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(54) **Method for the production of external vehicle bodywork components by stamping, using pre-painted metal sheet**

Verfahren zur Herstellung von äusseren Fahrzeugteilen durch Stanzen mit vorbeschichteten Blechen
Procédé pour la fabrication de parties extérieures de véhicules par estampage avec de tôles prérevêtues

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, DUSSELDORF DE pages 67 - 69 XP274131 B.
MEUTHEN 'Breitband-beschichtung anlagen mit
Pulverlackierung'

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Description

The present invention relates to a method for the production of external components by stamping using pre-painted metal sheet according to the precharacterising part of claim 1.

Such a method is known from e.g. document Stahl und Eisen, vol. 112, no. 4, 15. April 1992, pages 67 to 69, B. Meuthen: "Breitband-Beschichtungsanlagen mit Pulverlackierung".

Further it is known that the bath painting methods e.g. cataphoresis, anaphoresis and the like, used for the painting of mass-produced vehicle bodyworks have a number of drawbacks if applied to small or medium production runs, in which case they are not economic and are a possible cause of environmental pollution as a result of the low level of paint use. In the case of small or medium production runs, typical of some custom-built motor vehicle models (for instance convertibles, spiders, etc.) use has up to now been made of spray painting methods, followed by oven-drying of the body in order to evaporate the solvents and polymerize the paint. This method, however, also entails high costs, very bulky paint stations and possible environmental pollution due in particular to the solvents which are needed for spray painting; moreover, the degree of finish and the quality of the paint may be lacking as this method does not produce readily reproducible results.

It is also known to use, in particular for the production of the bodies of domestic electrical goods, pre-painted sheet which is already in a "finished" condition and which is then subject to the stamping operations needed to obtain the desired components. This method could resolve the problems described above if applied to the stamped external components of a custom-built vehicle bodywork, whose bearing structure is usually derived from that of mass-produced vehicles; it cannot, however, be applied to the body components of motor vehicles as it would in practice be impossible to store and move the sheets on conventional production lines without causing unacceptable damage to the paint. Consequently, in the motor industry, it is only known to use sheet pre-painted with a base coat and only for components which are not visible, for instance the internal parts of boxed bearing components of the body in which the pre-painting wholly or partly replaces the depositing of the first protective layer by cataphoresis, especially in those cases in which penetration of the paint would be difficult.

The object of the invention is to provide a method for the production of external vehicle bodywork components by stamping which resolves the drawbacks described above by using pre-painted sheet and makes it possible to produce, at the end of a single production line, body components which are painted with a final coat and ready for assembly on the body.

This object is attained according to the invention by the method as defined in claim 1.

Particular embodiments of the invention are subject of the dependent claims.

The invention is set out in further detail in the following non-limiting description of two embodiments thereof, made with reference to the accompanying drawings, in which:

Fig. 1 shows a production line adapted to carry out the method of the invention;

Fig. 2 shows a production line with a possible variant from that of Fig. 1.

In Fig. 1, a production line is shown overall by 1 and carries out, along the same single line 1, a method for obtaining, by stamping from a roll 2 of metal sheet, external vehicle bodywork components 3, for instance bonnets, mudguards and the like, which are already painted with a final coat and ready for assembly on the vehicle body.

The line 1 comprises in sequence a first known station 4 for the unwinding of the roll 2, a known station 5 disposed immediately downstream of the station 4 in which the roll 2 being unwound is cut (for instance by means of a mechanical cutting device) into sections i.e. down-sized cuts 6 and a conveyor device 7 of known type disposed immediately downstream of the station 5 on which the sections 6 are placed one after the other at a constant rhythm and along which there are disposed in sequence further respective stations 10, 11 and 12; the line 1 further comprises at least one stamping station 16 for the sections 3 disposed immediately downstream of the station 12 and served, in the non-limiting example shown, by respective robotized handling devices 17, preferably of the known type provided with suction take-up members, which take up the sections 6 from the belt 7 and, respectively, the finished components 3 stamped by the station 16 in order to deposit them on a storage rack 18 or, in a variant which is not shown, directly on a conveyor for an assembly line for the components 3 of the bodywork of a vehicle, which is not shown for purposes of simplicity.

According to the invention, the stations 10, 11 and 12 carry out a painting operation on the sections 3 directly on the same cutting and stamping line of the sections or directly on the line 1. In particular, the station 10 is a known washing and degreasing station for the sections 3 of the strip 2 of metal sheet and the station 11 is a known wiping and drying station. The washed and dried sections 3 are then supplied to the station 12 which, according to the invention, is formed by an oven of the known paternoster type modified so that it operates as a powder painting booth.

In detail, the oven forming the station 12 comprises a housing 20 and a moving component 21 on which the sections 3 rest and which has a vertical development and comprises an ascending branch 22 and a descending branch 23; at the summit of the two branches 22, 23 there is disposed within the housing 20 a heating means

24; according to the invention, there is disposed along the ascending branch 22 a powder painting device 25, of known electrostatic type, by means of which a powder paint of any known type is deposited by spraying on the sections 6 entering the station 12 and ascending along the branch 22 towards the summit of the oven and the heating means 24.

The spray depositing is carried out by the device 25 using the technology known as "airless" by means of which only the powder paint, without any carrier fluid, is sprayed on the sections 6; the powder paint is caused to adhere to the sections 6 electrostatically, electrically charging with a predetermined polarity the section of the ascending branch 22 disposed at the device 25 (for instance by means of an appropriate sliding contact), in order electrically to charge the sections 6 transported thereby with the same polarity, and charging the spray paint emerging from the device 25 with an opposite polarity.

According to the above description, the method of the invention for the production of the external bodywork components 3 by stamping is carried out as follows. In the first instance, use is made of a roll 2 of metal sheet pre-painted with a base coat which is widely commercially available; this is then treated in sequence along the same production line (in this case line 1) by cutting the roll 2 into sections 6, stamping each section 6 into the desired component and painting these sections with a final coat using a powder paint applied by means of an electrostatic painting operation, carried out within the oven of the known paternoster type forming the station 12.

The painting operation takes place, as shown in Fig. 1, upstream of the stamping operation; in particular, the sections 6 obtained as output from the station 5, after cleaning and drying (by means of the stations 10 and 11) are introduced into the paternoster oven 12 where the ascending branch 22 of the moving component 21 moves them towards the heating means 24 causing the sections 6 to pass through the painting device 25 where powder paint of the desired colour and quantity is deposited; the temperature increase generated by the means 24 causes the fusion and polymerization of the powder paint deposited on the sections 6 thereby providing a stable film of paint thereon; as they pass along the descending branch 23, the painted sections 6 move away from the means 24, gradually becoming cooler and leaving the station 12 at ambient temperature, where they are taken up by a handling device 17 for the stamping operation.

This takes place in a single stage in a single station 16 (for very simple components) or, more commonly, in subsequent stages in a plurality of stations 16 (not shown for simplicity) disposed in sequence and in cascade along the line 1. In each case the sections 6 are stamped to form the components 3 which, as they are obtained from sections of strip 2 which have already been painted, are, according to the invention, obtained

in the finished condition ready for assembly on the bodywork. The painted and stamped components 3 are then sorted outside of the line 1 by a further handling device 17.

According to the variant illustrated in Fig. 2, where similar or identical details to those already described are shown by the same reference numerals, the stations 10, 11 and 12 are disposed in sequence along a production line 100 similar to the line 1 downstream of the stamping station (or plurality of stations) 16, rather than upstream as in the case of the line 1. The production line 100 is otherwise identical to the line 1. Consequently, according to this variant of the method of the invention, the powder painting operation is carried out downstream of the stamping operation, rather than upstream as in the case of Fig. 1.

In particular, the strip 2 is cut into sections 6 in the station 5 and these sections are then taken up one by one by a first handling device 17 and supplied to the station (or plurality of stations) 16 and stamped into the shape of the components 3 to be obtained, as described above, providing as output from the station 16 semi-finished components or stamped sections 6a; these stamped sections 6a are taken up by a second handling device 17 and deposited on the belt 7 which conveys them through the stations 10, 11 and 12 where the sections 6a are subject to washing and degreasing, to wiping and drying and to powder painting in the desired colour, using the same methods as described above, and providing as output the finished components 3 (stamped and painted with a final coat) ready for assembly on the bodywork.

According to both the variants described, the powder painting takes place by bringing the sections 6 or 6a, as they ascend along the branch 22 of the paternoster station 12, to a temperature of approximately 50°C (as a result of the gradual heating due to their movement towards the heating means 24), then carrying out deposition, using an "airless" technology, of the powder paint on the sections 6, 6a and finally heating the sections 6, 6a again to approximately 120°C at the summit of the oven 12 and the respective branches 22, 23, at which temperature the paint fuses and polymerizes providing the desired film of final paint. The sections 6 or 6a are subsequently cooled to ambient temperature by heat dissipation as they descend along the branch 23. In each case, in order to achieve the desired results, it is necessary to use pre-painted metal sheets in order to provide the powder paint with an anchoring substrate.

Using the above methods, it has surprisingly been found that it is possible to obtain extremely stable and resistant layers of paint which are therefore able to withstand the stresses of a stamping operation without deterioration. It is evident that the method of Fig. 1 (stamping following painting) is applied in the case of components 3 of simple shape which may be obtained by stamping which is not very deep; in this case, the fact that the stamping station is disposed along the same

line as the painting station and immediately downstream of the latter, makes it possible to carry out the stamping operations while the layer of paint is still at the polymerization stage (in particular reticulation) and therefore has sufficient fluidity to follow the deformation of the sheet without peeling or becoming detached, although remaining sufficiently polymerized to be stably anchored to the section of sheet.

In contrast, the method of Fig. 2 is preferably used when it is necessary to carry out deep stamping operations (of the deep-drawing type) on the sections 6; in this case, however, the fact that the final coat painting operation is carried out using powder technology and immediately downstream of stamping, when the stamped sections 6a still have a certain residual tension and without the layer pre-painted with a base coat, even if possibly damaged, having had time to deteriorate, as could be the case when stored and painted subsequently on a different line, makes it possible to obtain a surface appearance of the final coat which is surprisingly good and free from defects.

In substance, therefore, by using the method as described it is possible to obtain, from a strip pre-painted with a base coat and using a single line, stamped components which are already painted with a final coat and can be immediately mounted on the vehicle, with the only limitation that fastening systems which do not ruin the paint, such as nails, rivets, screws, etc., have to be used. Moreover, vehicle production lines using components produced by the method of the invention are of extremely small size because of the omission of the booths and ovens conventionally used for the painting of the entire body which are replaced by the paternoster station 16 which is vertical and combines the oven and painting booth functions and which, as it has to treat the separate components (all of very reduced size when taken individually with respect to an overall bodywork) has very small dimensions with respect to conventional ovens and painting booths. The use of powder paint technology also makes it possible to eliminate any pollution (solvents are not used) and substantially to reduce power consumption.

Substantial advantages in respect of known methods are obtained from the above description. In particular, it is clear that the method of the invention is very advantageous for the small or medium production runs typical of custom-built vehicles, since a single line, with the simple re-equipment of the stamping stations, may produce all the components needed to assembly the bodywork of many different types of vehicle, avoiding any need to store the finished components and thereby making it possible to use "just-in-time" techniques providing substantial reductions in vehicle production costs.

Obviously, the painted components must be handled as delicately as possible along the line 1; use may be made, for this purpose, of robotized handling devices provided with suction take-up devices or, in a variant

which is not shown, manual handling by specialist operators.

Claims

1. A method for the production of external components (3) by stamping using a pre-painted metal sheet, wherein a roll (2) of a metal sheet pre-painted with a base coat is processed in sequence along a production line (1) by the steps of:

- (i)- unwinding the pre-painted metal sheet from the roll (2);
- (ii)- cutting the unwound, pre-painted metal sheet into down-sized cuts (6);
- (iii)- stamping each said down-sized cut (6) into the desired component (3);
- (iv)- painting each said down-sized cut (6) with a final coat using a powder paint applied by means of an electrostatic painting operation carried out in a painting station; **characterized in that**

(a)- said components are external vehicle bodywork components (3);

(b)- said painting station is an oven (12) of the paternoster type, comprising a housing (20), a moving component (21) and heating means (24), wherein the moving component (21) comprises an ascending branch (22) and a descending branch (23) and the heating means are disposed in the housing (20) at the top of the two branches (22,23);

(c)- said electrostatic painting operation is carried out by spraying the powder paint in correspondence with the ascending branch (22) and against the down-sized cuts (6) ascending along said latter branch (22) towards the top of the oven (12) and the heating means (24).

2. A method according to Claim 1, wherein said painting step (iv) is carried out before said stamping step (iii) and along the same working line (1), by placing said oven (12) along said working line (1) upstream of a stamping station (16).

3. A method according to Claim 1, wherein said painting step (iv) is carried out after said stamping step (iii) and along the same working line (1), by placing said oven (12) along said working line (1) downstream from a stamping station (16).

4. A method according to anyone of the foregoing claims, wherein, prior to said powder painting step, each said down-sized cut (6) is subject to a washing and a drying steps carried out in respective stations

(10,11) of said working line (1).

5. A method according to anyone of the foregoing claims, wherein:

(d)- said powder paint is applied onto said down-sized cuts (6) by means of "airless" spraying technology by means of a powder painting device (25) placed inside said oven (12) along said ascending branch (22) of said moving component (21); and wherein

(e)- each said painted down-sized cut (6) is gradually brought to the temperature of fusion and polymerisation of the powder paint along said ascending branch (22), by getting closer and closer to said heating means (24) at the top of the oven (12) and is subsequently cooled as it moves down said the descending branch (23) of the oven (12).

6. A method as claimed in anyone of the foregoing claims, wherein all said steps are carried out at respective stations (4,5,10,11,12,16) disposed in sequence along a single production line (1), at the beginning of which there is disposed said roll (2) of pre-painted sheet, and at the end of which the stamped and finishing painted bodywork components (3), ready for assembly on a vehicle bodywork, are taken up.

7. A method as claimed in claim 6, wherein the movement between one station and another (4,5,10,11,12,16) is obtained by manual handling of the said down-sized cuts (6).

8. A method as claimed in claim 6, wherein the movement between one station and another (4,5,10,11,12,16) is obtained by an automatic handling of the said down-sized cuts (6) carried out by robotized handling devices (17) having suction take-up devices.

Patentansprüche

1. Verfahren zur Herstellung von Außenkomponenten (3) durch Stanzen unter Verwendung eines vorgestrichenen Metallblechs, wobei eine Rolle (2) eines mit einem Grundanstrich vorgestrichenen Metallblechs entlang einer Fertigungsstraße (1) nacheinander durch folgende Stufen bearbeitet wird:

(i)- Abwickeln des vorgestrichenen Metallblechs von der Rolle (2);

(ii)- Schneiden des abgewickelten, vorgestrichenen Metallblechs in Stücke geringerer Größe (6);

(iii)- Stanzen jedes der abgeschnittenen Stücke (6) zu der gewünschten Komponente (3);

(iv)- Lackieren jedes der abgeschnittenen Stücke (6) mit einer Endlackierung unter Verwendung einer Pulverfarbe, die mittels eines elektrostatischen Lackierverfahrens, welches in einer Lackierstation durchgeführt wird, aufgetragen wird; dadurch gekennzeichnet, daß

(a)- es sich bei den Komponenten um äußere Fahrzeugkarosseriekomponenten (3) handelt;

(b)- die Lackierstation ein Ofen (12) des Paternostertyps ist, der ein Gehäuse (20), eine bewegliche Komponente (21) und Heizmittel (24) enthält, wobei die bewegliche Komponente (21) einen aufsteigenden Abschnitt (22) und einen absteigenden Abschnitt (23) umfaßt, und die Heizmittel in dem Gehäuse (20) an der Spitze der beiden Abschnitte (22, 23) angeordnet sind;

(c)- das elektrostatische Lackierverfahren durch Aufsprühen der Pulverfarbe im Verlauf des aufsteigenden Abschnitts (22) und gegen die abgeschnittenen Stücke (6), welche entlang des letzteren Abschnitts (22) in Richtung der Spitze des Ofens (12) und der Heizmittel (24) aufsteigen, durchgeführt wird.

2. Verfahren gemäß Anspruch 1, wobei die Lackierstufe (iv) vor der Stanzstufe (iii) und entlang der gleichen Fertigungsstraße (1) durchgeführt wird, indem der Ofen (12) entlang der Fertigungsstraße (1) stromaufwärts von der Stanzstation (16) angeordnet wird.

3. Verfahren gemäß Anspruch 1, wobei die Lackierstufe (iv) nach der Stanzstufe (iii) und entlang der gleichen Fertigungsstraße (1) durchgeführt wird, indem der Ofen (12) entlang der Fertigungsstraße (1) stromabwärts von der Stanzstation (16) angeordnet wird.

4. Verfahren nach wenigstens einem der vorhergehenden Ansprüche, wobei vor der Pulverlackierstufe jedes der abgeschnittenen Stücke (6) Wasch- und Trockungsstufen, die in den jeweiligen Stationen (10, 11) der Fertigungsstraße (1) durchgeführt werden, unterzogen wird.

5. Verfahren nach wenigstens einem der vorhergehenden Ansprüche, wobei:

(d)- die Pulverfarbe auf die abgeschnittenen Stücke (6) mittels einer "luffreien" Aufsprühtechnik mittels einer Pulverlackiervorrichtung (25), die sich im Innern des Ofens (12) entlang des aufsteigenden Abschnitts (22) der bewegli-

chen Komponente (21) befindet, aufgetragen wird; und wobei

(e)- jedes der abgeschnittenen Stücke (6) entlang des ansteigenden Abschnitts (22) nach und nach auf die Schmelz- und Polymerisationstemperatur der Pulverfarbe gebracht wird, indem es näher und näher an die Heizmittel (24) an der Spitze des Ofens (12) gebracht und nachfolgend bei Herabbewegen auf dem absteigenden Abschnitt (23) des Ofens (12) abgekühlt wird.

6. Verfahren nach wenigstens einem der vorhergehenden Ansprüche, wobei alle Stufen in den jeweiligen Stationen (4, 5, 10, 11, 12, 16), die nacheinander entlang einer einzigen Fertigungsstraße (1), an deren Anfang die Rolle (2) des vorgestrichenen Blechs angeordnet ist, und an deren Ende die gestanzten und mit der Endlackierung versehenen Karosserieteile (3), fertig zum Zusammenbau mit einer Fahrzeugkarrosserie, aufgenommen werden, angeordnet sind, durchgeführt werden.
7. Verfahren gemäß Anspruch 6, wobei die Bewegung der abgeschnittenen Stücke (6) zwischen den Stationen (4, 5, 10, 11, 12, 16) manuell durchgeführt wird.
8. Verfahren gemäß Anspruch 6, wobei die Bewegung der abgeschnittenen Stücke (6) zwischen den Stationen (4, 5, 10, 11, 12, 16) automatisch durch Robotervorrichtungen (17), welche Ansauggreifvorrichtungen aufweisen, durchgeführt wird.

Revendications

1. Procédé pour la production par estampage de composants extérieurs (3) en utilisant une tôle pré-peinte, dans lequel un rouleau (2) de tôle pré-peinte avec une peinture primaire est traité en séquence le long d'une chaîne de production (1) par les étapes suivantes :
- (i) dérouler la tôle pré-peinte du rouleau (2) ;
- (ii) couper la tôle pré-peinte déroulée en sections sous-dimensionnées (6) ;
- (iii) estamper chacune desdites sections sous-dimensionnées (6) en le composant désiré (3) ;
- (iv) peindre chacune desdites sections sous-dimensionnées (6) avec un revêtement final en utilisant une peinture en poudre appliquée au moyen d'une opération de peinture électrostatique effectuée dans un poste de peinture ; caractérisé en ce que

(a) lesdits composants sont des composants extérieurs de carrosserie de véhicule

(3) ;

(b) ledit poste de peinture est une étuve (12) du type pater-noster, comprenant un carter (20), un composant mobile (21) et un moyen de chauffage (24), dans lequel le composant mobile (21) comprend une branche ascendante (22) et une branche descendante (23) et le moyen de chauffage est disposé dans le carter (20) au sommet des deux branches (22, 23) ;

(c) ladite opération de peinture électrostatique est effectuée en pulvérisant la peinture en poudre en correspondance avec la branche ascendante (22) et contre les sections sous-dimensionnées (6) montant le long de ladite dernière branche (22) en direction du sommet de l'étuve (12) et du moyen de chauffage (24).

2. Procédé selon la revendication 1, dans lequel ladite étape de peinture (iv) est effectuée avant ladite étape d'estampage (iii) et le long de la même chaîne de travail (1), en plaçant ladite étuve (12) le long de ladite chaîne de travail (1) en amont d'un poste d'estampage (16).
3. Procédé selon la revendication 1, dans lequel ladite étape de peinture (iv) est effectuée après ladite étape d'estampage (iii) le long de la même chaîne de travail (1), en plaçant ladite étuve (12) le long de ladite chaîne de travail (1) en aval d'un poste d'estampage (16).
4. Procédé selon l'une quelconque des revendications précédentes, dans lequel, avant ladite étape de peinture en poudre, chacune desdites sections sous-dimensionnées (6) est soumise à des étapes de lavage et de séchage effectuées dans des postes respectifs (10, 11) de ladite chaîne de travail (1).
5. Procédé selon l'une quelconque des revendications précédentes, dans lequel :

(d) ladite peinture en poudre est appliquée sur lesdites sections sous-dimensionnées (6) au moyen d'une technologie de pulvérisation "sans air" au moyen d'un dispositif de peinture en poudre (25) placé dans ladite étuve (12) le long de ladite branche ascendante (22) dudit composant mobile (21) ; et dans lequel (e) chacune desdites sections sous-dimensionnées peintes (6) est progressivement amenée à la température de fusion et de polymérisation de la peinture en poudre le long de ladite branche ascendante (22), en se rapprochant progressivement dudit moyen de chauffage (24) au niveau du haut de l'étuve (12) et est ensuite refroidie pendant qu'elle se déplace vers le bas

le long de ladite branche descendante (23) de l'étuve (12).

6. Procédé selon l'une quelconque des revendications précédentes, dans lequel toutes ces étapes sont effectuées en des postes respectifs (4, 5, 10, 11, 12, 16) disposés en séquence le long d'une chaîne de production unique (1), au début de laquelle est disposé ledit rouleau (2) de tôle pré-peinte, et à la fin de laquelle les composants de carrosserie estampés et peints en finition (3), prêts à être montés sur une carrosserie de véhicule, sont prélevés. 5 10
7. Procédé selon la revendication 6, dans lequel le mouvement entre un poste et un autre (4, 5, 10, 11, 12, 16) est obtenu par une manutention manuelle desdites sections sous-dimensionnées (6). 15
8. Procédé selon la revendication 6, dans lequel le mouvement entre un poste et un autre (4, 5, 10, 11, 12, 16) est obtenu par une manutention automatique desdites sections sous-dimensionnées (6) effectuée par des dispositifs de manutention robotisés (17) ayant des dispositifs de préhension à ventouses. 20 25

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FIG. 1

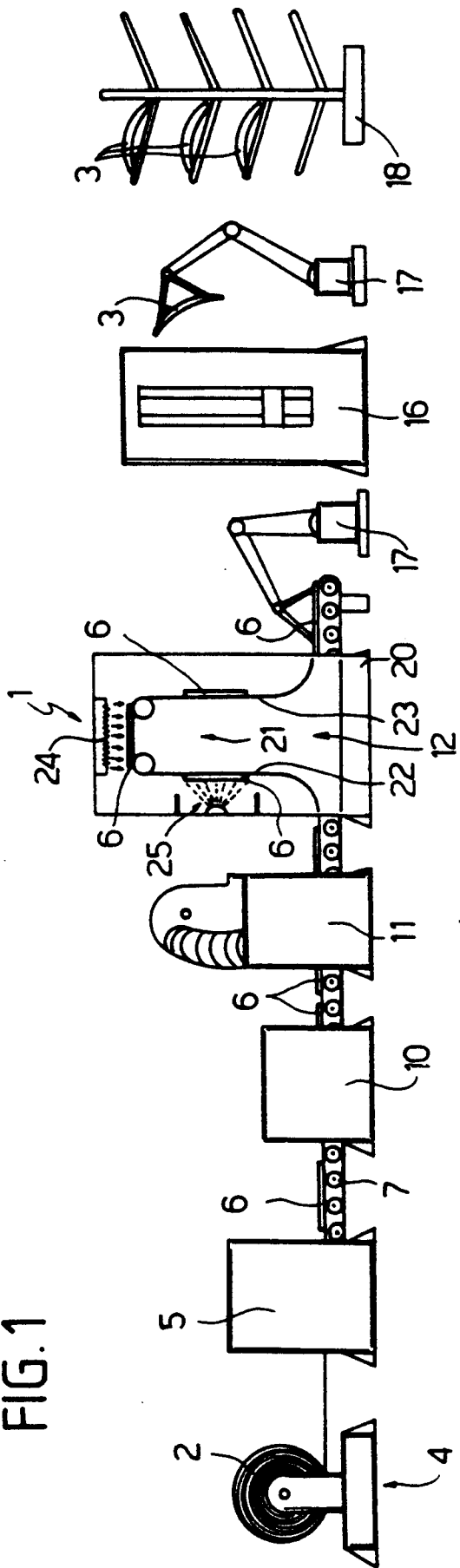


FIG. 2

