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(71) Applicant: **Dot A/S**

5863 Ferritslev (DK)

(72) Inventor: **BRORSBØL, Søren**

6823 Ansager (DK)

(74) Representative: **Budde Schou A/S**

Dronningens Tvaergade 30

1302 Copenhagen K (DK)

(54) MOUNTING SYSTEM FOR HOT-DIP SURFACE TREATMENT

(57) A mounting system for holding at least one article such as a profile during a hot-dipping surface treatment such as galvanization. The mounting system comprises a suspension means such as a hook adapted for attaching to a first end of the article and a support frame

for supporting a second end of the article resting on the support frame. The second end of the article being opposite to the first end and the support frame being positioned below the suspension means.

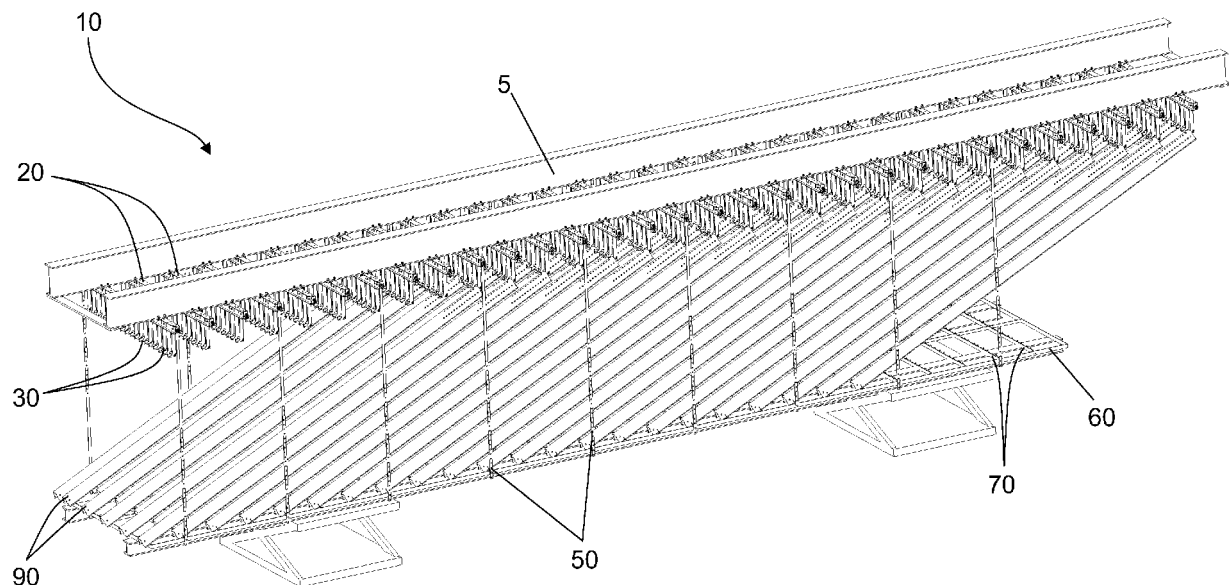


FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to the field of handling articles for surface coating, more specifically to mounting and handling articles for galvanization through hot-dipping.

BACKGROUND OF THE INVENTION

[0002] Surface coating of articles such as galvanization of various metal articles that are intended for bring outside in all types of conditions is essential for the durability of these articles as it provides resistance to corrosion.

[0003] To achieve a surface coating of high quality it is essential that the articles to be coated via hot-dipping are mounted at an angle that ensures an even coating and that minimises the number of and location of drip-points. At many coating sites such mounting is done manually by workers using metal wire to tie the articles to be coated in place in at least two points to create the desired angle. This is labour intensive and thus a very expensive process.

[0004] In the art it has been attempted to find alternative ways of mounting articles to be surface coated, but they each pose some disadvantages.

[0005] Some systems use hooks for hanging the articles to be coated but hanging an article to be coated in a single point on a hook will in most cases lead to poor angling of the article. Other systems rely on perforated containers such as baskets that the article can be placed in during the hot-dipping procedure. While such containers may allow a suitable placement of the article the contact surfaces that the article is resting on will not be coated as the rest of the article and will need to be locally re-coated after the hot-dipping process. Furthermore, the container holding the article will be exposed to the harsh conditions of many cycles of pre-treatment and hot-dipping which includes the extreme temperature differences cause when dipping the container and the article in molten metal. Such repeated treatment causes a strain to the container making it unsustainable to use complex structures with structurally weaker points such as welds.

[0006] Hence, there is a need for a suspension system suitable for hot-dip coating of articles that minimise these challenges while decreasing the amount of manual labour required to mount the articles.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide a reusable mounting system for holding articles during hot-dipping surface treatments that a resilient to the harsh hot-dipping treatment, which enable good positioning of the articles to undergo surface treatment and which enable easy and efficient mounting and dismounting of

the articles.

[0008] The above object and advantages, together with numerous other objects and advantages, which will be evident from the description of the present invention, are according to a first aspect of the present invention obtained by:

A mounting system for holding at least one article such as a profile during a hot-dipping surface treatment, said mounting system comprising

a suspension mean adapted for attaching to a first end of said article,
a support frame for supporting a second end of said article resting on said support frame, said second end being opposite to said first end, said support frame being positioned below said suspension means.

[0009] By an article is understood any object that is to be surface coated through a dipping procedure. Such articles are preferably made from metal such as iron or steel. The objects may be of various different shapes, sizes and mass.

[0010] In a preferred variant the article is a metal profile such as but not limited to a U-profile, a C-profile, or a square profile. In a more preferred variant, the length of the profile is at least 3 times longer than the longest side of the cross-section of the profile, such as 10 times longer.

[0011] By an end of the article, i.e. the first end or the second end, is understood a region of the article close to an edge of an article. By the end being a region is understood that it is not simply the edge of the article but a length of the article from the edge, such as a region being between a twentieth and a third of the length of the article. The geometry of the first end and the second end respectively depends on the article. For example, if the article is a table the first end and the second end may both be corners, if the article is a profile the first end and second end are chosen with respect to the longitudinal direction of the profile.

[0012] By the second end being opposite to the first end is understood that the second end is at a further side of the article relative to the first end. In a preferred variant, the second end may be the furthest region of the article relative to the first end determined in a direct line. In another variant the second end may be the furthest region of the article relative to the first end determined in a direct line within a plane tangent to at least two points on the article. For example, if the article is a profile the first end and the second end are preferably the regions furthest apart along the length of the profile. In another example the article may be a table with a rectangular tabletop; in case the first end is a corner of the tabletop, the second end may be the diagonally placed corner of the tabletop, or it may be the unattached end of a table leg.

[0013] By the mounting system being suited for a hot-dipping procedure is understood that the mounting sys-

tem is capable of withstanding being dipped into molten metal during the coating procedure as well as withstanding the stress from the subsequent cooling when the mounting system and mounted articles are retracted from the dipping-vat.

[0014] While the mounting system is suited for use with hot-dipping it is to be understood that it may also be used at other times such as in the cleaning process leading up to the hot-dipping, such as for transporting mounted articles and/or dipping them in water or acid and/or salt solutions in preparation for the surface coating.

[0015] In a preferred variant the surface coating is zinc, and the hot-dipping procedure is galvanization.

[0016] By the support frame being positioned below the suspension means is to be understood with respect to gravity, such that an when the first end of an article is attached to the suspension means the second end being opposite the first end will drop towards the support frame under the force of gravity.

[0017] As the upper beam is gravitationally higher than the lower beam an article suspended by a first end from a suspension means of the upper beam will have its second end which is not suspended drop towards the lower beam due to gravity.

[0018] By having a mounting system comprising a suspension means located above a support frame, an article mounted in the mounting system may be positioned at a suitable angle by having a first end attached to and hanging from the suspension means while the second end is resting on the support frame. Such mounting allows for minimising the number of contact points between the article and the mounting system as the contact points may be a single point at the suspension means and a single or few points at the support frame. At the same time placement of the second end on the support frame allows for adjustment of the angle of the article to direct the dripping points, whereas having the article hanging only from a single point on a suspension means would make adjustment of the angling of the article limited. Furthermore, hanging a first end of the article on a suspension means that may be fixed in place significantly lowers the amount of manual labour needed compared to tying an end of the article to an upper beam. The system of a fixed suspension means in combination with a support frame also requires less training to properly mount the article in the mounting system than tying of either or both ends of the article would.

[0019] According to a further embodiment of the first aspect of the invention, the mounting system comprises an upper beam for receiving the suspension means, the suspension means are releasably connected to the upper beam.

[0020] By releasably connected is understood that the releasable component may be attached, removed and reattached to the part it is connected to. A releasable component may thus also be exchanged with another component if for example a replacement is needed because the releasably connected component is worn. An-

other benefit of a releasable connection is the opportunity for customisability by releasably connecting a component at a different place on a part it may releasably be connected to. For example, the suspension means releasably connected to the upper beam may be released and removed when dismounting articles or to exchange or rearrange suspension means on the upper beam.

[0021] In some variants the mounting system may comprise an upper beam, the suspension means being fixedly connected to the upper beam.

[0022] It is to be understood that the upper beam is located gravitationally higher than the support frame. As the upper beam is gravitationally higher than the lower beam an article suspended by a first end from a suspension means of the upper beam will have its second end drop towards the lower beam due to the force of gravity.

[0023] In a preferred variant of the first aspect of the invention the mounting system comprises a plurality of suspension means for mounting multiple articles simultaneously, the suspension means being connected to the upper beam adjacently to each other.

[0024] Multiple suspension means allows the mounting of several articles next to each other thereby allowing multiple articles to be transferred, treated and surface coated simultaneously by moving the mounting system.

[0025] In a preferred variant the suspension means are mounted equidistantly with respect to each other on the upper beam.

[0026] In a preferred variant of the first aspect of the invention, the upper beam is a U-profile.

[0027] In a preferred variant the U-profile is arranged such two side sides of the U-profile are arranged substantially parallel with respect to the lower beam

[0028] A U-profile provides the necessary structural integrity for mounting the suspension means while using less material than a four-sided or solid structure. Furthermore, the open side of the U-profile provides easy access for mounting and inspecting the suspension means.

[0029] Having an open structure also minimises the amount of the coating material which will be trapped within the upper beam without being able to flow out once the mounting system is raised from the dipping-vat.

[0030] In a preferred variant the lower beam is made from a plate being a single piece of material. The plate may have structuring along one or more edges but does not comprise bends.

[0031] According to a further embodiment of the first aspect of the invention, the mounting system comprising a plurality of upper beams for supporting a plurality of suspension means.

[0032] By having a plurality of upper beams, multiple articles may be mounted adjacently on the same upper beam as well as adjacently on adjacent upper beams.

[0033] According to a further embodiment of the first aspect of the invention, the upper beam comprises a slit for receiving part of the suspension means, the slit being located in the side of said upper beam facing the support frame.

[0034] In a preferred variant the thickness of the slit is substantially the same as or slightly larger than the thickness of the suspension means such that the suspension means may enter the slit.

[0035] According to a further embodiment of the first aspect of the invention, the upper beam comprises a slot for receiving part of said mounting means, said slot being in a different side of said upper beam than the side facing the support frame.

[0036] In a preferred variant the length of the slit is shorter than the length of the slot.

[0037] By having a slot in addition to the slit the suspension means may be mounted more stably as it may engage the upper beam in multiple places. If the slot is shorter than the slit, the slot may provide guidance for the suspension means while the suspension means can pass through the slit but not the slot allowing the slot to function as a guide in multiple directions.

[0038] According to a further embodiment of the first aspect of the invention, the mounting system comprises a locking plate for releasably fixing the suspension means to the upper beam, the locking plate comprising locking slots adapted to engage taps of the suspension means.

[0039] According to a further embodiment of the first aspect of the invention, the suspension means being a hook, the hook comprising an elongated part, and at a first end of the elongated part said hook comprising a protruding part for receiving the first end of the article, the hook comprising an extension at a second end of the elongated part for stabilizing the mounting of the hook to the upper beam, the hook comprising a tap for engaging a locking slot.

[0040] In a preferred variant the thickness of the extension is smaller than the thickness of the elongated part of the hook. In another preferred variant the width of the extension is smaller than the width of the elongated part of the hook.

[0041] In a preferred variant the elongated part of the hook is mounted in the slit of the upper beam when the hook is attached to the upper beam. In a preferred variant the extension of the hook engages the slot of the upper beam when the hook is attached to the upper beam.

[0042] According to a further embodiment of the first aspect of the invention, the suspension means comprising a throughgoing hole for receiving a crossbar.

[0043] By using a crossbar for releasably fixing the position of the suspension means relative to each other it is possible to ensure a known position of each suspension means thereby making the process of mounting articles to them easier.

[0044] While the flexibility of the suspension means being releasable has multiple advantages, being able to fix them may make the mounting of articles on the suspension means easier as the suspension means do not move away if pushed so that it is known where the mounting position is.

[0045] According to a further embodiment of the first

aspect of the invention, the support frame comprising a lower beam for receiving the second end of said article, the lower beam being arranged substantially parallel to the upper beam.

[0046] By the lower beams being substantially parallel to the upper beams is understood that they have a similar lengthwise orientation when the mounting system is assembled such that the upper beams and support frame is connected by carrying straps. By substantially parallel is understood that the relative angle between the upper beam and the lower beam projected onto the same plane is no more than 30 degrees.

[0047] In some preferred variants the support frame will comprise outer beams arranged substantially perpendicular to the lower beam. One or more lower beams may be connected to the outer beams of the support frame. In some variants the support frame may comprise stabilising beams that may have any orientation with respect to the lower beams.

[0048] According to a further embodiment of the first aspect of the invention, the upper beam and the lower beam are arranged staggered with respect to each other such that an article attached to a suspension means of the upper beam will be angled when resting on the support beam.

[0049] By the upper beam and lower beam being arranged staggered is understood that they are not located in the same plane if that plane is perpendicular to a face of the upper beam and the face of the lower beam, unless both the upper beam and the lower beam are round. In other words, a weight at the end of a string affected by gravity and extending downwards from the plane of the upper beam would not hit the lower beam when intersecting the parallel plane of the lower beam as the lower beam is displaced with respect to the upper beam.

[0050] The staggering of the lower beam with respect to the upper beam has the benefit that an article attached at a first end to the support means and resting with its second end on the lower beam will not be extending directly downwards but will instead need to be angled.

[0051] In a preferred variant the mounting system comprises more lower beams than it comprises upper beams. By having more lower beams than upper beams the angling of an article may be adjusted by choosing which of the lower beams the article rests on and the mounting system becomes suitable for a bigger span of article lengths.

[0052] In another variant of the invention the at least one upper beam is aligned directly above one lower beam. In some variants where the mounting system comprises a plurality of upper beams and a plurality of lower beams a subset of the upper beams and the lower beams may be arranged such that the upper beams of the subset are aligned substantially above the lower beams of the subset of lower beams while the collective group of all upper beams is staggered with respect to the collective group of all lower beams.

[0053] According to a further embodiment of the first

aspect of the invention, the lower beam of the support frame comprising a plurality of serrations for pointwise supporting the article, the serrations being on the upward facing side of the lower beam.

[0054] By serrations is meant a structure of adjacent peaks. By the upwards facing side of the lower beam is understood the side, which is facing the plane of the upper beam, that is upward with respect to gravity.

[0055] The raised points of the serrated structure minimises the surface of contact between the lower beam and an article resting on it. Having a smaller surface of contact minimises the areas of the article which is insufficiently coated during the hot-dip treatment.

[0056] According to a further embodiment of the first aspect of the invention, the plurality of serrations comprises at least one protruding serration, the height of the protruding serration being larger than the height of remaining plurality of serrations, such as the height of the protruding serration being 1.5-20 times the height of the remaining plurality of serrations, such as 3-10 times the height of the remaining plurality of serrations.

[0057] The protruding serrations provide structuring for aligning the articles and keeping the separated such that the articles will not come into contact when the mounting system is moved.

[0058] According to a further embodiment of the first aspect of the invention, the mounting system comprises a carrying strap for adjustably fixing the distance between the upper beam and the support frame, the carrying strap being releasably connected to said upper beam. In a preferred variant the carrying strap is releasably connected to the upper beam and to the support frame.

[0059] By a carrying strap is understood an elongated structure. In a preferred variant the carrying strap is an elongated rigid structure such as a bar or rod made of a single piece of metal. In another variant the carrying strap may be made of a flexible material such as a weave.

[0060] In a preferred variant the carrying strap is attached to the outside of the support frame, i.e. on the side facing away from the lower beams. In a preferred variant the carrying strap is connected to an end of the upper beam.

[0061] In a preferred variant the mounting system comprises at least two carrying straps, said carrying straps being releasably connected to a first and a second end of an upper beam, respectively.

[0062] By having the distance between the upper beam and the support frame adjustably fixed by the carrying strap the mounting system is suitable for use with articles of varying length. Furthermore, adjusting the distance between the upper beam and the support frame is an additional way in which the angling of mounted articles may be adjusted.

[0063] Having the suspension means being releasably connected enables fast removal of the articles after the dip-coating has been done. In addition, realisable connect suspension means provides versatility in the position of the suspension means as well as the distance

between them if multiple suspension means are attached to the same upper beam.

[0064] According to a further embodiment of the first aspect of the invention, each of the carrying straps having at a first end a throughgoing connection notch for connecting to said upper beam and each of said carrying straps having at a second end at least two throughgoing connection eyes for connecting to said support frame.

[0065] By having multiple connection eyes for connecting to the support frame it is possible to adjust the distance between the upper beam and the support frame by choosing which of the connection eyes the support frame is connected to.

[0066] In a preferred variant the connection notch is oblong or elongated such that it may be lifted around a peg at the end of the upper beam and be kept in place by gravity. With such a configuration with an elongated notch and a peg, the carrying strap may be connected to the upper beam without the need of a separate fastening means.

[0067] The mounting system according to any of the preceding claims, parts of said mounting system being releasably assembled using locking means such as locking rings and/or stoppers.

[0068] By using locking rings, it is possible to releasably connect the carrying strap to the support frame without introducing a structurally weak point prone to breaking due to harsh treatments during hot-dipping.

[0069] In a preferred variant all separate structures of the support frame are connected with locking rings. Separate structures may include but are not limited to lower beams, outer beams, and/or stabilizing beams.

[0070] In a preferred variant of the invention the mounting system comprises no welds below the upper beam, such that no part of the mounting system which needs to be dipped into a vat for the article to be coated comprises a weld.

[0071] According to a preferred variant of the first aspect of the invention, the support frame and the carrying straps being made from titanium. In a more preferred variant at least part of the locking means is made from titanium.

[0072] Titanium is a preferred material for components of the mounting system that will be dipped into vats during the surface coating as titanium is resilient to both the pre-treatment and the hot-dipping providing a durable mounting system.

[0073] In a preferred variant of the locking ring, the locking ring is C-shaped, having two rounded legs connected by a flat base. In a more preferred variant, the rounded legs have indents on the sides facing each other.

[0074] In a preferred variant the mentioned embodiments are combined as a mounting system for holding at least one article such as a profile for hot-dipping surface treatment, the mounting system comprising

- a suspension means for attaching to a first end of an article,

- a support frame for supporting a second end of the article resting on the support frame, the second end being opposite to the first end, and the support frame being positioned below the suspension means,
- an upper beam for receiving the suspension means, the suspension means being releasably connected to the upper beam,
- a lower beam for receiving said second end of said article said lower beam being part of said support frame, said lower beam being arranged substantially parallel to said upper beam,
- a carrying strap for adjustably fixing the distance between said upper beam and said support frame, said carrying strap being releasably connected to said upper beam.

SHORT LIST OF THE DRAWINGS

[0075] In the following, examples of embodiments are described according to the invention, where:

Fig. 1 illustrates a mounting system connected to carrier beams and with multiple articles mounted.

Figs. 2a-2b show suspension means mounted in an upper beam and an unmounted example of a suspension means.

Fig. 3 shows the support frame along with lower beams and carrying straps.

Fig. 4 shows lower beams with serrations and the mounting of articles thereon.

Fig. 5 illustrates assembly of the support frame, lower beams and carrying straps using locking rings.

DETAILED DESCRIPTION OF THE DRAWINGS

[0076] The invention will now be explained in more detail below by means of examples with reference to the accompanying drawings.

[0077] The invention may, however, be embodied in different forms than depicted below, and should not be construed as limited to any examples set forth herein. Rather, any examples are provided so that the disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like reference numerals refer to like elements throughout. Like elements will, thus, not be described in detail with respect to the description of each figure. A detailed description of embodiments of the mounting system.

[0078] Fig. 1 is an illustration of an embodiment of an assembled mounting system 10 supporting several articles 90 where the example articles 90 illustrated are profiles.

[0079] The embodiment shown in Fig. 1 comprises a plurality of upper beams 20 and each of the upper beams

20 has a plurality of suspension means 30 releasably attached. In a preferred embodiment the suspension means 30 are hooks.

[0080] A support frame 60 is shown having a plurality of lower beams 70. In preferred embodiment the upper beams 20 and lower beams 70 are oriented substantially parallel. The support frame 60 further has outer beams 62 that connect the lower beams 70 to each other. The support frame 60 further has a stabilisation beam 64 for strengthening the construction of the support frame 60.

[0081] The upper beams 20 and the support frame 60 are connected by a plurality of carrying straps 50. The carrying straps 50 ensure that the distance between the upper beams 20 and the support frame 60 is fixed when the mounting system 10 is being handled and transported. The distance between the upper beams 20 and the support frame 60 may be adjusted using the same carrying straps 50 by connecting the support frame 60 to different positions on the carrying straps 50.

[0082] In a preferred embodiment, as illustrated in Fig. 1 the mounting system 10 comprises a plurality of upper beams 20, suspension means 30, lower beams 70 and carrying straps 50 as such embodiments enable the mounting of multiple articles 90 in the same mounting system 10 and the handling and treatment of multiple articles 90 simultaneously. In other embodiments there may be a different number of upper beams 20, suspension means 30, lower beams 70 and/or carrying straps 50 to accommodate different amounts or types of articles 90 or to have the overall dimensions or weight of the mounting system 10 be suitable for the treatment site.

[0083] In Fig. 1 a plurality of articles 90 are shown mounted in the mounting system 10. Each article 90 is mounted by suspending a first end 91 of the article 90 from a suspension means 30 and supporting a second end 92 of the article 90 on a lower beam 70, the lower beam on which the second end 92 of the article 90 rests is not directly below the suspension means 30 from which the first end 91 is suspended such that the suspended and supported article 90 is mounted at an angle. When multiple article 90 of substantially identical dimensions are mounted on the same mounting system 10, they are preferably mounted at the same angle such that they are substantially parallel to each other. Having the articles 90 mounted substantially parallel to each other allows for efficient use of the space in the mounting system 10 stacking and avoiding the articles 90 getting into contact with each other which would otherwise lead to a less complete coating of the articles 90 that are in contact with each other.

[0084] In some embodiments upper beams 20 and lower beams 70 may be placed directly above and below each other with respect to gravity substantially in the same plane, this is especially suited for embodiments where the mounting system 10 has multiple upper beams 20 and multiple lower beams 70 such that neighbouring lower beams 70 are displaced to different degrees with respect to any single upper beam 20. In some embodi-

ments the collection of upper beams 20 may be displaced with respect to the collection of lower beams 70 such that articles 10 mounted on the suspension means 30 and resting on a lower beam 70 will be placed at an angle with respect the force of gravity.

[0085] Some embodiments may have more upper beams 20 than lower beams 70. This may also be the case where the upper beams 20 are equidistantly spaced apart with the same separating distance as the separating distance of the lower beams 70 which are similarly spaced apart. In such a case the area of upper beams 20 may extend beyond the area of lower beams 70 while the angling of the articles 90 ensure that the second end 92 of the articles 90 are within the region of the support frame 60.

[0086] In some embodiments there may be more lower beams 70 than there are upper beams 70 preferably such that the distance between adjacent lower beams 70 is smaller than the distance between adjacent upper beams 20. By having shorter spacing between the lower beams 70 it becomes possible to adjust the angle α at which the article 90 is mounted by adjusting the distance between the suspension means 30 and the lower beam as well as on which lower beam 90 the second end 92 of the article 90 is resting.

[0087] The mounting system may have one or more carrier beams 5 releasably connected either below and to the supporting frame 60, above and to the upper beams 30 or both. In a preferred variant the upper beams 20 are connected to a carrier beam 5 during movement of the mounting system 10 such that the upper beams 20 may be moved collectively, e.g. lifted by a crane. The mounting system 10 may be connected to carrier beams 5 compatible with existing coating workflows.

[0088] Fig. 2a illustrates an upper beam 20 with a plurality of suspension means 30 in the form of hooks mounted to the upper beam 20. It is to be understood that the suspension means could take another form than hooks or it might be hook with a different shape than the one illustrated in Figs. 2a and 2b.

[0089] The number of suspension means 30 attached to the upper beam 20 may vary. In a preferred embodiment the number of suspension means 30 is adjustable as the suspension means 30 may be removed and reattached to the upper beam 20. A suspension means 30 may be mounted in each of the slits 22 or in only a single or some of the slits 22 to control the placement and distance between suspension means 30.

[0090] In a preferred embodiment the upper beam 20 comprises a plurality of slits 22 for receiving part of the suspension means 30. The upper beam 20 may further comprise a plurality of slots 24 for receiving a different part of the suspension means 30, such that the suspension means 30 engages both the slit 22 and the slot 24 when mounted in the upper beam 30.

[0091] In a preferred variant the upper beam 20 is a U-profile and the slit 22 are located in a side of the profile having only one neighbour such that part of the suspen-

sion means 30. In a preferred variant the slot 24 is in a different side of the C-profile than the slit, either in the opposing side as in the embodiment illustrated in Fig. 2a or in the side adjacent to the side with the slit 22.

[0092] The upper beam 20 may further comprise a releasable locking plate 45 adapted to releasably fix suspension means 30 to the upper beam 20. In a preferred embodiment, the locking plate 45 has a length similar to that of the upper beam 20. In preferred embodiments where the upper beam 20 is a C-profile the locking plate 45 is placed within the opening of the C-profile such that it is adjacent two to sides of the profile and closes the opening of the C. In preferred embodiments the locking plate 45 comprises a plurality of locking slots 47 for engaging part of the suspension means 30. The locking plate 45 may be releasably attached to the upper beam 20 by connection means such as bolt.

[0093] The upper beam 20 may further endplates and/or comprise a first peg 27 at a first end of the upper beam 20 and a second peg at a second end 28 of the upper beam 20, both of said first 27 and second peg 28 protruding away from the suspension means 30. The first 27 and second peg 28 respectively may be used for connection of the carrying straps 50.

[0094] Fig. 2b shows an embodiment of a suspension means 30. The suspension means 30 comprises an elongated part 32 and a protruding part 34 at a first end of the elongated part 32. In a preferred variant the protruding part 34 extends in a substantially perpendicular manner with respect to the length of the elongated part 32 in an L-shape or a J-shape. In a preferred variant the protruding part 34 has a catch 35 in the end furthest from the protruding part 34 of the suspension means 30. In a preferred variant the catch 35 extends substantially in the same direction as the elongated part 32. The catch is adapted to engage with a hole in an article 90 to be mounted on the suspension means 30 thereby ensuring that it does not unintentionally disengage the engagement means 30 during treatment. At the second end of the elongated part 32 opposite to the first end with the protruding part 34, the suspension means 30 comprises an extension 36. The extension 36 may extend in the same direction as the elongated part 32, in the same direction as the protruding part 34 or in the opposite direction of the protruding part 34. In a preferred embodiment the width and/or the thickness of the extension 36 is smaller than the width and/or thickness of the elongated part 32. In a preferred embodiment the suspension means 30 comprises a tap 37 the tap increasing the width of the elongated part 32 in the same direction as the protruding part 34. Preferably the tap 37 is located in the top half of the elongated part 32, in other words closer to the second end than the first end. The tap 37 is adapted to engage a locking slot 47 in the locking plate 45 whereby the suspension means 30 is releasably kept in place in the upper beam 20.

[0095] In a preferred embodiment when the suspension means 30 are mounted in the upper beam 20 a sec-

tion of the elongated part 32 of the suspension means 30 engages the slit 22 and at least a section of the extension 36 engages the slot 24. In preferred embodiments the cross-sectional area of the slit 22 is larger than that of the elongated part 32 of the suspension means 30 such that also the tap 37 may pass through the slit 22 when the suspension means 30 is mounted in the slit 22. In preferred embodiments the cross-sectional area of the extension 32 of the suspension means 30 that engages with the slot 24 is substantially the same as the cross-sectional area of the slot 24 with any tolerance such that the cross-sectional area of the extension 36 is smaller than the cross-sectional area of the slot 24 and never larger, such that the extension 36 may be mounted in the slot 24. Similarly the cross-sectional area of the tap 37 is substantially the same as the cross-sectional area of the locking slot 47.

[0096] By having the cross-sections of the slit 22 and slot 24 substantially match the cross-sections of the respective parts of the suspension means 30 intended to engage with them, the suspension means 30 may be mounted stably such that the positions of the suspension means 30 are not like to change once they are mounted as the suspension means cannot rotate or angle inside the slit 22, slot 24 and locking slot 47.

[0097] In preferred embodiments where the width and/or the thickness of the extension 36 is smaller than the width and/or thickness of the elongated part 32, the extension 36 can enter the slot 24 while the elongated part 32 of the suspension means 30 cannot. The extension 36 may thus function as a guide for the placement of the suspension means 30 relative to the upper beam 20 in multiple directions.

[0098] In preferred embodiment the suspension means 30 is made of titanium. In another preferred embodiment the suspension means 30 is made of stainless steel.

[0099] In preferred embodiments the mounting system 10 the suspension means 30 comprises a throughgoing hole 39 for receiving a crossbar 40. In a preferred variant the throughgoing holes 39 is in the half of the suspension means 30 closest to the first end. In a preferred variant comprising a plurality of suspension means 30 attached to the same upper beam 20, the throughgoing holes 39 line up when the suspension means 30 are mounted, such that a single crossbar 40 may extend through the throughgoing holes 39 of the suspension means 30 simultaneously. The crossbar 40 is adapted to fix the position of the first end of the suspension means 30 relative to each other thereby making it easier to suspend articles from the suspension means 30 as the positions and distance is known. The crossbar 40 may for example fix the position by a press-fit of the crossbar 40 when angled correctly in the throughgoing hole 39 and/or by the use of locking means 80 that limit the movement of the crossbar 40.

[0100] In preferred embodiment the crossbar 40 is limiting the movement of the suspension means 30 relative

to each other while a locking plate 45 is used to releasably mount the suspension means 30 to the upper beam 20.

[0101] In other variants the suspension means 30 may be mounted to the upper beam 20 using a crossbar 40. In such variants the first 21 and second end 21' of the upper beam 20 also comprises throughgoing holes for receiving the crossbar 40. The throughgoing holes of the upper beam 20 and the throughgoing holes 39 of the suspension means being placed such that they are aligned when the suspension means 30 are mounted in the upper beam 20. In a preferred variant the extension 36 of the suspension means 30 helps ensure the correct alignment of the suspension means 30 such that the throughgoing holes 29 and 39 line up and can receive the crossbar 40 simultaneously. Thereby the suspension means 30 are held in position on the upper beam 20 being reattachably connected thereto. In the case of embodiment having multiple suspension means 30 all suspension means 30 to be mounted in the same upper beam 20 may be locked in position simultaneously by the same crossbar 40.

[0102] In some embodiments the cross section of the crossbar 40 matches the cross section of the throughgoing holes 39 of the suspension means 30. In such variants the crossbar may be kept in place by releasable fastening means 80 preventing lateral translation of the crossbar 40. In some embodiments, such fastening means 80 may be nuts interacting with threading at the ends of the crossbar 40. In other embodiments such fastening means 80 may be in the form of locking rings 82.

[0103] In other embodiments of the invention the crossbar 40 may lock in place through press fitting. In such embodiment the cross section of the crossbar 40 may be different from the cross section of the throughgoing holes 39 of the suspension means 30. For example, the cross-section of the crossbar 40 may be rectangular while the throughgoing holes 39 are substantially triangular. In such a case the long side of the rectangular cross section of rectangular crossbar 40 may be similar to a leg of the triangular the throughgoing holes 39 of the suspension means 30 such that the hypotenuse is longer than the long side of the rectangular cross section of rectangular crossbar 40. In such a case the crossbar 40 may easily be inserted while angled substantially parallel to the hypotenuse and once the crossbar 40 has been inserted in all of the intended throughgoing holes 39, the crossbar 40 may be rotated towards being substantially parallel to the leg of the triangular throughgoing holes 39 having a substantially similar dimension to the long side of the rectangular cross section of the crossbar 40 to lock in place by pressing fitting and/or friction locking between the throughgoing holes 39 and the crossbar 40. In such cases locking means 80 may also be used to further secure the crossbar 40 and restrict its movement.

[0104] In a preferred embodiment of the system, the suspension means 30 are mounted in the upper beam 20 by first inserting the one or more suspension means 30 into the slits 22 of the upper beam until the extension

36 of the suspension means 30 engages the slot 24 of the upper beam 20. Once the suspension means 30 are placed in the upper beam 20 the locking plate is placed within the opening of the upper beam 20 such that the locking slots 47 engages the tabs 37 of the suspension means 30. Once in place the locking plate 45 is releasably fixed to the upper beam 20. In some variants the crossbar 40 may be engaged with the throughgoing holes 39 of the suspension means 30 before the suspension means 30 are positioned in the upper beam 20 allowing them to be positioned simultaneously. In other variants the suspension means 30 may be attached to the upper beam 20 before the crossbar 40 is connected to the suspension means 30.

[0105] Fig. 3 shows a support frame 60 having outer beams 62, lower beams 70 and stabilisation beams 64. The support frame 60 is further shown connected to carrying straps 50.

[0106] In preferred embodiments the support frame 60 comprises multiple lower beams 70. In such preferred embodiments the support frame 60 further comprises at least two outer beams 62 which are preferably perpendicular to said lower beams 70 and connecting said lower beams 70. In preferred embodiments the lower beams 70 are reattachably connected to the support frame 60. Having the lower beams 70 be reattachable allows customisability with regards to the number and placement of lower beams 70 as well as replacement of lower beams 70 when they get worn. In preferred variants the lower beams 70 are reattachably secured to the outer beams 62 using fastening means 80, such as locking rings or stoppers.

[0107] In some embodiments the support frame 60 may comprise stabilisation beams 64 for strengthening the structure of the support frame 60 allowing it to be used with heavier articles 90 resting on the support frame 60 than can be mounted on similar support frames 60 without stabilisation beams 64.

[0108] The carrying straps 50 have connection notches 52 at a first end 51. The connection notches are adapted for connecting with the first peg 27 or the second peg 28 of an upper beam 20. In a preferred variant the notches 52 are oblong or elongated structures that can be connected to the pegs 27,28 by hanging on the pegs held by gravity. In such preferred embodiments the pegs 27,28 comprise a stub at the end not connected to the upper beam 20 and facing opposite the force of gravity when the upper beam 20 is mounted at the top of the mounting system 10. Such a stub can then prevent that the carrying straps 50 may slide off of the pegs 27,28 when mounted thereon. The oblong or elongated shape of the notches 52 enables the notches 52 to pass around the stubs of the pegs when the carrying straps 50 are connected to the upper beam 20. In some preferred embodiments locking rings may be used to releasably secure the first end of the carrying strap 50 to the upper beam 20.

[0109] In a preferred embodiment the carrying straps

50 comprises several connection holes 54 in the half of the carrying strap 50 closest to the second end 53. The support frame is adapted to be connectable to any of the connection holes 54 of the carrying strap 50. The distance between the upper beam 20 connected to the connection notch 52 of the carrying strap 50 and the support frame connected to the connection hole 54 may be adjusted by choosing which connection hole 54 out of the various connection holes 54 the support frame 60 is connected to. In embodiments where the support frame 60 is connected to multiple carrying straps 50 the support frame 60 may be connected to connection holes 54 providing a substantially constant distance between every upper beam 20 and the support frame 60. Such arrangement is beneficial for mounting numerous articles 90 of similar dimensions. In other variants the support frame 60 may be angled by connecting it to connection holes 54 at increasing distance from neighbouring upper beams 20 on one side and at decreasing distance from neighbouring beams 20 on the opposite side. Such arrangement may be beneficial if mounting numerous articles 90 of varying dimensions or mounting articles 90 of irregular shape.

[0110] In a preferred embodiment the carrying straps 50 are releasably secured to the support frame 60 by fastening means 80, such as locking rings or stoppers.

[0111] In preferred embodiments of the invention the support frame 60 is connected to a carrying strap 50 at a point where the lower beam 70 is also connected to the support frame 60. In such embodiments the lower beam 70 and the carrying strap 50 may be held in place by the same fastening means such as a locking ring. In other variants the carrying straps 50 may be connected elsewhere on the support frame 60. In a preferred variant the carrying straps 50 are connected to the support frame 60 such that one or more of the carrying straps 50 may be rotated around the point of connection. This enables rotating a carrying strap 50 away from the region between the upper beam 20 and the support frame 60, e.g. to be placed substantially parallel to an outer beam 62 of the support frame 60 such that a larger region of free access for mounting articles 90 is temporarily created and the carrying strap 50 may be rotated back in position after the mounting of one or more articles 90.

[0112] Fig. 4 illustrates an example of how serrations 75 and protruding serrations 77 on a lower beams 70 of the support frame 60 may benefit the mounting of the second ends 92 of articles 90. It is noted that only a section of a lower beam 70 is shown, in preferred embodiments serrations may be present on the entire section of the lower beam 70 between where the ends of the lower beam 70 is connected to another part of the mounting system 10, e.g. between the outer beams 62 of the support frame 60 or between carrying straps 50. In preferred embodiments the ends of the lower beams 70 which connect to other parts of the mounting system 10 need not comprise serrations.

[0113] In a preferred embodiment, the serrations are on the side of the lower beams 70 facing upward when

the lower beams 70 are mounted in the support frame 60.

[0114] In a preferred embodiment a plurality of serrations 75 of substantially the same height are placed abreast on the upward facing side of the lower beam 70, i.e. the side facing the suspension means 30. In a more preferred embodiment pluralities of serrations 75 placed abreast are separated by protruding serrations 77. In some embodiments of the invention the protruding serrations 77 are between 1.5 and 20 times higher than the serrations 75 such as 3-10 times higher than the serrations.

[0115] The protruding serrations 77 may help guide the second end 92 of the articles 90 into place as for example by keeping adjacent articles 90 separated by placing the articles 90 such that there are protruding serrations 77 between neighbouring articles 90. The protruding serrations 77 may also for example contribute to keeping the second ends 92 of the articles 90 in place by articles 90 being placed such that the protruding serrations 77 are between parts of the second end 92 of the article 90 such that it cannot freely slide along the lower beam 70 in a direction perpendicular to the protruding serrations 77.

[0116] In some embodiments the protruding serrations 77 may be equidistant along the length of the lower beam 70. In other embodiments the protruding serrations 77 may be distributed in a repeating pattern with varying distance, e.g. in groups of protruding serrations 77 having a first distance between the protruding serrations of the group 77 and a second distance between the protruding serrations 77 of neighbouring groups of protruding serrations 77. In a preferred embodiment the groups of protruding serrations 77 consists of two protruding serrations 77. In other embodiments the groups of protruding serrations 77 may comprise more than two protruding serrations 77.

[0117] In other embodiments the lower beam 70 comprises only serrations 75 of substantially the same height.

[0118] In preferred embodiments all the lower beams 70 of the mounting system 10 comprises serrations 75 and possibly protruding serrations 77. In other embodiments only some of the lower beams 70 of the mounting system 10 comprises serrations 75 and possibly protruding serrations 77.

[0119] Fig. 5 shows a cut-out of a corner of a mounting system 10 where a carrying strap 50 and a lower beam 70 respectively is connected to an outer beam 62. The connections of Fig. 5 illustrating preferred types of fastening means 80 for fastening components of the mounting system 10 to each other. One preferred type of fastening means 80 being locking rings 82. Another preferred type of fastening means 80 being stoppers 84.

[0120] Figure 5 illustrates the use of locking rings 82 for the fastening of the connection of one end of a lower beam 70 to an outer beam 62 of the support frame 60 as well as the connection of a carrying strap 50 to the same outer beam 62. It is to be understood that the same type of locking means is preferably used for fastening of other

connections of the mounting system 10, such as but not limited to the other end of the same lower beam 70 to another outer beam 62 such that both ends of a lower beam 70 is connected to the remainder of the support frame 60 using locking rings 82, additional carrying straps 50, stabilization beams 64 to outer beams 62 and/or to lower beams 70. Locking rings may also be used for example for fastening the crossbar 40 to the suspension means 30 and/or the upper beam 20 as well as the fastening of the locking plate 45 to the upper beam 20.

[0121] Using locking rings 82 as fastening means 80 has the benefit of providing a releasable connection that may fix the components in place relative to each while being releasable after the coating process is finished such that the mounting system 10 may be reconfigured and customised for the next articles 90 to be mounted in the mounting system 10. Furthermore, the locking rings 82, enable the connection of components of the mounting system 10 without needing joints such as welds which would be prone to breaking under the stress of common hot-dipping surface treatment processes such as galvanization.

[0122] In a preferred variant the locking rings 82 are constructed as a single piece of solid metal. In a more preferred embodiment, the locking rings 82 are constructed as a single piece of solid titanium. That the locking ring 82 is a single piece of solid metal ensures that there are no joints on the locking ring 82 which might otherwise be a weak region on the construction prone to being damaged by the surface coating. Locking rings 82 also have the benefit of not having fine features increasing the surface area compared to a substantially smooth surface which might otherwise trap coating material and complicate release of the locking means 80.

[0123] Locking rings 82 being made of titanium, further has the benefit of being chemically resistant to the majority of surface treatments.

[0124] The locking rings 82 may be used in different configurations depending on the design of the part which it is to engage with. The locking ring 82 is adapted to wedge between one component of the mounting system 10 and another component of the mounting system 10 such that the presence of the locking ring 82 hinders the relative movement of the respective components relative to each other even though they could move when the locking ring 82 was not wedged between them.

[0125] In some embodiments the locking ring 82 may block passage of a protruding part of a first component of the mounting system 10 which has passed through an opening of a second part of the mounting system 10 such that the first part of the mounting system 10 cannot return through the opening of the second part of the mounting system 10 without the locking ring 82 first being removed. For example, a beam tap 72 of a lower beam may be led through an outer opening of an outer beam 62. Once the beam tap 72 has passed through the outer opening the locking ring 82 may be wedged between the beam tap 72 and the region of the outer beam 62 having the outer

opening such that the locking ring 82 blocks the beam tap 72 from returning through the outer hole 62.

[0126] In a preferred embodiment the locking ring 82 does not comprise a closed ring, rather the locking ring 82 is a crescent or C-shaped structure with an open side such that a beam tap 72 may pass through the open side to engage with the locking ring 82. In such preferred embodiments the two legs of the locking ring are rounded. The rounded legs of the locking ring being connected by a flat base, the flat base being opposite of the opening. In a preferred variant of the locking ring 82 each of the legs of the locking ring 82 comprises an indent for engaging a beam tap 72. In preferred variants the locking ring 82 the flat base is the narrowest section of the locking ring. In a preferred embodiment the locking ring is symmetric with respect to the middle of the flat base. Such preferred embodiments of the locking ring 82 provide a structure with the necessary elasticity to engage the beam tap 72 and decreasing metal deformation while being strong enough enabling locking of the structures. Furthermore, such structures decrease the amount of material necessary to construct the locking rings 82 thereby keeping the cost of the locking rings 82 low. Such preferred locking rings 82 may be used in combination with other locking rings 82 with different shapes.

[0127] In some embodiments a stopper 84 may be used instead of or in combination with locking rings 82. In a preferred variant the stopper has a uniform cross-sectional area which matches or is slightly smaller than the opening or hole it is to engage such as the connection holes 54 of the carrying strap 50. Preferably the geometry of the stopper 54 and the hole is approximately the same, and in a more preferred variant they are substantially circular. A benefit of the circular shape is that it is possible to rotate the component with the hole, e.g. the carrying strap 50 with the connection hole 54 around the stopper 84 while the carrying strap 50 is still blocked from being fully released from the support frame 60 by the key in the stopper channel 85. However, in some variant they may have different shapes with respect to each other or the same shape which is not round.

[0128] In preferred embodiments the stopper 84 comprises a stopper channel 85 perpendicular to the longitudinal axis of the stopper 84. In a preferred variant the stopper channel is throughgoing. In other variants the stopper channel 85 may be blind in one end. A key may be placed in the stopper channel 85, the key being longer than the stopper channel 85 such that it extends beyond the surface of the stopper 84 thereby blocking the passage of the hole of the component attached to the stopper 84. For example in the case of a carrying strap 50 being connected to the support frame 60, the key extends beyond the stopper channel 85 such that the connection hole 54 cannot pass the end of the stopper 84 thereby keeping it connected to the support frame 60. In some variants the key may be a piece of wire which is passed through the stopper channel 85 before the ends are wound around each other to prevent it from sliding out

of the stopper channel 85 unintentionally. The key may be removed from the stopper channel 85 if the parts of the mounting system 10 is to be disengaged, e.g. if the position of the support frame 60 is to be adjusted with respect to the suspension means 30 by changing which of the connection holes 54 the support frame 60 is connected to.

[0129] The use of a round stopper 84 with a key in a stopper channel 85 is particularly beneficial with respect to the carrying straps 50 as some of them may be released at the first end connected to the upper beam 20 while they remain attached at the second end connected to the support frame 60, such that the carrying strap 50 may rotate to be approximately perpendicular to the outer beam 62 of the support frame 60, thereby allowing access to hanging the articles 90 on the suspension means 30. The other carrying straps 50 may remain connected in both ends during such a procedure and once the articles in one area have been mounted the carrying strap 50 may be rotated back into place and connected to an upper beam 20. In such cases a fastening means 80 in the form of a stopper 84 may be preferable to a locking ring 82 as it may have more clearance for rotation than in the tight fit of a locking ring 82. However, some or all of the carrying straps 50 may still be connected using locking ring 82 which are also capable of being removed to release and remove, replace or rotate the carrying straps 50 or other components of the mounting system 10.

[0130] While Fig. 5 shows the lower beam 70 being mounted using a beam tap 72 and the carrying strap 50 being mounted using a stopper 84 it is to be understood that this is simply an example embodiment and that other embodiments may for example use only one type of locking ring connection, the outer beam 62 may comprise protrusions for the connection holes 54 of the carrying strap 50 to engage with and/or stoppers 84 may be used for the connection of beams 68,64,70.

[0131] In a preferred embodiment of the mounting system 10 the components of the mounting system 10 are dimensioned such that all locking rings 82 used with the same mounting system 10 are of substantially the same dimensions, such that sorting and choosing locking rings for each connection is not necessary thereby simplifying the assembly process. In other embodiments it may be preferable to use locking rings 82 with different dimensions depending for the various types of connections to provide the necessary strength of the various components which will be subject to different stresses during the handling and surface coating procedures.

Claims

1. A mounting system for holding at least one article such as a profile during a hot-dipping surface treatment, said mounting system comprising

a suspension means adapted for attaching to a

- first end of said article,
a support frame for supporting a second end of
said article resting on said support frame, said
second end being opposite to said first end, said
support frame being positioned below said sus-
pension means. 5
2. The mounting system according to claim 1, compris-
ing an upper beam for receiving said suspension
means, said suspension means being releasably
connected to said upper beam. 10
3. The mounting system according to any of the pre-
ceding claims comprising a plurality of upper beams
for supporting a plurality of suspension means. 15
4. The mounting system according to any of the pre-
ceding claims said upper beam comprising a slit for
receiving part of said suspension means, said slit
being located in the side of said upper beam facing
said support frame. 20
5. The mounting system according to any of the pre-
ceding claims said upper beam comprising a slot for
receiving part of said mounting means, said slot be-
ing in a different side of said upper beam than the
side facing the support frame. 25
6. The mounting system according to any of the pre-
ceding claims, said mounting system comprising a
locking plate for releasably fixing said suspension
means to said upper beam, said locking plate com-
prising locking slots adapted to engage taps of the
suspension means. 30
7. The mounting system according to any of the pre-
ceding claims, said suspension means being a hook,
said hook comprising an elongated part, and at a
first end of said elongated part said hook comprising
a protruding part for receiving said first end of said
article, said hook comprising an extension at a sec-
ond end of said elongated part for stabilizing the
mounting of said hook to said upper beam, said hook
comprising a tap for engaging a locking slot. 40
8. The mounting system according to claim, said sus-
pension means comprising a throughgoing hole for
receiving a crossbar. 45
9. The mounting system according to any of the pre-
ceding claims, said support frame comprising a lower
beam for receiving said second end of said article,
said lower beam being arranged substantially paral-
lel to said upper beam. 50
10. The mounting system according to claim 9, said up-
per beam and said lower beam being arranged stag-
gered with respect to each other such that an article
attached to a suspension means of the upper beam
will be angled when resting on said support beam.
11. The mounting system according to any of the pre-
ceding claims, said lower beam of said support frame
comprising a plurality of serrations for pointwise sup-
porting said second end of said article, said plurality
of serrations being on the upward facing side of the
lower beam.
12. The mounting system according to claim 11, said
plurality of serrations comprising at least one pro-
truding serration, the height of said protruding ser-
ration being larger than the height of remaining plu-
rality of serrations, such as the height of said pro-
truding serration being 1.5-20 times the height of the
remaining plurality of serrations, such as 3-10 times
the height of the remaining plurality of serrations.
13. The mounting system according to any of the pre-
ceding claims, comprising a carrying strap for ad-
justably fixing the distance between said upper beam
and said support frame, said carrying strap being
releasably connected to said upper beam.
14. The mounting system according to claim 13, each
of said carrying straps having at a first end a through-
going connection notch for connecting to said upper
beam and each of said carrying straps having at a
second end at least two throughgoing connection
eyes for connecting to said support frame.
15. The mounting system according to any of the pre-
ceding claims, parts of said mounting system being
releasably assembled using locking means such as
locking rings and/or stoppers. 55

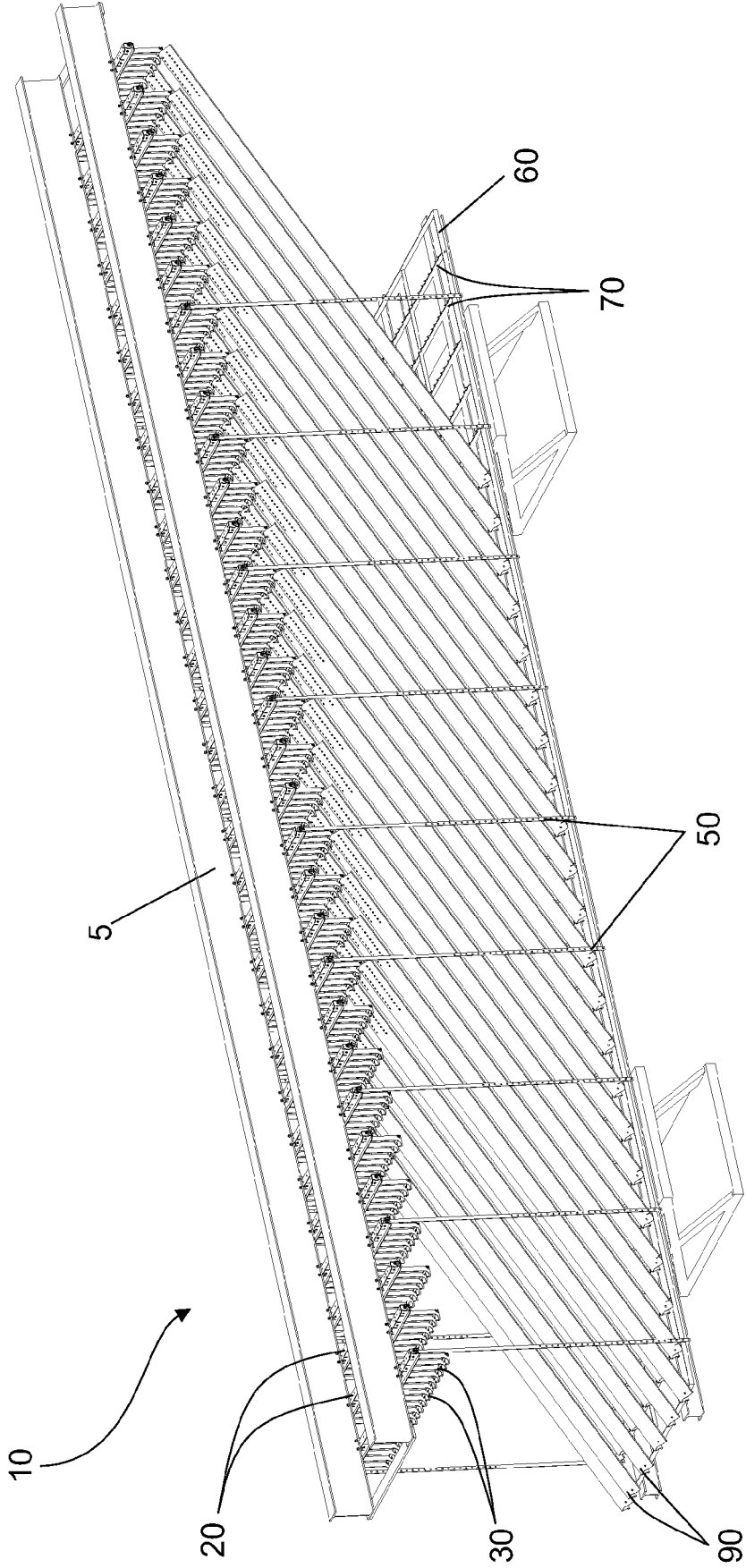


FIG. 1

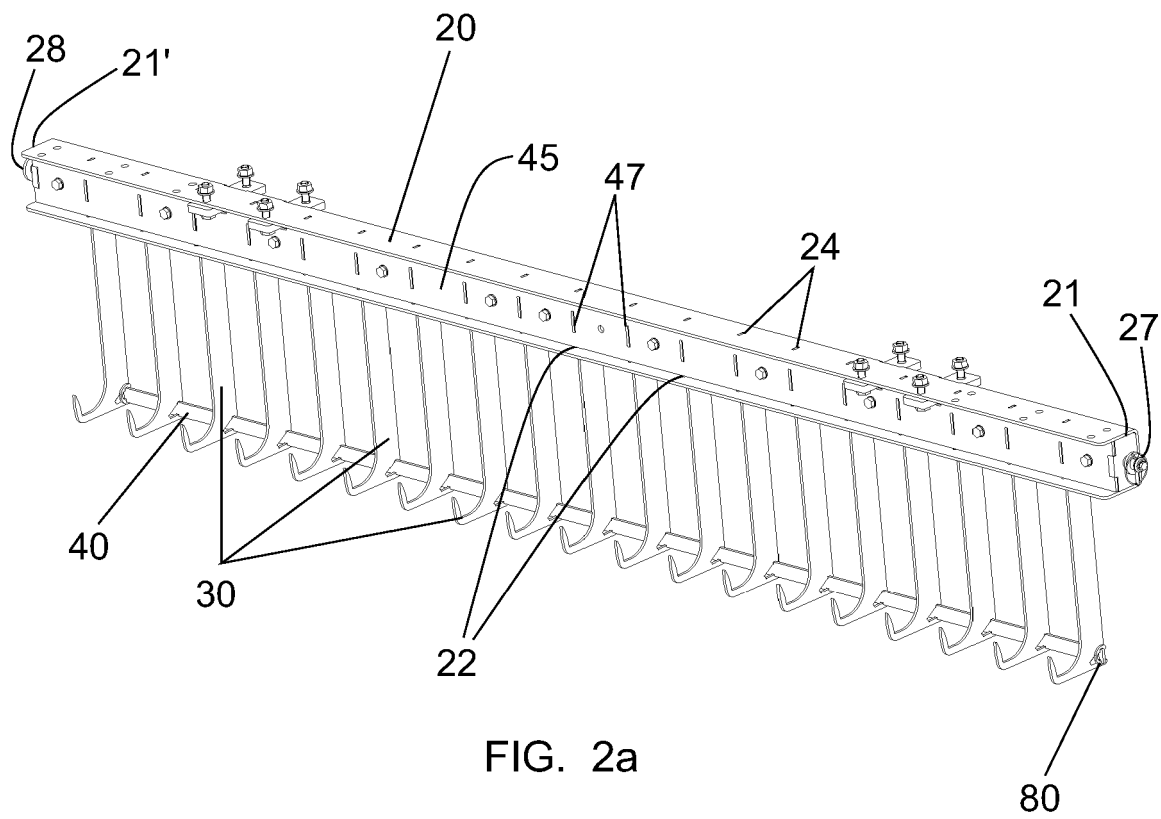


FIG. 2a

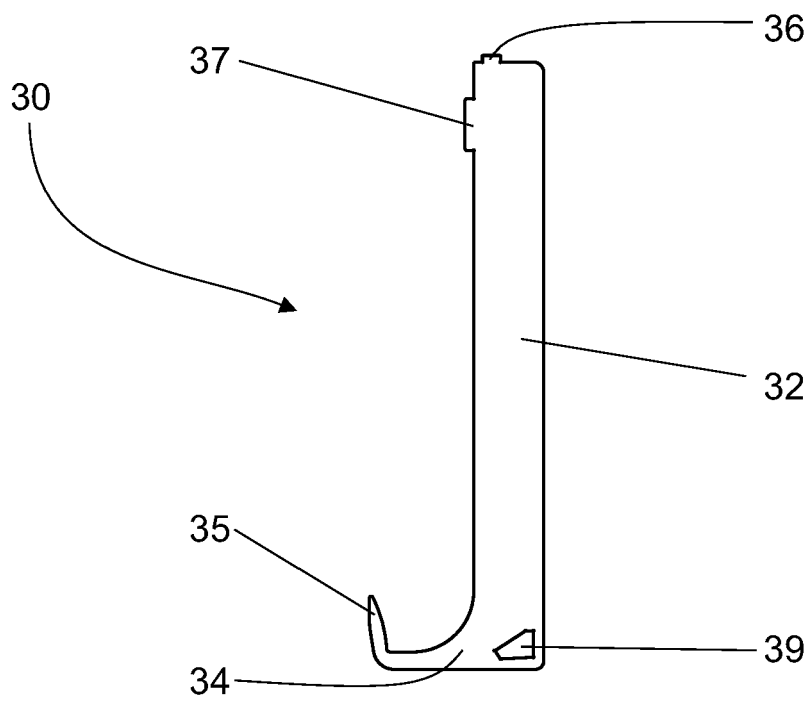


FIG. 2b

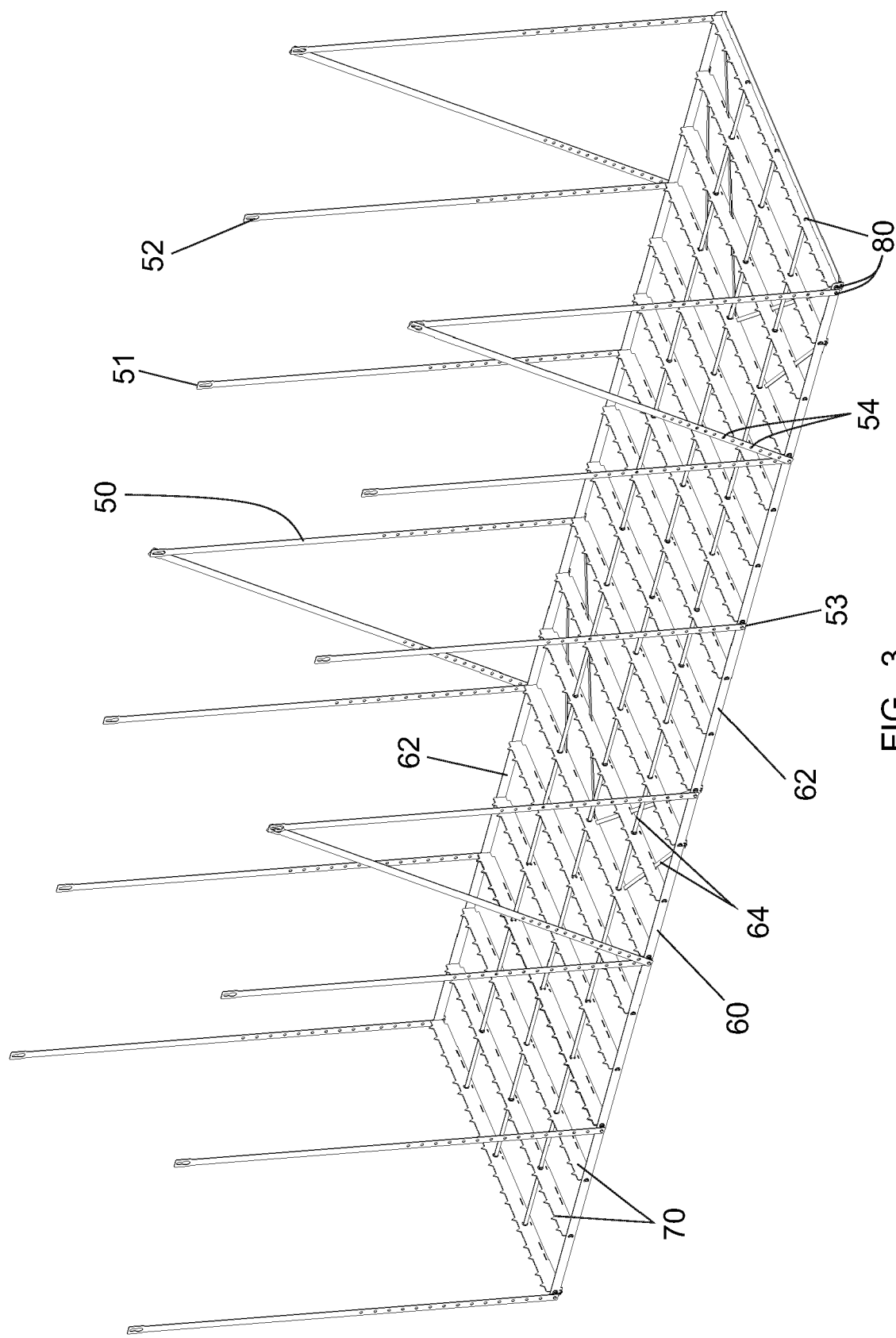


FIG. 3

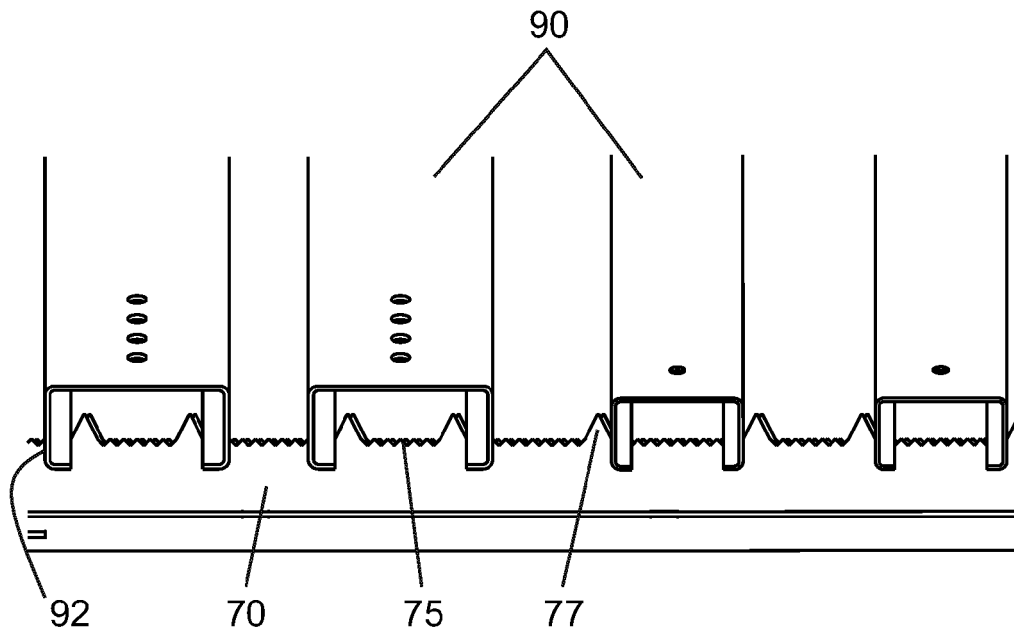


FIG. 4

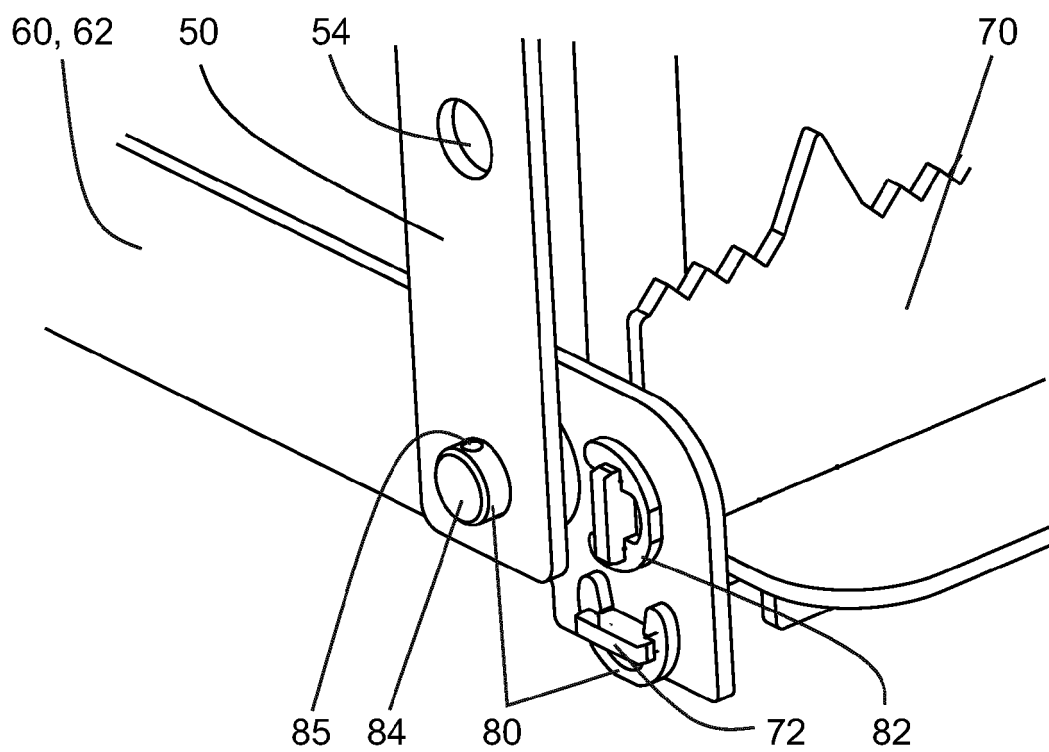


FIG. 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 21 20 2254

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			C23C F27D C25D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		12 November 2021	Chalaftris, Georgios
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			

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