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(54) **Method and apparatus for surface treatment of a metal plate**

(57) The present invention relates to a method for surface treatment of a metal plate (12), particularly a stainless steel plate, destined to be used as covering material in building, furnishing and the like, in order to

achieve a visible surface being extremely favourable from the aesthetical point of view; in this treatment a substantially smooth surface (12a) of said plate (12) is subject to an etching of abrasive material.

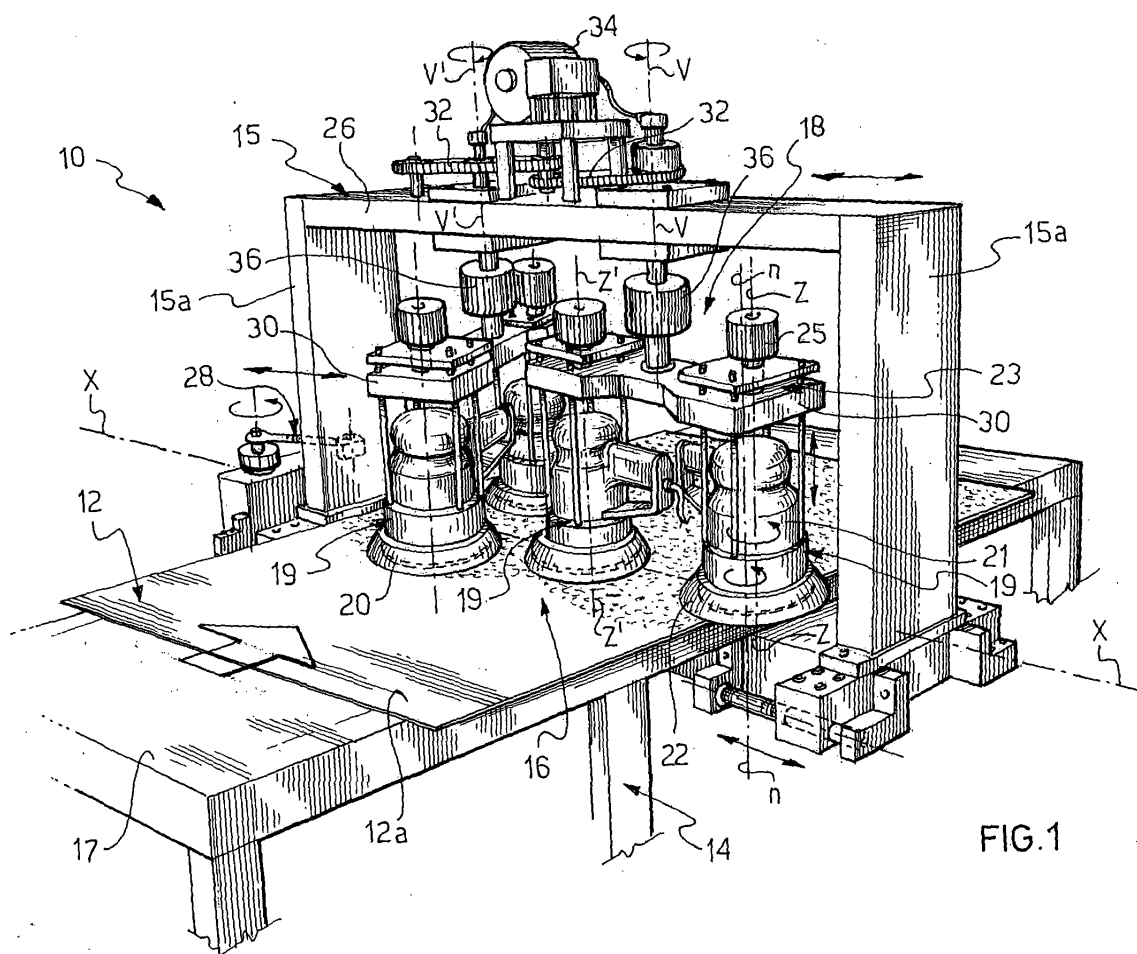


FIG. 1

Description

Field of Application

[0001] The present invention broadly relates to the manufacturing of a metal plate, particularly a stainless steel plate, destined to be used as covering material in building, in furnishing and the like.

[0002] In particular, the invention relates to a method for surface treatment of a metal plate, particularly a stainless steel plate, equipment to put into effect the method and the plate itself treated in such a way.

Prior Art

[0003] As it is known, metal plate linings, particularly with stainless steel, have reached great diffusion in furnishing and building, especially for furniture of great value. Growing quality expectations have pushed manufacturers to develop enhanced methods for surface treatment of plates.

[0004] Surface polishing treatments are known, which provide the plate visible external surface with an identical aspect, even better, to that of a mirror.

[0005] Surface satinizing treatments are also known, obtained in a number of different ways, also by means of chemical agents, which give silky effects, almost pearly, to the surface.

[0006] The so treated plates, although generally satisfying the need of offering an excellent aspect, present a known drawback, which, so far, has been forcedly ignored. In fact, known plates, faultless when at work, are subject to a progressive degradation, determined because of non ideal use conditions, e.g. because of clumsy cleaning practices. In fact cleaning with unsuitable mechanical means easily leads to scratches on the surface, while cleaning with unsuitable chemicals easily leads to a damage of the surface due to stains and rims.

[0007] Furthermore, known satinizing and polishing treatments highlight a main working direction: it is therefore necessary, when setting up, to pay attention so that the plates, when they are put into contact, are correctly orientated, i.e. all arranged along main working directions parallel one another. This implies a slower setting up. From time to time, in an attempt to overcome this orientation problem, dividing elements of different material are interposed among the various plates, thus creating discontinuity between plates: it is clear that also this way of operating implies slowdown during of setting up.

Summary of the Invention

[0008] The underlying problem of this invention is to provide a method for surface treatment of a metal plate, particularly a stainless steel plate, destined to be used as covering material in building, in furnishing and the like, able to overcome the above drawbacks with refer-

ence to the prior art.

[0009] This problem is solved, according to the present invention, by a method wherein, starting from a steel plate having substantially smooth surface, said surface is subject to the etching of an abrasive material.

[0010] Preferably said etching consists of sand papering the surface with an abrasive paper.

[0011] Preferably, the abrasive paper is applied to the plate surface according to a roto-orbital movement.

[0012] The advantages and features of the method for surface treatment of a metal plate, particularly a stainless steel plate, destined to be used as covering material in building, in furnishing and the like, according to the present invention will be clearer from the description of an embodiment thereof, given hereinafter with reference to an equipment to put it into effect shown in the accompanying non-limitating drawings.

Brief Description of the Drawings

[0013]

Figure 1 is a schematic perspective view of an equipment to put into effect the method for surface treatment of a metal plate, particularly a stainless steel plate, destined to be used as covering material in building, furnishing and the like, according to the present invention.

Figures 2 and 3 respectively show a plate and an enlarged portion of said plate.

Detailed Description of a Preferred Embodiment

[0014] Referring to Figure 1, an equipment for surface treatment of a metal plate 12, in accordance with this invention, is shown and globally indicated with 10.

[0015] In particular, the metal plate 12 is rectangular and made of stainless steel, e.g. AISI 316, of 800x600 mm size: the plate 12 is then made-to-measure cut, in the form of band, and after the treatment of the present invention, it is ready to be set up.

[0016] Alternatively, the metal plate 12 can be a continuous plate in the form of a ribbon, e.g. 60 cm wide: in this case, the plate 12, after the treatment of the present invention, must be again made-to-measure transversally cut to be ready to be set up. Advantageously, in the case of the steel ribbon, the equipment 10 of this invention is mounted along a working line of the ribbon itself, e.g. in front of a cutting station where the ribbon is made-to-measure transversally cut into the final sizes, in bands.

[0017] The thickness of the plate 12 is 0.5 mm, for example, and it has a visible surface 12a.

[0018] The equipment 10 comprises, in a frame 14, a treatment area 16. The treatment area comprises a support plane 17, whereon the plate 12 to be treated is located and moved forward, the support plane 17 thus

moving towards the treatment area 16: the support plane 17 is for example a transporting belt or a powered roller route. The best results are obtained at forwarding speed of plate 12 comprised between 1 and 30 meters per minute.

[0019] In the treatment area 16, the plate 12 to be treated is subject to an etching of abrasive material on the surface 12a of the plate 12, which is substantially flat and smooth. The flat surface opposite to the surface 12a is laid to rest on the support plane 17 of the treatment area 16.

[0020] More precisely, the frame 14 has a portal 15 straddling the treatment area 16, of the type comprising two uprights 15a supporting a crossbeam 26. On the portal 15, sand papering means 18 of the smooth surface 12a of the plate 12 are provided.

[0021] In a modified embodiment of the invention, the plate 12 can be stationary in the treatment area 16, whereas the equipment 10, or at least the portal 15 with the sand papering 18, has a relative longitudinal forwarding movement with respect to the plate 12.

[0022] In the embodiment, the sand papering means 18 include four smoothing units 19, known *per se*, of the type comprising a body 21 and a head 22, said head 22 being rotatably driven, around an axis z-z substantially perpendicular to the smooth surface 12a of the plate 12, by an electric motor housed within the body 21. Great results are obtained with circular heads 22 of about 150 mm diameter and rotating at 20 to 120 rpm.

[0023] Conventionally, the head 22 rotates around an axis z-z, which in turn rotates around an axis n-n parallel thereto and slightly offset therefrom, thus obtaining a roto-orbital movement. This roto-orbital movement is of the type used in sand papering or polishing equipment known in prior art. A value typically used for the eccentricity of such a movement is of 3 mm, with an orbital frequency from 1,000 to 12,000 orbits per minute. Of course, the possibility of a simple rotation around the axis z-z is not excluded.

[0024] Mounted on the underside of the head 22 is an abrasive surface 20, generally provided with an abrasive paper.

[0025] The abrasive paper can be chosen among the various types commercially available. The best results are obtained with papers whose granulometry ranges from 60 to 320.

[0026] The sand papering units 19 are linked to the portal 15 and equipped with vertical movement means 23 of lifting at the end of operation, where the abrasive paper is spaced with respect to the smooth surface 12a, and of releasing while operating, where the abrasive paper is led to be engaged with the smooth surface 12a of the plate 12.

[0027] The vertical movement means 23 comprise a cylinder 25, e.g. pneumatic, interposed between the sand papering unit 19 and the crossbeam 26 of the portal 15, which respectively raises or lowers the sand papering unit 19 itself, along a perpendicular direction of

the smooth surface 12a of the plate 12.

[0028] Moreover, each sand papering unit 19 has horizontal movement means 24, effective to move the sand papering unit 19, and, finally, the head 22, along a pre-determined path in a plane parallel to the support plane 17 of the treatment area 16. More precisely, this horizontal movement is a roto-translatory movement, thus comprising both a translatory and a rotary movement.

[0029] The translatory movement is carried out by sliding each sand papering unit 19, linked to the portal 15, in the direction of the crossbeam 26, of the axis x-x, of the portal 15. The crossbeam 26 extends parallel to the support plane 17 and the portal 15 itself is moved along the axis x-x itself, e.g. by means of a crank-and-rod group 28 mounted between the frame 14 and a bottom end portion of an upright 15a of the portal 15.

[0030] The rotatably movement is for example implemented by mounting the sand papering units 19 coupled in pairs on two holders 30, rotatably connected to the crossbeam 26 respectively along an axis v-v and an axis v'-v', which are parallel to the rotation axis z-z of each head 22 and substantially perpendicular to the crossbeam 26. The holders 30 are rotated around the respective axis v-v and v'-v' by means of respective transmissions 32 connected to the rotation shaft of an electric motor 34. In the embodiment illustrated, the transmissions 32 are chains, but gear transmissions could be provided.

[0031] It is clear that holders 30 can be more than two, in case of a greater width of the plate to be treated. In any case, the heads work in pairs, and the number of pairs is selected according to the width of the plate to be treated, taking into account that a pair of heads treats about 330 mm. In case the plate has a maximum width of about 3000 mm, a number of head pairs equal to ten is to be provided.

[0032] In view of the various rotation movements that are provided for sand papering means 18, suitable rotating electrical collectors 36 are used, in particular to connect electrically the sand papering units 19, where the respective electrical motor is provided in the respective body 21 of each sand papering unit 19.

[0033] The electrical collectors 36 are of the type commercially known; in particular, each holder having the pair of sand papering unit 19 has an electrical rotating collector 36 of the type comprising a part integral with the axis v-v i.e. v'-v', where to the electric cables (not shown) are led from the two sand papering units, and a stationary part with respect to that axis v-v, i.e. v'-v', wherefrom the cable, (not shown) connected to the electrical network leaves.

[0034] Obviously, the equipment 10 of the invention can comprise, at most, a single sand papering unit 19, always equipped with horizontal movement means 24 effective to actuate a roto-translatory movement.

[0035] In this exemplified case, the translatory movement is carried out by sliding the sand papering unit 19, linked to the portal 15, along the direction of the cross-

beam 26, of the axis x-x, of the portal 15. The crossbeam 26 extends parallel to the support plane 17, and the portal 15 itself is moved along the axis x-x itself, e.g. through a crank-and-rod group 28.

[0036] The rotatably movement is carried out by mounting the sand papering unit 19 on a holder 30 rotatably connected to the crossbeam 26 along an axis v-v, which is parallel to the rotation axis z-z of the head 22 and substantially perpendicular to the crossbeam 26. The holder 30 is rotated around the axis v-v through a transmission 32 connected to the rotation shaft of an electric motor 34.

[0037] It is also clear that the equipment 10 of the invention can alternatively include only two sand papering units 19, mounted in pair on a single holder 30, being quite similar to the one just described.

[0038] The operation of the equipment 10 for surface treatment of a plate metal 12, in accordance with the invention, is hereinafter precised.

[0039] The instance of an equipment 10 whose sand papering means 18 comprise two holders 30 each equipped with two heads 22, will be considered illustratively.

[0040] The heads 22 are initially spaced from the plate 12, which has been arranged in the treatment area 16.

[0041] Now, the cylinders 25 lower the sand papering unit 19 until the abrasive surface 20 contact the smooth surface 12a of the plate 12: in general, the contact pressure is just due to the weight-force of the sand papering unit 19.

[0042] Now the relative longitudinal forwarding movement between the plate 12 and the sand papering means 18 is now carried out. In general, the plate 12 is moved forward through the treatment area 16 by the belt conveyor of the support plane 17, whereas the sand papering means 18 act thereon.

[0043] The roto-translatory movement of the heads 22, four in this embodiment, rotating with roto-orbital movement is composed with the forwarding movement of the plate 12: thus, these combined movements take place with a fairly high degree of freedom, so that it is not possible to recognize a main working direction on the surface of the treated plate 12. It is worth precising also that the translatory movement of the portal 15 along the axis x-x performed by the crank-and-rod group 28 allows the treatment to be carried out over the full width of the plate 12.

[0044] It should be noted that the sand papering treatment for the stainless steel is conveniently dry made, the operation not needing the use of any particular fluid.

[0045] After the treatment of the surface 12a of plate 12 is completed, the cylinders 25 raise the heads 22, so that the abrasive surface is detached from the surface of the plate 12: the plate 12 is now ready for use.

[0046] The invention also relates to a method for surface treatment of a metal plate, particularly a stainless steel plate 12, destined to be used as covering material in building, furnishing and the like, the method subject-

ing a substantially smooth surface 12a of the plate to the etching of an abrasive material.

[0047] More precisely, this etching, according to the inventive method, is carried out with sand papering means 18 comprising at least a sand papering unit 19 with a head 22 rotating around an axis z-z substantially perpendicular to said smooth surface 12a of said plate 12, said head 22 being provided with an abrasive surface 20. Furthermore, the abrasive surface 20 is abrasive paper and said head 22 performs a roto-orbital movement with respect to said axis z-z.

[0048] The invention further relates to a metal plate, in particular of stainless steel, to be used as covering material in building, furnishing and the like, obtained according to the just exposed method, carried out by the above described equipment 10.

[0049] The visible surface 12a of the plate 12 has a plurality of, in thick number, of micro-grooves or scratches 37 with mixtilinear trend, resulting from the combination of the linear and circular displacements imposed by the equipment 10 to each single abrasive punctiform element of the abrasive paper. In particular, as from the description of the equipment 10, the displacements are the following:

two circular displacements around the axes z-z and n-n of the sand papering unit 19, resulting in a roto-orbital displacement;

a circular displacement around the axis v-v of the holder 30;

a continuous longitudinal linear displacement forwarding the plate 12;

finally, a linear displacement, alternative in the cross direction, in the x-x direction.

[0050] As shown in the enlargement of Figure 3, the surface 12a of the plate 12 treated according to the invention, carefully closely observed, has a visual effect recalling a very thin grid or filigree, almost a decoration, made of different filiform paths with apparently random trend, achieving a global practically uniform effect.

[0051] In addition, the surface roughness of the plate surface 12a is quite moderate.

[0052] The major advantage of this method for surface treatment of a metal plate, particularly a stainless steel plate, destined to be used as covering material in building, furnishing and the like, according to the present invention, stays in that it obtains plates with a visible surface being extremely favourable from the point of view of the field of furnishing.

[0053] Another advantage of the invention is that the treated plates keep in time their superficial esthetical characteristics, admirably masking the scratches they undergo during operation.

[0054] A further advantage is that the the surface of

the treated plate has a uniform aspect it allows an easier set up, being allowed by any orientation of the plates.

[0055] The method for surface treatment of a metal plate, particularly a stainless steel plate, destined to be used as covering material in building, in furnishing and the like, as well as the equipment to put into effect the method and metal plate, particularly stainless steel plate, destined to be used as covering material in building, in furnishing and the like, can undergo modifications by the skilled person, all within the scope of the invention as defined in the following claims.

Claims

1. A method for surface treatment of a metal plate (12), particularly a stainless steel plate, destined to be used as covering material in building, furnishing and the like, said metal plate (12) having a substantially smooth surface (12a), characterised in that it subject said substantially smooth surface (12a) to an abrasive material etching.
2. A method according to Claim 1, **characterised in that** said etching is carried out with sand papering means (18) comprising at least one sand papering unit (19) with a head (22) rotating around an axis (z-z) substantially perpendicular to said smooth surface (12a) of said plate (12) said plate being provided with an abrasive surface (20).
3. A method according to Claim 2, **characterised in that** said abrasive surface (20) is abrasive paper, and that said head (22) performs a roto-orbital movement with respect to said axis (z-z).
4. An equipment (10) for surface treatment of a metal plate (12), particularly a stainless steel plate, destined to be used as covering material in building, furnishing and the like, **characterised in that** it comprises, within a frame (14), a treatment area (16) where a substantially smooth surface (12a) of said plate (12) is subject to an abrasive material etching.
5. An equipment (10) according to Claim 4, **characterised in that** said etching is carried out with sand papering means (18), which comprise at least one sand papering unit (19) with a head (22) rotating around an axis (z-z) substantially perpendicular to said smooth surface (12a) of said plate (12), said head being equipped with an abrasive surface (20).
6. An equipment (10) according to Claim 5, **characterised in that** said abrasive surface (20) is abrasive paper, and that said head (22) performs a roto-orbital movement with respect to said axis (z-z).
7. An equipment (10) according to Claim 4, **characterised in that** said treatment area (16) comprises a support plane (17), a flat surface opposite to said smooth area (12a), resting on said support plane (17) going forward in said treatment area (16).
8. An equipment (10) according to Claim 7, **characterised in that** said support plane (17) is a belt conveyor or a powered roller path.
9. An equipment (10) according to Claim 5, **characterised in that** said frame (14) includes a portal (15) straddling said treatment area (16), of the type comprising two uprights (15a) supporting a crossbeam (26), said sand papering means (18) of said smooth surface (12a) of the plate (12) being provided on said portal (15).
10. An equipment (10) according to Claim 9, **characterised in that** said plate (12) keeps stationary in said treatment area (16), whereas said portal (15) has a relative longitudinal forwarding movement with respect to said plate (12).
11. An equipment (10) according to Claim 5, **characterised in that** said sand papering unit (19) is of the type comprising a body (21) and said head (22), said head (22) being rotatably driven by an electric motor housed in said body (21).
12. An equipment (10) according to Claim 9, **characterised in that** said sand papering unit (19) is linked to said portal (15) and provided with vertical movement means (23) of lifting at the end of operation and releasing while operating.
13. An equipment (10) according to Claim 12, **characterised in that** said vertical movement means (23) comprise a cylinder (25) interposed between said sand papering unit (19) and said crossbeam (26) of the portal.
14. An equipment (10) according to Claim 9, **characterised in that** said sand papering unit (19) has horizontal movement means (24), which move said smoothing over unit (19) along a predetermined path in a plane parallel to said support plane (17) of the treatment area (16).
15. An equipment (10) according to Claim 14, **characterised in that** said horizontal movement is a roto-translatory movement, comprising a translatory and a rotary movement.
16. An equipment (10) according to Claim 15, **characterised in that** said translatory movement is carried out by sliding said sand papering unit (19), linked to said portal (15) along the direction (x-x) of said

crossbeam (26) of the portal, said crossbeam (26) being arranged parallelly to said support plane (17) and said portal (15) being moved in said direction (x-x) through a crank-and-rod group (28) mounted between said frame (14) and a bottom end portion of an upright(15a) of the portal (15).

17. An equipment (10) according to Claim 15, **characterised in that** said rotary movement is carried out by mounting said sand papering unit (19) on a holder (30), rotably connected to said crossbeam (26) along an axis (v-v) being parallel to the rotation axis (z-z) of said head (22) and substantially perpendicular to said crossbeam (26).

18. An equipment (10) according to Claim 17, **characterised in that** said holder (30) is rotated around said axis (v-v) through a transmission (32) connected to the rotation shaft of an electric motor (34).

19. An equipment (10) according to Claim 18, **characterised in that** said transmission (32) is either a chain or a gear transmission.

20. An equipment (10) according to Claim 15, **characterised in that** said sand papering units (19) are four, and that said rotary movement is carried out by mounting said sand papering units (19) coupled in pairs on two holders (30), rotably connected to said crossbeam (26) along two respective axes (v-v;v'-v') being parallel to the rotation axis (z-z) of each head (22) and substantially perpendicular to said crossbeam (26).

21. An equipment (10) according to Claim 15, **characterised in that** said sand papering units (19) are two, and that said rotary movement is carried out by mounting said sand papering units (19) coupled on one holder (30), rotably connected to said crossbeam (26) along an axis (v-v) being parallel to the rotation axis (z-z) of each head (22) and substantially perpendicular to said crossbeam (26).

22. An equipment (10) according to either Claim 17 or 20 or 21, **characterised in that** suitable rotating electrical collectors (36) are used for electrically connecting said sand papering units (19).

23. An equipment (10) according to Claim 4, **characterised in that** said metal plate(12) is already made-to-measure cut, in the form of a band.

24. An equipment (10) according to Claim 4, **characterised in that** said metal plate (12) is a continuous plate in the form of a ribbon, to be subsequently made-to-measure cut.

25. An equipment (10) according to Claim 24, **characterised in that** it is mounted along a working line of said ribbon, in front of a cutting station where the ribbon is cut transversely made-to-measure cut in bands to suit final size.

terised in that it is mounted along a working line of said ribbon, in front of a cutting station where the ribbon is cut transversely made-to-measure cut in bands to suit final size.

26. A metal plate (12), particularly a stainless steel plate, for covering in building, furnishing and the like, **characterised in that** it is obtained according to the method of either Claim 1 or 2 or 3.

27. A metal plate (12), particularly a stainless steel plate, for covering in building, furnishing and the like, **characterised in that** it is obtained by means of the equipment (10), according to any of Claims 4 to 25.

28. A metal plate (12), particularly a stainless steel plate, for covering in building, furnishing and the like, **characterised in that** it comprises micro-grooves (37) distributed in large number on a smooth surface (12a) thereof.

29. A metal plate (12) according to Claim 28, **characterised in that** said micro-grooves have a substantially mixtilinear trend.

30. A metal plate (12) according to Claim 29, **characterised in that** said trend reproduces the path of a punctiform abrasive element on said smooth surface (12a), said path resulting from a linear and circular displacements.

31. A metal plate (12) according to Claim 30, **characterised in that** the linear displacements are two and that the circular displacements are three.

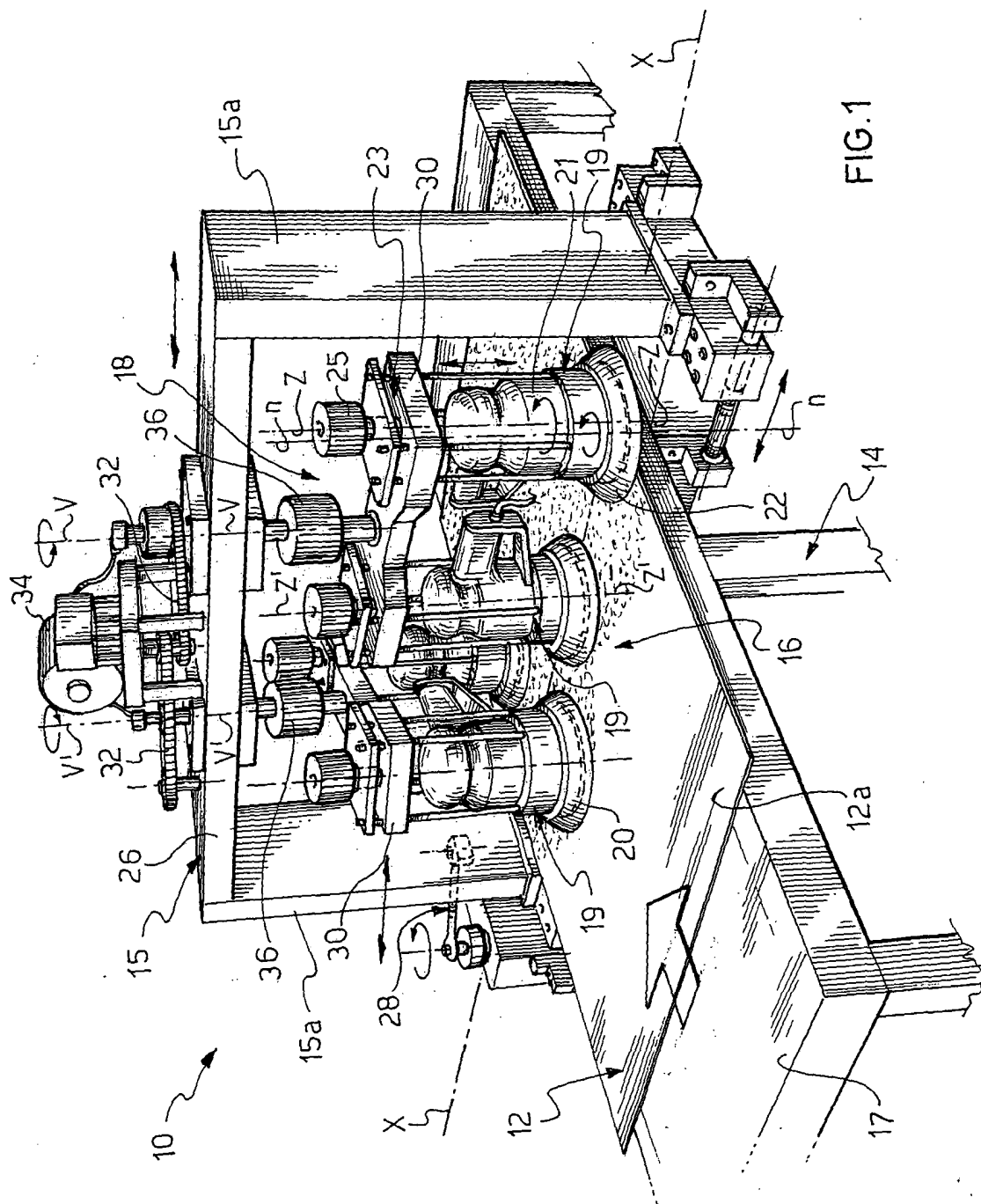
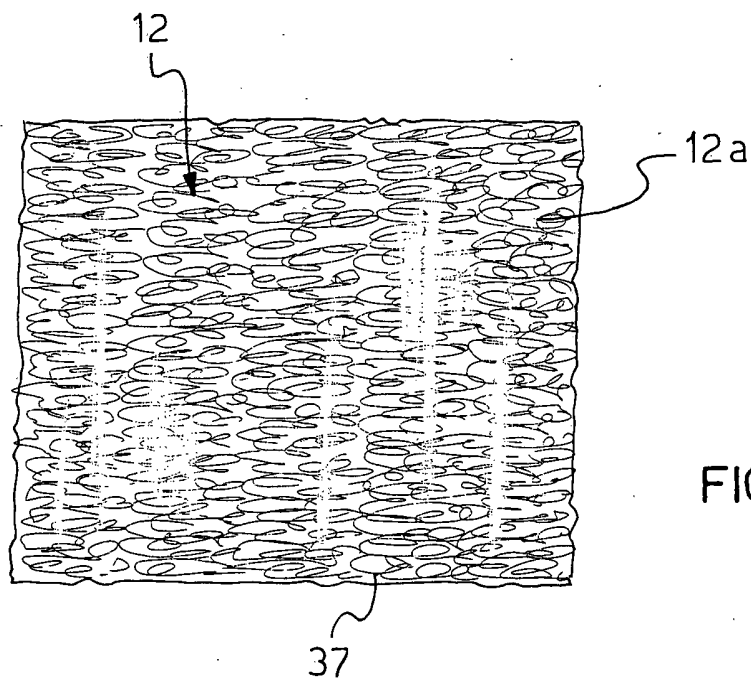
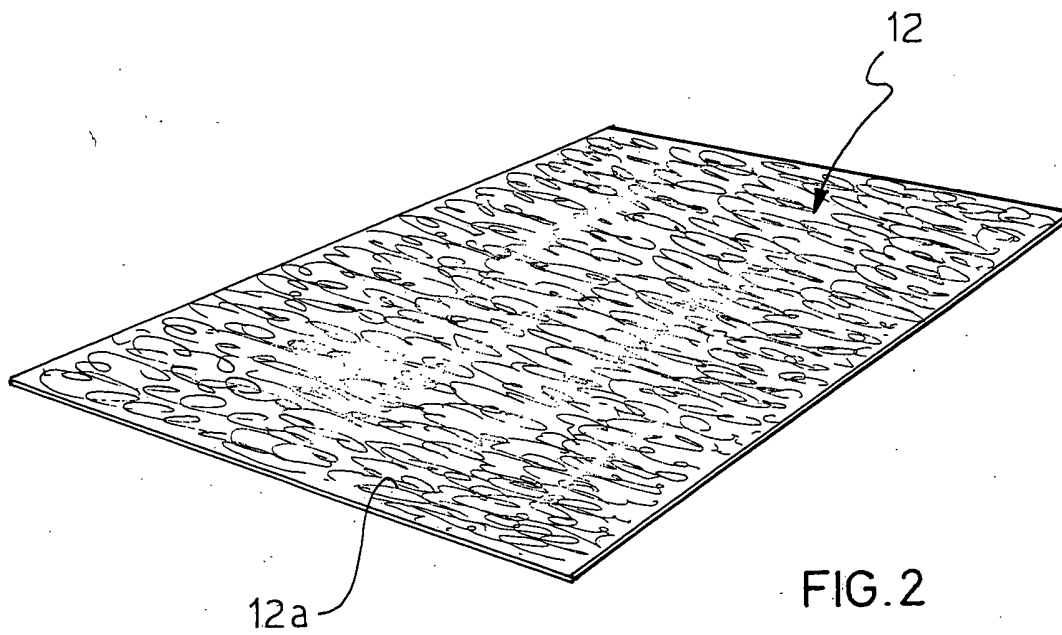


FIG. 1





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5490

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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