dry pigment formulations, each dry pigment formulation consisting of one or more dry pigments; dispensing a set of dry pigment doses selected from the plurality of dry pigment doses, the set of dry pigment doses corresponding to a desired paint colour when dispersed in a paint base.

In a third aspect the invention provides a dry pigment dispensing method including: storing a plurality of dry pigment doses, each dry pigment dose comprising grains or particles of one of a plurality of dry pigment formulations, each dry pigment formulation consisting of one or more dry pigments; dispensing a set of dry pigment doses selected from the plurality of dry pigment doses, the set of dry pigment doses corresponding to a desired paint colour when dispersed in a paint base.

In a fourth aspect the invention provides a dry pigment dispensing system including: a dry pigment storage unit including a plurality of storage regions, each region adapted to store a plurality of dry pigment doses; a dispensing mechanism configured to dispense a set of dry pigment doses from one or more of the storage regions, the set of dry pigment doses corresponding to a desired paint colour when dispersed in a paint base.

Preferably the dispensing system includes a user input device configured to receive from a user a unique identifier of the desired paint colour.

Preferably the unique identifier is a machine readable code and the user input device is a code reader.

Preferably the machine readable code is a barcode or QR code.

Alternatively the unique identifier is a paint name or descriptor.

Preferably the dispensing system includes a plurality of physical paint swatches, each carrying a sample of paint colour and the unique identifier corresponding to the sample of paint colour.

Preferably the dispensing mechanism includes a holding chamber configured to receive a set of dry pigment doses from the storage regions and to hold the set of dry pigment doses and a release mechanism configured to release the set of dry pigment doses from the holding chamber.

Preferably the dispensing system includes a verification system for verifying that a correct set of dry pigment doses has been moved from the storage regions to the holding chamber.

Preferably the dispensing system includes an output device configured to indicate a paint base in which the dispensed set of dry pigment doses is to be dispersed to provide the desired paint colour.

In a fifth aspect the invention provides a dry pigment colorant comprising grains or particles of a single dry pigment formulation, the dry pigment formulation consisting

of two or more dry pigments, the dry pigment formulation corresponding to a desired paint colour when dispersed in a paint base.

In a further aspect the invention provides a dry pigment dose form, including: one or more walls defining an interior volume and an amount of dry pigment contained in the interior volume, the one or more walls including one or more first polymer walls and one or more second polymer walls, the first and second polymers being soluble in a paint base.

Preferably the one or more first walls form a recess and the one or more second walls seal across an opening of the recess to form the interior volume.

Preferably the one or more first walls are formed from a polymer film having a first thickness and the one or more second walls have a second thickness less than the first thickness.

Preferably the one or more first walls are soluble in a paint base over a first time period and the one or more second walls are soluble in the paint base over a second time period less than the first time period.

In a further aspect the invention provides a dry pigment dose form including: one or more polymer walls defining an interior volume and an amount of dry pigment contained in the interior volume, the polymer walls being soluble in a paint base.

Preferably the one or more polymer walls are sealed together to define the interior volume. Preferably the one or more polymer walls are sealed together by heat seals or welds.

In another aspect the invention provides a dry pigment dose strip including a plurality of conjoined dry pigment dose forms according to the previous aspect.

Preferably the dry pigment dose strip includes a line of weakness between each adjacent pair of dry pigment dose forms.

In a further aspect the invention provides a dry pigment dispenser including a plurality of storage regions configured to hold a plurality of rolled dry pigment dose strips according to the previous aspect and configured for dispensing of dry pigment doses from the rolled dry pigment dose strips.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a storage container according to one embodiment;
Figure 2 shows a dispensing system according to one embodiment;
Figure 3 is a side view of the dispensing system of Figure 2;
Figure 4 is a front view of the dispensing system of Figure 2;
Figure 5 is a schematic diagram of a dispensing system according to a further embodiment;
Figure 6 is a schematic diagram of a dispensing system according to another embodiment;
Figure 7 is a schematic diagram of a swatch according to one embodiment;
Figure 8 is a schematic diagram of a swatch according to a further embodiment;
Figure 9 shows a paint base container according to one embodiment;
Figure 10 shows a dry pigment dose according to one embodiment;
Figure 11 shows a dispensing system according to a further embodiment;
Figure 12 is a further view of the dispensing system of Figure 12;
Figure 13 shows a dispensing system according to another embodiment;
Figure 14 is a further view of the dispensing system of Figure 13;
Figure 15 shows a dry pigment dose according to a further embodiment;

Figure 15A is a side view of the dry pigment dose of Figure 15;

Figure 16 shows a dry pigment dose according to another embodiment;

Figure 16A is a side view of the dry pigment dose of Figure 16;

Figure 17 shows a dry pigment dose according to yet a further embodiment;

Figure 17A is a side view of the dry pigment dose of Figure 17;

Figure 18 shows a number of dry pigment doses manufactured in a continuous strip form;

Figure 19 shows the dry pigment doses of Figure 18 in a rolled form for storage, transport and/or dispensing; and

Figure 20 shows a number of rolls of dry pigment doses arranged side by side for dispensing.

DETAILED DESCRIPTION

The Applicant has devised a new paint system that provides improved accuracy of paint colour as well as improved retail systems and an improved colour range. Crucially, accuracy depends only on correct counting or dispensing of a correct set of dry pigment doses at the point of sale. This removes the need for accurate measurement of colorant volume or weight at the point of sale and reduces other risks of mis-tinting associated with liquid colorant and prior art dry pigment systems. This in turn removes the need for accurate measurement equipment and user skill and training in the point of sale environment. This not only reduces costs and error in traditional retail sales channels, but also creates opportunities for point-of-sale outside the paint retail environment.

The dose form may be any suitable form for delivery of the dry pigments into a liquid paint base. For example, solid tablets or capsules may be used. The dose form must be dispersible in the paint base, preferably within a short time period. In some embodiments the dose form may be dispersible in the paint base without the requirement for mechanical mixing. The dose form may be designed to be mixed into the base paint at either the point of sale or the point of use by the consumer.

Further, in preferred embodiments the Applicant's system relies on dry pigment doses each comprising a single pigment formulation. Each pigment formulation is produced from one or more dry pigments, preferably a plurality of dry pigments. In preferred dose forms, the pigment formulation is prepared in granular or particulate form and then formed into the dose form. This further improves the accuracy of the final paint colour because the granular or particulate form of the dry pigment formulation (rather than the unprocessed dry pigments) is measured and formed into a dry pigment dose. Each grain or particle in a dry pigment dose therefore includes the same dry pigments (i.e. the grains and particles are uniform in their content) and each dose will have accurate amounts of the pigments making up the dry pigment formulation. Each dry pigment dose may be considered a single colour dose, since it is formed from a single pigment formulation. I.e. the grains or particles in a dry pigment dose are uniform.

In some embodiments, where the final colorant is sold in a package or dose form for addition to the colour base, the colour of the colorant may be indicative of the colour of the paint. This will be the case where grains or particles of a single dry pigment formulation make up the colorant.

However, in other embodiments the final colorant will be a mix of two or more dry pigment doses. In these embodiments the individual doses may not reflect the final paint colour.

In this specification a dry pigment formulation includes one or more dry pigments, preferably two or more dry pigments. A dry pigment dose is a dose (i.e. a predetermined or standardised unit or quantum or aliquot) of dry pigment formulation. A set of doses includes one or more dry pigment doses corresponding to a desired colour, when dispersed in a base.

Pigments provide opacity and colour to base solutions, such as paints, coatings, inks, and the like, and alter the appearance by absorbing and scattering light. Pigments may play a role in regulating gloss, and may contribute anti-corrosive properties and reinforce the coating film. Pigments may be classified as active and inactive pigments; the inactive pigments used in coatings such as paints are commonly referred to as fillers. Active pigments may be organic or inorganic. Inorganic pigments include metal oxides such as, for example, zinc oxide, titanium dioxide, iron oxides, metal oxides, metal powders, metal fibres, alumina, Al(OH)3, carbon black, graphite, coal, ground minerals, and the like. Organic pigments are generally composed of carbon, oxygen and nitrogen, as well as other elements such as copper and hydrogen. Quinacridones, napthols, benzinidazolones, pyrroles, acrylides and phthalocyanines are exemplary organic pigments.

The dry pigment doses may also include any suitable combination of dispersants, disintegrating agents (which add disintegration of the dose when mixed with liquid base), fillers, surfactants and/or tabletting aids.

The dry pigment doses each comprise a substantially homogeneous amount of a single dry pigment formulation. A predetermined set of dry pigment doses (one or more doses, but in most cases a plurality of doses) may be mixed with a specified amount of a specified liquid base material to produce a mixed material having a predetermined colour.

A dry pigment formulation is prepared from one or more dry pigments. In preferred embodiments the dry pigment formulations are produced from two or more dry pigments. However, some of the dry colour pigment formulations may in some embodiments include only a single dry pigment.

In one embodiment a dry pigment formulation may be prepared as follows. Any suitable combination of suitable dry pigments may be chosen to make up the dry pigment formulation. The combination may depend on a desired colour, and on

compatibilities between different pigments, as will be well understood by those skilled in the art. The pigments may be chosen from a pigment range including but not limited to: azo pigments, Benzimidazolone pigments, phthalocyanine pigments, synthetic iron oxides, rutile pigments, cobalt blue, ultramarine blue, violate manganese, anhydrous iron oxides, limonite and umber pigments and filler pigments such as calcium carbonate, natural and precipitated chalks, and clays.

Precise, predetermined amounts or proportions of the appropriate dry pigments required to achieve a preselected colour are measured.

In one embodiment the pigments may be wet or dry milled to reduce particle size, before or after mixing with each other. The pigments may then be dispersed, for example in a Ross high shear disperser, with one or more polycarboxylic acid dispersants (such as those commercially available from The Dow Chemical Company, Henan Kingway Chemicals Co Ltd and BASF) and a polymeric surfactant. The dispersants and surfactants may be in liquid form, such that a suspension of dry pigments is formed.

The suspension of dry pigments may then be sprayed dried, for example in a lab scale Buchi 290 Spray dryer heated to an inlet temperature of 200 degrees centigrade.

In another embodiment individual pigments may be dispersed in an aqueous solution of a mixture of one or more ionic and non-ionic surfactants to provide single pigment dispersions with a Hegman gauge reading of greater than 7.5 units. The dispersions are blended to provide a homogenous colour dispersion with a total solids content of 60 to 70% (w/w). This colour dispersion is then spray dried to provide a particulate formulation of colour with a median particle diameter of 20 to 200 µm, particle size distribution of less than 1.25 and bulk density of 0.9 to 1.1 g/mL. Spray drying has been performed using both a GEA Niro VERSATILE-SD™ size 6.3 spray dryer (GEA

Process Engineering) equipped with a pressure nozzle and a GEA Niro MOBILE MINOR™ spray dryer (GEA Process Engineering) equipped with a rotary atomiser.

The resultant pigment formulation is an easy dispersible pigment that can be stirred directly into an aqueous paint system. Preferably the dry pigment formulation will disperse in the paint without the need for mechanical mixing. However, in some embodiments mechanical mixing may be used (for example using mechanical mixers that are already common in the paint retail environment).

Thus, the measured dry pigments are mixed to a substantially homogeneous form and the resulting mixture is formed into a granular or particulate form. In preferred forms each grain or particle contains a substantially similar blend of the dry pigments (i.e. the pigments forming the dry pigment formulation). Preferably the grains or particles are of substantially similar size. For example, the grains may be between 2 and 400 μm, preferably 20 to 200μm, in diameter.

The grains or particles of dry pigment formulation are then formed into a dry pigment dose. A predetermined amount of grains or particles is measured and then formed into a dose. The creation of grains or particles of dry pigment formulation before creation of the dry pigment dose contributes to the final accuracy of the paint colour.

The dose may preferably be a tablet or capsule. However, other dose forms such as sachets or containers may be used in some embodiments. Preferably the entire dose form, including any outer containing layer, is suitable for dispersal in a liquid base. This ensures that the entire dose is easily added, without error, to the liquid base.

In one embodiment the dose is a tablet form, preferably an encapsulated tablet form. The tablet must have sufficient strength to survive handling, but should break apart and disperse quickly once added to the liquid base. A tablet form may include a soluble outer layer designed to assist in forming of the tablet or in protection of the

tablet before addition to the liquid base. The outer layer should break down quickly once added to the liquid base. Suitable materials will depend on the base. For example, in water-based paints the outer should be water-soluble, while in oil-based paints the outer should be soluble in the appropriate oil.

In a preferred form, the dose is a capsule form. Preferably the capsule casing will ultimately dissolve completely, so that there are no solid remnants in the liquid paint. Preferably the pigment is released into the paint in a short time, although the casing itself may dissolve in slightly slower time. It should be possible to disperse the pigments fully in the paint base with around 2-10 minutes mixing time (using manual mixing, but optionally a mechanical mixer may be used). Further, the capsule casing should not significantly alter the properties of the paint.

One embodiment of capsule is shown in Figure 10. In this embodiment a two part capsule is used. The capsule 100 includes a lower portion 101, which may be made from a suitable film soluble in the paint base, including any suitable polymer film. The lower portion 101 may be made from a solution-cast polyvinyl alcohol film. The film may have a thickness that provides sufficient structure to the capsule, but which dissolves in the paint base over an acceptable time frame. The film may have a thickness around 0.05-0.2mm, preferably around 0.1-0.15mm.

The capsule may also include an upper layer or sealing portion 102. The upper layer 102 should be formed from a material that dissolves in the paint base over an acceptable time frame. However, due to the two part construction of the capsule, the upper layer 102 need not contribute to the same extent as the lower portion 101 to the structure of the capsule. Thus, in one embodiment, it is possible to use a material for the upper layer 102 that dissolves more quickly than the lower portion 101.

The upper layer 102 may also be formed from a material that can be joined to the lower portion by conventional techniques such as heat sealing, heat welding or the

use of suitable adhesives. This joining of the two portions 101, 102 forms a closed capsule with an interior volume 103. The dry pigment colorants 104 may be added to this interior volume 103 before joining of the two portions 101, 102. A small sealing lip or perimeter 105 may be provided for joining of the lower and upper portions 101, 102.

The upper layer 102 may be formed from a suitable polymer film. The upper layer 102 may be a polyvinyl alcohol film of around 0.05mm thickness, such as MonoSol M8630 polyvinyl alcohol film. The Applicant's testing shows that the upper layer 102 formed of 0.05mm polyvinyl alcohol film will dissolve quickly in paint (in approximately 30 seconds). Note that this layer must dissolve in a paint base that will be at room temperature and (in the case of water-based paints) is only around 50-60% water. In some embodiments the upper layer may dissolve sufficiently to release the dry pigments in less than five minutes, preferably less than 2 minutes, more preferably less than one minute. This exposes the pigments, which will be mixed into the paint base. The lower portion 101 may dissolve in slower time, but preferably dissolves entirely within about an hour, preferably less than half an hour. This two part structure therefore provides sufficient rigidity through the lower portion 101 for convenient handling and storage of the doses, but quick dispersal of pigments through dissolution of the upper layer 102.

The polyvinyl alcohol films used for the lower and upper portions 101, 102 may be around 88% hydrolysed polyvinyl alcohol; and may have an average molecular weight of around 30,000-70,000 Dalton.

The lower portion 101 may be shaped by any suitable process. In one embodiment the lower portions 101 may be vacuum formed.

In one embodiment the capsule 100 may be a short cylinder, with a height of around 6mm and a radius of around 22mm. However, any suitable dimensions may be used.

For manufacturing of the capsules, a piece of solution cast polyvinyl alcohol film may be introduced to a shaped vacuum former. The polyvinyl alcohol film may be heated. Once the film is softened the vacuum may be applied to draw the film into the mould to form the lower portion 101.

The dry pigments 104 may then be added to the shaped lower portion 101. The upper layer 102 may then be placed across the opening of the lower portion 101 and a heated stamper, heat welder or the like used to seal around the sealing lip 105.

Figures 15 to 17 show three further embodiments of dry pigment dose 120.

Figure 15 shows a dry pigment dose 120 that is approximately square when viewed in plan. The dose 120 may be around 24 millimetres square in this view. Figure 15A is a side view of this dose 120, and this dose may be around 5mm thick. Such a dose 120 may include around 1mL of dry pigment formulation.

Figure 16 shows a dry pigment dose 120 that is rectangular when viewed in plan. The dose 120 may be around 24 millimetres by 48 millimetres in this view. Figure 16A is a side view of this dose 120, and this dose may also be around 5mm thick. Such a dose 120 may include around 5mL of dry pigment formulation.

Figure 17 shows a dry pigment dose 120 that is rectangular when viewed in plan, but has a different orientation to that of Figures 16 and 16A. The dose 120 may be around 24 millimetres by 48 millimetres in this view. Figure 17A is a side view of this dose 120, and this dose may also be around 5mm thick. Such a dose 120 may include around 5mL of dry pigment formulation.

In the embodiments of Figures 15 to 17 the dry pigment doses are in sachet form, with the sachet walls formed from a single film that is soluble in the paint base (e.g. a water-soluble film for an acrylic paint base, such as for example: polyvinyl alcohol

film.). The sachet may be formed using a suitable 'form, fill, seal' method using appropriate heat welding or similar techniques to form the individual sachets as they are filled. Such sachets are also sometimes known as 'pillow packs' or 'pillow pouches'.

The film may have a thickness that provides sufficient structure to the capsule, but which dissolves in the paint base over an acceptable time frame. The film may have a thickness around 0.02-0.2mm, preferably around 0.03-0.06mm.

In other embodiments the sachets may have dimensions (height by length by width) in the range 15mm x 15mm x 2.5mm to 150mm x 150mm x 40mm.

Each dry pigment dose 1, 100, 120 may be printed with a colour patch 121 indicative of the colour provided by the dry pigment formulation included in that dose. Branding information may also be printed on the dry pigment dose if desired.

Figure 18 shows a plurality of dry pigment dose sachets 120. Each dose is formed as a sachet separated from its neighbours by heat welds or similar. This creates a plurality of conjoined sachets forming a strip 122. The individual sachets may also be separated by lines of weakness, such as perforations or the like, allowing the sachets to be conveniently separated from each other.

As shown in Figure 19 the strip 122 may be rolled to a roll form 123 of conjoined sachets 120. This toll form 123 may be fitted to a suitable wheel dispensing system 125, such as illustrated in Figure 20. A plurality of sachet rolls 123 are arranged side by side, each mounted on a wheel 126. The wheels 126 may be mounted on a suitable axle, which may be undriven for manual dispensing, or may be mechanised for automated dispensing.

As shown in Figure 20, two or more wheels 126a, 126b may be provided for each dose type. The first wheel 126a may store and dispense dry pigment doses of a first

size (e.g. 1mL) and the second wheel 126b may store and dispense dry pigment doses of a second size (e.g. 5mL). The dry pigment doses carried by the first and second wheels 126a, 126b, being of the same dose type, are formed from the same dry pigment formulation. The wheel dispensing system 125 may include a plurality of such pairs of wheels.

The capsules may be stored in a dry environment to preserve the life of the polymer layers. The use of a desiccant may be used to limit deformation or shape changes of the capsules. In particular, the storage containers and dispensing machines discussed below may provide a dry environment, through the use of suitable desiccants or the like.

In one embodiment each capsule may contain 0.1 to 500 grams of dry pigment, preferably around 0.1 to 50 grams of dry pigment, more preferably around 0.1 to 20 grams of dry pigment. In the overall paint system, with doses of different pigment formulations, the weights of dry pigment in a single capsule may vary between the different formulations. Further, two or more dose forms of the same pigment formulation may be provided, each with a different weight of dry pigment.

The number of dry pigment dose formulations in the paint system is preferably between 8 and 32, more preferably 8-24, ideally around 16. Each dose preferably consists of grains or particles of one of these formulations. More than one dose size of a particular formulation may be provided. This range of formulations provides the ability to build a large range of final paint colours.

The dry pigment doses may be packaged for convenient shipping and distribution in retail sites. For example, the dry pigment doses may be packaged centrally in storage containers and then shipped to retailers. The storage containers may be configured for installation in a dispensing machine, as discussed below.

The applicants contemplate the use of the commercially available ED pigments. Other types of dry, surface-coated pigments that have a surface coating that facilitates relatively rapid and complete dispersal in a base solution may also be used. Readily dispersible, dry surface-coated pigments that are developed in the future, having as yet unanticipated surface chemistries, that have rapid and complete dispersal properties in specified base solutions are also contemplated for use in the compositions and methods of the present invention.

It may be desirable to derive pigment formulations using a combination of dry pigments having the same or similar surface chemistries. Combining pigments having the same or similar surface chemistries procured from a single manufacturer may be preferred, for example, in some situations. In other circumstances, it may be possible to combine pigments having different surface chemistries that are compatible with one another and with common base solutions. The present invention contemplates formulations comprising combinations of pigments having the same, similar and dissimilar surface chemistries.

A filler composition may be mixed with the combination of dry pigments prior to dose formation. Filler components may be referred to as "inactive pigments," and may be formulated to confer desirable properties to the base solution and the final, mixed solution. Fillers often comprise inorganic minerals in powder form that are not soluble in the base paint and are typically white or slightly colored. Fillers are used to increase the bulk of the solution (e.g., paint) and to enhance the performance of the solution (e.g., paint). Examples of fillers include calcium carbonate, silicates (such as talc, kaolin, and mica), silica, glass beads, aluminium titanate, silicon carbide, silicon nitride and barium sulphate. Other materials may also be used as fillers.

The ratio of filler composition to pigment mixture may vary according to colour formulations, base solution, and the like. In some embodiments, an amount of filler is added to the pigment mixture to provide a desired total weight of mixture.

Each dry pigment formulation (plus any filler compositions or and any other desired components), may be processed to provide a substantially homogeneous preparation with accurate chromophoric characteristics, ready to be granulated and then formed into doses in desired quantities.

The dry pigment doses may be packaged for distribution to retailers and customers, and because they are stable and lightweight, they may be conveniently and inexpensively distributed to a variety of final destinations. A relatively modest facility may be employed for colour formulation, mixing of the dry pigment formulations, dose formation and may achieve wide distribution of the dry pigment doses. The systems, and compositions are environmentally sound and require modest energy inputs, both in terms of production of the dry pigment mixtures, and in terms of distribution of them to customers and users. The doses may be packaged in any suitable pouches, or packets, or other types of containers, but preferably are packaged in containers adapted for mounting on the dispensing machine, as discussed below.

The dry pigment doses 1 may be packaged in storage containers 2 such as the storage tubes shown in Figure 1. Each storage tube 2 holds a plurality of dry pigment doses 1, which in the embodiment shown are generally disc-shaped tablets 1. The storage container 2 also includes a base or mount 3 configured for attachment to a dispensing machine. The bottom of the container 2 is open, allowing doses to be dispensed through the base or mount 3. A seal or releasable closure may be provided at the base to close this opening during transport. In some embodiments this closure may be automatically released by mounting of the container 2 on the dispensing machine.

Preferably a unique mount is provided for each position in the dispensing machine, and a cooperating mount 3 is provided on the corresponding storage tube 2. This ensures that only the correct storage tube 2 (which has been centrally packed with the correct dry pigment doses 1) can be received in a particular mount in the

dispensing machine. This may be achieved using different arrangements of mounting features 4. Any suitable mounting features may be used. In the embodiment shown right angle slots 4 will cooperate with suitable protrusions on the dispensing machine mount.

Figure 2 shows a dispensing machine 6 including a plurality of storage chambers or containers 2, each holding a plurality of dry pigment doses 1. The storage containers 2 are preferably individually replaceable. The dispensing machine 6 also includes an outlet 7 from which a set of dry pigment doses is dispensed. The dispensing machine 6 has a dispensing head 8 supported at a convenient height by a support 9. Table 10 supports a container (not shown) placed under the outlet 7 to collect the dispensed dry pigment doses. The set of doses may be dispensed directly into a paint base container, or into an intermediate container.

Figures 3 and 4 are side and front views of the dispensing machine 6.

Figure 5 is a schematic diagram illustrating the working of the dispensing machine 6. Each dispensing tube 2 mounts to a unique mount 15 on the dispensing machine 6. A dispensing mechanism includes dispensers 16 associated with each unique mount. Each dispenser 16 is controlled by a controller 18 via control line 19 to dispense a number of dry pigment doses from the corresponding storage container 2. Each dispenser may be any suitable mechanism capable of dispensing a set number of doses. For example, the dispenser may include a moving part with an aperture shaped to receive a dry pigment dose from the container 3. Movement of the moving part (which may be a rotating wheel or a shuttle that moves linearly) causes the aperture to move to a position where the dose can fall downwards. This operation may be repeated to dispense further doses from that container 2.

A set of dry pigment doses corresponding to a desired paint colour is dispensed by the dispensers 16 into a holding chamber 20. In the holding chamber a verification step may be performed to reduce the chance of an incorrect set of doses being

dispensed (for example if one of the storage tubes 2 is empty). One or more sensors 21 may be associated with the holding chamber 20 and may provide signals to the controller 18 over sensor line 22. The sensors may include weight sensors, optical sensors etc arranged to detect the presence of dry pigment doses in the holding chamber 20.

Further, each dose may have properties that can be detected for verification purposes in the holding chamber, as well as elsewhere in the dispensing system. For example, each dose comprises a single dry pigment formulation. Each dose therefore has a characteristic colour, or optical properties, that can be detected by appropriate optical sensors. Similarly, each dose may have a set weight, dimensions or other characteristics that can be sensed for verification purposes. A human verification may be performed simply by visual inspection of the doses in the holding chamber, which may have transparent walls for this purpose. This may involve a check against a picture of the correct doses, which may for example be printed on a paint swatch or displayed on a suitable display.

An outlet dispenser 24 is controlled by the controller 18 over control line 25 in order to dispense the set of dry pigment doses from the holding chamber 20 through the outlet 7.

Figure 6 shows an alternative arrangement in which a dispenser 16', holding chamber 20' and outlet dispenser 24' is provided for each storage tube 2. Sensors 27 may also be provided in the storage tubes or containers 2, for example to detect when the container 2 is empty or nearly empty. Sensors 27 (such as optical sensors) may also verify that the correct dose is held in the correct position in the dispensing machine. Similar techniques may be used to those discussed above in relation to verification in the holding chamber 20.

Each storage and dispensing module is connected to the controller by a control and sensing line 28.

In each of Figures 5 and 6 the controller includes a processor 30 and a colour database or lookup table 31. A user input device 32 receives a unique identifier of paint colour that will generally be input by a user. The unique identifier may be any suitable identifier, such as a barcode, QR code, paint name, paint number, electronic code (e.g. RFID tag), punch card etc. The user input device 32 may be a suitable reader, such as a barcode reader, QR code reader or RFID reader. Alternatively the user input device may be a keypad or the like allowing the user to input the paint name or number. More than one user input device 32 may be provided, allowing different types of unique identifiers to be input.

Figure 7 shows a paint swatch 33, which may be in the form of a printed card. The swatch 33 includes a paint colour sample 34 together with a unique identifier 35, shown in the form of a QR code. Further identifiers such as a paint name and any other desired information may also be printed on the paint swatch. In use, a user having chosen their paint colour using a range of swatches, takes the chosen swatch to the user input device 32, and either enters the unique identifier 35 or causes the input device 32 to read the unique identifier 35. The controller receives signals corresponding to the unique identifier from the user input device 32. The controller then uses the paint colour database or lookup table 31 to determine a set of dry pigment doses that corresponds to the chosen paint colour, when dispersed in a liquid paint base. The controller controls the dispensing mechanism in order to dispense the set of dry pigment doses from the storage container 2 to the outlet 7.

The dispensing system may also include an output device 36. The output device may be a printer, audio output (speaker) or preferably a display. The output may provide the user with confirmation or notification of one or more of the following: paint colour chosen (e.g. paint name or unique identifier), dispensing complete, correct paint base to be used etc. In one embodiment the output device 36 may print a ticket or label with a corresponding QR code / identifier and optionally a colour swatch. This ticket or label may conveniently be used at a later time for re-order of

further paint colorants. The ticket or label may be attached to a paint tin, or simply retained by the user. In a further embodiment the dispensing system may be linked to other point of sale systems, such as a cash register system, allowing the cash register system to print the QR code / identifier on a sales receipt.

Paint is often sold in a variety of container volumes (500mL, 1L, 4L, 10L). In one embodiment the user is also enabled to select a paint volume required. The dry pigment doses required to give the desired paint colour depends on the required volume. The system may include a further input device allowing a paint volume to be selected, or this function may be provided by the user input device 32. Alternatively, the paint swatch may include two or more identifiers 35, 35' (Figure 8), all corresponding to the same paint colour but each to a different paint volume. Reading of the appropriate identifier will result in dry pigment doses being dispensed for the correct paint volume.

In another embodiment the system verifies the correct paint base. In this embodiment the paint containers 40 (Figure 9) each carry a unique identifier 41 such as a barcode, QR code or RFID tag. The identifier will identify the base type and, optionally, volume. The dispensing system prompts the user to scan the paint base identifier and confirms that the correct base has been chosen for the desired paint type. Further, the volume determination on which the dispensing step is based may be based on this scan of the physical paint base container.

Figures 11 and 12 shows another embodiment of dispensing machine 6 including a plurality of storage units 112, each holding a plurality of dry pigment doses. The storage units 112 are preferably individually replaceable. The storage units may be appropriate chambers, or preferably carousels as shown in Figure 12. The dispensing machine 6 also includes an outlet 7 from which a set of dry pigment doses is dispensed. A user may present a scoop, cup, bag or other receptacle within recess 8 below the outlet 7, to receive dispensed dry pigment doses. One or more user interface devices 113, 114, 115, 116 may be provided. These devices

may include one or more of: a barcode reader, a QR code reader, an RFID reader, a keypad, a touchscreen, buttons, dials, speakers, display screens, printers, stamps or the like allowing the user to input information into the machine 6, or receive information from the machine 6. The machine may include a transparent cover 117, allowing a user to see the various colours printed on the individual dry pigment doses.

The machine of Figures 11 and 12 is a free standing model. Figures 13 and 14 shows a further embodiment of dispensing machine 6 intended for wall-mounting. In this machine the dry pigment doses may be stored in chambers 118 running front to back within the machine 6. The machine may otherwise be similar to that of Figures 11 and 12.

In contrast to prior systems, the Applicant uses centrally produced accurate dry pigment doses. At point of sale tinting accuracy depends only on dispensing of the correct number of each dry pigment dose, i.e. correct dispensing of a set of doses, which is essentially a selection and counting operation rather than a measurement operation. No measurement of weight or volume is required at point of sale. Importantly, this removes the effects of retail staff skill, and retail apparatus, on final paint colour.

Accuracy is ensured by accurate central production of the dry pigment doses. Expensive and accurate measurement equipment is required only at the central point of dose production.

Preferred embodiments of methods and compositions of the present invention are described above with reference to preparation of paints and other coatings using solvent-based or aqueous-based base solutions. It will be appreciated, however, that these methods may be used to formulate dry pigment preparations for use with other types of liquid base materials, such a various types of coatings, varnishes, lacquers,

stains, and the like, as well as inks, automotive paints and coatings, and other types of industrial paints and coatings.

It will also be appreciated that, while methods and packaged dry pigment mixtures of the present invention have been described primarily for use in connection with liquid base solutions such as various types of coatings and paints, the packaged dry pigment mixtures of the present invention may be used and mixed to confer desired colour properties to base materials having a dry particulate or a "wet" composition. Methods and compositions of the present invention may be applied, for example, to materials such as plasters, clays, grouts and the like, that are often packaged as dry materials and made-up by mixing a liquid solution. Methods and compositions of the present invention may also be applied, for example, for use with other types of particulate building materials, with slurries, and with materials that are "wet" such as mixed plasters, clays, concretes, caulking and the like.

While the present invention has been illustrated by the description of the embodiments thereof, and while the embodiments have been described in detail, it is not the intention of the Applicant to restrict or in any way limit the scope of the appended claims to such detail. Further, the above embodiments may be implemented individually, or may be combined where compatible. Additional advantages and modifications, including combinations of the above embodiments, will readily appear to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details, representative apparatus and methods, and illustrative examples shown and described. Accordingly, departures may be made from such details without departure from the spirit or scope of the Applicant's general inventive concept.

CLAIMS:

1. A dry pigment paint system including:
    i. a plurality of dry pigment doses, each dry pigment dose comprising grains or particles of one of a plurality of dry pigment formulations, each dry pigment formulation consisting of one or more dry pigments;
    ii. one or more liquid paint bases;

    wherein a set of dry pigment doses selected from the plurality of dry pigment doses provides a defined paint colour when dispersed in a paint base.

2. A paint system as claimed in claim 1, wherein at least some of the dry pigment formulations each include a plurality of dry pigments.

3. A paint system as claimed in claim 1 or 2, wherein each dry pigment formulation includes a plurality of dry pigments.

4. A paint system as claimed in any preceding claim wherein each dry pigment dose is a tablet.

5. A paint system as claimed in any one of claims 1 to 3 wherein each dry pigment dose is a capsule or sachet.

6. A paint system as claimed in any preceding claim, wherein each dry pigment dose further includes one or more: dispersants, disintegrating agents, fillers, surfactants and/or tabletting aids.

7. A paint system as claimed in any preceding claim wherein each dry pigment dose includes a predetermined amount of dry pigment formulation.

8. A paint system as claimed in any preceding claim, including between 8 and 32 dry pigment formulations and the same number of dry pigment dose types, each type including dry pigment doses of a single formulation.

9. A paint system as claimed in any preceding claim, including between 8 and 24 dry pigment formulations and the same number of dry pigment dose types, each type including dry pigment doses of a single formulation.

10. A paint system as claimed in any preceding claim, including 16 dry pigment formulations and 16 dry pigment dose types, each type including dry pigment doses of a single formulation.

11. A paint system as claimed in any preceding claim including one or more paint bases.

12. A dry pigment production method including:
    i. producing a plurality of dry pigment doses, each dry pigment dose comprising grains or particles of one of a plurality of dry pigment formulations, each dry pigment formulation consisting of one or more dry pigments;
    ii. dispensing a set of dry pigment doses selected from the plurality of dry pigment doses, the set of dry pigment doses corresponding to a desired paint colour when dispersed in a paint base.

13. A dry pigment dispensing method including:
    i. storing a plurality of dry pigment doses, each dry pigment dose comprising grains or particles of one of a plurality of dry pigment formulations, each dry pigment formulation consisting of one or more dry pigments;

ii. dispensing a set of dry pigment doses selected from the plurality of dry pigment doses, the set of dry pigment doses corresponding to a desired paint colour when dispersed in a paint base.

14. A dry pigment dispensing system including:
    i. a dry pigment storage unit including a plurality of storage regions, each storage region adapted to store a plurality of dry pigment doses;
    ii. a dispensing mechanism configured to dispense a set of dry pigment doses from one or more of the storage regions, the set of dry pigment doses corresponding to a desired paint colour when dispersed in a paint base.

15. A dispensing system as claimed in claim 14, including a user input device configured to receive from a user a unique identifier of the desired paint colour.

16. A dispensing system as claimed in claim 15, wherein the unique identifier is a machine readable code and the user input device is a code reader.

17. A dispensing system as claimed in claim 16 wherein the machine readable code is a barcode or QR code.

18. A dispensing system as claimed in claim 15 wherein the unique identifier is a paint name or descriptor.

19. A dispensing system as claimed in any one of claims 15 to 18 including a plurality of physical paint swatches, each carrying a sample of paint colour and the unique identifier corresponding to the sample of paint colour.

20. A dispensing system as claimed in any one of claims 14 to 19 wherein the dispensing mechanism includes a holding chamber configured to receive a set of dry pigment doses from the storage regions and to hold the set of dry pigment

doses and a release mechanism configured to release the set of dry pigment doses from the holding chamber.

21. A dispensing system as claimed in claim 20 including a verification system for verifying that a correct set of dry pigment doses has been moved from the storage regions to the holding chamber.

22. A dispensing system as claimed in any one of claims 14 to 21 including an output device configured to indicate a paint base in which the dispensed set of dry pigment doses is to be dispersed to provide the desired paint colour.

23. A dry pigment colorant comprising grains or particles of a single dry pigment formulation, the dry pigment formulation consisting of two or more dry pigments, the dry pigment formulation corresponding to a desired paint colour when dispersed in a paint base.

24. A dry pigment dose form, including: one or more walls defining an interior volume and an amount of dry pigment contained in the interior volume, the one or more walls including one or more first polymer walls and one or more second polymer walls, the first and second polymers being soluble in a paint base.

25. A dry pigment dose form as claimed in claim 24 wherein the one or more first walls form a recess and the one or more second walls seal across an opening of the recess to form the interior volume.

26. A dry pigment dose as claimed in claim 24 or 25 wherein the one or more first walls are formed from a polymer film having a first thickness and the one or more second walls have a second thickness less than the first thickness.

27. A dry pigment dose as claimed in claim 24, 25 or 26 wherein the one or more first walls are soluble in a paint base over a first time period and the one or more

second walls are soluble in the paint base over a second time period less than the first time period.

28. A dry pigment dose form including: one or more polymer walls defining an interior volume and an amount of dry pigment contained in the interior volume, the polymer walls being soluble in a paint base.

29. A dry pigment dose form as claimed in claim 28 wherein the one or more polymer walls are sealed together to define the interior volume.

30. A dry pigment dose form as claimed in claim 29 wherein the one or more polymer walls are sealed together by heat seals or welds.

31. A dry pigment dose strip including a plurality of conjoined dry pigment dose forms as claimed in any one of claims 28 to 30.

32. A dry pigment dose strip as claimed in claim 31 including a line of weakness between each adjacent pair of dry pigment dose forms.

33. A dry pigment dispenser including a plurality of storage regions configured to hold a plurality of rolled dry pigment dose strips as claimed in claim 31 or 32 and configured for dispensing of dry pigment doses from the rolled dry pigment dose strips.

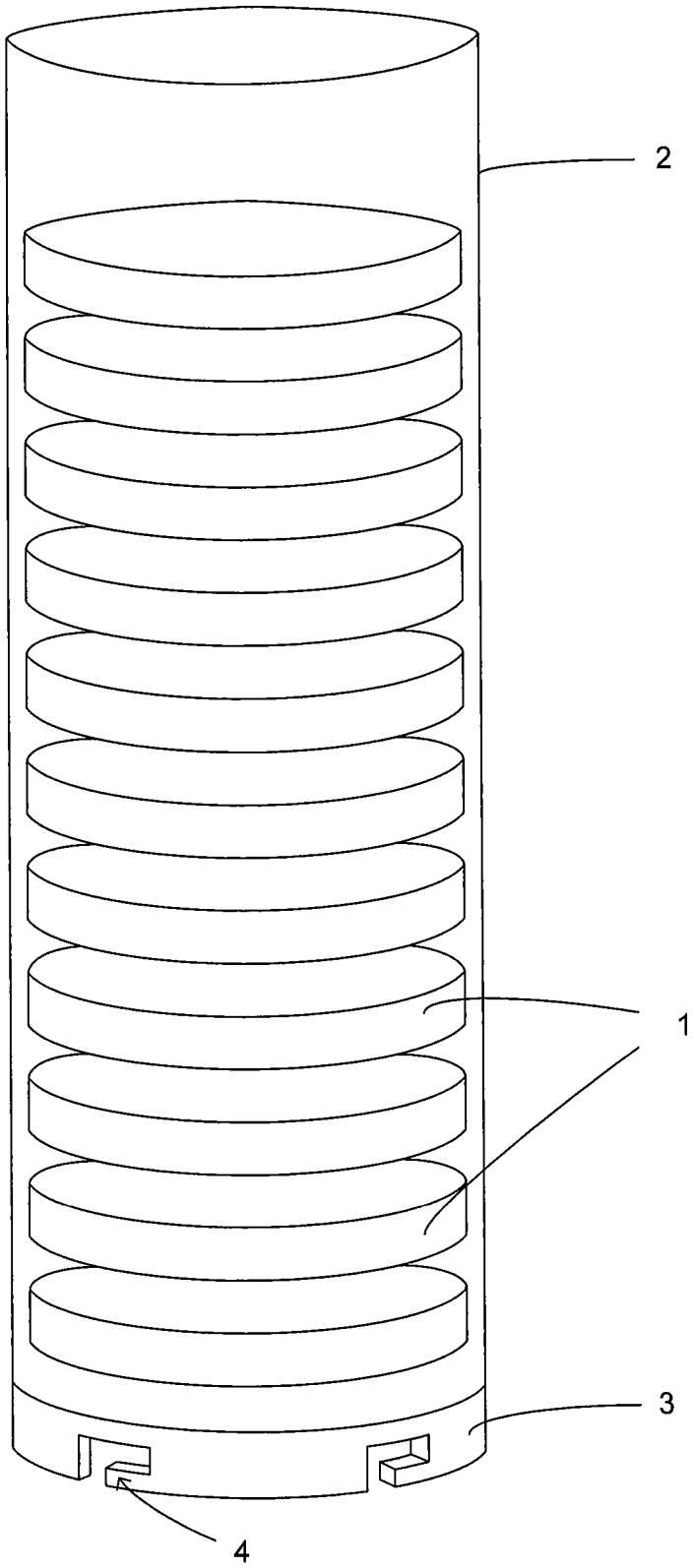

Figure 1

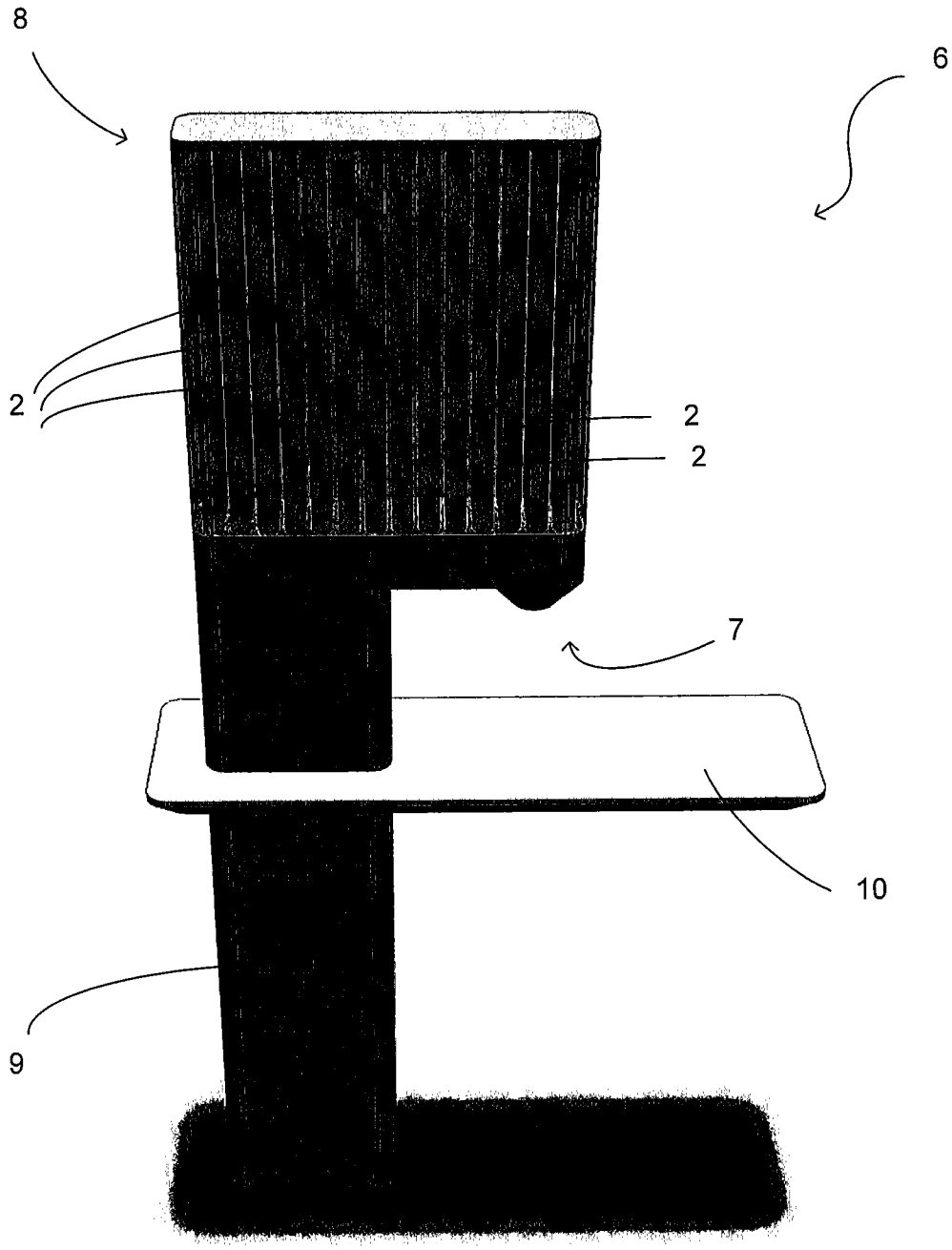

Figure 2

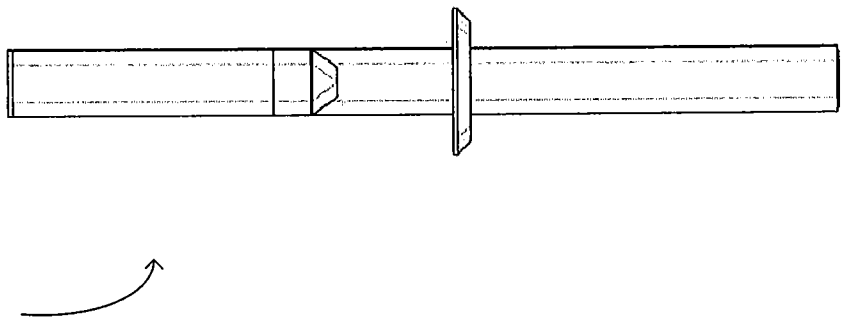

Figure 4

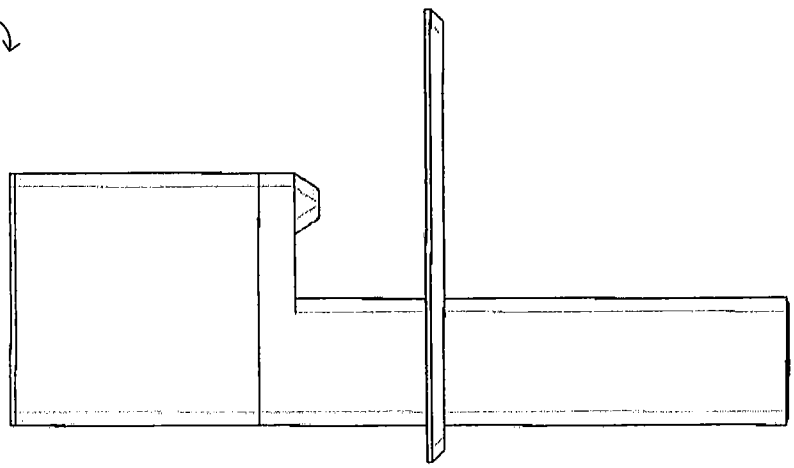

Figure 3

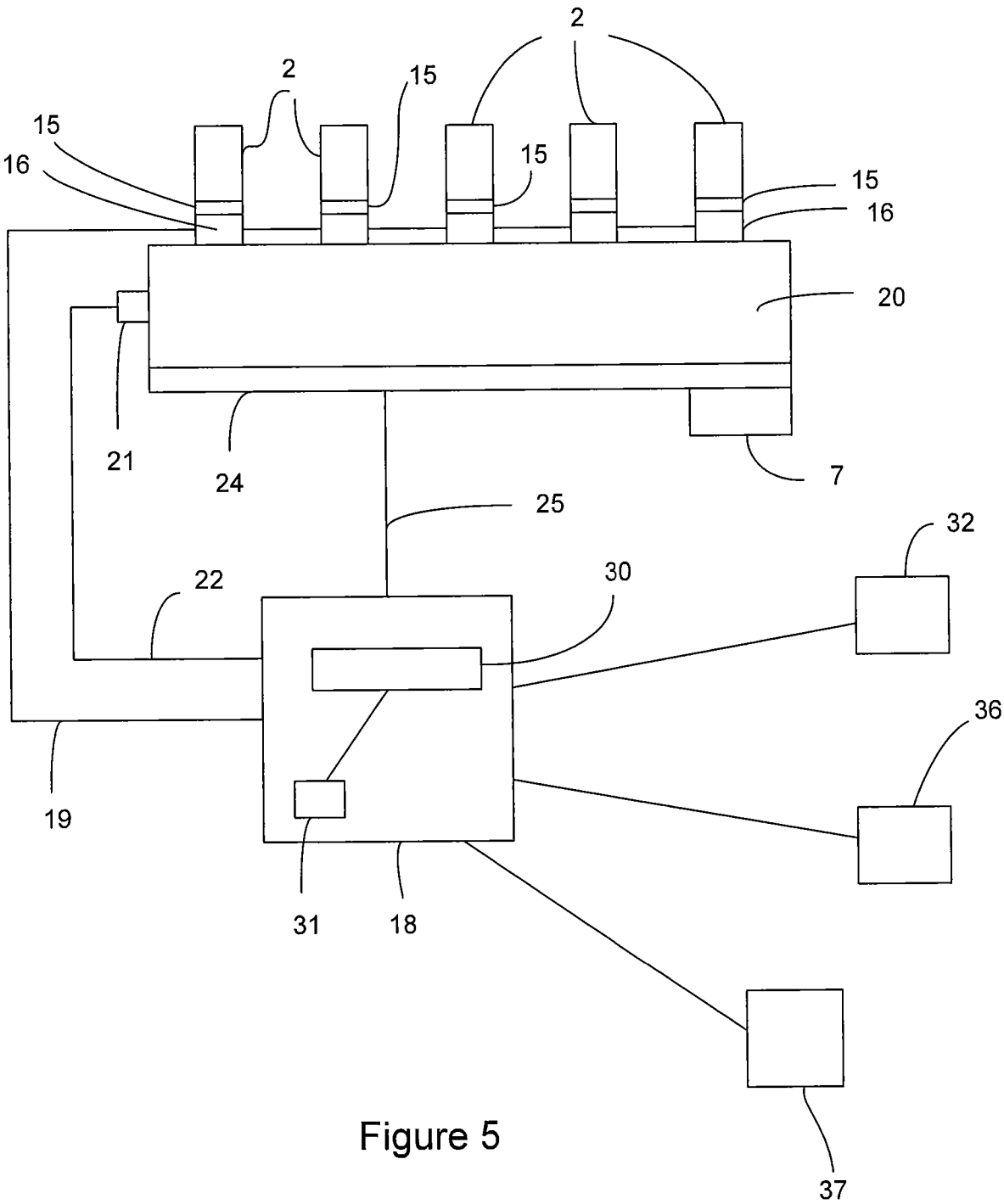

Figure 5

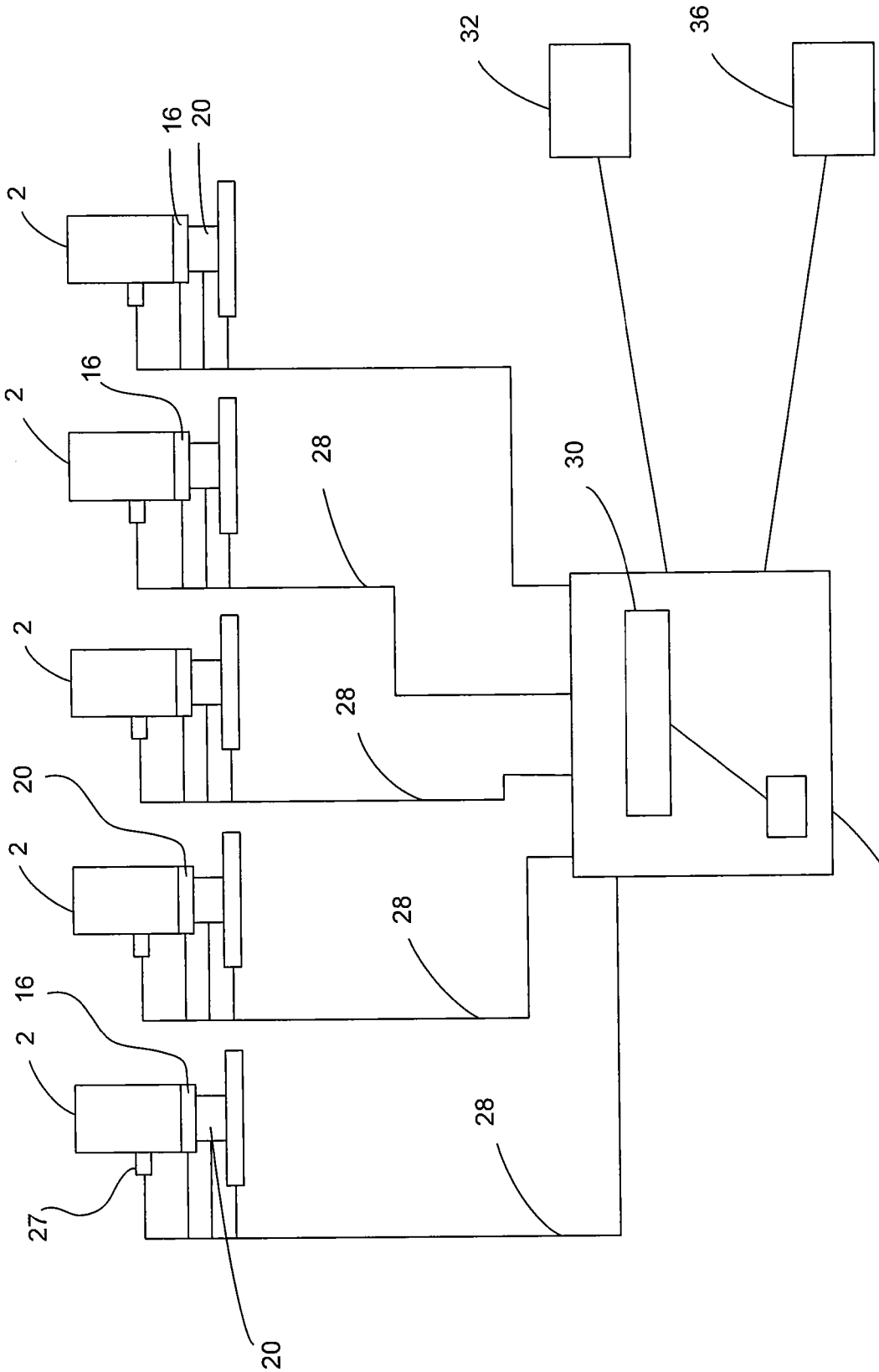

Figure 6

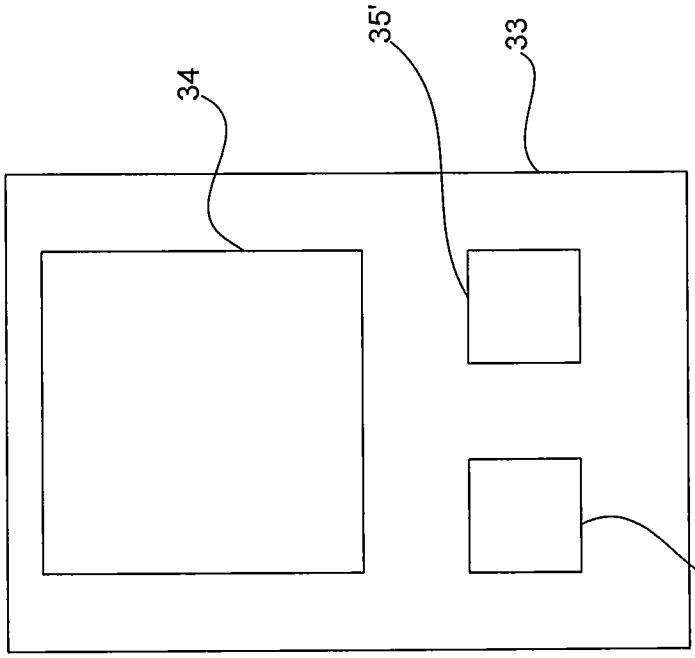

Figure 8

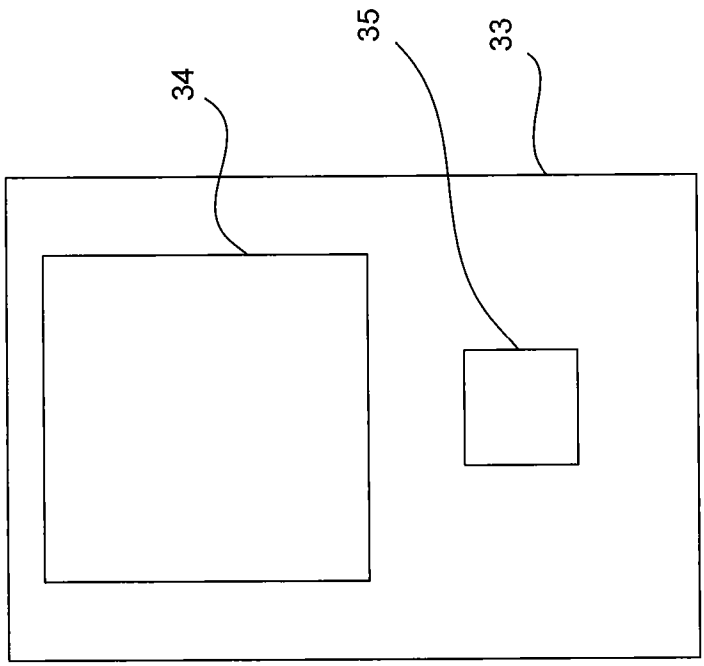

Figure 7

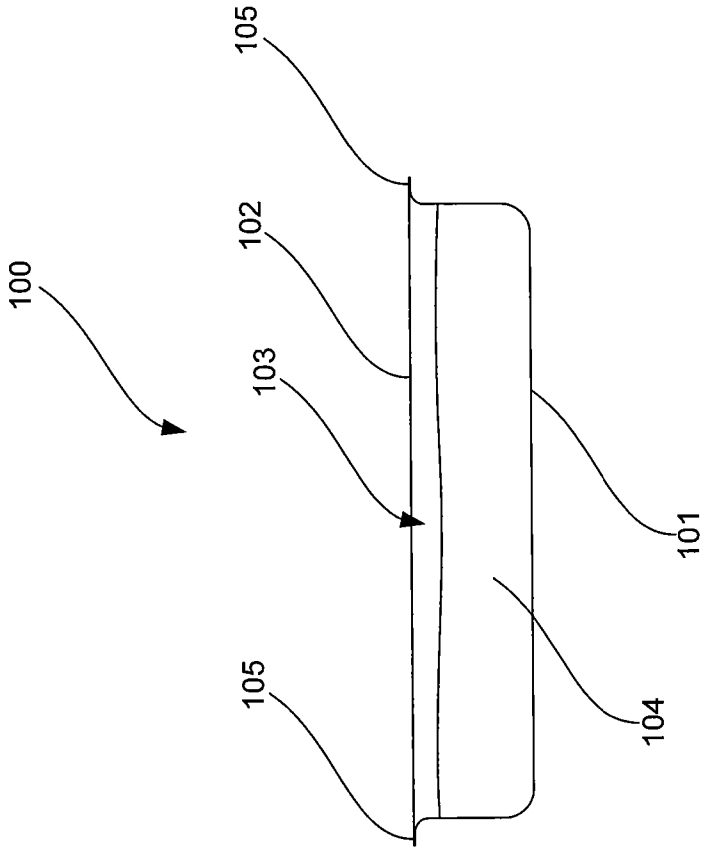

Figure 10

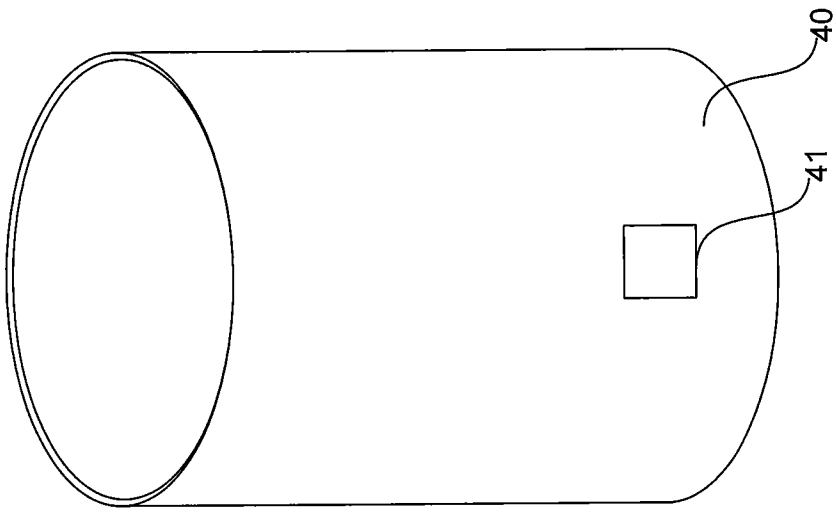

Figure 9

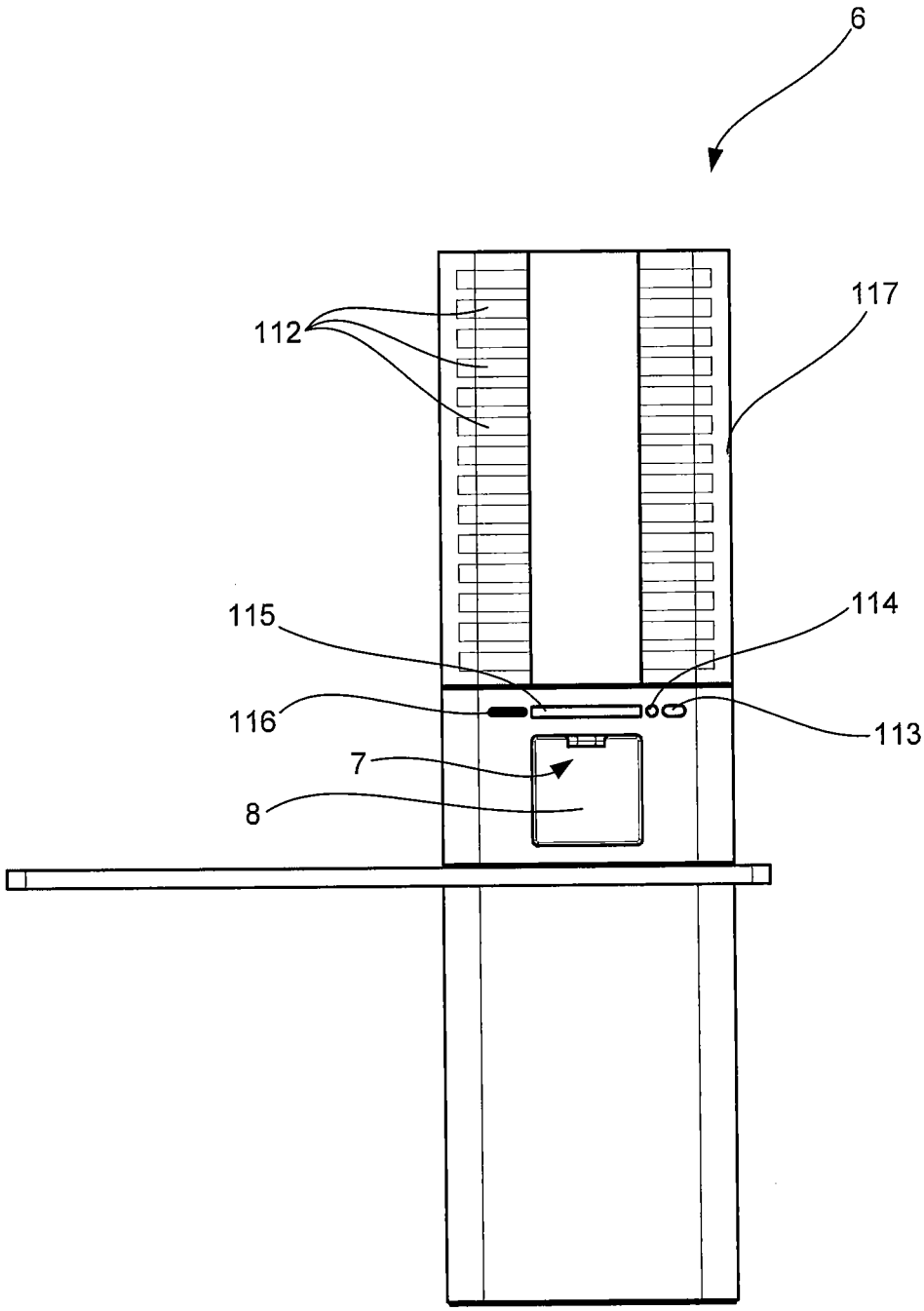

Figure 11

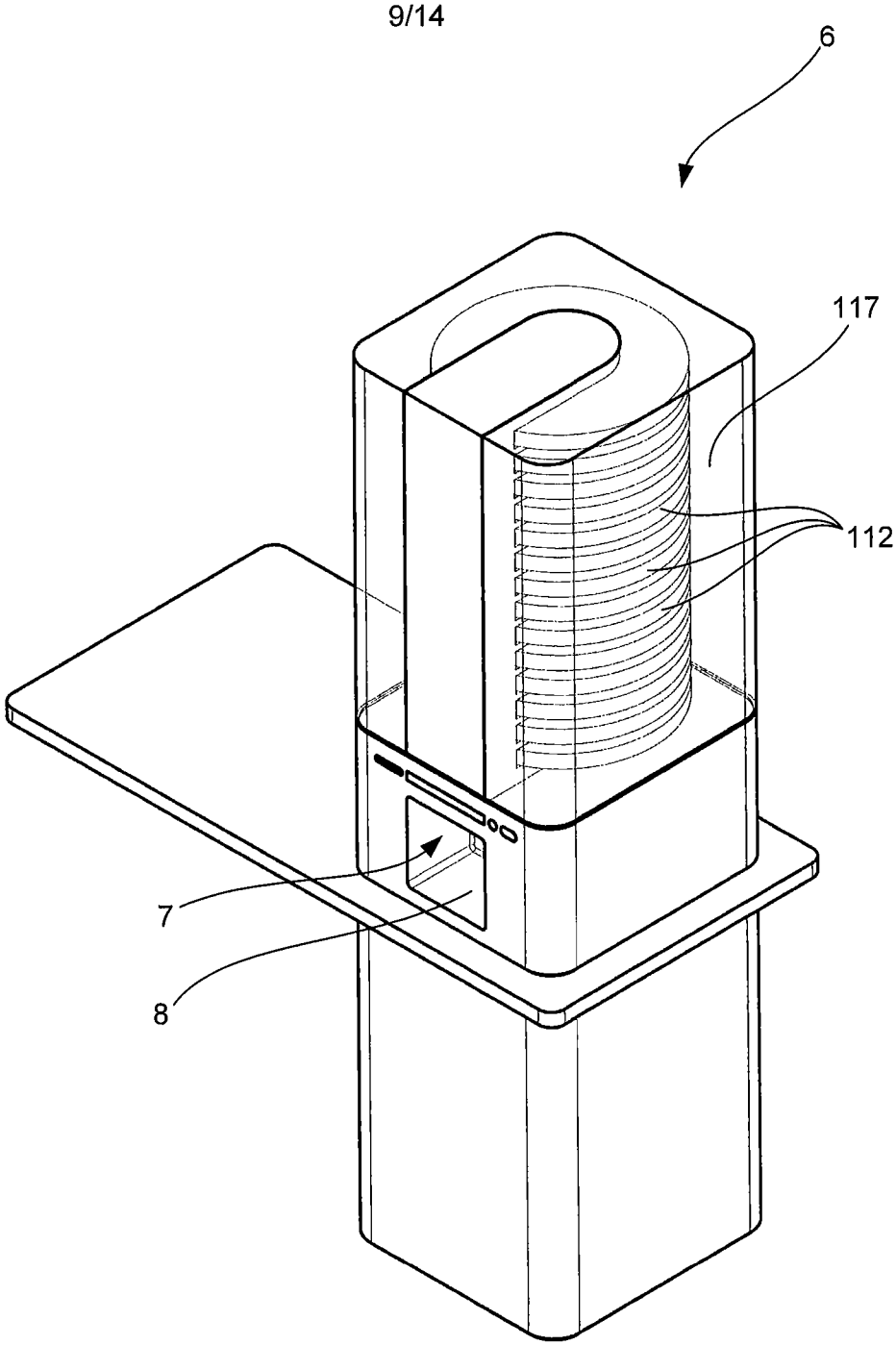

Figure 12

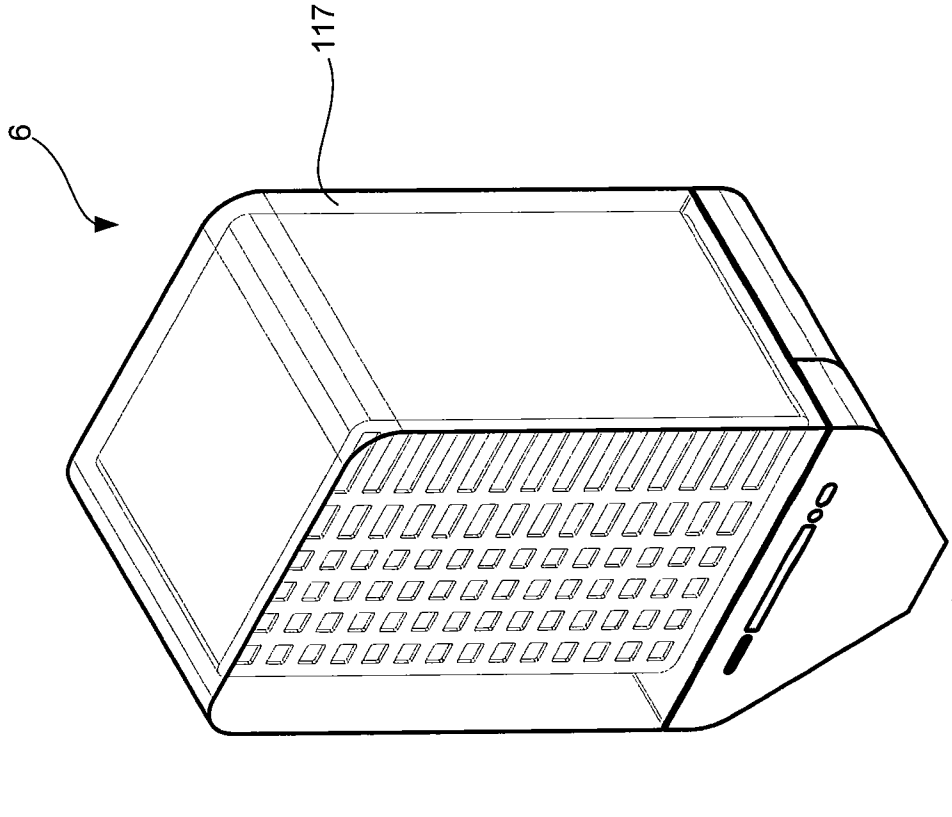

Figure 14

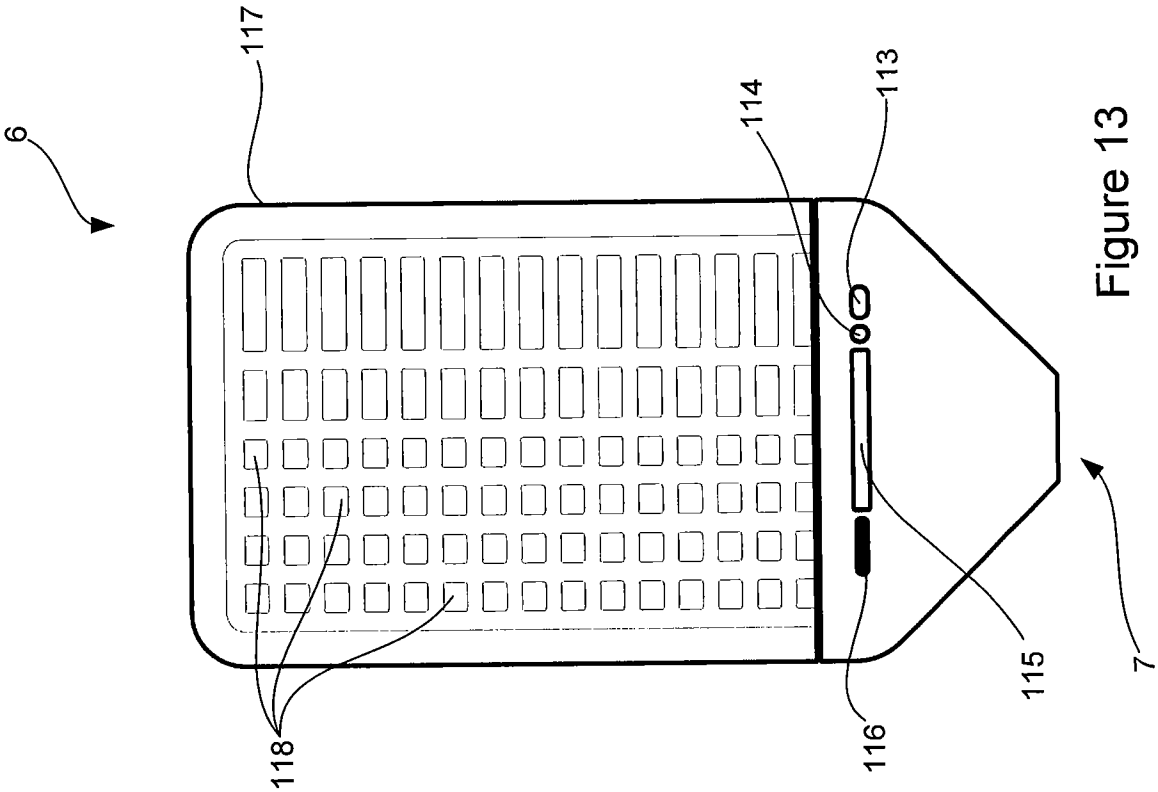

Figure 13

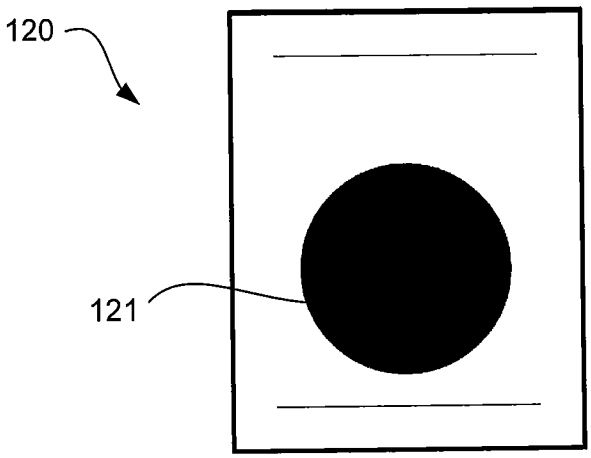

Figure 15

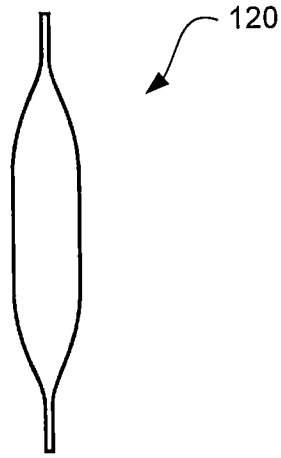

Figure 15A

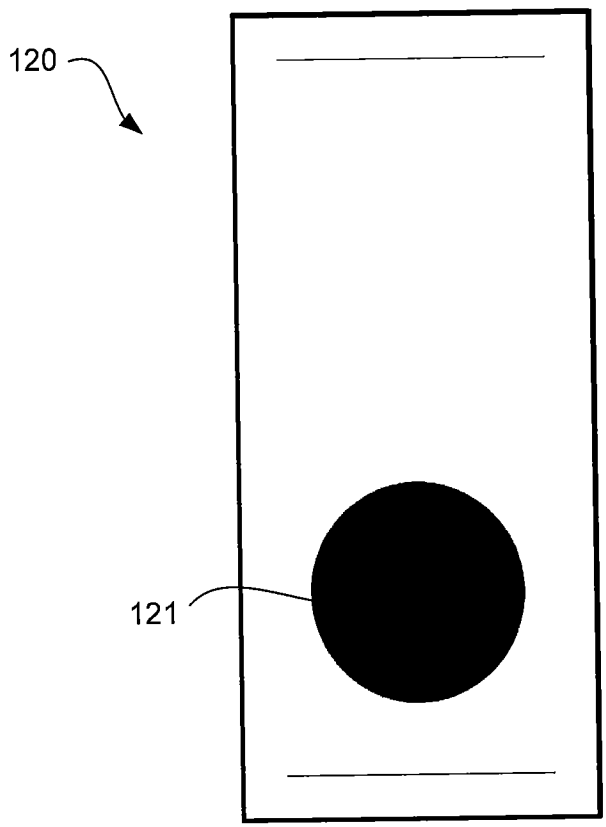

Figure 16

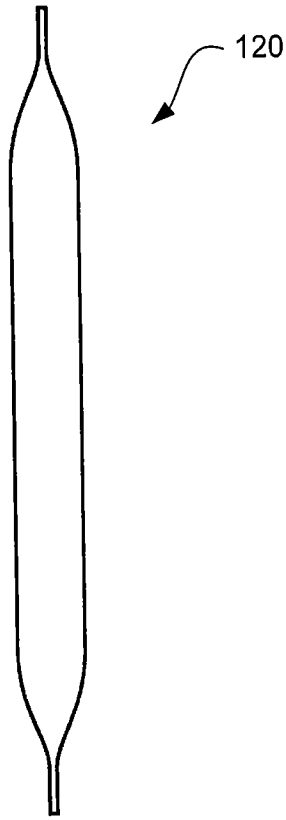

Figure 16A

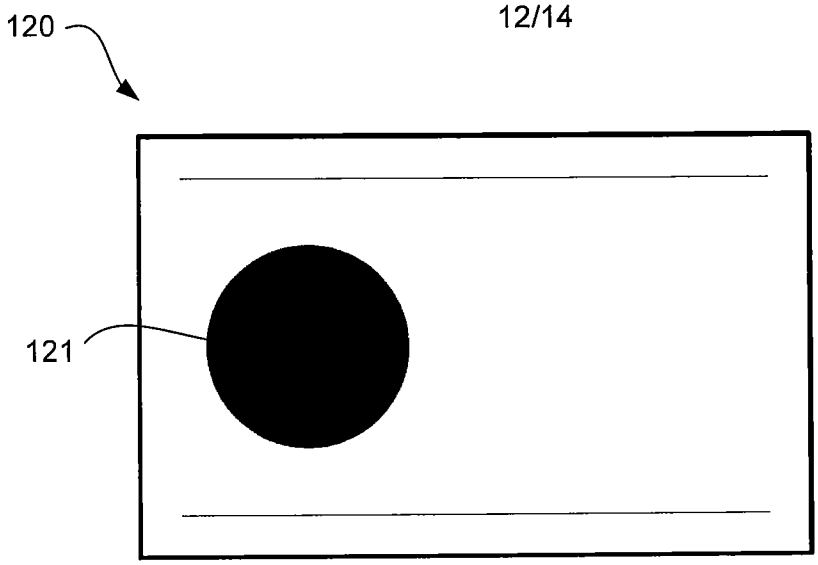

Figure 17

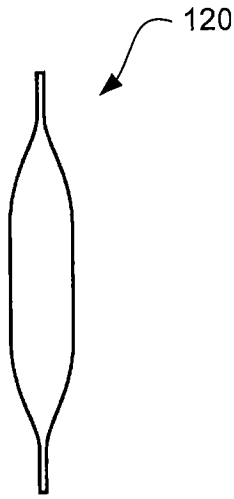

Figure 17A

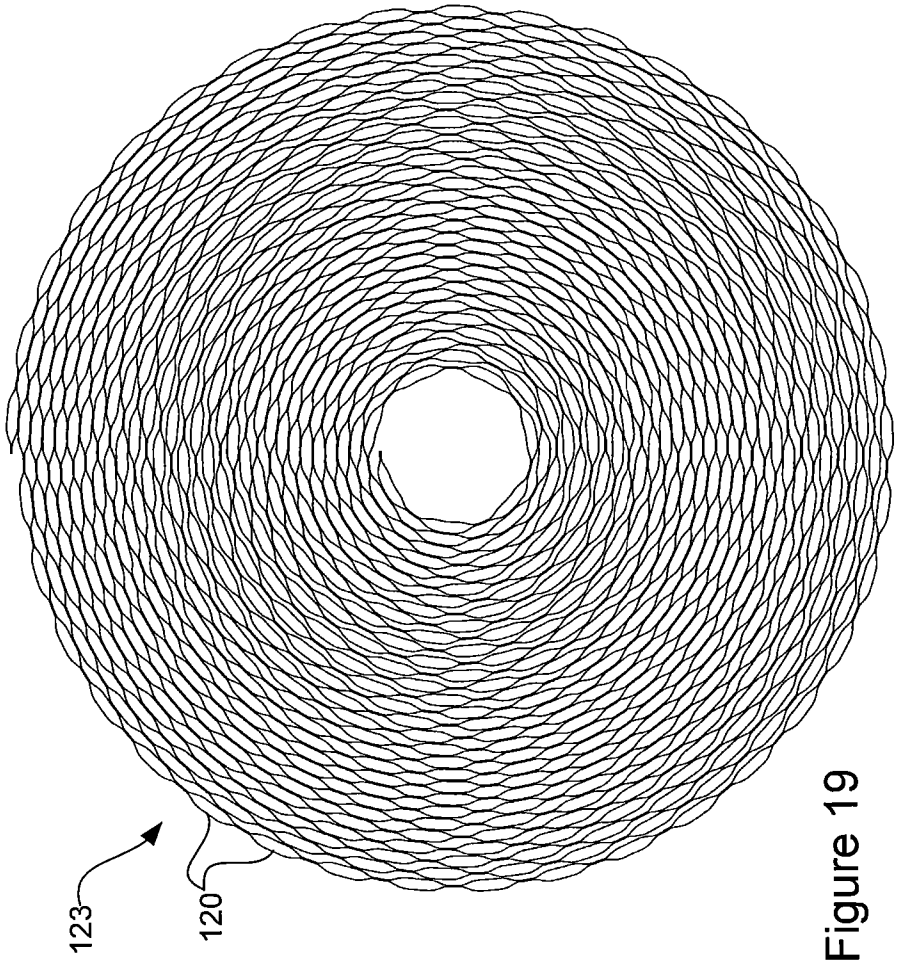

Figure 19

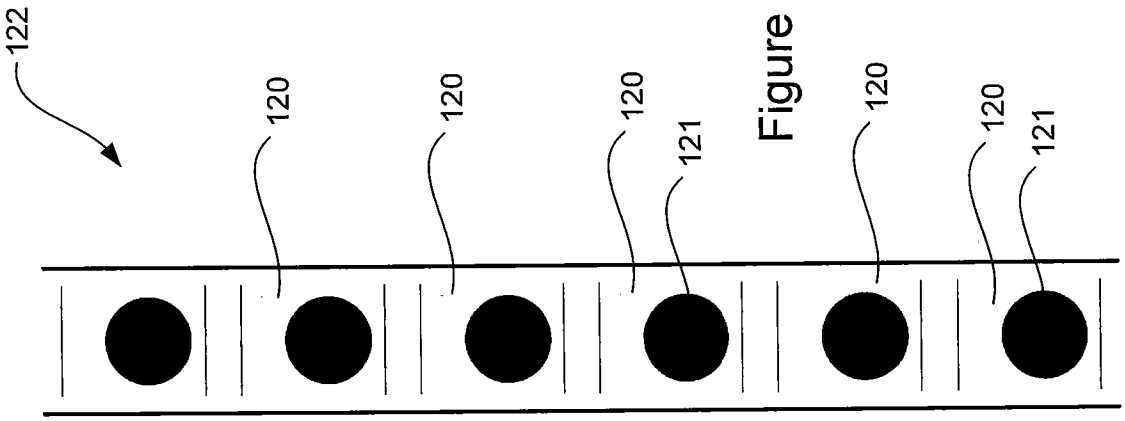

Figure 18

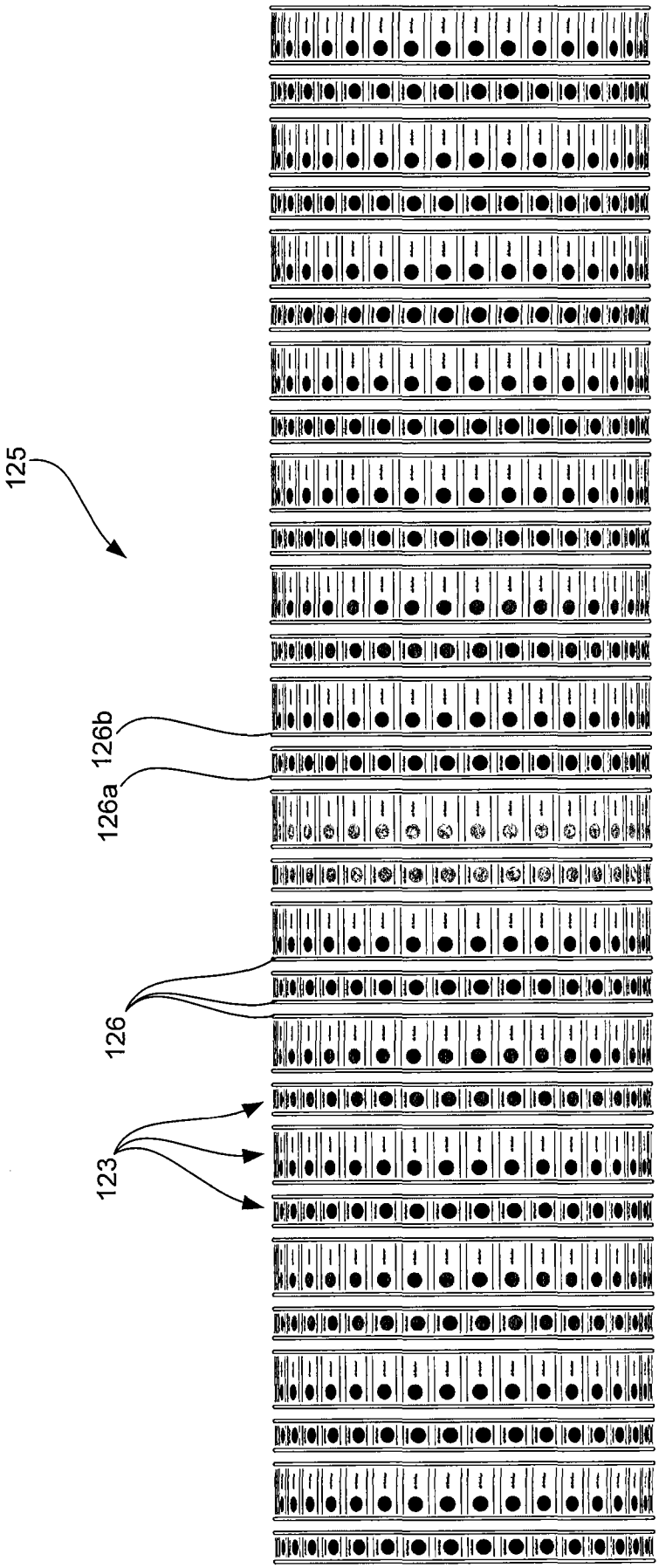

Figure 20