

(19)



(11)

EP 3 269 897 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.01.2018 Bulletin 2018/03

(51) Int Cl.:
E04F 13/04 ^(2006.01) **E04B 1/98** ^(2006.01)

(21) Application number: **17181564.0**

(22) Date of filing: **14.07.2017**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
 GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
 PL PT RO RS SE SI SK SM TR**
 Designated Extension States:
BA ME
 Designated Validation States:
MA MD

(71) Applicant: **Fiorin, Walter**
31022 Preganziol (IT)

(72) Inventor: **Fiorin, Walter**
31022 Preganziol (IT)

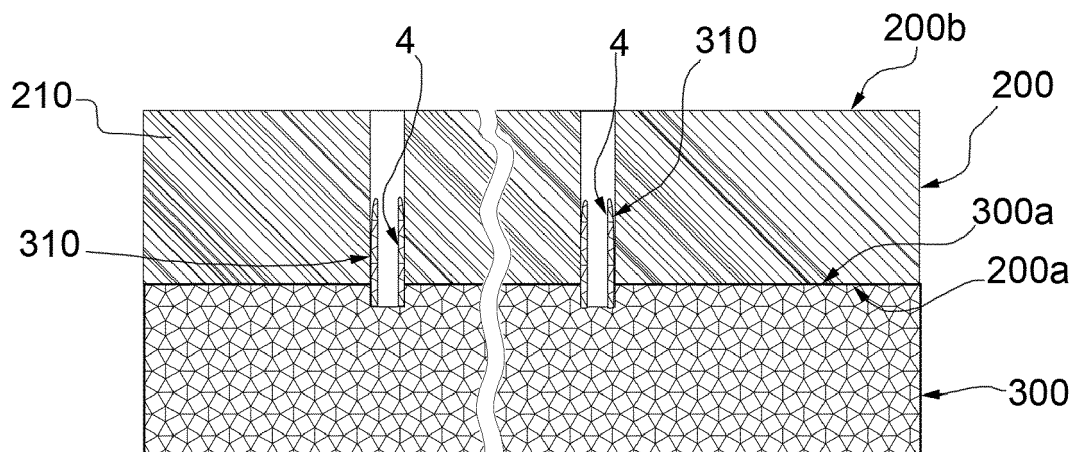
(74) Representative: **Zamprogno, Bruno et al**
STUDIO TORTA S.p.A.
Via Viotti, 9
10121 Torino (IT)

(30) Priority: **15.07.2016 IT 201600074430**

(54) ELASTIC ANCHORING OF PLASTER LAYERS

(57) Anchoring elastic system (1) to strengthen the anchorage of a plaster layer (300) to a plaster-holding structure (200). The system (1) comprises a plurality of springs (3) (5), each of which is formed by a first portion (3a) (5a) and a second portion (3b) (5b), which extends projecting from said first portion (3a) (5a) along a longitudinal axis (A); a plurality of holes (4), which are formed at least partially on said top surface (300a) of the plaster layer (300) and extend along axes approximately parallel

and spaced apart from one another; and wherein the second portion (3b) (5b) of each said spring (3) (5) is fitted in a respective hole (4) so that the respective first portion (3a) (5a) is arranged with its own base resting on the top surface (200b) of the support structure (200); the second portion (3b) (5b) of the spring (3) (5) is rigidly integral with the inner wall of the hole (4) by way of a fixing means (M) arranged in the hole 4 itself.

**FIG.2****EP 3 269 897 A1**

Description

[0001] The invention relates to an anchoring elastic system structured to strengthen the anchorage performed by a plaster-holding structure of a building on a plaster layer.

[0002] In particular, the invention concerns the elastic fixing - to a plaster-holding structure - of a plaster layer, preferably with frescos and/or decorated, of a preferably ancient building, such as a villa or a cathedral, or a church, or similar valuable ancient structures with frescos, to which explicit reference will be made in the description below without because of this loosing in generality.

[0003] It is known that ancient techniques for the creation of ceilings of ancient buildings (for example villas or churches of the nineteenth century) destined to be frescoed involved providing a plaster support structure in the area of the ceiling of the building. Some support structures used in the aforesaid buildings usually comprise a grid of straight wood rods or laths (commonly referred to, in the restoration field, with the technical terms "wattles" or "rafters"), which extend parallel and spaced apart from one another, so as to form slits. The technique further involved manually crating a layer of mixture against the bottom wall of the support structure, so as to form the plaster layer (usually referred to with the term "arriccio", i.e. a rough underlayer). In particular, the mixture layer created by so doing comprised stiff anchoring tongues or ribs, which project from the top surface of the layer, so as to be fitted between the slits of the support structure. The solidification and consolidation of the plaster (plaster carbonatation process) cause the ribs (and, hence, the plaster) to hang from/be anchored to the laths.

[0004] Ceilings built with the technique described above are subjected to the formation of cracks/fissures and/or to the detachment of significant portions of the plaster layer from the framework, thus causing evident problems both for the safety of people and or objects standing under the ceiling and in terms of damaging of decorations and/or frescos made on the plaster. The detachment of the plaster layer from the framework is usually caused by the vibrations produced by sources of noise present in or passing by the buildings. External vibrations, when they hit the building, are transferred to the plaster layer of the ceiling through the roof structure, thus causing its damaging.

[0005] The detachment of the plaster layer from the framework is further caused by thermo-hygrometric sudden changes generated both by heating systems and by humidity variations taking place in the area of the ceiling, mainly due to the people present in the building, especially in churches/cathedrals. Humidity variations cause different size variations of the laths and of the plaster layer, which cause a progressive crumbling of the ribs, which - hence - weaken the mechanical anchoring of the plaster to the framework, until it completely ceases to

exists, thus causing the detachment.

[0006] Some systems that are currently largely used to solve the technical problems described above involve pouring, onto the top surface of the framework, a consolidating liquid resin of the film-like type, which penetrates the space comprised between the ribs and the laths and gets into the slits of the laths, so as to impregnate the portions of plaster and the laths, thus causing them to be integral with one another. The distribution of the resin on the extrados surface and the degree of penetration thereof into the plaster layer can hardly be controlled. Therefore, it often happens, in particular in ceilings with a thin plaster layer, that the resin completely crosses the plaster layer until it reaches the outer surface and accidentally also impregnates the fresco, thus incorporating - in the visible surface thereof - oxides and/or particles that have deposited on the fresco over time. The presence of consolidated resin on the fresco causes an irreversible deterioration and, hence, a damage of the fresco. In fact, the resin can be removed only with solvents that, however, on the one hand, remove the oxides and/or particles incorporated in the resin, but, on the other hand, heavily affect the pigments of the fresco, thus damaging them permanently.

[0007] Furthermore, the resin forms a film that covers the plaster layer and the laths, thus reducing the transpiration and dehumidification thereof. This reduction causes, on the one hand, a progressive oxidation of the fresco, which gets darker as time goes by, and, on the other hand, the formation of a barrier that prevents the relative humidity present inside the building from correctly going through the ceiling and freely flow outwards.

[0008] In case the resin application technique is performed correctly, the resin selectively penetrates the crumbled portions of the ribs, so as to form a partial waterproofing of the ceiling that covers the ribs, thus leaving the laths uncovered. However, in this case, the humidity present in the ceiling concentrates in the laths, thus determining a high size variation thereof and causing a greater erosion of the ribs.

[0009] In order to overcome the technical drawbacks described above, the Applicant designed a mechanical anchoring structure to steadily anchor the plaster layer to the support layer of a ceiling of a building, which is described in European patent application EP 2 696 009 A1 filed by the Applicant. Even though the mechanical anchoring structure described in EP 2 696 009 A1 is particularly advantageous, the Applicant wants to find a solution that further improves anchoring performances.

[0010] Therefore, the object of the invention is to provide an anchoring elastic structure, which, on the one hand, is capable of assisting the plaster-holding structure in keeping the plaster layer anchored to the structure itself and, on the other hand, at the same time, is capable of expelling the humidity/water accumulated in the plaster layer, so as to cause a drying thereof.

[0011] This object is achieved by the invention, as it relates to a system and method to assist a plaster-holding

layer in keeping a plaster layer anchored to the plaster-holding structure itself, according to the appended claims.

[0012] The invention will now be described with reference to the accompanying drawings, which show a non-limiting embodiment thereof, wherein:

- Figure 1 is a schematic view, with sectional parts and parts on a larger scale for greater clarity, of a portion of a ceiling of a building provided with an anchoring elastic system according to the invention;
- Figures 2 to 7 are schematic views of corresponding operating steps of the method set forth by the invention;
- Photo 8 is a vertical section of an anchoring spring of the anchoring elastic system according to the invention; whereas
- Photo 9 is a vertical section of a signalling spring of the anchoring elastic system according to the invention.

[0013] With reference to Figure 1, number 100 indicates, as a whole, an example of a vertical section of the structure of a ceiling of a building, preferably an ancient one (which is shown only partially and in a schematic manner, with enlarged parts and removed parts for greater clarity), for example a villa or a church or a cathedral or any other similar ancient building. The ceiling structure shown in Figure 1 is merely an example and is not limiting for the purposes of the invention. In other words, the invention can conveniently be used also in ceilings having a structure that is different from the one shown and described hereinafter, or in vertical walls of a building, which have at least one plaster layer and a plaster layer support structure.

[0014] In the example shown in Figure 1, the ceiling has a bottom surface (110) (commonly referred to with the technical term "intrados"), which faces the inner space of the building and can preferably - though not necessarily - be decorated and/or frescoed, and an top surface 120 (commonly referred to with the technical term "extrados"), which preferably faces the roof (garret) of the building.

[0015] The ceiling 100 comprises a support structure 220 and at least one plaster layer 300 with a predetermined thickness, which is integral with the support structure 200.

[0016] According to an explanatory embodiment, the support structure 200 can be obtained through a plaster-holding framework, which can be connected - in a known manner - to the walls and/or the roof of the building (for example, through beams that are properly connected to one another and to the building) and can be structured so as to hold the plaster layer 300 anchored to the bottom surface 200a of the support structure 200. According to an embodiment shown in Figure 1, the plaster layer 300 extends so as to cover the bottom surface 200a of the support structure 200, thus forming the bottom surface

110 of the ceiling 100.

[0017] As to the plaster-holding framework making up the support structure 200, in the example shown, it extends along a preferably horizontal plane and comprises a plurality of beam of laths 210. In the example shown, the laths 210 extend parallel to one another, so as to be approximately coplanar, and are spaced apart from one another, so as to delimit grooves or slits 220 between one another. The laths 210 of the support structure 200 can be made of wood and/or stone and/or earthenware or similar materials (namely, any other so-called mineral support), which are suited to support the plaster layer 300. Generally, the laths 210 can have a substantially rectangular section and have a width that preferably - though not necessarily - ranges from 2 to 5 cm, whereas the slit 220 can have a predetermined width between two laths 210 that preferably - though not necessarily - ranges from 1 to 2 cm.

[0018] Furthermore, it is understood that flat and horizontal structure of the ceiling 100 described above and shown in figure 1 is not limiting for the purposes of the invention, but it is was exclusively used to make the description of the invention clearer. In other words, the structure of the ceiling 100, instead of being horizontal and flat, as provided for by the description and the drawings of this patent application, could have different shapes, such as - for example - the shape of a semi-spherical cap having a circular, elliptical, polygonal plan, and a vertical section with the shape of a semicircle, a parabola or the like (not shown).

[0019] With regard to the plaster layer 300, it can comprise a solid mixture including lime and calcium carbonate or similar materials. In the example shown in Figure 1, the plaster layer 300 has a top surface 300a (opposite the visible bottom surface 110), which covers the bottom surface 200a of the support structure 200, so as to form a homogeneous covering layer with a predetermined thickness, and partially penetrates/projects into the top slits 220 of the support structure 200, in order to form rigid crests or ribs 310 between the laths 210, which are structured to remain trapped between two adjacent laths 210, so as to anchor the plaster layer 300 to the support structure 200.

[0020] With reference to Figure 1, number 1 further indicates, as a whole, the present invention concerning an anchoring elastic system comprising a plurality of elastic organs, which are designed to strengthen/restore/maintain the fixing/anchoring of a least one plaster layer 300 to the support structure 200 above, so as to prevent it from detaching from the support structure itself.

[0021] The anchoring elastic system 1 according to the invention is aimed at "assisting" the support structure 200 in keeping the plaster layer 300 anchored to the structure 200. In other words, the anchoring elastic system 1 strengthens the anchorage that is mainly performed by the support structure 200 on the plaster layer 300, so as to prevent and/or limit the detachment of the plaster layer 330 due to the causes described above.

[0022] According to a preferred embodiment shown in Figure 1, one or more elastic means perform an anchoring and vibration dampening function, and are each provided with a wire helical tubular anchoring spring 5, which extends along a longitudinal axis A and consists, in turn, of a first helical tubular portion 5a, which is structured to be arranged so as to rest/strike against the top surface 200b of the support structure 200, and a second helical tubular portion 5b, which is structured to be fitted, in use, into a preferably dead hole 4, which, in the example shown, is made so as to project/protrude in the plaster layer 300, through the surface 300a, which faces the support structure 200. According to a possible embodiment, the hole 4 can be made so as to have the opening on the top surface 200b and cross the support structure 200 as well as, at least partially, the plaster layer 300 starting from the surface 300a.

[0023] According to a preferred explanatory embodiment shown in Figure 1, the first 5a and the second tubular portion 5b of the tubular spring 5 are shaped to as to be about mushroom-shaped and comprise respective filiform cylindrical windings, which are formed by spires arranged beside one another, which extend side by side and coaxial to the axis A.

[0024] In the example shown in Figure 1, the first top portion 5a is shaped so as to approximately form a cylindrical cup-shaped body, with a central hole in its base/bottom wall, and defines the head of the mushroom, whereas the second bottom tubular portion 5b projects from the base/bottom of the first portion 5a along the axis A and is approximately shaped like an elongated cylinder defining the stem.

[0025] The first tubular portion 5a has an outer diameter that is greater than the diameter of the hole 4 and, in the example shown, is arranged with its base striking against the top surface 200b of the support structure 200, whereas the second tubular portion 5b has an outer diameter that is smaller than the diameter of the hole 4, so as to be easily inserted/fitted into the latter. In the example shown in Figure 1, the springs 5 can be structured so that the relative spires have a constant pitch. In the rest condition, each spire of the spring 5 can preferably strike against the adjacent spire/s, so as to be side by side with them.

[0026] The parameters characterizing the springs 5 making up the structure 1, namely the composition, the length, the elastic constant, the number of spires, the outer diameter, the section of the wire, the distribution/positioning of the springs 5 on the surface 300a, for example their mutual distance and the mutual distance of the holes 4, substantially depend - at least - on the thickness of the plaster layer 300 and on the load/weight of the plaster layer 300 to be supported.

[0027] Tests carried out by the Applicant proved, for example, that a spring 5 having a first portion 5a, which is provided with a wire with a circular section of 0.3 mm and with an outer diameter of 8 mm, and a second portion 5b, which is provided with a wire with a section of 0.3 mm

and with an outer diameter of 2 mm, exerts an longitudinal elastic force along the axis A that is capable of supporting a weight of approximately 30 Kg, whereas its axial deflection/deformation starts when the weight applied exceeds approximately 3 Kg. Furthermore, the Applicant found out that, by increasing the circular section of the wire from 0.3 to 0.5 mm, the spring 5 exerts a force that is capable of supporting a weight of approximately 35 Kg. Therefore, for example, in order to anchor a plaster layer with average dimensions having, for example, a weight/m² ranging from 10 to 40 Kg/m², you can use springs 5 that are dimensioned so as to have a first portion 5a having an outer diameter ranging from about 6 mm to about 10 mm, preferably 8 mm, and a second portion 5b having an outer diameter ranging from about 0.5 mm to about 5 mm, preferably 2 mm.

[0028] By properly varying the diameters of the two portions 5a and 5b of the spring 5 and the section of the wire, it is possible to carefully calibrate both the maximum weight of the plaster layer to be supported and the dampening that can be exerted upon the forces deriving from vibrations hitting the plaster layer. For example, if it is needed to secure the anchorage of and dampen the vibrations acting upon a frescoed thin plaster (in the range of some mm) (carbonate putty used for frescos) having a reduced weight/m² and in order to minimize the impact of the structure on the fresco, it is possible to use springs 5 having extremely small dimensions, in which - for example - the second portion 5b has an outer diameter of approximately 0.1 mm. The use of these springs is extremely advantageous, as it allows to anchor the frescoed plaster through the execution of holes having an extremely small diameter, for example equal to 0.11 m.

[0029] It is understood that the first portion 5a and the second portion 5b of the tubular spring 5 can have a tubular shape other than the one described above, such as, for example, the shape of a truncated cone and/or of a cone, whereas the length of the second portion 5b basically depends on the thickness of the support structure 200 and on the depth of the hole 4. The length of the second portion 5b can correspond, for example, to the sum of the thickness of the support structure 200 and the depth of the hole 4 in the plaster layer 300.

[0030] According to the embodiment in which the support structure 200 consists of a plaster-holding framework shown in Figure 1 and the plaster layer 300 is provided with the ribs 310 arranged inside the slits 220, one or more holes 4 of the anchoring elastic structure 1 can be preferably made in the ribs 310, whereas the first portions 5a of the springs 5 are arranged so as to rest on the top face of the laths 210 and one or more second portions 5b are fitted into the holes 4 made in the ribs 310.

[0031] The Applicant further found out that, when the force exerted by the plaster layer 300 causes the plastic deformation of the tubular spring 5, the latter collapses and lengthens until it reaches a maximum extension in which it conveniently keeps the plaster layer 300 anchored to the support structure 200. In this way, it is ob-

tained both the advantage of conveniently preventing the plaster layer 300 from falling towards the floor below, thus causing a condition of danger for the people standing there, besides the disruption of the fresco, and the advantage of subsequently being able to take the plaster layer 300 back to the initial position of anchoring to the support structure 200, in which - then - the plaster layer 300 can be fixed to the support structure 200. In this case, indeed, you simply need to exert a simple upward pulling/lifting of the elongated springs 5, so as to lift the plaster layer 300 and take it back to its initial position in which it is fixed to the support structure 200.

[0032] The Applicant further found out that the tubular spring 5, thanks to its structure with wound spires, defines an inner duct, which establishes a communication between the wall of the hole 4 and the air on the outside of the hole 4, thus conveniently determining a local dehumidification of the plaster layer 300 surrounding the hole 4. To this regard, the plaster layer 300, because of the reasons described above, tends to accumulate water/humidity, which, in turn, contains hygroscopic salts. The natural drying of the plaster layer 300 causes the crystallization of the hygroscopic salts inside the plaster layer 300, which increase their volume up to sixteen times the initial condition. This expansion generates a pressing of the crystallized salts towards the material surrounding them amounting to approximately 600-800 atmospheres, thus determining local decohesions in the plaster layer 300 and, hence, causing the detachment of the latter from the support structure 200. The Applicant found out that, by making a plurality of holes 4 in the plaster layer 300 and by fitting the helical tubular springs 5, in particular the second portion 5b thereof, into them, you obtain aeration and discharge ducts, which help let out the humidity contained in the plaster layer 300. During the expulsion, said humidity also drags out the hygroscopic salts. On the inside of the springs 5, the humidity tends to dry and the salts crystallize, thus increasing their volume. In this condition, unlike the plaster layer, which is rigid and tends to be subjected to decohesions, the helical spring 5 axially deforms/stretches upwards in a controlled manner under the pressure due to the expansion of the salts, thus causing micro-movements thereof in the hole 4, which progressively push them out of the hole 4. Furthermore, during the deformation of the spring 5, its spires move apart from one another, thus increasing the area of contact between the expelled salts recovered/contained in the spring 5 and the wall of the hole 4, thus determining - for the salts - a progressively increasing rise in the absorption of the water present in the plaster layer. Furthermore, during its deformation, the spring 5 protects the hole from 4 from micro-grinding, as the diameter of the helical spring 5 progressively decreases. The absence of micro-grinding is clearly convenient especially in the presence of frescos/decorations on the plaster layer.

[0033] According to a preferred embodiment shown in Figure 1, the distal end of the second portion 5b of the tubular spring 5 present inside the hole 4 can conveniently

be made integral with the inner wall of the hole 4, namely with the plaster layer 300, through a fastening/gluing material M. Preferably, the fastening/gluing material M can conveniently comprise a mixture or a liquid mix with adhesive material and/or resins. For example the liquid/half-liquid mixture can consist of one or more crystallizing resins, such as, for example, epoxy resins and/or polyurethane resins.

[0034] The Applicant found out that, by exclusively fixing the distal end of the second portion 5b of the tubular spring 5 to the plaster layer 300 through the injection of a given quantity of fastening/gluing material M into the hole 4, the remaining part of the tubular body 5 is free to deform both longitudinally (i.e. axially) along the axis A and radially, thus supporting the exchange between the external air and the humidity present in the plaster layer 300, inside the hole 4.

[0035] The fastening of the end of the spring 5 to the plaster layer 300 is not limited to the use of the fastening/gluing material M, but, according to variants that are not shown herein, it can be carried out by means of mechanical anchoring organs (not shown), such as, for example, threaded nuts steadily/rigidly fitted into the holes 4, into which you can then screw a properly threaded straight inner end of the spring 5.

[0036] According to a preferred embodiment shown in Figure 1, the anchoring elastic system 1 can preferably comprise, furthermore, one or more elastic signalling organs, which are structured to visually signal a condition of presence/absence of a detachment of the plaster layer 300 from the support structure 200, so as to allow users to monitor the plaster layer 300.

[0037] According to a preferred embodiment shown in Figure 1, the elastic signalling organs are each provided with a monitoring spring 3, which, similarly to the anchoring spring 5, comprises a first tubular portion 3a, which rests on the top surface 200b of the support structure 200, and a second portion 3b, which is fitted into the hole 4.

[0038] The first portion 3a of the spring 3 is tubular, whereas the second portion 3b of the spring 3 comprises a filiform stem, which is defined by an extension of an end of the first tubular portion 3a.

[0039] The first portion 3a of the spring 3 always has a substantially cylindrical shape coaxial to the axis A and is preferably formed by helical spires that, in the rest position, are preferably axially spaced apart from one another.

[0040] According to a preferred explanatory embodiment shown in Figure 1, the filiform stem defining the second portion 3b of the spring extends starting from a filiform end (the top one in Figure 1) of the first portion 3a, which is opposite relative to the respective resting base thereof on the top surface 200b, and centrally crosses the inner duct of the first portion 3a along a substantially straight direction parallel to the axis A, in order to then extend inside the hole 4.

[0041] The monitoring spring 3 is structured so as to

ensure that the first portion 3a, namely the tubular portion 3a is deformed between a resting position indicative of the absence of detachment (shown in Figure 1), wherein the first portion 3a is at its maximum longitudinal and radial extension, and a signalling position indicative of the presence of detachment (shown in Figure 6 and 7), wherein the first portion 3a is deformed both longitudinally (Figure 6) and radially (Figure 7) in response to traction exerted on the filiform stem by the plaster layer 300 during the detachment thereof from the support structure 200.

[0042] According to the example shown in Figure 6, in the signalling position, the first portion 3a is compressed against the top surface 200b of the support structure 200, thus reducing its length and its outer diameter.

[0043] The springs 3 and 5 can be made of a metal material, such as, for example, (stainless) steel or titanium, aluminium or copper or any other similar metal alloy. The springs 3 and 5 could also be made of carbon fibre or plastic material and/or with mixtures of epoxy and/or polyurethane resins. The length of the second portion 5a of the spring 5 and the length of the second portion 3a of the spring 3 can further be sized based on the depth of the hole 4 and/or on the (vertical) thickness of the support structure 200 and/or on the height of the slit 220.

[0044] With reference to Figure 1, the anchoring elastic system 1 can further comprises a helical cylindrical sliding spring 11, which is fitted into the hole 4 and/or the slit 220 and can house, on the inside, the filiform stem defining the second portion 3b of the spring 3.

[0045] According to a preferred embodiment (which is not shown herein), the anchoring elastic system 1 can conveniently comprise, furthermore, a mesh, for example a mesh made of a metal material or the like, which rests on the top face 200b of the support structure 200, whereas the springs 5 and 3 are arranged so as to have the relative first portions 5a and 3a resting on the mesh itself and the second portions 5b and 3b fitted into the holes 4 through the through openings present in the mesh. The Applicant found out that, by interposing the preferably metal mesh between the top face 200b of the support structure 200 and the first portions 5a and 3a of the springs, you obtain the advantage of ensuring the stability and the usability of the system 1 even when the support structure 200 has deteriorated resting areas. In this case, the mesh itself defines a connection structure between the springs, which ensures a complete anchoring of the ceiling layer, even in local areas of the support structure that, after having deteriorated/having been damaged, could not be capable of locally carrying out an anchoring action upon the underlying portion of plaster layer.

[0046] With reference to Figures 2 to 7, hereinafter you can find a description of the method to strengthen the anchorage performed by the support structure 200 on the plaster layer 300 through the anchoring organs described above.

[0047] The method comprises the step of making a plurality of preferably dead holes 4 in the top surface 120 of

the plaster layer 300, preferably - though not necessarily - in the ribs 310, in case the support structure 200 comprises the aforesaid framework (Figures 2 and 3), so that the opening of the hole 4 faces the slit 210. Obviously, the holes 4 can also be directly made in the support structure 200, for example through the laths 210, so as to partially extend in the plaster layer 300. In other words, the method according to the invention is not limited to the creation of the holes 4 in the ribs 310, but it can also include the creation of the holes 4 in any other point of the top surface 300a of the plaster layer 300, if necessary by perforating the layers and/or the laths or boards present in the support structure 200 above the plaster layer 300.

[0048] The depth of the holes 4 in the plaster layer 300 changes according to the dimensions of the springs 5 and 3 and/or to the load/weight of the plaster layer 300 to be supported and to the thickness thereof. Preferably, the hole 4 can have a depth, in the plaster layer 300, that is approximately equal to half the thickness of the plaster layer 300 itself.

[0049] For example, in case of a thin frescoed plaster layer having, for example, a thickness of 5 mm, the hole 4 could have a depth of about 2.5 mm, whereas, in case the plaster layer has a thickness of 2 cm, the depth of the hole 4 could be about 1 cm. Preferably, in case the plaster layer 300 consists of different layers on top of one another, wherein the first layer fulfils the function of "arriccio" provided with the ribs 310 for the anchorage to the support structure, and the last layer, opposite the first one, is frescoed, the portion of hole 4 in the plaster layer 300 can conveniently have a depth that is equal to the thickness of the first layer, namely the arriccio, so as not to affect the frescoed layer.

[0050] With reference to Figures 4 and 5, the method comprises the step of injecting a given quantity of liquid fastening/gluing material M into the holes 4. The quantity of material M injected into the hole 4 is adjusted so as to cover only the end portion of the spring 5 fitted into the hole 4.

[0051] The method comprises, furthermore, the step of fitting the second tubular portions 5b of the springs 5 into the holes 4, so that, on the one hand, the tubular end (the bottom one in Figure 5) of each second portion 5b is immersed in the fastening/gluing material M and, on the other hand, the first portion 5a of each spring 5 is arranged so as to strike/rest against the top surface 200b of the support structure 200 (Figures 4 and 5).

[0052] The method preferably comprises, furthermore, the step of fitting the second portions 3b defining the filiform stems of the signalling springs 3 into the holes 4, so that, on the one hand, the free end (the bottom one in Figure 5) of each stem is buried/immersed in the fastening/gluing material M and, on the other hand, the first portion 3a of each spring 3 is arranged so as to strike/rest against the top surface 200b of the support structure 200 (Figures 4 and 5) in the rest position. In case there is the spring 11, the latter is fitted into the hole 4 before fitting

the relative spring 3, so as to define a sliding duct for the stem 3b. The presence of the spring 11 prevents the hole 4 from being damaged, namely it forbids the micro-grinding of the inner wall of the hole 4 during the fitting of the stem 3b and/or during the detachment of the plaster layer 300.

[0053] With reference to Figures 6 and 7, in case the plaster layer 300 starts detaching from support structure 200 above, the second portion 5b of the tubular springs 5 elastically deforms along the axis A and elastically counters the detachment itself, causing, at the same time, the partial compression/squeezing of the first portion 5a of the spring 6 on the top surface 200b of the support structure 200. The spring 5 can reach a maximum extension, beyond which the second portion 5b collapses/deforms permanently and stretches, conveniently keeping the plaster layer 300 hanging from the support structure 200 at a predetermined maximum detachment distance. Then, the plaster layer 300 can advantageously be brought back to the starting position by pinching the top ends of the springs 6 and lifting them upwards.

[0054] With reference to Figures 5 and 6, in case of detachment of the plaster layer 300 from the support structure 200, the filiform stem defining the second portion 3b of the spring 3 transmits the axial force exerted by the plaster layer 300 to the (top) end of the first portion 3a, thus causing a progressive compression thereof, which depends on the extent of the detachment, namely on the distance of the plaster layer 300 from the support structure 200. With reference to the explanatory embodiment shown in Figures 5 and 6, the first portion 3a is subjected to a variation of length L1 - L2 between the rest position and the operating position that substantially corresponds to the distance between the plaster layer 300 and the support structure 200 in the detachment position.

[0055] The advantages of the system and of the method according to the invention are evident from the description above. In particular, the anchoring system, thanks to the elastic action exerted by the springs, is capable of assisting the main anchoring action carried out by the support structure on the plaster layer, allows users to restore the anchorage of the plaster layer in case of detachment in a simple, economic and quick manner as well as with an extremely reduced impact on the plaster layer, with all the consequent advantages when the plaster layer is frescoed, and performs - at the same time - a humidity removal action, which removes humidity from the plaster layer, thus conveniently determining the drying thereof.

[0056] Finally, it is clear that the anchoring elastic system and the method described above can be subjected to changes and variations, according to the features set forth in the claims, without for this reason going beyond the scope of protection of the invention.

Claims

1. A method to strengthen the anchorage of a plaster layer (300) to a plaster-holding structure (200); said plaster layer (300) having a first surface (300a) arranged facing, and immediately close to a first surface, (200a) of said plaster-holding structure (200), said method being **characterized in that** it comprises of the following steps:

arranging a plurality of springs (5) (3), each of which is constituted by a first tubular portion (5a) (3a) and a second portion (5b) (3b) which extends projecting from said first tubular portion (5a) (3a) along a longitudinal axis (A); forming at least on said first surface (300a) of the plaster layer (300) a plurality of holes (4) which extend along respective axes about parallel and spaced apart from one another; fitting the second portions (5b) (3b) of the springs (5) (3) in respective said holes (4) so as to arrange the respective first portions (5a) (5b) resting on the first surface (200a) of the support structure (200); making the second portions (5b) (3b) of the springs (5) (3) integral with the inner walls of the corresponding holes (4) by way of fixing means (M) provided in the holes (4) themselves.

2. The method according to claim 1, wherein some of said springs (5) are anchoring springs for the plaster layer (300) and are each constituted of a about mushroom-shaped wire helical spring wherein the first portion (5a) and the second portion (5b) have a cylindrical or conical shape and form the head and the stem of the spring (5) respectively.
3. The method according to claim 1, wherein some of said springs (3) are springs for monitoring the state of detachment of the plaster layer (300) and each constituted of a wire helical spring which has an approximately cylindrical or conical-shaped first tubular portion (3a) and a second portion (3b) defined by a filiform stem which forms an extension of one top filiform end of said first portion (3a) and extends along a substantially rectilinear direction coaxial to said longitudinal axis (A) so as to be at least partially fitted in said hole (4).
4. The method according to claim 2, wherein said fastening means (M) comprise a fastening mixture made of adhesive material and/or resin; said method comprising the step of injecting a predetermined quantity of said fastening mixture into said hole (4) so as to rigidly fix only an end portion of said second portion (3b) to the inner wall of said hole (4).
5. The method according to claim 1, comprising the

step of fitting in said hole (4), an additional tubular-shaped wire helical spring (11) interposed between said second portion (3b) and the inner wall of said hole (4).

6. The method according to claim 3, wherein said monitoring springs (3) are structured so as to ensure that the respective first tubular portion (3a) is deformed between a resting position indicative of the absence of detachment of the plaster layer (300) wherein said first portion (3a) is at its maximum longitudinal and radial extension, and a signalling position indicative of the presence of detachment of the plaster layer (300), wherein said first portion (3a) is deformed longitudinally and radially in response to traction exerted on the filiform stem (3b) by the plaster layer (300). 5 10 15
7. The method according to claim 2, wherein said first (5a) and second portion (5b) of the anchoring spring (5) are structured to deform simultaneously to elastically counteract the detachment of said plaster layer (300) from said support structure (200). 20
8. The method according to claim 2, wherein said second portion (5b) of the anchoring spring (5) has an outer diameter comprised between about 1 and about 2 mm, and/or said first portion (5a) has an outer diameter comprised between about 6 mm and about 8 mm. 25 30
9. An anchoring elastic system (1) to strengthen the anchorage of a plaster layer (300) to the plaster-holding support structure (200) itself; said plaster layer (300) having a top surface (300a) facing towards, and immediately next to, the bottom surface (200a) of said plaster-holding structure (200), said system (1) being **characterized in that** it comprises: 35
a plurality of springs (3) (5), each of which is formed by a first portion (3a) (5a) and a second portion (3b) (5b); the second portion (3b) (5b) extends projecting from said first portion (3a) (5a) along a longitudinal axis (A) ; 40
a plurality of holes (4), which are formed at least partially on said top surface (300a) of the plaster layer (300) and extend along axes approximately parallel and spaced apart from one another; and wherein 45
the second portion (3b) (5b) of each said spring (3) (5) is fitted in a respective hole (4) so that the respective first portion (3a) (5a) is arranged with its own base resting on the top surface (200b) of the support structure (200); 50
the second portion (3b) (5b) of the spring (3) (5) is rigidly integral with the inner wall of the hole (4) by way of a fixing means (M) arranged in the hole 4 itself. 55

10. The system according to claim 9, wherein some said springs (5) are each formed by an approximately mushroom-shaped wire helical anchoring spring, wherein the first portion (5a) and said second portion (5b) have a cylindrical or conical shape and form the head and the stem of the spring (5) respectively.

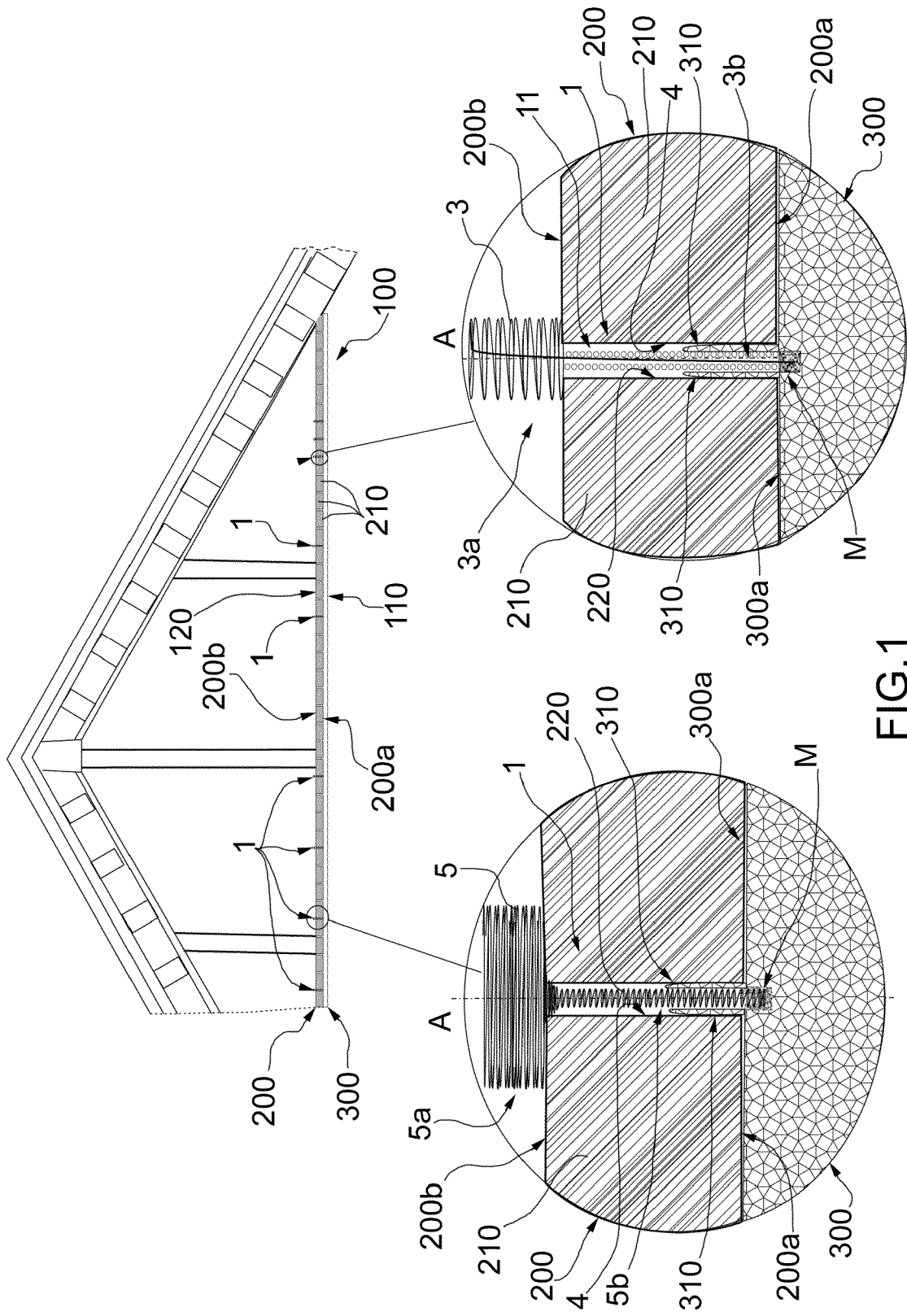


FIG.1

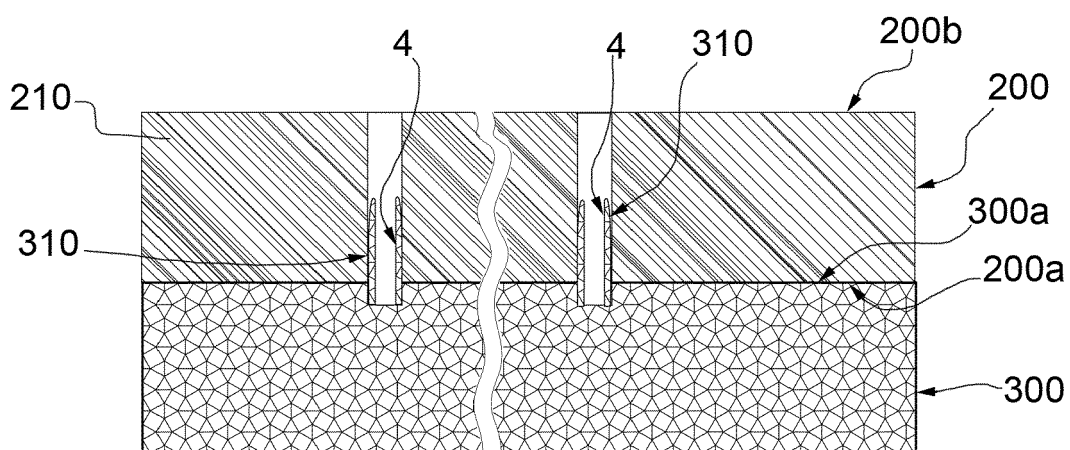


FIG. 2

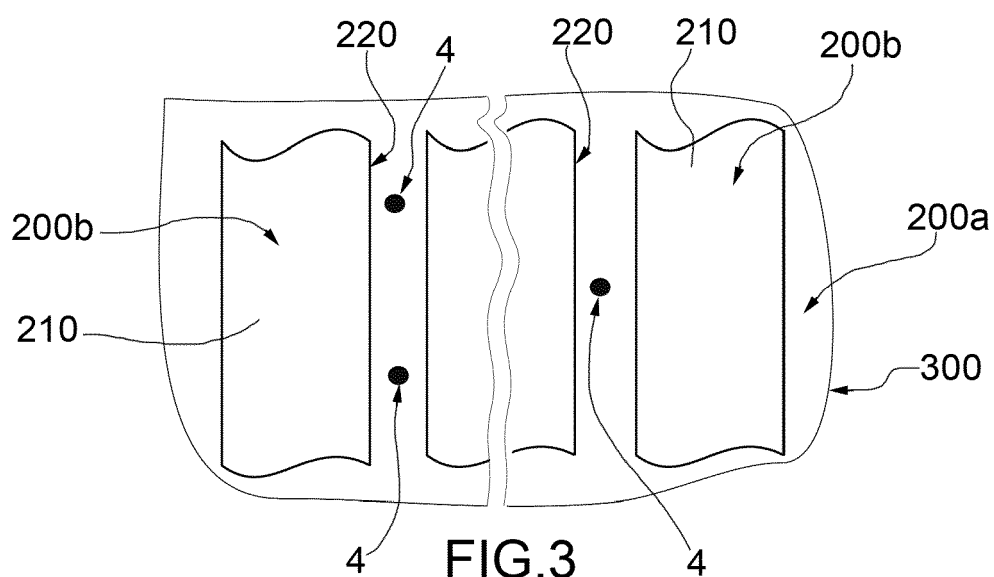


FIG. 3

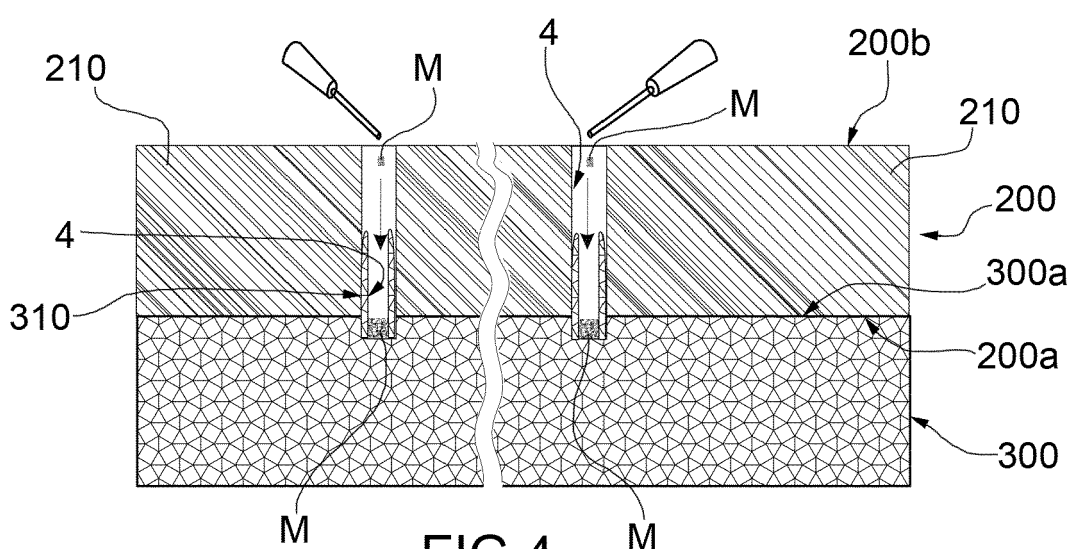
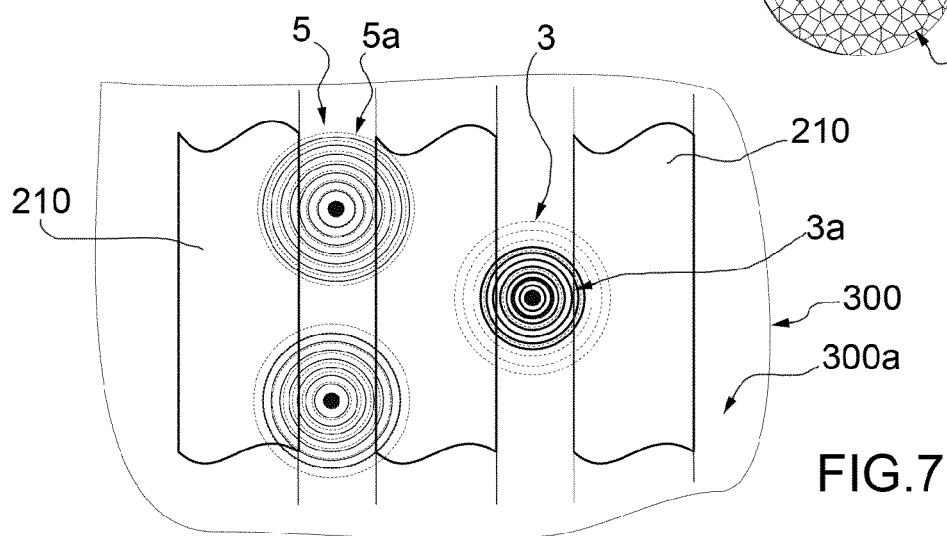
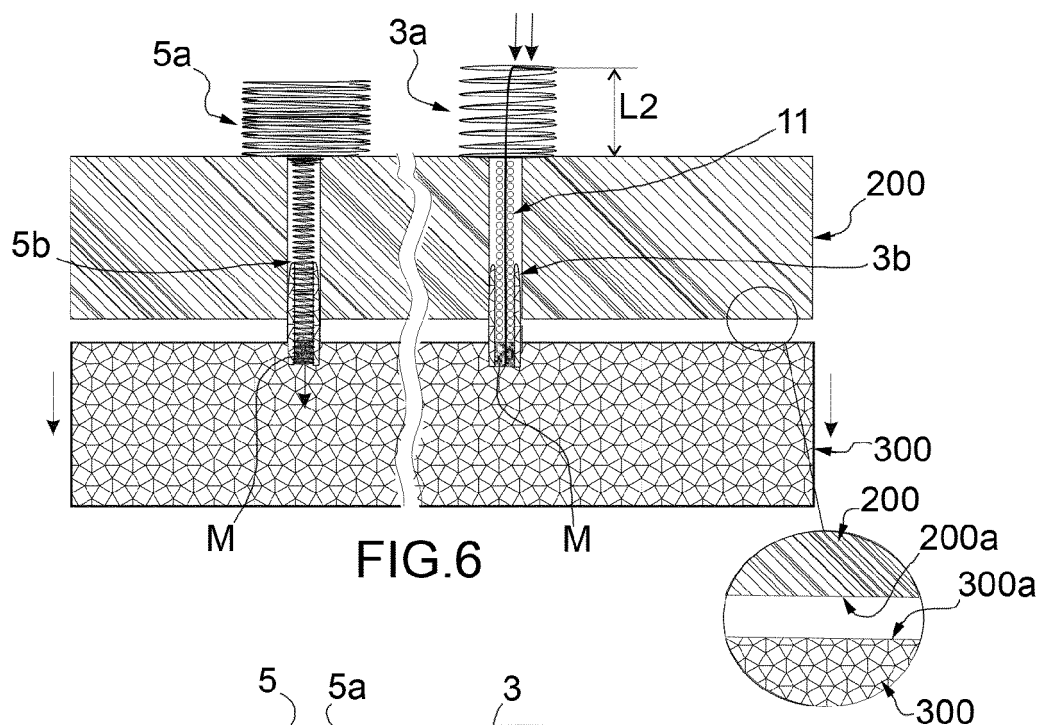
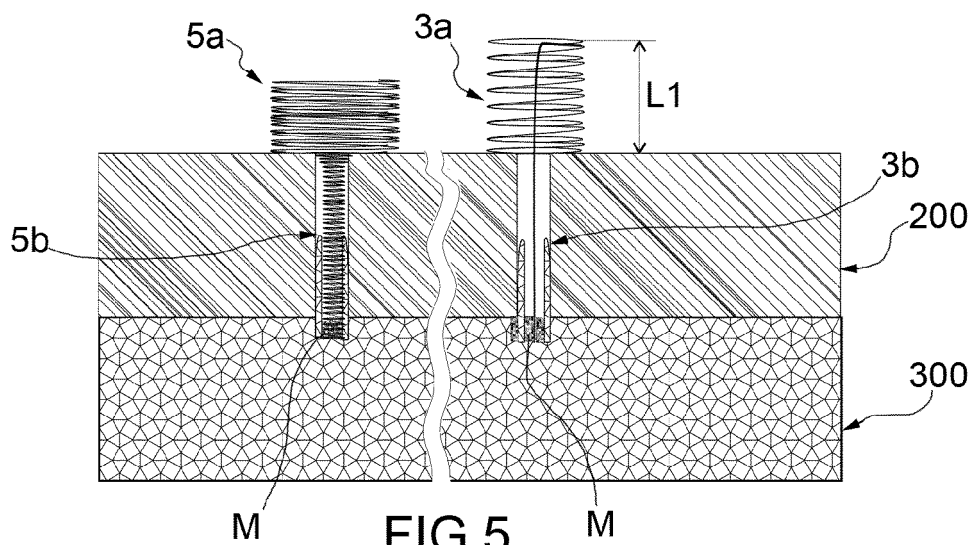


FIG. 4



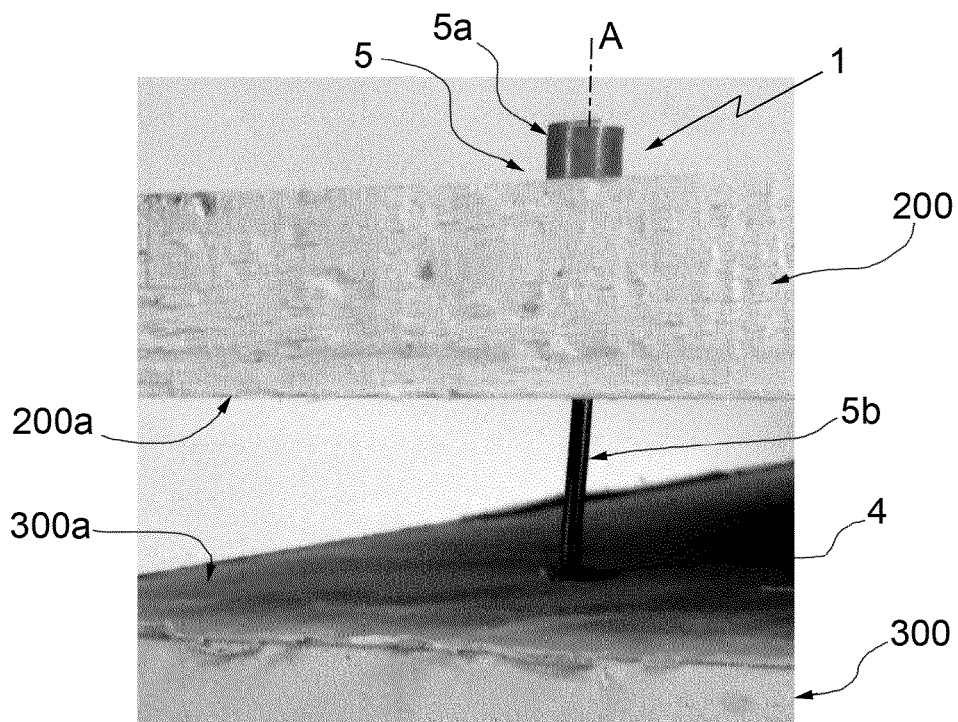


FIG.8

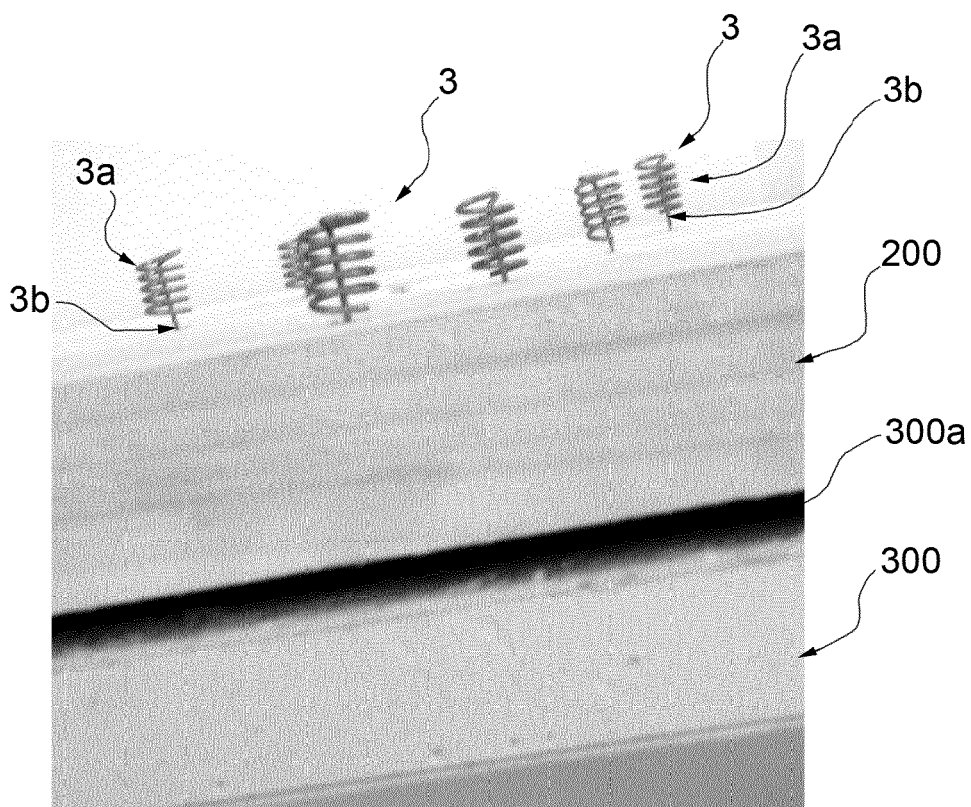


FIG.9



EUROPEAN SEARCH REPORT

Application Number
EP 17 18 1564

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	EP 2 696 009 A1 (FIORIN WALTER [IT]) 12 February 2014 (2014-02-12) * paragraph [0055] - paragraph [0061]; figures 10-13 *	1-10	INV. E04F13/04 E04B1/98
A	DE 38 15 299 A1 (STAUCH MATTHIAS [DE]) 16 November 1989 (1989-11-16) * abstract; figures 1-3 *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04F E04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 December 2017	Examiner Khera, Daljit
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 18 1564

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-12-2017

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2696009	A1	12-02-2014	NONE
DE 3815299	A1	16-11-1989	NONE

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2696009 A1 [0009]