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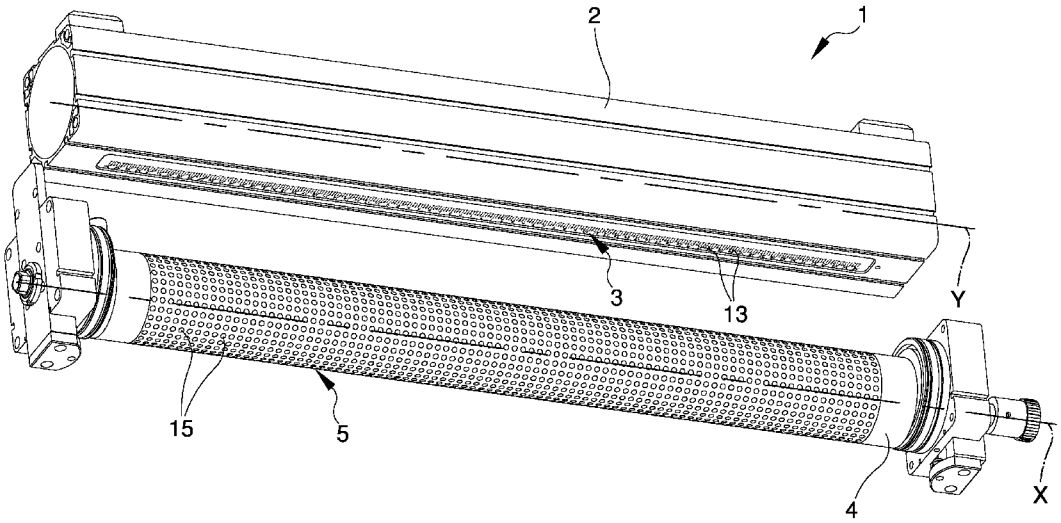

Fig.2

(57) Abstract: The equipment (1) for the enameling of manufactured articles, comprises: an internally hollow container (2) for the collection of enamel to be applied on a manufactured article (M), where the container (2) is provided with at least one group (3) of through orifices (13) for the outflow of the enamel; at least one roller (4) housed out of axis inside the container (2) and operable in rotation around a relevant axis (X), where the volume interposed between the inner walls of the container (2) and the roller (4) defines a containment chamber (8) of the enamel, the orifices (13) protruding inside the containment chamber (8); and where the roller (4) is provided with at least one set (5) of protrusions (15) adapted to open and close the orifices (13) during the rotation of the roller itself to allow and prevent respectively the enamel from flowing out of the container (2).

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EQUIPMENT FOR THE ENAMELING OF MANUFACTURED ARTICLES

Technical Field

The present invention relates to a piece of equipment for the enameling of manufactured articles.

Background Art

In the ceramic field, different methods for applying enamel to tiles are well known.

A first known method involves the use of a device, in jargon called "bell", which allows the formation of a film of enamel under which the tile is passed.

This first methodology has however a number of drawbacks.

First of all, it involves the extensive use of enamel to maintain the continuity of the film which, besides entailing a high cost, also involves a significant increase in the weight of the tile. For this reason, the use of the bell is not very suitable for enameling tiles made using the single-firing process which, as is well known, require a low quantity and weight of enamel.

Another drawback of this first known method is the difficulty of applying enamel uniformly on the tiles. In fact, the quantity of applied enamel is greater at the edges of the tile and lesser in the central area.

Last but not least, in order to cover the entire tile surface, the film defined by the bell must have a greater extension than the tile itself, which entails a considerable waste of material. The enamel which falls outside the tile is generally recovered and reused. However, the recovered enamel has a different density than the original enamel, thus giving rise to color shades which are different to the initial ones.

A second known method, defined in jargon as "airless", involves the application of the enamel by means of atomization. More specifically, this method is carried out by means of a plurality of nozzles which are adapted to atomize the enamel and which are arranged inside the relevant enameling booths.

However, this second known method also has a number of drawbacks.

It does in fact involve considerable material waste, even up to 50% of the dispensed material, which remains in suspension inside the relevant booth. To

overcome these drawbacks, most of the booths currently used for this enameling method are provided with a suction system, complete with a relevant filter to avoid dispersion into the atmosphere of the particles of atomized enamel which remain in suspension inside. This, however, gives rise to further drawbacks, linked to the disposal of the enamel which accumulates in the filters and to the fact that the suctioned enamel, a percentage of which can be recovered and reused, has a different density than the one initially dispensed and, therefore, can give rise to different color shades.

Yet another drawback of this described second method consists in the fact that it is difficult, particularly for medium-large sizes, to apply the enamel uniformly on the surface to be covered.

An enameling method of the type known in the ceramic industry to overcome the drawbacks of the aforementioned known methods provides for the application of enamel by means of a series of nozzles which are adapted to dispense a relevant strip of enamel on the manufactured article to be enameled of identical width, so that the adjacent strips join together to define a substantially homogeneous layer of enamel. Preferably, such nozzles are adapted to dispense enamel at a pressure below 1 bar, so as to allow the release of a substantially continuous thread of enamel and such as to define a strip of enamel on the manufactured article to be enameled.

These nozzles each comprise a relevant electronically-controllable shutter, which is adapted to open/close a relevant enamel exit opening.

However, this enameling method does also have a number of drawbacks.

In fact, the enamel applied in this way features a number of shadings in the areas where the dispensed strips are joined, which affects the quality and aesthetic result of the finished product.

Some equipment for the enameling of manufactured articles is known from US 2003/230647 and DE 4416747 patent documents.

In particular, US 2003/230647 describes an equipment comprising an internally hollow load-bearing body inside which is housed to measure a roller in turn provided with an internal cavity meant to receive the enamel to be dispensed. The load-bearing body is provided with a plurality of orifices for dispensing the

enamel on the outside and the roller is in turn provided with a plurality of holes adapted to allow the transit of the enamel contained inside the roller itself towards the outside following their alignment with the above-mentioned orifices. Immediately downstream of each hole, the roller is also provided with a relevant protrusion adapted to close the orifices during its rotation around the relevant axis and pushed towards the internal wall of the load-bearing body by relevant elastic means.

US 2003/23064 does not allow uniform enameling of the relevant manufactured article to be decorated, inasmuch as, due to the presence and proximity of the holes and of the protrusions defined on the relevant roller, it involves the dispensing of a plurality of lines on the manufactured article itself. Such lines are then visible on the manufactured article and give it an irregular appearance.

The equipment covered by patent document US 2003/23064 also has the drawback that the orifices can become blocked during normal operation, compromising the correct exit of the enamel.

Patent document DE 4416747 describes an equipment for the enameling of manufactured articles comprising a hollow body, adapted to contain the enamel to be dispensed and provided with a plurality of orifices, inside which a cylinder is housed in turn provided with a series of cavities, so that when such cavities reach the orifices the enamel comes out towards the outside.

The equipment described by patent document DE 4416747 does not however permit uniformly enameling the relevant manufactured article, inasmuch as, in this case too, the enamel comes out in the form of lines, thus affecting the aesthetic appearance of same.

Description of the Invention

The main aim of the present invention is to provide a piece of equipment which allows overcoming the drawbacks of the aforementioned prior art.

In particular, the present invention aims at providing a piece of equipment which allows distributing the enamel uniformly over the surface of the relevant manufactured articles, thus obtaining a high surface quality and at the same time reducing material waste to the utmost.

Within this aim, one object of the present invention is to make a piece of

equipment that allows managing the amplitude, the frequency and the position of the quantity of dispensed enamel in an easy and flexible way.

Another object of the present invention is to provide a piece of equipment which is simple to make and operate.

Not the least object of the equipment forming the subject of the present invention is to avoid the deposit and consolidation of the enamel and, at the same time, to prevent the orifices becoming blocked.

Yet another object is to provide a piece of equipment which does not require the use of suction systems for the disposal of the enamel particles which remain in the air after its application.

Another object of the present invention is to provide an equipment for the enameling of manufactured articles which allows overcoming the aforementioned drawbacks of the prior art within the scope of a simple, rational, easy, efficient to use and cost-effective solution.

The aforementioned objects are achieved by the present equipment according to claim 1.

Brief Description of the Drawings

Other characteristics and advantages of the present invention will become more evident from the description of a preferred, but not exclusive embodiment of a piece of equipment for the enameling of manufactured articles, illustrated by way of an indicative, but non-limiting example, in the attached drawings in which:

Figure 1 is an axonometric view of a piece of equipment according to the invention;

Figure 2 is an exploded view of the equipment of Figure 1;

Figure 3 is an axonometric view of a portion of the container of the equipment of Figure 1;

Figure 4 is an axonometric view of a portion of the roller of the equipment of Figure 1;

Figure 5 is an enlarged view of a detail of the roller of Figure 4;

Figure 6 is an axonometric view of a portion of the container of the equipment of Figure 1, in an alternative embodiment;

Figure 7 is a side elevation view of the roller of the equipment of Figure 1, in an alternative embodiment;

Figure 8 is a longitudinal section of the equipment of Figure 1;

Figure 9 is an enlarged view of a detail of Figure 8;

Figure 10 is a cross-section of the equipment of Figure 1;

Figure 11 is an enlarged view of a detail of Figure 10, with the orifices in the closed configuration;

Figure 12 is an enlarged view of a detail of Figure 10, with the orifices in the open configuration;

Figure 13 is an axonometric view of the equipment of Figure 1 during operation;

Figure 14 is an axonometric view of a piece of equipment according to the invention in a particular embodiment;

Figure 15 is an axonometric view of a piece of equipment according to the invention in a particular embodiment.

Embodiments of the Invention

With particular reference to these figures, reference numeral 1 globally indicates a piece of equipment for the enameling of manufactured articles, especially ceramic products.

According to the invention, the equipment 1 comprises an internally hollow container 2 for the collection of enamel to be applied on a manufactured article M, which is provided with at least one group of through orifices for the outflow of the enamel.

Advantageously, the container 2 is under pressure, e.g. between 0.5 bar and 3 bar. More specifically, the container 2 has one or more channels 12 for feeding the enamel inside it. By closing the orifices, it is also possible to make the enamel re-circulate inside the container 2 through the channels 12, the minimum number of which in this case must be two.

In the present description, the group of orifices defined on the container 2 is identified with the reference number 3, while the individual orifices are identified with the reference number 13.

Suitably, the container 2 is meant to be supported by a load-bearing frame 20

and the equipment 1 comprises movement means 10 for moving the manufactured article M to be enameled along a direction of forward movement V. The movement means 10 define a supporting surface of the manufactured article M placed below the orifices 13, and are composed e.g. of a plurality of motor-driven belts.

The container 2, of the hollow type, may have a cylindrical shape, in which case the group 3 of orifices 13 is preferably defined along its side wall, or it may have a box shape, in which case the group 3 of orifices 13 is defined on the wall delimiting the bottom of the container itself.

In the preferred embodiment shown in the illustrations, the container 2 has a box-shaped on the outside and internally has a circular section. Conveniently, the orifices 13 are defined at the portion of the side wall of the container 2 arranged, in use, downwards.

The container 2 therefore has a relevant axis, corresponding to its internal axis. The axis of the container 2, identified in the illustrations with Y, therefore corresponds to the axis passing through the center of its internal circular section and to its longitudinal axis.

Inside the container 2 is housed at least one roller 4 operable in rotation around a relevant axis, identified in the figures by X.

According to the invention, the roller 4 is out of axis with respect to the container 2, i.e. the axis X is misaligned with respect to the axis Y.

The volume interposed between the inner walls of the container 2 and the roller 4 defines a containment chamber 8 of the enamel.

Advantageously, the section of the containment chamber 8 is decreasing towards the orifices 13. In other words, the volume of the containment chamber 8 decreases moving downwards. This means that the enamel is collected at the lower section area of the containment chamber 8, near the orifices 13, thus facilitating its exit following the opening of the orifices themselves.

According to the invention, furthermore, the orifices 13, which face onto the inside of the containment chamber 8, protrude inside it. In other words, the orifices 13 have a portion which extends towards the inside of the containment chamber 8, and this results in a discontinuity with respect to the wall which

delimits the containment chamber itself or with respect to the inner side wall of the container 2.

The roller 4 is provided with at least one set of protrusions adapted to open and close the orifices 13 during the rotation of the roller itself, so as to allow and prevent respectively the enamel from flowing out of the container 2. In the present description, the set of protrusions defined on the roller 4 is identified with reference numeral 5, while the individual protrusions are identified with reference numeral 15.

In other words, during the rotation of the roller 4 around the axis X, the protrusions 15 reach the orifices 13, overlapping these so as to obstruct the transit of the enamel, and then, again following the rotation of the roller 4, move in order to reopen them.

The fact that the orifices 13 are protruding towards the inside of the containment chamber 8 makes it possible both to ensure that they close following the overlapping of the protrusions 15, which only interact with the orifices themselves, and at the same time, that there is no interaction, and therefore friction, between the protrusions 15 and the inner wall of the container 2.

The protrusions 15 then slide on the top of the orifices 13, obstructing the access mouth thereof. The trajectory covered by the protrusions 15 is therefore substantially tangential to the top of the orifices 13. In other words, during the rotation of the roller 4, the protrusions 15 “sweep” the access mouth of the orifices 13 removing any lumps of enamel that could be deposited on the mouth and creating an effect of mixing of the enamel which prevents the sedimentation thereof.

The roller 4 is opportunely made of elastomeric material, in order to allow the deformation of the protrusions 15 following the interaction with the orifices 13 and, thereby, ensuring the closure thereof.

Preferably, the equipment 1 comprises adjustment means for adjusting the position of the axis X of the roller 4 with respect to the container 2. The adjustment means therefore allow modifying the position of the axis X with respect to the axis Y of the container 2, e.g. so as to compensate for any closing

inaccuracies due to the wear of the parts.

The adjustment means can be of the mechanical type, e.g. by means of register screws or other solutions known to the person skilled in the art, or, alternatively, of the electronic type.

Advantageously, the roller 4 is of the solid type. In other words, inside the roller 4 transit channels for the enamel or the like are not defined.

The orifices 13 can be closed either simultaneously, so that the internal volume of the container 2 is isolated from the outside and no enamel can come out, or sequentially, so that the orifices 13 are closed according to a predefined sequence during the rotation of the roller 4.

In the embodiment shown in the illustrations, each protrusion 15 is adapted to overlap a relevant orifice 13, obstructing it, when the set 5 of protrusions 15 reaches the group 3 of orifices 13.

More particularly, to each orifice 13 corresponds a relevant protrusion 15, so that there is therefore an instant when all the orifices 13 are closed by a relevant protrusion 15. The duration of the time interval wherein the orifices 13 remain closed depends on the rotation speed of the roller 4 and on the relevant sizes of the orifices and the protrusions themselves.

Preferably, the protrusions 15 are bigger than the orifices 13. The protrusions 15 can, e.g., have a parallelepiped section and the orifices 13 a circular section, although conformations of different types cannot be ruled out.

More particularly, the roller 4 has a plurality of recesses 11 defining the protrusions 15. The protrusions 15 are therefore defined by a series of recesses 11 obtained on the roller 4 and their external surface corresponds to the external surface of the roller itself, so they do not exceed its external diameter. The recesses 11 allow the transit of the enamel towards the orifices 13 during the rotation of the roller 4. More in detail, during the rotation of the roller 4, the enamel is pushed through the recesses 11 by the pressure.

The orifices 13 are therefore opened and closed as a result of the transit over these of the recesses 11 and of the protrusions 15, respectively.

Appropriately, the amplitude of the recesses 11, and therefore of the protrusions 15, determines the opening time of the orifices 13, the rotation speed of the

roller 4 being equal.

In the embodiment of the equipment 1 shown in the illustrations, the group 3 of orifices 13 comprises at least one row 23 of orifices 13 extending along a first direction 6. The orifices 13 belonging to a same row 23 are therefore substantially aligned with each other (except for machining tolerances) along the same direction 6. Similarly, the set 5 of protrusions 15 also comprises at least one series 25 of protrusions 15 extending along the first direction 6, where the protrusions 15 arranged along each series 25 are substantially aligned (except for machining tolerances) along the first direction 6 with the orifices 13 arranged along at least one of the rows 23. The protrusions 15 are therefore arranged so as to be aligned with at least one relevant orifice 13 and to overlap them during the rotation of the roller 4.

Conveniently, the first direction 6 is substantially parallel to the axis X of rotation of the roller 4. In the embodiment shown in the illustrations, the first direction 6 is arranged transversely to the direction of forward movement V of the manufactured article M.

In more detail, since the contact between the roller 4 and the container 2 is of the linear type, in order for the protrusions 15 to be able to close the orifices 13 at the same time, these must be defined along a direction of the roller 4.

Preferably, the group 3 of orifices 13 and the set 5 of protrusions 15 comprise a plurality of rows 23 and a plurality of series 25 respectively, (two in this specific case, but embodiments cannot be ruled out wherein a greater number of rows 23 and series 25 is provided), where the number of series 25 is at least equal to the number of rows 23 and where the protrusions 15 of each series 25 are aligned along the first direction 6 with the orifices 13 of at least one relevant row 23, so that the protrusions 15 overlap to the orifices 13 when the set 5 of protrusions 15 reaches the group 3 of orifices 13.

It can therefore happen that the number of series 25 of the protrusions 15 is equal to the number of the rows 23 of orifices 13, e.g., two rows 23 and two series 25, or that the number of series 25 is greater than that of the rows 23, e.g., two rows 23 and three or four series 25, in order to increase the closing frequency of the orifices 13. As the number of series 25 or the number of sets 5

increases, so does the number of times the orifices 13 are closed with each turn of the roller 4.

The closing time of the orifices 13 depends on their size and on the relevant protrusions 15, as well as on the rotation speed of the roller 4, the number of series 25 or of sets 5, as well as the rotation speed of the roller 4, affects the closing frequency of the orifices 13, i.e., the number of times the orifices 13 are closed in the unit of time.

Preferably, as in the embodiment shown in Figures 6 and 7, the orifices 13 arranged along one row 23 are staggered with respect to the orifices 13 of the adjacent rows 23 along a second direction 7 substantially orthogonal to the first direction 6. Similarly, the protrusions 15 arranged along a series 25 are staggered with respect to the protrusions 15 of the adjacent series 25 along the second direction 7, which is therefore arranged orthogonally to the axis X of the roller 4. It follows, therefore, that the first direction 6 defines a predefined angle α with the line joining the orifice/protrusion 13, 15 of a row/series 23, 25 with the nearest orifice/protrusion 13, 15 of the adjacent row/series 23, 25. This way, the dispensing areas of the enamel coming out of each row 23 of orifices 13 are staggered with respect to those of the adjacent rows 23, thus allowing more uniform enameling and a better coverage of the spaces compared to the case in which the dispensing areas obtained from the adjacent rows 23 are aligned with each other. The distance between the adjacent rows 23 (and therefore the amplitude of the angle α) defines the distance between the dispensing areas on the manufactured article M to be enameled along the second direction 7, while the rotation speed of the roller 4 and the sizes of the orifices 13 and of the protrusions 15, define instead the time in which the orifices 13 remain closed. The quantity of enamel dispensed by each orifice 13 depends instead on the opening time of the orifices 13, i.e. on the distance between the consecutive protrusions 15 responsible for closing the same orifice 13. Therefore, through the orifices 13, drops of enamel are dispensed which give rise to a substantially punctiform application on the manufactured article M. As the opening time of the orifices 13 increases, so does the size of the dispensed drop.

Figure 13 shows, schematically and by way of example, the distribution of the

enameled areas on a manufactured article M. As can be seen, the enamel applied is of the punctiform type and the enameled areas recover the distribution of the orifices 13 defined on the container 2. By adjusting the parameters such as the rotation speed of the roller 4, the sizes of the orifices 13 and of the protrusions 15 and the forward movement speed of the manufactured article M, the quantity of enamel dispensed at each opening of the orifices 13 can be changed, as can the reciprocal distance of the points where the enamel is applied, so as to obtain uniform enameling both as regards the quantity of enamel dispensed on the surface of the manufactured article M and its distribution.

It should be noticed that during the enamel dispensing step on the manufactured article M the roller 4 rotates around the relevant axis X.

Advantageously, the roller 4 comprises a plurality of sets of protrusions 15 angularly spaced apart from one another along the circular extension of the roller itself.

Therefore, as already mentioned above, the angular distance between each set 5 of protrusions 15 also affects the closing frequency of the orifices 13. More in particular, the smaller the angular distance between a set 5 of protrusions 15 and the next set, the greater the closing frequency of the orifices 13, the rotation speed of the roller 4 being equal. In other words, the smaller the angular distance between one set 5 of protrusions 15 and the next set, the shorter the time that elapses between two successive closures of the orifices 13, the rotation speed of the roller 4 being equal, i.e., the shorter their opening time. The orifices 13 are therefore opened and closed in a sequential and cyclic way, i.e., with a determinate frequency, following the transit of each set 5 of protrusions 15 at the group 3 of orifices 13 defined on the container 2.

In the preferred embodiment shown in Figures 3, 4 and 5, the container 2 comprises a single row 23 of orifices 13 and a plurality of series 25 of protrusions 15 equally spaced the one from the other over the entire extension of the external surface of the roller 4. This specific arrangement of the orifices 13 and of the protrusions 15 makes it possible to apply a high number of enamel points on the manufactured article M and with a high frequency.

The Figures 11 and 12 identify the closing and opening positions of the orifices 13 respectively.

Advantageously, the equipment 1 comprises motor means 14 adapted to operate the roller 4 in rotation around the axis X. More in detail, such motor means 14 comprise electronic control means for controlling the rotation of the roller 4 around the axis X.

Suitably, the equipment 1 also comprises a command and control unit 9 adapted to command the start and movement of the motor means 14. More in particular, the equipment 1 comprises sensor means 16, e.g. of the type of a photocell, operationally connected to the command and control unit 9 and adapted to detect the position of the manufactured article M to be enameled in relation to the orifices 13. The command and control unit 9 is also operationally connected to the movement means 10 and is programmed so as to control the rotation of the roller 4 according to the position of the manufactured article M with respect to the orifices 13 and to its forward movement speed V so as to vary the quantity and/or frequency of the enamel dispensed through the orifices themselves.

More specifically, the command and control unit 9 is configured to command the rotation of the roller 4 following the detection of the transit of the manufactured article M to be enameled and to interrupt it once such transit has been completed. The command and control unit 9 is therefore programmed to operate the roller 4 in rotation, thus allowing the enamel to be dispensed only when the manufactured article M passes below the orifices 13, thereby avoiding any waste of material. Opportunely, when the rear edge of the manufactured article M has passed beyond the orifices 13, the command and control unit 9 commands the interruption of enamel dispensing, blocking the rotation of the roller 4. More specifically, the command and control unit 9 stops the roller 4 in a position wherein the protrusions 15 block the orifices 13 to prevent the transit of the enamel.

At the same time, the command and control unit 9 is configured to adjust the rotation speed of the roller 4 according to the forward movement speed of the manufactured article M and to the type of application to be obtained. In

particular, by increasing the rotation speed of the roller 4, the forward movement speed of the manufactured article M being equal, the quantity of enamel dispensed at each opening of the orifices 13 is reduced, i.e. the size is reduced of the relevant point applied on the manufactured article M, and at the same time the dispensing frequency is increased, i.e. the distance between two consecutive dispensing operations along the direction of forward movement V is reduced, so that the dispensed enamel points are closer to one another.

The operation of the present invention is as follows.

Depending on the width of the manufactured article M to be enameled, the equipment 1 with the most suitable dimensions is chosen or the closing means are adjusted in order to regulate the extension of the rows 23 of orifices 13 responsible for dispensing the enamel.

The container 2 is then fed with enamel at a substantially constant pressure, equal to about 1 bar, which is collected inside the containment chamber 8.

The rotation of the roller 4 is then synchronized by the command and control unit 9 with the forward movement of the manufactured article M to be enameled, so that the dispensing of the enamel through the orifices 13 starts when the manufactured article M reaches the orifices themselves and stops once it has passed them.

The command and control unit 9 also acts on the means of control of the rotation of the roller 4 to adjust its rotation speed, according to the forward movement speed of the manufactured article M, in such a way as to vary the quantity of dispensed enamel at each opening of the orifices 13 and the dispensing frequency, i.e. the distance between two successive dispensing operations along the direction of forward movement V.

Appropriately, the rotation speed of the roller 4 corresponds to the forward movement speed of the manufactured article M to be enameled.

Alternatively, the command and control unit 9 can intervene on the movement means 10 to vary the forward movement speed of the manufactured article M, the rotation speed of the roller 4 being equal.

As can be easily appreciated, as a result of the pressure inside the container 2, the enamel comes out through the orifices 13, thus falling on the manufactured

article M which transits below the orifices themselves.

The orifices 13 are then closed by the protrusions 15 by effect of the rotation of the roller 4. By effect of the rotation of the roller 4, the protrusions 15 interact with the top of the orifices 13, closing their access mouth facing inside the containment chamber 8.

More particularly, the rotation of the roller 4 conveys the sets 5 of protrusions to the group 3 of orifices 13 and, as soon as the protrusions 15 of each series 25 overlap the orifices 13 of the corresponding rows 23, the container 2 is without openings towards the outside so that the enamel does not come out.

As already mentioned above, the reciprocal position of the orifices 13 arranged in rows 23 adjacent to one another determines the position and the distance of the areas in which the enamel is dispensed, the sizes of the orifices 13 and of the relevant protrusions 15, as well as the rotation speed of the roller 4, determine the closing time of the orifices 13, the angular distance between the sets 5 of protrusions and the rotation speed of the roller 4 determine the opening/closing frequency of the orifices 13, the distance between two consecutive protrusions 15 determines the opening time of the corresponding orifice 13 and, therefore, the quantity of enamel dispensed.

It has in practice been ascertained that the described invention achieves the intended objects and, in particular, the fact is underlined that the equipment forming the subject of the present invention allows enameling a manufactured article in an effective and uniform manner.

The misalignment of the roller with respect to the container allows defining a chamber for the collection of enamel outside the roller itself and having a conformation such as to allow the collection of the enamel at the orifices, thus facilitating the exit thereof. At the same time, the shape of the orifices, protruding towards the inside of the containment chamber, ensures their correct and effective closure by the protrusions defined on the roller.

The equipment thus conceived allows the enamel to be applied in a punctiform manner on the manufactured article M to be enameled, so as to obtain, as a result of the natural expansion of the enamel thus dispensed on the relevant surface, a uniform enameling free of aesthetic defects.

In particular, by adjusting the process parameters, such as the position of the orifices and protrusions, the angular distance of the sets of protrusions and the rotation speed of the roller, it is possible to modify at will the size of the enamel drops dispensed and the distance between them.

Moreover, in order to vary the quantity of enamel applied to a manufactured article, it is necessary to adjust the enamel feeding pressure inside the containment chamber and the forward movement speed of the manufactured article itself.

The equipment according to the invention does not therefore have any construction or manufacturing limits and is able to adapt easily to any production requirement.

Furthermore, the particular shape of the orifices, protruding towards the inside of the enamel containment chamber, and the closure "by rubbing" due to the tangential contact of the protrusions with the mouth of the orifices themselves, allows removing any residues or lumps of enamel that may deposit at this point. The rotary movement of the roller therefore makes it possible to keep the orifices free of any bodies that could obstruct the transit of the enamel.

At the same time, the shape of the containment chamber and the movement of the roller inside it allow the continuous mixing of the enamel, thus preventing this from depositing on the bottom and producing areas of different densities.

CLAIMS

1) Equipment (1) for the enameling of manufactured articles, characterized by the fact that it comprises:

an internally hollow container (2) for the collection of enamel to be applied on a manufactured article (M), where said container (2) is provided with at least one group (3) of through orifices (13) for the outflow of the enamel;

at least one roller (4) housed out of axis inside said container (2) and operable in rotation around a relevant axis (X),

where the volume interposed between the inner walls of said container (2) and said roller (4) defines a containment chamber (8) of the enamel, said orifices (13) protruding inside said containment chamber (8);

and characterized by the fact that said roller (4) is provided with at least one set (5) of protrusions (15) adapted to open and close said orifices (13) during the rotation of the roller itself to allow and prevent respectively the enamel from flowing out of said container (2).

2) Equipment (1) according to claim 1, characterized by the fact that each of said protrusions (15) overlaps a relevant orifice (13), obstructing it, when said set (5) of protrusions (15) reaches said group (3) of orifices (13).

3) Equipment (1) according to claim 1 or 2, characterized by the fact that said set (5) of protrusions (15) is adapted to substantially close simultaneously said group (3) of orifices (13).

4) Equipment (1) according to one or more of the preceding claims, characterized by the fact that said group (3) of orifices (13) comprises at least one row (23) of orifices (13) extending along a first direction (6), and by the fact that said set (5) of protrusions (15) comprises at least one series (25) of protrusions (15) extending along said first direction (6), the protrusions (15) arranged along each of said series (25) being substantially aligned along said first direction (6) with the orifices (13) arranged along at least one of said rows (23).

5) Equipment (1) according to claim 4, characterized by the fact that said first direction (6) is substantially parallel to the axis of rotation of said roller (4).

6) Equipment (1) according to claim 4 or 5, characterized by the fact that said

group (3) of orifices (13) comprises a plurality of said rows (23) and said set (5) of protrusions (15) comprises a plurality of said series (25), where the number of said series (25) is at least equal to the number of said rows (23) and where the protrusions (15) of each of said series (25) are substantially aligned along said first direction (6) with the orifices (13) of at least one of said rows (23).

7) Equipment (1) according to claim 6, characterized by the fact that the orifices (13) of one of said rows (23) are staggered with respect to the orifices (13) of the adjacent rows (23) along a second direction (7) substantially orthogonal to said first direction (6).

8) Equipment (1) according to one or more of the preceding claims, characterized by the fact that said roller (4) comprises a plurality of said sets (5) of protrusions (15) angularly spaced apart from one another along the circular extension of the roller itself.

9) Equipment (1) according to one or more of the preceding claims, characterized by the fact that said roller (4) has a plurality of recesses defining said protrusions (15).

10) Equipment (1) according to one or more of the preceding claims, characterized by the fact that said protrusions (15) are bigger than said orifices (13).

11) Equipment (1) according to one or more of the preceding claims, characterized by the fact that it comprises closure means for closing at least one part of said orifices (13) moveable along said first direction (6).

12) Equipment (1) according to one or more of the preceding claims, characterized by the fact that the section of said containment chamber (8) is decreasing towards said orifices (13).

13) Equipment (1) according to one or more of the preceding claims, characterized by the fact that it comprises adjustment means for adjusting the position of the axis of said roller (4) with respect to said container (2).

14) Equipment (1) according to one or more of the preceding claims, characterized by the fact that it comprises electronic control means for controlling the rotation of said roller (4) around the relevant axis.

15) Equipment (1) according to one or more of the preceding claims,

characterized by the fact that it comprises movement means (10) for moving the manufactured article (M) to be enameled along a direction of forward movement (V), sensor means (16), adapted to detect the position of the manufactured article (M) to be enameled in relation to said orifices (13) and by the fact that it comprises at least one command and control unit (9) which is operationally connected to said movement means (10), to said sensor means (16) and to said control means, where said command and control unit (9) is configured to control the rotation of said roller (4) around the relevant axis according to the position of the manufactured article (M) with respect to said orifices (13) and to its forward movement speed so as to vary the quantity and/or frequency of the enamel dispensed through the orifices themselves.

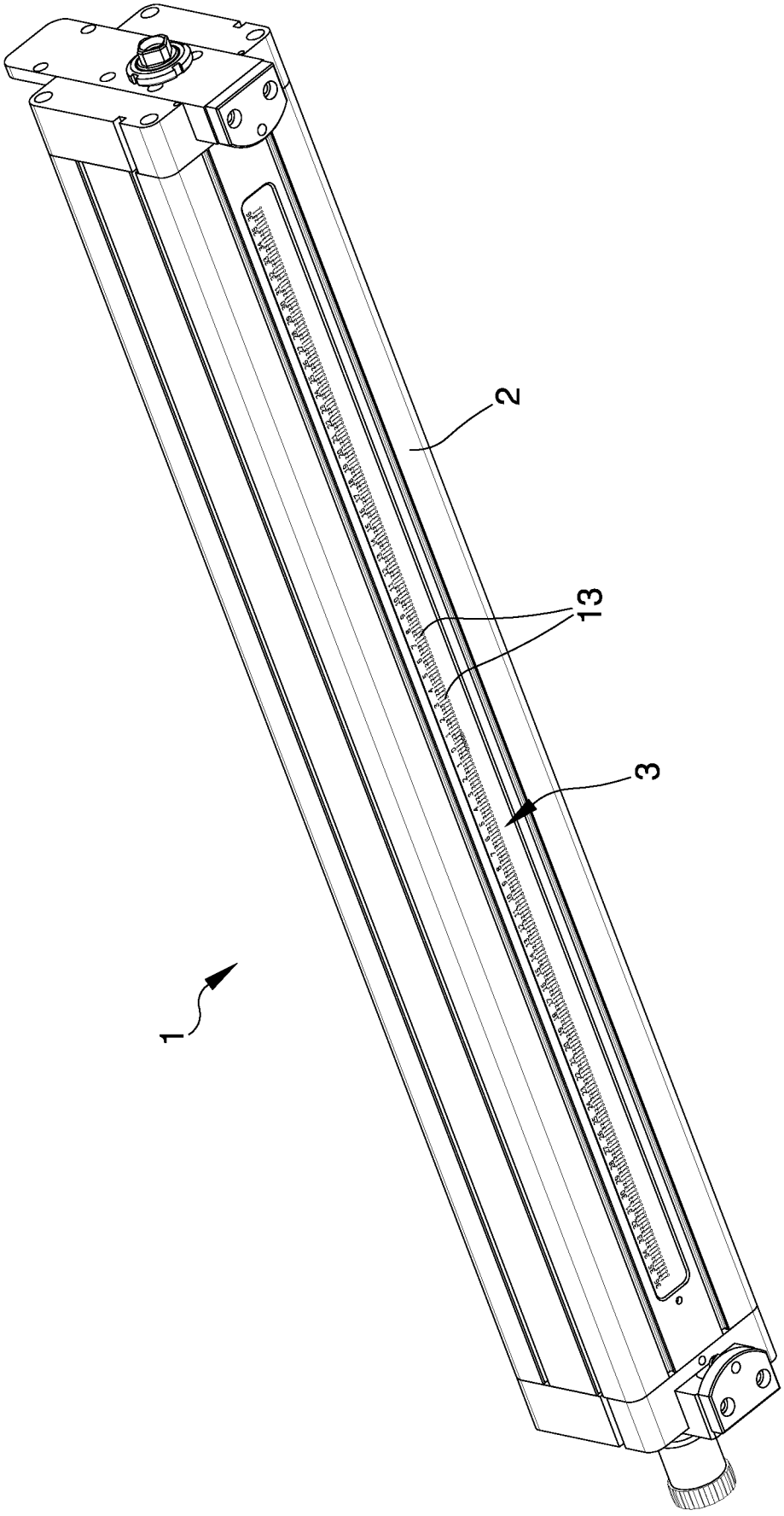


Fig.1

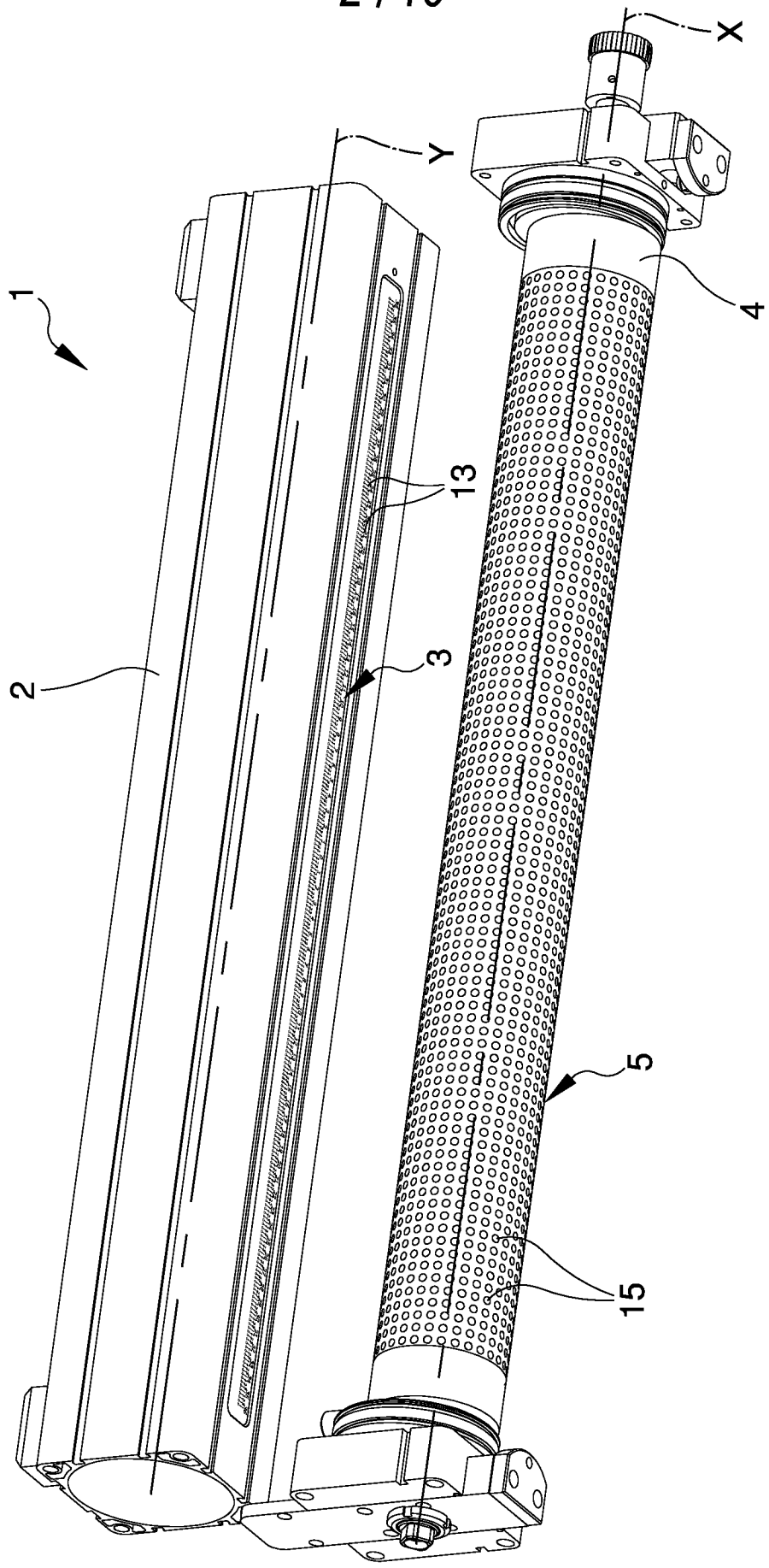


Fig.2

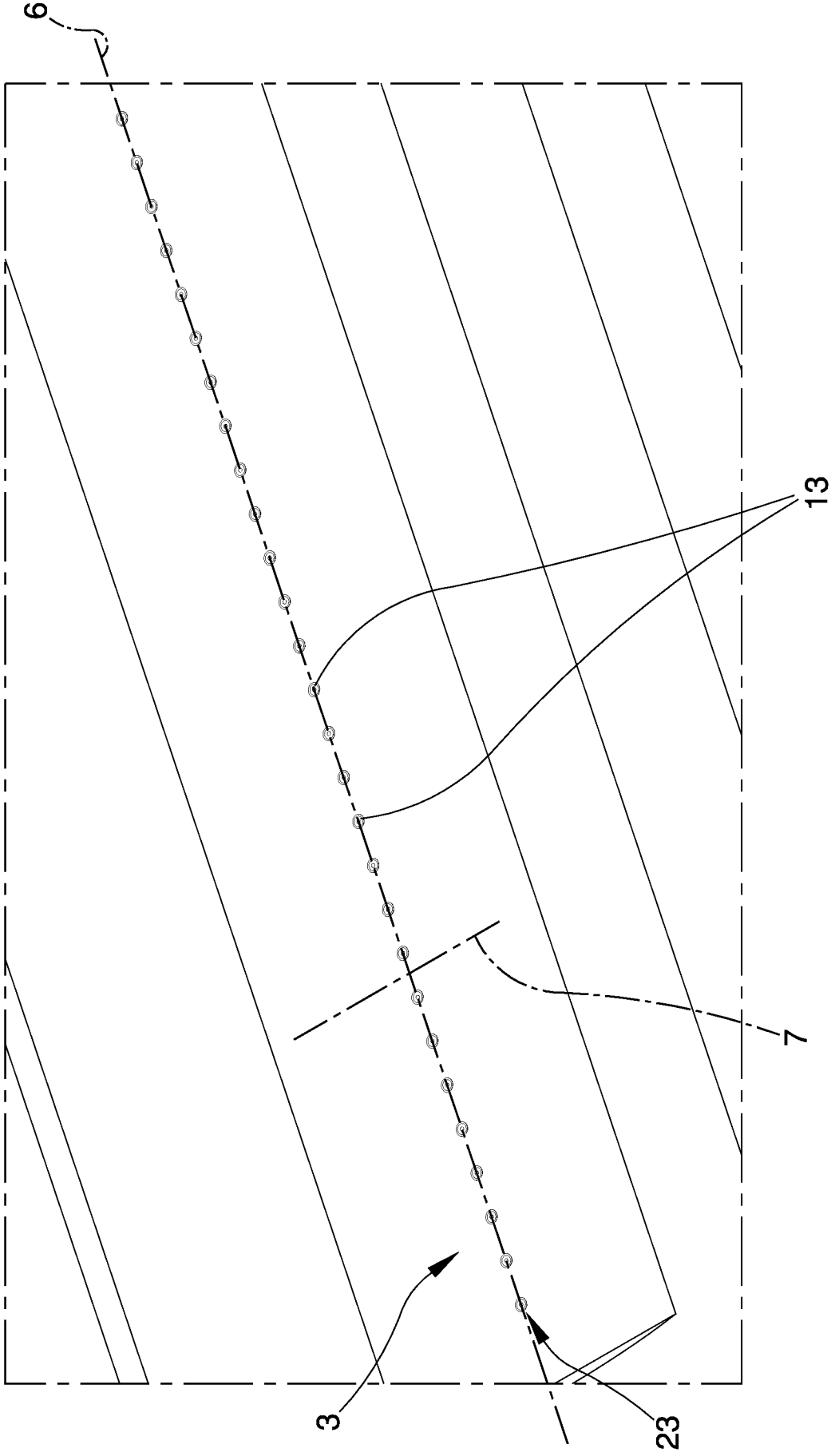


Fig.3

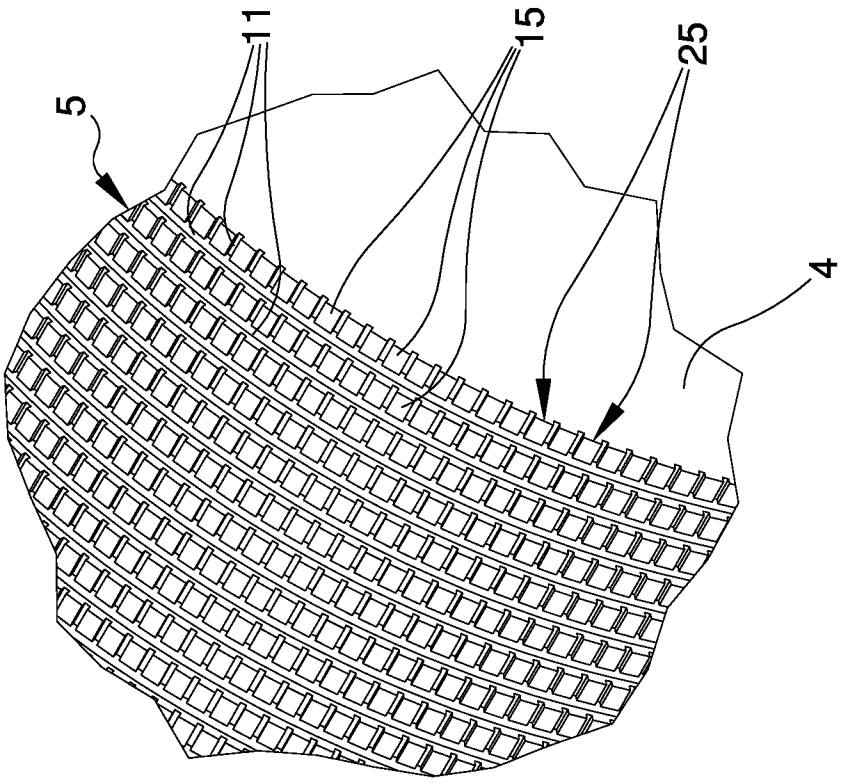


Fig.5

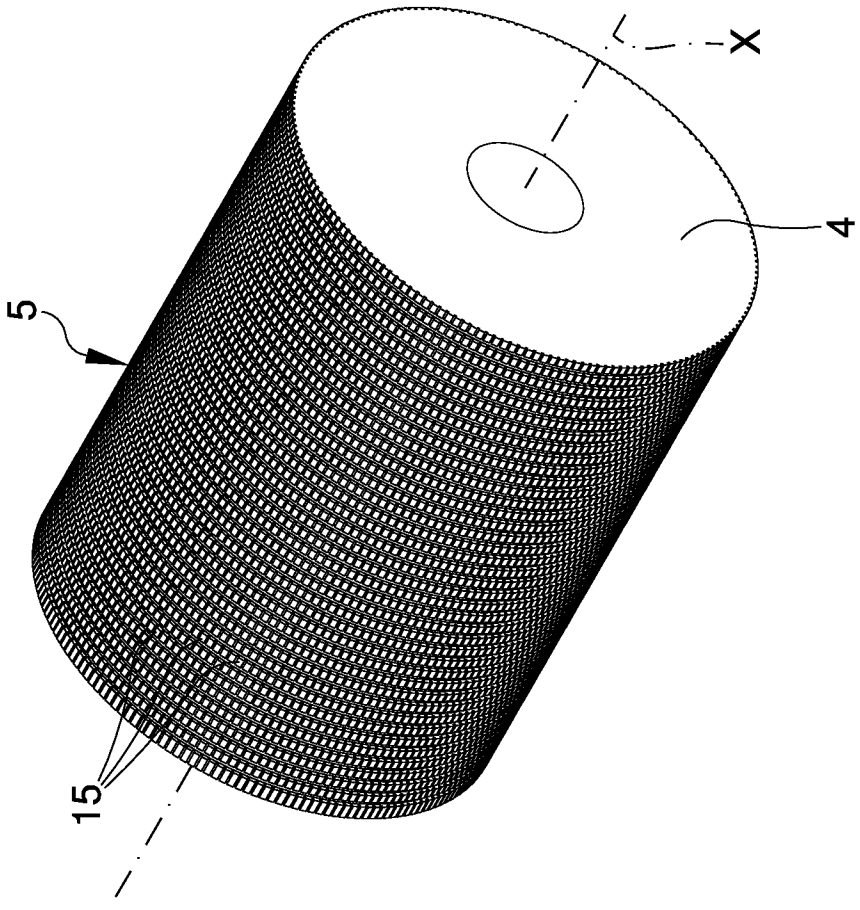


Fig.4

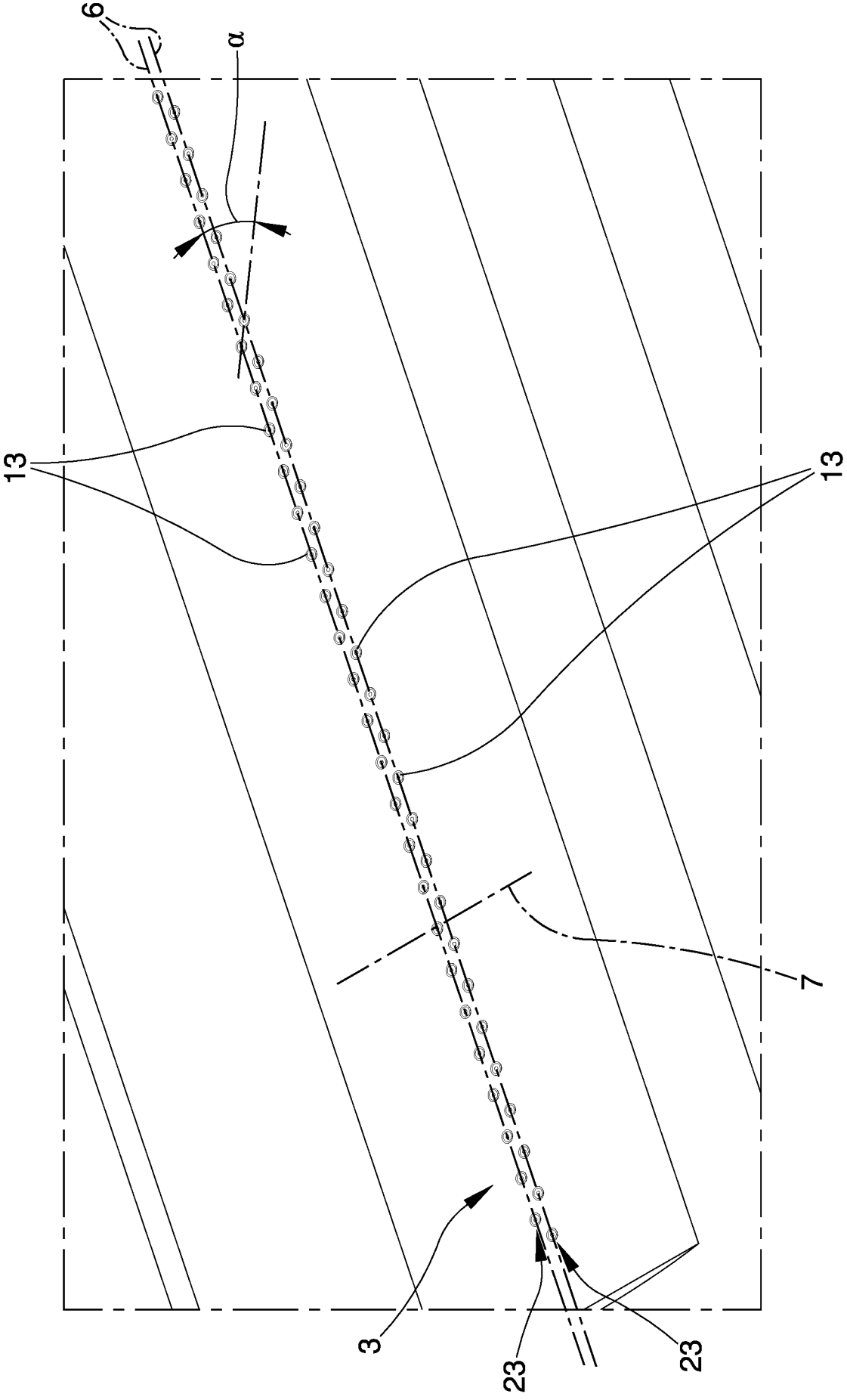


Fig.6

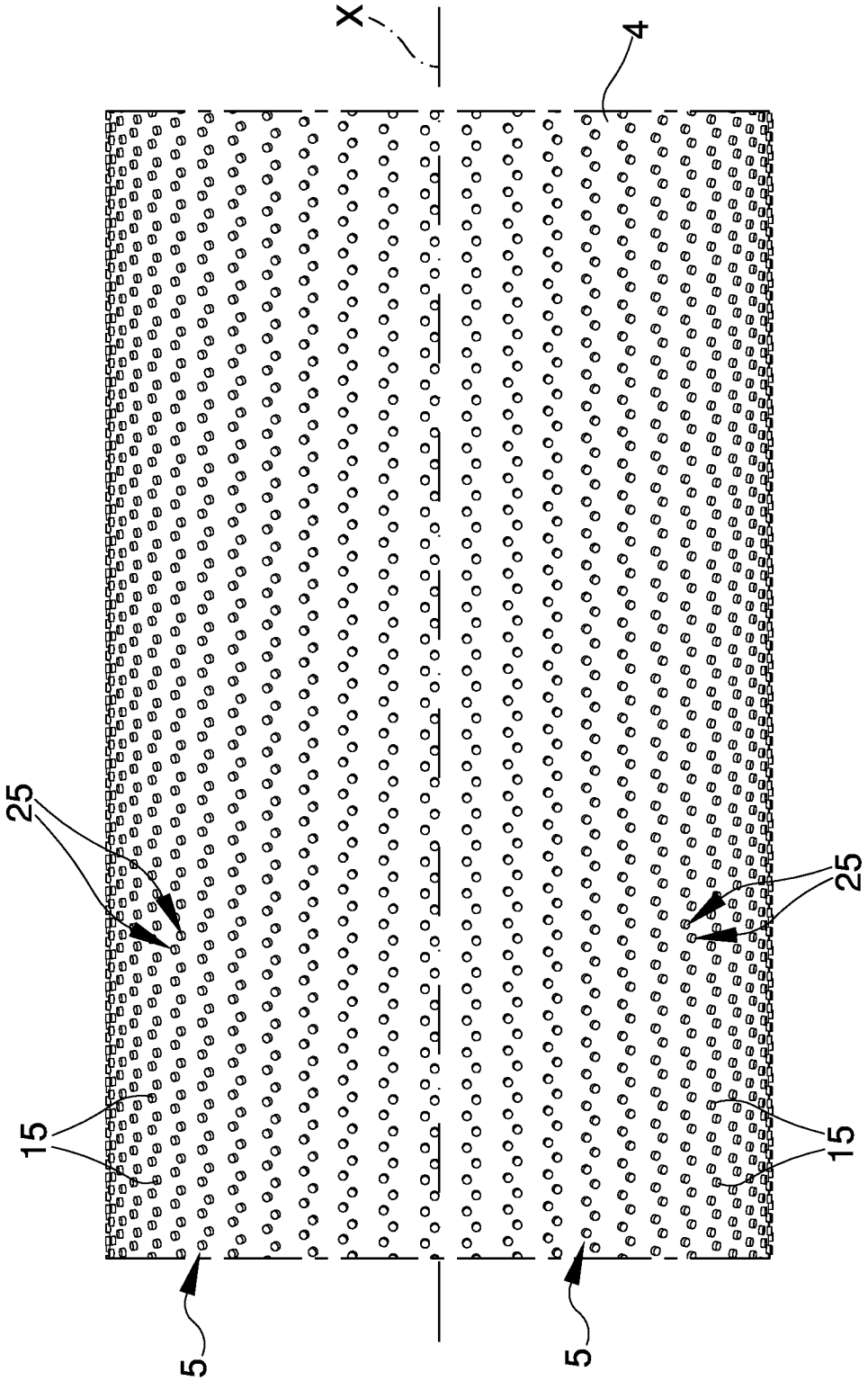


Fig.7

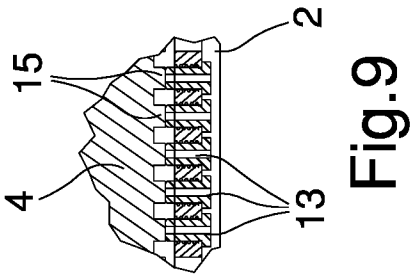


Fig.9

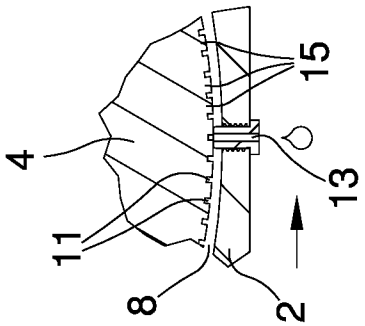


Fig.12

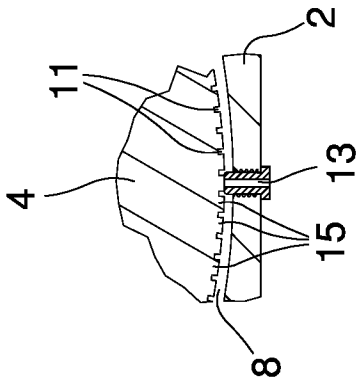


Fig.11

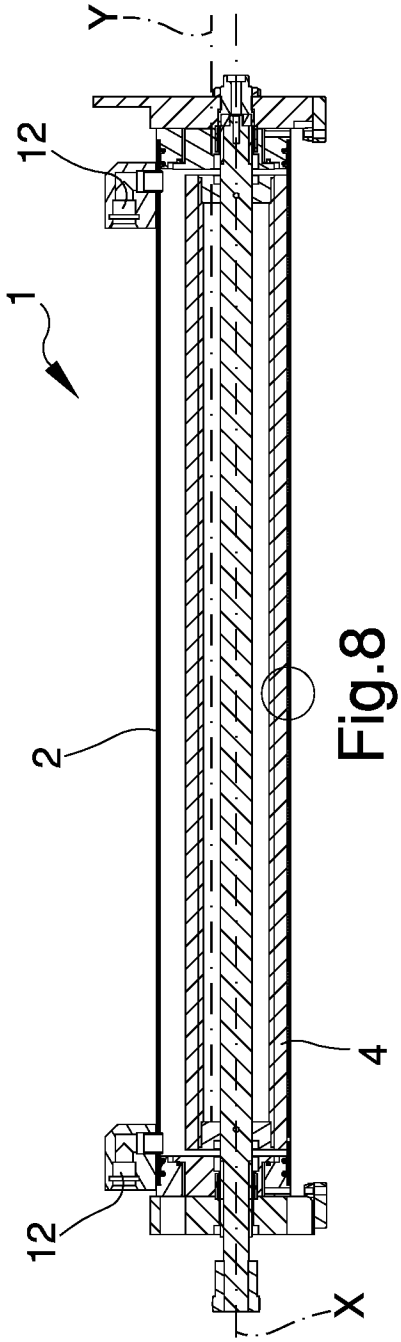


Fig.8

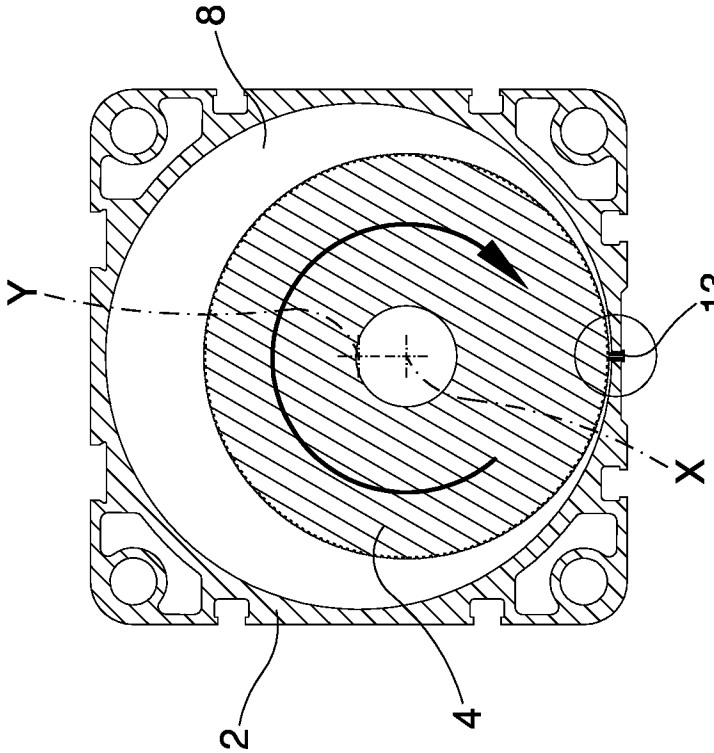


Fig.10

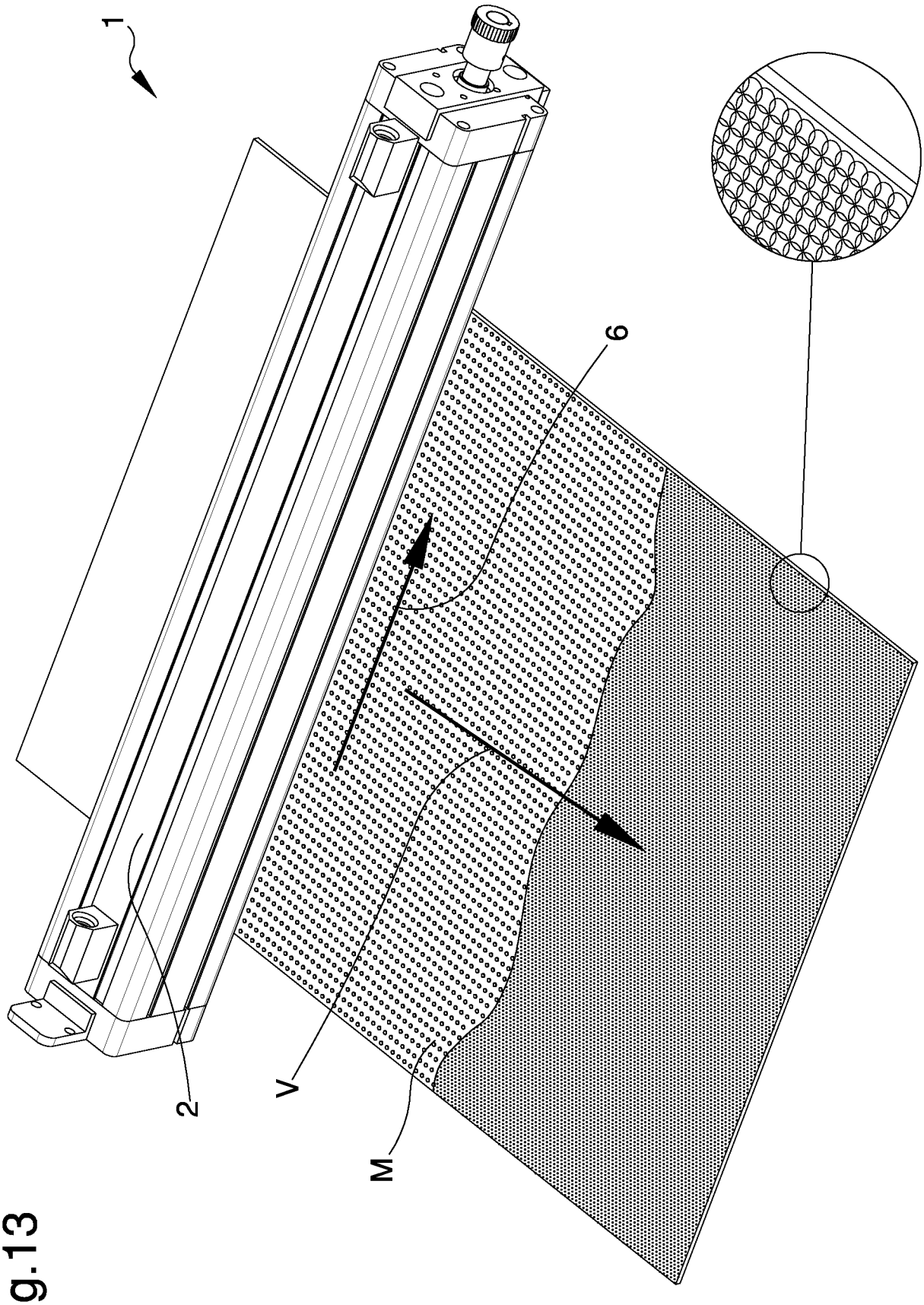
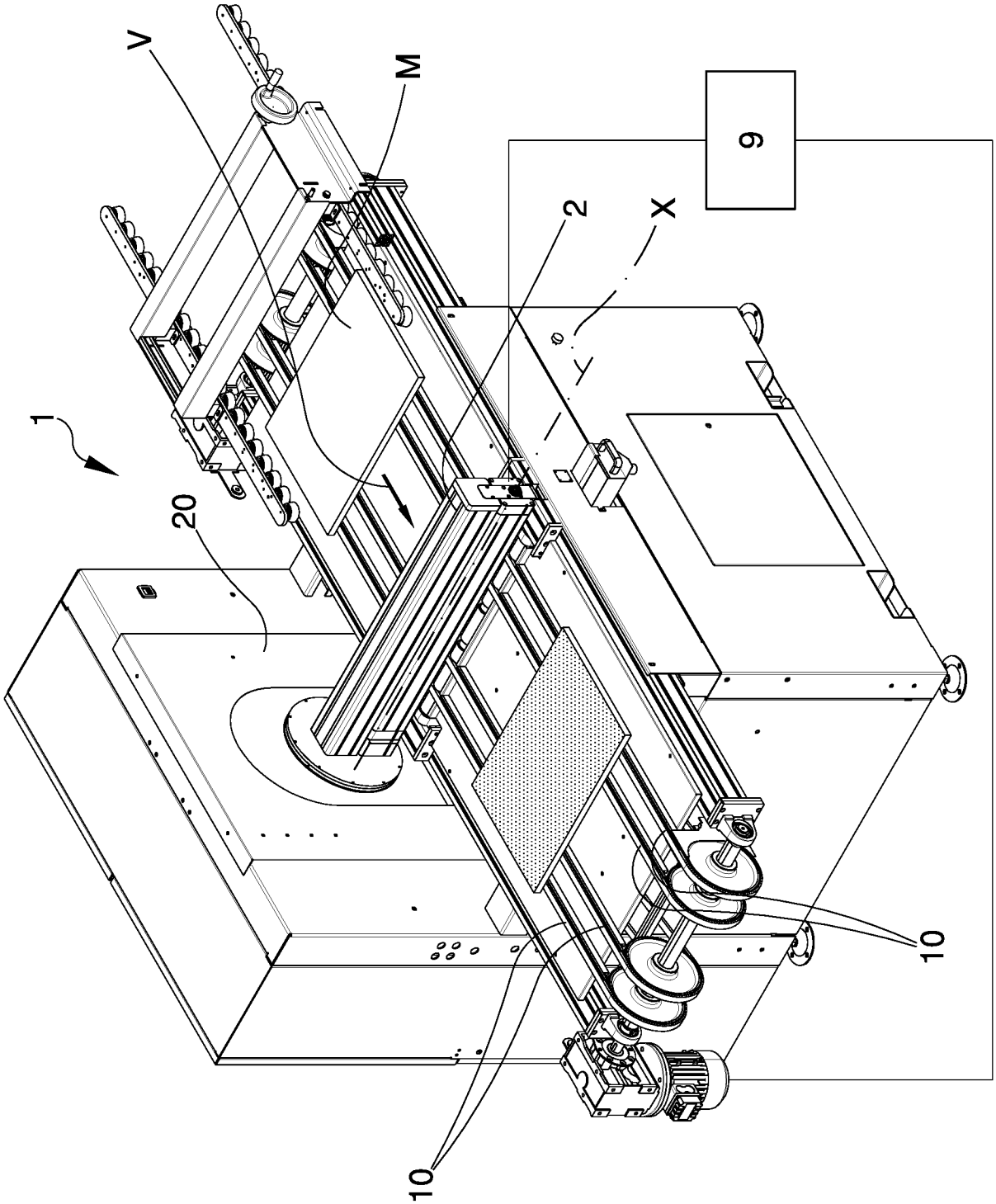


Fig.13

Fig.14



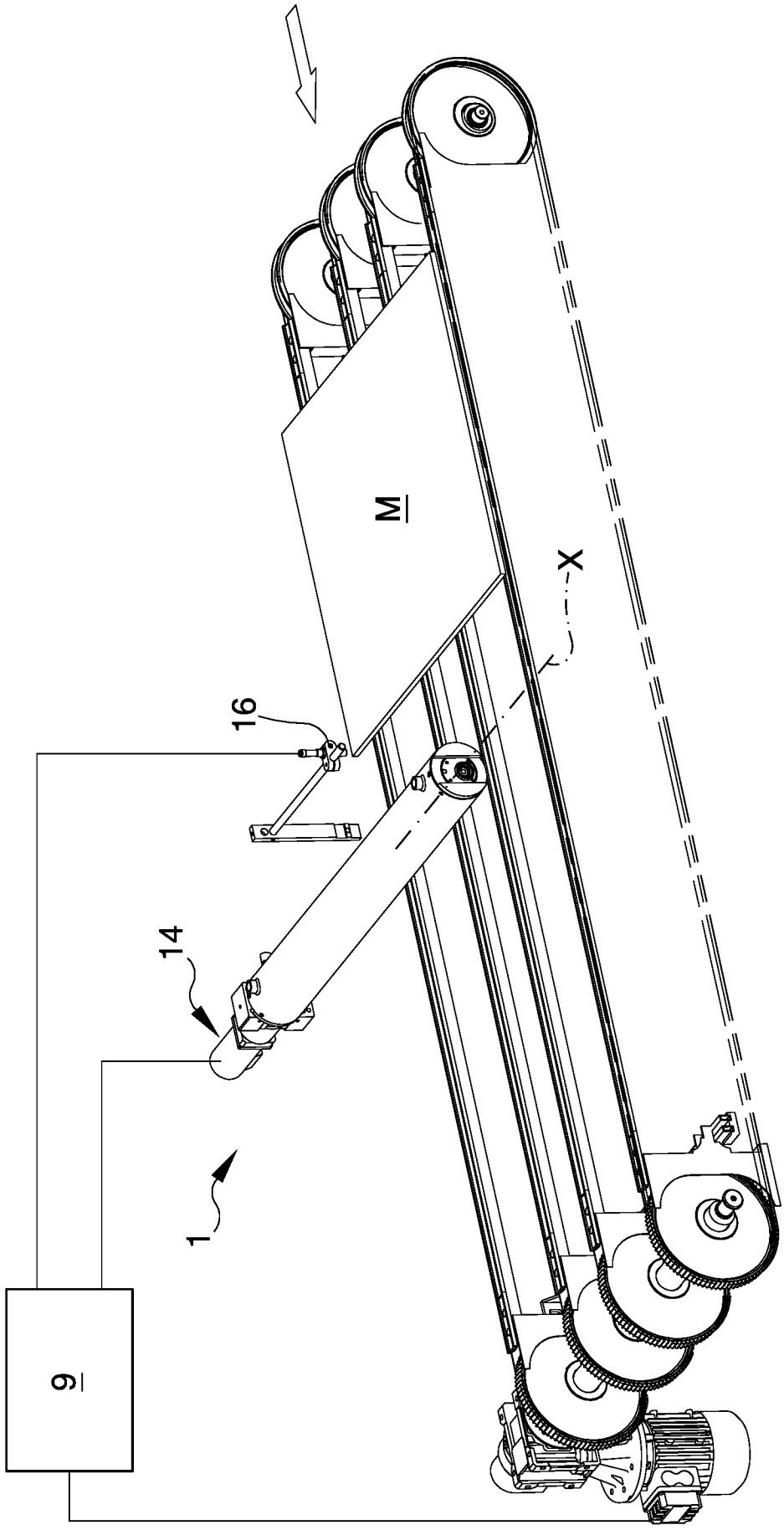


Fig.15

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/060123

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05C5/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017/209926 A1 (3M INNOVATIVE PROPERTIES CO [US]) 7 December 2017 (2017-12-07)	1-5,8-15
A	page 10, line 22 - line 24 page 11, line 9 - line 22 figure 6	6,7

A	US 6 464 785 B1 (PUFFE WOLFGANG [DE]) 15 October 2002 (2002-10-15) column 5, line 1 - line 41 figures 1A, 2A	1-15

A	US 2005/241574 A1 (SCHNEIDER UWE [US]) 3 November 2005 (2005-11-03) paragraph [0046] - paragraph [0048] figures 1-4	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 September 2019	12/09/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Roldán Abalos, Jaime

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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