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(54) **Process for producing pre-coated metal sheet.**

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Description

This invention relates to a process of producing pre-coated metal sheet having a surface decoration and suitable for use in the manufacture of bekeware and other products intended for use at high temperatures.

Such pre-coated metal sheet is used in the production of bakeware and other products by various manufacturing methods including: pressing; stamping; roll-forming and deep drawing. It avoids the necessity of applying a coated finish to the product after the manufacturing process which for some products can present difficulties both in the application of a coated finish and in the obtaining of an acceptable finish.

The coating may be applied in a continuous process, for example in a manner similar to that disclosed in US Patent Specification No. 4,485,132 which describes a method of continuous coating a metal sheet.

Hitherto the pre-coated metal sheet which has been produced for use in the manufacture of bakeware and other products intended for use at high temperatures has had a plain finish; it has not had patterns, printing or other surface decoration on it. The present invention provides pre-coated metal sheet which has a surface decoration.

According to the present invention there is provided a process characterised in that it comprises performing on a travelling metal sheet in strips form the continuous steps of successively cleaning a surface of the sheet, applying a bonding agent to the cleaned surface, applying over the bonding agent by roller means a coating composition comprising a solvent based paint which is heat-stable at temperatures of 250°C and higher and provides a flexible finished coating, and baking the coating at a temperature in the range of 350°C to 450°C to dry the coating, and the subsequent continuous steps of applying a decoration on to the baked coating by a pigmented printing medium compatible with the coating composition and curing the applied printing medium to fix it on the coating.

The coated sheet may be produced in flat form but preferably it is coiled. By applying the coating by the reverse roll method, that is by having the roller means and sheet moving in opposite directions where they make contact for the application of the coating to the sheet, the deposition of the coating on the sheet can be closely controlled, which assists in obtaining a good quality coated finish on the sheet. Applying the coating without opposition of movement between the roller means and sheet is possible but the deposition of the coating on the sheet may be more difficult to control.

The printing medium may be applied by roller means or possibly by silk screen printing means.

The coating may be applied to both sides of the sheet. When the coating is applied to both sides the printing medium may also be applied to both sides or just to one of them, depending upon the manufacture in which the coated sheet is intended to be used.

Some examples of suitable materials for the coating are heat resistant lacquers, a polyethylene sulphonate (PES) for flame and very high temperature resistance, and non-stick materials such as Fluon, Nuon, Teflon and Xylan (registered trade marks). Different coating materials may be used on the two sides of the sheet. For example, for use in the manufacture of some bakeware products the side of the sheet which will be at the exterior of a product may be coated with PES and the opposite side may be coated with a non-stick material.

The coating may be opaque, translucent or metallic.

In general the examples of coatings mentioned will withstand usual pressing and forming operations to which the coated sheet may be subjected in the manufacture of a product. PES and the non-stick materials will withstand more difficult forming and deep drawing operations. For extreme conditions of manufacture involving rough handling and severe forming, or where the surface finish of a product made from the coated sheet is particularly critical a protective strippable film, for example of polyethylene, may be applied to the coated sheet after the printing medium has been applied. That film will be removed after the product has been formed.

The printing medium which is applied to the coating must be compatible with the coating material. Generally it will contain the same base constituent as the coating material although concentrations of that constituent and of solvent and pigment will vary to suit the application of the printing medium by the roller means.

The sheets may be of mild or stainless steel, aluminium or its alloys, or possibly other metals, including clad metals such as Hi-Top or aluminized steel.

Typically the sheet will be of a thickness of 0.25 to 1.00 mm when the sheet is of steel or up to 1.5 mm if the sheet is of aluminium.

In general the printing medium will be applied to a thickness which is about a quarter of that of the coating.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figures 1 and 2 are schematic layouts respectively of a coil-coating line for carrying out on strip metal sheet the coating stage of the process according to the present invention, and a line for carrying out the stage of applying the printing medium to the coated strip metal sheet, and

Figure 3 is a plan view of a portion of the strip metal sheet after the printing medium has been applied to it.

For convenience the process will be described as applied to the production of pre-coated steel or aluminum sheet in strip form which is intended to be used for the manufacture of bakeware products capable of withstanding high temperatures of 250°C and higher.

Referring to Figure 1, raw steel or aluminium strip 1, which initially is in a coil 2, is wound off the coil and taken through a series of tensioning rollers 3 to a degreasing station 4 at which a hot alkali degreasing agent is sprayed on the two sides of the strip to remove soluble foreign matter. From the degreasing station 4 the strip passes between abrasive brushing rollers 5 which remove insoluble contaminants from the strip. It then passes on to a washing station 6 at which it is rinsed with hot water to wash away the alkali and contaminants loosened by the brushing rollers 5. Next the cleansed strip has a chemical bonding agent (for example a chromate) applied to it by rollers 8 before entering an oven 7 where any moisture remaining on the strip is driven off. From the oven the strip is directed over various rollers 9 to a coating station 10 at which coatings are applied to both surfaces of the strip by respective sets of applicating rollers 11 and 12 which operate on the reverse roll method. To one surface is applied a coating of PES (such as that supplied by Crown Decorative Products Limited under the name Crown Nuon 500 which is solvent based and available in a variety of colours), and to the other a coating of a non-stick material such as one of those previously mentioned herein is applied. After the coating station 10 the strip is taken through a baking oven 13 at a peak oven temperature of 400—430°C for 60 seconds to dry off solvents of the coatings and bake the coatings. From the baking oven the coated strip passes through a cooling station 14 where it is cooled by water jets before being taken through a series of rollers 15 and being wound back into a coil 16.

Each of the coatings on the strips is plain and extends over the full surface of the side of the strip to which it is applied.

For the next stage of the method reference is to be had to Figure 2 of the accompanying drawings. The coated strip is subsequently wound off the coil 16, taken through tensioning rollers 17 and on by way of other guide rollers 18 to a printing station 19, at the printing station 19 a printing medium is applied for example as a decorative pattern, to the PES coating of the strip by means of a suitably embossed roller 20 which operates on the forward roll method, that is it is rotating in the direction of movement of the strip, the speed of travel of the strip and the rotational speed of the roller being synchronised to ensure good definition in the pattern printed on the strip. A suitable printing medium is that supplied by Crown Decorative Products Limited under the name Crown Coilprint 500. From the printing station 19 the coated and printed strip is taken through a curing oven 21 where the printing medium is cured. Typically when Crown Coilprint 500 is applied as the printing medium the strip is heated in the curing oven at a peak metal temperature of 400—430°C for 60 seconds. Upon leaving the curing oven 21 the coated and printed strip is cooled at a cooling station 22 by water jets and passed round a series of rollers 23 before finally being wound into a coil 24 again.

A portion of the coated strip with the pattern printed on it is shown in Figure 3. Other patterns, or other decoration, may be printed on the coated strip, as desired.

The resultant coated and printed strip is ready for use in the manufacture of bakeware products by known pressing or other forming operations.

Instead of being coiled between the coating and printing stages, the coated strip, after having been passed through the baking oven and cooled, could pass dierctly on to the printing station for the application of the printing meduim, and from there through the curing oven and further cooling station before being wound into a coil.

If a protective strippable film is required to be added to the coated and printed strip before the strip is subjected to the product manufacturing operations, the film may be applied to the strip by rollers after the curing oven and the final cooling station.

Claims

1. A process of producing pre-coated metal sheet having a surface decoration and suitable for use in the manufacture of bakeware and other products intended for use at high temperatures, characterised in that it comprises performing on a travelling metal sheet (1) in strips form the continuous steps of successively cleaning a surface of the sheet, applying a bonding agent to the cleaned surface, applying over the bonding agent by roller means (11, 12) a coating composition comprising a solvent based paint which is heat-stable at temperatures of 250°C and higher and provides a flexible finished coating, and baking the coating at a temperature in the range of 350°C to 450°C to dry the coating, and the subsequent continuous steps of applying a decoration on to the baked coating by a pigmented printing medium compatible with the coating composition and curing the applied printing medium to fix it on the coating.

2. A process according to claim 1 characterised in that a chromate bonding agent is applied to the cleaned surface and the coating material is a sovent based, heat-stable polyethylene sulphonate.

3. A process according to claim 1 or claim 2 characterised in that the raw metal sheet (1) is initially wound into a coil (2) from which the sheet is then continuously drawn and passed through a series of work stations at which the said steps are successively performed, and the coated sheet with the printing medium applied to it is wound into a further coil (24) after the curing step.

4. A process according to any preceding claim characterised in that the coated sheet is cooled and wound into a coil (16) after the baking step, and is subsequently wound off that coil for the application of the printing medium.

5. A process according to any preceding claim characterised in that in the step of applying the coating to the sheet (1) the sheet is moved in a direction opposite to that in which the roller

means (11, 12) is turning as it applies the coating to the sheet.

6. A process according to any preceding claim characterised in that the printing medium is applied to the coating by roller means (20), the sheet being moved during the step of applying the printing medium in the direction of rotation of the roller means.

7. A process according to any preceding claim characterised in that it includes the further step of applying a protective strippable film to the coated sheet after the printing medium has been applied to the coating and cured.

8. A process according to claim 2 or any of claims 3 to 7 as dependent from claim 2 characterised in that the metal sheet (1) has the coating of a polyethylene sulphonate applied to one surface, has a coating of a non-stick material applied to the other surface, and has the printing medium applied to the coating of polyethylene sulphonate.

Patentansprüche

1. Verfahren zur Herstellung vorbeschichteten Blechs, welches eine Oberflächendekoration aufweist und für die Herstellung von Backformen und anderen Produkten geeignet ist, die bei hohen Temperaturen verwendet werden sollen, dadurch gekennzeichnet, daß an einem vorlaufenden Blech (1) in Bandform nacheinander die Verfahrensschritte der Reinigung einer Oberfläche des Blechs, der Aufbringung eines Haftmittels auf die gereinigte Oberfläche, der Aufbringung einer Beschichtungszusammensetzung, welche eine bei Temperaturen von 250°C und darüber wärmebeständige und eine flexible fertige Beschichtung ergebende Farbe auf Lösungsmittelbasis umfaßt, mittels Rollen (11, 12) auf das Haftmittel und der Wärmebehandlung der Beschichtung bei Temperaturen im Bereich von 350°C bis 450°C zum Trocknen der Beschichtung durchgeführt werden, und daß nachfolgend die kontinuierlichen Verfahrensschritte der Aufbringung einer Dekoration auf die ausgehärtete Beschichtung mittels eines pigmentierten, mit der Beschichtungszusammensetzung kompatiblen Druckmediums und der Aushärtung des aufgebrachten Druckmediums zwecks Fixierung desselben auf der Beschichtung durchgeführt werden.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß auf die gereinigte Oberfläche ein Chromat-Haftmittel aufgetragen wird und das Beschichtungsmaterial ein wärmebeständiges Polyäthylen-Sulfonat auf Lösungsmittelbasis ist.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das Blech (1) im Ausgangszustand zunächst zu einem Coil (2) aufgewickelt ist, von welchem das Blech kontinuierlich abgezogen und durch eine Reihe von Arbeitsstationen hindurchgeleitet wird, in denen die erwähnten Verfahrensschritte nacheinander durchgeführt werden, und daß das beschichtete Blech mit dem aufgetragenen Druckmedium nach der Aushärtung zu einem weiteren Coil (24) aufgewickelt wird.

4. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß das beschichtete Blech nach der Wärmebehandlung gekühlt und zu einem Coil (16) aufgewickelt und nachfolgend von diesem Coil zur Aufbringung des Druckmediums wieder abgewickelt wird.

5. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß bei dem Verfahrensschritt der Aufbringung der Beschichtung auf das Blech (1) das Blech in einer Richtung bewegt wird, die der Richtung, in der sich die Rollenanordnung (11, 12) beim Aufbringen der Beschichtung auf das Blech dreht, entgegengesetzt ist.

6. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß das Druckmedium auf die Beschichtung durch eine Rollenanordnung (20) aufgebracht wird, wobei das Blech bei dem Verfahrensschritt der Aufbringung des Druckmediums in Drehrichtung der Rollenanordnung bewegt wird.

7. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß es den weiteren Vorfahrensschritt der Aufbringung eines abziehbaren Schutzfilms auf das beschichtete Blech nach der Aufbringung und Aushärtung des Druckmediums umfaßt.

8. Verfahren nach Anspruch 2 oder einem der Ansprüche 3 bis 7, soweit sie von Anspruch 2 abhängen, dadurch gekennzecihnet, daß das Blech (1) auf der einen Seite die Beschichtung mit einem Polyäthylensulfonat trägt und auf der anderen Seite ein Trennmaterial aufweist, wobei das Druckmedium auf die Beschichtung mit dem Polyäthylensulfonat aufgebracht ist.

Revendications

1. Procédé pour fabriquer une tôle pré-enduite, portant un motif décoratif superficiel et convenant pour être utilisée dans la fabrication de produits cuits au four et d'autres produits destinés à être utilisés à de hautes températures, caractérisé en ce qu'il consiste à mette en oeuvre sur une tôle en déplacement (1) se présentant sous la forme de bande, les étapes continues consistant à réaliser successivement un nettoyage d'une surface de la tôle, appliquer un agent de liaison à la surface nettoyée, appliquer sur l'agent de liaison, à l'aide de moyens en forme de rouleaux (11, 12), une composition d'enduction comprenant une peinture à base de solvants, qui est stable à la chaleur à des températures de 250°C et plus et fournit un revêtement fini souple, et cuire le revêtement à une température située dans la gamme allant de 350°C à 450°C de manière à faire sécher ce revêtement, et les étapes ultérieures continues consistant à appliquer un motif décoratif sur le revêtement cuit, à l'aide d'un milieu d'impression pigmenté, compatible avec la composition d'enduction et à faire cuire le milieu d'impression appliqué afin de le fixer sur le revêtement.

2. Procédé selon la revendication 1, caractérisé en ce qu'on applique un agent de liaison formé d'un chromate sur la surface nettoyée et que le

matériau d'enduction est un sulfonate de polyéthylène formé à partir d'un solvant et thermiquement stable.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce qu'on enroule initialement la tôle brute (1) sous la forme d'une bobine (2), à partir de laquelle la tôle est alors tirée continûment et traverse une série de postes de travail, dans lesquels lesdites étapes sont successivement mises en oeuvre, et qu'on enroule la tôle enduite, sur laquelle est appliqué le milieu d'impression, pour former une autre bobine (24), à la suite de l'étape de cuisson.

4. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce qu'on fait refroidir la tôle enduits et qu'on l'enroule sous la forme d'une bobine (16) après l'étape de cuisson et qu'on déroule ultérieurement cette bobine, pour l'application du milieu d'impression.

5. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que, lors de l'étape d'application du revêtement sur la tôle (1), on déplace cette dernière dans une direction opposée à celle dans laquelle les moyens en forme de rouleaux (11, 12) tournent, lors de l'application du revêtement sur la tôle.

6. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que le milieu d'impression est appliqué sur le revêtement à l'aide de moyens en forme de rouleaux (20), la tôle étant déplacée pendant l'étape d'application de milieu d'impression, dans le sens de rotation des moyeux en forme de rouleaux.

7. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il inclut l'étape supplémentaire consistant à appliquer une pellicule protectrice pouvant être décollée, sur la tôle enduite, une fois que le milieu d'impression a été appliqué sur le revêtement et a durci.

8. Procédé selon la revendication 2 ou l'une quelconque des revendications 3 à 7, considérées comme dépendantes de la revendication 2, caractérisé en ce que le revêtement formé d'un sulfonate de polyéthylène est appliqué sur une surface de la tôle (1), sur l'autre surface de laquelle est appliqué un revêtement formé d'un matériau anti-adhésif, et que le milieu d'impression est appliqué sur le revêtement formé de sulfonate de polyéthylène.

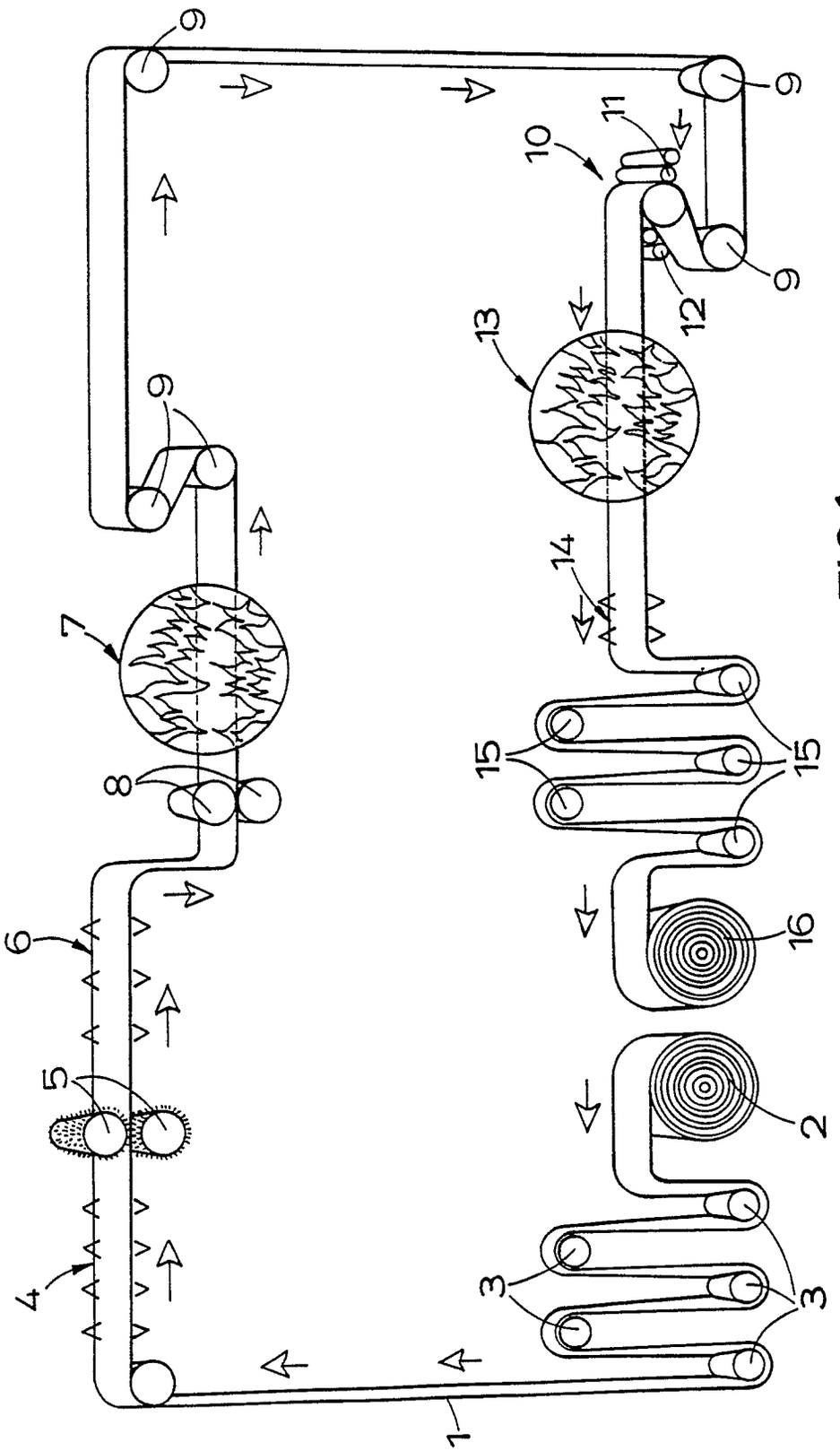

FIG.1.

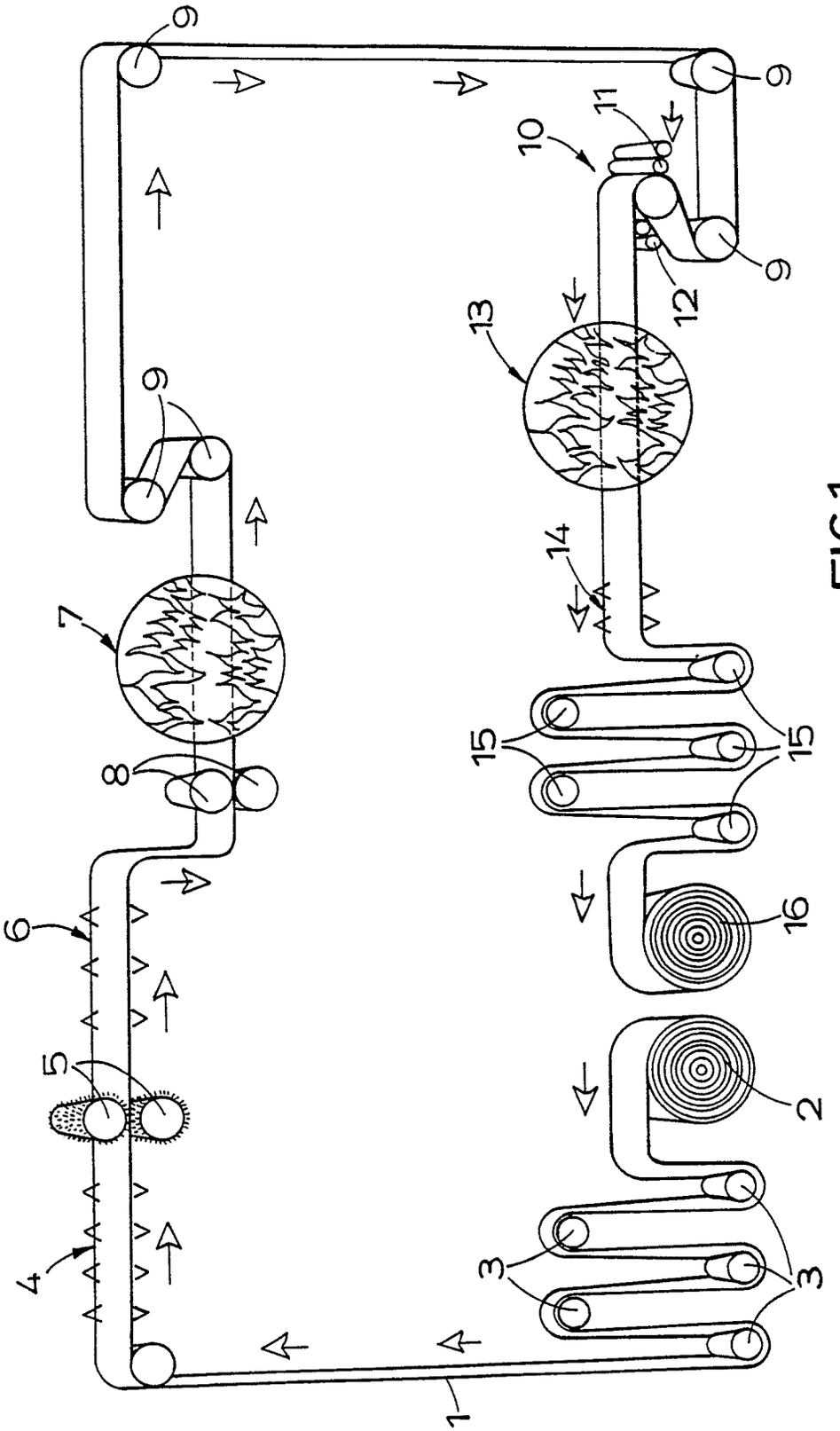

FIG.1.