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(54) **Equipment for drying flexible laminar surfaces**

(57) Equipment (1) for drying flexible laminar surfaces including a conditioning tunnel (2), which temporarily receives the laminar surfaces treated with liquid agents in order to perform a drying operation on them, and ad-
duction means (3), operatively connected with the conditioning tunnel (2), suitable to transport the surfaces to the conditioning tunnel (2), comprising a set of support

belts (4), each equipped with an upper surface (4a) suitable to temporarily receive in spread position a laminar surface, said support belts (4) being operatively connected with actuator means which move each of the support belts (4) into the conditioning tunnel (2).

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Description

[0001] The present invention concerns an improved equipment for drying flexible laminar surfaces, particularly the treated leathers in tannery industry.

[0002] As known, the finishing of the flexible laminar surfaces, such as animal leathers, is the final step of the entire process of treatment and includes the combination of the operations of painting, drying, printing and so on, intended to ennoble the flexible laminar surface previously treated in other equipments.

[0003] The aforesaid operations affect essentially the working of the surface layer of the leather in order to assure that this latter takes appropriate characteristics in relation to the outward appearance, touch and mechanical strength, fundamental properties for the quality of the finished product.

[0004] The sequence and type of operations which qualify the process of finishing predominantly depend on the features of the good item to be produced, and from the physical/chemical features of the semifinished material to be finished.

[0005] In particular, the painting operation takes place in a spray booth where the laminar surfaces, loaded on a conveyor belt, are treated through spraying means which provide to sediment paint on any of the sides of the laminar surface or leather, creating a liquid layer which, once dried, forms the finishing skin or film.

[0006] At the end of the painting process, such a film can include even several layers of paint, applied to the laminar surface by alternating sediment phases (performed through spraying, glazing, smearing and so on) to drying phases.

[0007] Once the painting phase is completed, the leathers, always advancing on a conveyor belt, such as of the threads type, cross a drying equipment where the drying of the paint previously deposited occurs and, finally, are discharged onto collection means for the sorting.

[0008] Drying times and methods are determined by the quantity and type of substances which make up the paint.

[0009] During drying, the flexible laminar surface, such as leather, is extremely sensitive to dust present in the environment and to any mechanical contact carried on the painted side.

[0010] According to the known technique, current drying equipments comprise a drying tunnel which develops along a longitudinal direction and receives the laminar surfaces previously treated in the paint spray booth in order to perform on them the drying operation.

[0011] When the drying or cross-linking times of the film facing long, it would be necessary to get a tunnel of high length, solution which is inconvenient and sparely not feasible for the huge space which it would require inside a factory.

[0012] It is run to an auxiliary air-conditioning tunnel, coupled downstream with the drying tunnel from which

it receives the laminar surfaces in order to efficiently complete the drying operation.

[0013] The laminar surface is transported from the drying tunnel to the air-conditioning tunnel through adduction means, typically carriages with trays one stacked over the other (so-called "rack" system) or an aerial system comprising support poles ("sticks dryers").

[0014] In case of adduction means of the carriages type, leathers of reduced sizes, not exceeding the sizes of 2.5x1 meters, are laid down into the various trays.

[0015] In case of adduction means of poles type, leathers move suspended, on horseback of the various poles, resulting in practice hung during transport from the drying tunnel to the air-conditioning tunnel.

[0016] The carriages with the leathers laid down on the stacked trays and the support poles, one consecutive the other, on which the leathers are suspended enter into the air-conditioning tunnel where the final drying stage takes place, under prefixed conditions of temperature and air humidity.

[0017] Nevertheless, drying plants of the known art briefly just described present some recognized drawbacks.

[0018] The main drawbacks are related to the specific construction type of the used adduction means of the known equipment cited above.

[0019] Indeed, in case of equipments with sticks dryers, during transport from one tunnel to the other one, the flexible laminar surfaces are suspended on the support poles from which hang down, according to a vertical plane, for almost all of their section.

[0020] This leads to two kinds of drawbacks, the first one of which is represented by the fact that the flexible laminar surface, at the section which rests on the support pole, is subjected to stresses which nullifies the quality of the finished product.

[0021] Secondly, the treatment sustained by the flexible laminar surface in the next step into the air-conditioning tunnel is not entirely homogeneous and uniform at least at the section of the laminar surface itself which is supported by the pole.

[0022] Another drawback of the equipments with sticks dryers refers to the fact that the condition assumed by the flexible laminar surface during transport, suspended on the support pole and then hanging down, involves an inevitable, although minimal, surface sliding of the residual liquid paint not yet settled and dried, with consequent loss of quality of the finished product and sometimes necessity to perform a new cycle of painting and subsequent drying.

[0023] In case of transport equipment with the "rack" system, a first drawback comes from the fact that through the adduction means of the trays type it is not possible to transport laminar surfaces of any size, but only laminar surfaces having maximum size of about 2,5x1 meters.

[0024] Furthermore, a drawback common to both the mentioned finishing equipments is represented by the fact that the air-conditioning tunnel is able to process only

flexible laminar surfaces of the same type, therefore lots formed by laminar surfaces just subjected to a specific painting and intended to a well defined application.

[0025] This means that the operative conditions inside the air-conditioning tunnel, in terms of temperature, humidity and air treatment, once set, remain necessarily as such until the end of the production lot formed by a particular type of flexible laminar surfaces which require the same treatment in the conditioning tunnel.

[0026] Change of the aforesaid operative conditions occurs at present only by stopping the operation of the equipment.

[0027] The known equipments, therefore, do not allow to adapt continuously, without stopping the equipment, the operative conditions inside the conditioning tunnel to the variation of the type of flexible laminar surface to be treated, thus resulting little versatile in this regard.

[0028] The present invention aims to overcome the drawbacks of the known art described above.

[0029] In particular, main purpose of the invention is to provide an improved equipment for drying flexible laminar surfaces which, compared to equivalent equipments of the known type, allows to improve the quality of the finished product, at least with reference to the drying process.

[0030] Within such a purpose, it is a task of the present invention to provide an improved equipment for drying flexible laminar surfaces in which the adduction means are able to transport any flexible laminar surface to the conditioning tunnel in a more appropriate manner, without locally stressing it.

[0031] It is another task of the present invention to make available an improved equipment for drying flexible laminar surfaces which allows a treatment in the conditioning tunnel more efficient, uniform and homogeneous than the prior art.

[0032] It is a further task of the invention to implement an improved equipment for drying flexible laminar surfaces which, compared to the state of the art, reduces the surface sliding of the not yet fully dried paint on the laminar surfaces themselves.

[0033] It is a last but not least purpose of the present invention to plan an improved equipment for drying flexible laminar surfaces of simple construction such as to be fitted out in reasonable times even in yet existing production factories or to allow the conversion to its technical features of already operating similar equipments of the known type.

[0034] The aforesaid purposes are achieved through an improved equipment for drying flexible laminar surfaces as to the attached claim 1, to which they refer for the sake of brevity.

[0035] Additional features of detail of the improved equipment of the invention are set forth in the corresponding dependent claims.

[0036] Advantageously, the improved equipment of the invention allows to obtain at the end of the drying process flexible laminar surfaces of high quality, under-

stood as softness, aesthetic effect and mechanical strength, greater than that one offered by similar equipments currently available on the market in the tannery field.

[0037] Through the improved equipment of the invention, namely the adduction means with which it is provided, the flexible laminar surfaces remain substantially always in a horizontal position during the drying process: this allows to maximize the effectiveness of the treatments performed upstream, during and downstream the drying process.

[0038] Still advantageously, the improved equipment according to the invention allows to effectively and optimally treat in the time unit a large number of flexible laminar surfaces.

[0039] Equally advantageously, the improved equipment which is here claimed can be mounted by experienced technicians in the field with efforts at least comparable to those ones of equipments of the known type.

[0040] In advantageous manner, moreover, the improved equipment of the invention is able to operate on any type of flexible laminar surface, regardless of the sizes of the latter.

[0041] Said purposes and advantages, as well as others which will emerge below, will appear to a greater extent by the following description relating to a preferred embodiment of the invention given by illustrative, but not limited to, way with the help of the attached drawings in which:

- figure 1 is a simplified and schematic side view of the equipment of the invention;
- figure 2 is an enlargement of figure 1.

[0042] The improved equipment of the invention, used for drying flexible laminar surfaces, such as leathers, synthetic leathers, hides and similar, not shown for simplicity, is shown in figure 1, where it is globally indicated with 1.

[0043] It is observed that the improved equipment 1 includes a conditioning tunnel, overall indicated with 2, which temporarily receives the laminar surfaces treated with liquid agents, for example inside a paint spray booth, in order to perform a drying operation on them.

[0044] The improved equipment 1 includes adduction means, as a whole indicated with 3 and operatively connected with the conditioning tunnel 2, carrying the laminar surface to the conditioning tunnel 2.

[0045] According to the invention, the adduction means 3 include a plurality of support belts, each denoted with 4 and equipped with an upper surface 4a adapted to temporarily receive in a spread position a laminar surface, operatively connected with actuator means, not visible in the enclosed figures, which move each of the support belts 4 into the conditioning tunnel 2.

[0046] Preferably but not necessarily, the improved equipment 1 includes a drying tunnel, on the whole indicated with 5, which insists on a reference surface P, for example the floor of an industrial factory, and temporarily

receives laminar surfaces in order to perform on the latter a preliminary drying operation.

[0047] In particular, the drying of the paint from the flexible laminar surfaces is assigned for about 90% to the drying tunnel 5 and for the remaining percentage to the conditioning tunnel 2.

[0048] The drying tunnel 5 is placed upstream the conditioning tunnel 2 with which is operatively connected through a part of the aforesaid adduction means 3.

[0049] The drying tunnel 5 is of the type in itself known to the person in the art, including for example a series of fans 6 which are interested in succession by the passage of the flexible laminar surface advancing along the direction indicated by the arrow F.

[0050] The conditioning tunnel 2 is connected superiorly with the drying tunnel 5: this design choice allows to preserve space at the industrial factory in which the improved equipment 1 is mounted, without affecting in any way the performance of the equipment 1 since the flexible laminar surfaces are subjected to a double and subsequent drying process.

[0051] Advantageously, the improved equipment 1 includes control means, not illustrated and constituted for example by a central processing and control unit which can be programmed by the user, electrically connected with the actuator means in order to adjust their operation so that the actuator means themselves move each of the support belts 4 from a first position, in which is faced to the outlet 5a of the drying tunnel 5, to a second position in which is contained inside the conditioning tunnel 2.

[0052] In advantageous way, the adductions means 3 also include guide means, on the whole indicated with 7, operatively connected with the actuator means.

[0053] The guide means 7, such as rollers sliding on rails, support the support belts 4 and define between the drying tunnel 5 and the conditioning tunnel 2 an articulated closed circuit 8, better highlighted in figure 2, along which the actuator means move the support belts 4.

[0054] Figure 2 shows, also, that the support belts 4 are arranged one adjacent and consecutive to another on the guide means 7 and present each a cantilevered first end 4b and a second end 4c fixed to the guide means 7.

[0055] The upper surface 4a of each of the support belts 4 defines a plane, for example with an area of 3,5x3,5 meters, on which each of the laminar surfaces is supported in a spread position.

[0056] These dimensions of the upper surface 4a of every support belt 4 allow to move any type of flexible laminar surfaces in general treated in the tannery industry, as known having sizes lower than 3,5x3,5 meters.

[0057] In the aforesaid first position of each of the support belts 4, such a plane is sloped of an acute angle α with respect to a horizontal direction X.

[0058] Preferably but not necessarily, each of the support belts 4 is connected by transmission means, not shown, with an engine member and communicates with the drying tunnel 5 through an inclined cross ramp 9,

coupled externally with the treatment chamber 10 of the drying tunnel 5 and at the outlet 5a.

[0059] In practice, in the aforesaid first position, each of the support belts 4 constitutes the extensions of the cross ramp 9 along the sloped plane previously cited.

[0060] According to the preferred embodiment of the invention described herein, the conditioning tunnel 2 comprises an outer casing 11 and an inner framework 12 which defines a plurality of elementary cells 13, aligned one with another along a pair of vertical longitudinal directions Y_1 and Y_2 parallel each other.

[0061] In that second position mentioned before, each of the elementary cells 13 houses one of the support belts 4 on which the laminar surface is spread.

[0062] Moreover, each of the elementary cells 13 belonging to the first longitudinal direction Y_1 is side-by-side and horizontally coplanar to one of the elementary cells 13 belonging to the second longitudinal direction Y_2 .

[0063] In addition, each of the elementary cells 13 defined along the first direction Y_1 communicates with the adjacent elementary cell 13 defined along the longitudinal direction Y_2 through lateral openings, not shown, made in the vertical uprights 17 of the inner framework 12.

[0064] Beyond this, each of the elementary cells 13 defined along the first longitudinal direction Y_1 is pneumatically insulated and independent from the elementary cell 13 defined along the second longitudinal direction Y_2 and flanked and coplanar to it.

[0065] Finally, the elementary cells 13 defined along each of the longitudinal directions Y_1 , Y_2 are mechanically separated and insulated each other through horizontal beams 14 belonging to the inner framework 12.

[0066] In preferred but not exclusive manner, each of the elementary cells 13 includes diffusion means, on the whole indicated with 15, operatively connected with the control means and facing towards the inside of the elementary cells 13.

[0067] The diffusion means 15, such as a series of spraying nozzles for distributing conditioned air, act on the flexible laminar surface which little by little is housed in the various elementary cells 13 in order to dry it.

[0068] It is understood that other embodiments of the invention may provide that the elementary cells are aligned each other even along a single longitudinal direction or along more than two longitudinal directions parallel each other: this aspect depends on the constructive choice and needs also dictated by the available spaces in the productive factory.

[0069] In any case, the aforesaid constructive concept of the conditioning tunnel 2, a sort of operative storehouse, allows to effectively process in the time unit a large number of flexible laminar surfaces, keeping them continuously in a horizontal position, ideal to assure uniformity and homogeneity of treatment to the finished product.

[0070] Furthermore, the provision of a proper number, for example ten, of elementary cells 13 along each longitudinal direction Y_1 , Y_2 allows to leave the flexible lam-

inar surfaces inside the conditioning tunnel 2 for the time required to effectively perform the final drying phase, as it will be better appear further on with the explanation of the operation of the improved equipment 1.

[0071] Mainly, however, the advantage brought by the aforesaid constructive concept of the conditioning tunnel 2 consists in that each elementary cell 13 is managed by the control means independently from the others in terms of temperature, humidity and operating conditions of the diffusion means 15.

[0072] This allows to treat simultaneously, without interruption, inside the conditioning tunnel 2 flexible laminar surfaces which even differs each other in respect to shape, thickness, colour, type of paint deposited, final destination and so on, contrary to what is allowed by similar equipments of known type.

[0073] The benefits in production terms are obvious, such as less stops of the equipment in order to program new operating conditions within the conditioning tunnel 2 when the type of the flexible laminar surface to be treated varies.

[0074] The operative flexibility allowed by the improved equipment 1 of the invention, thanks to the special kind of conditioning tunnel 2 with which is fitted, is extremely high and however greater than that one of the equipments of the known technique.

[0075] At preferential title, the improved equipment 1 of the invention includes collection means, which can be seen in figure 1 where they are as a whole indicated with 16 and consisting for example of a shaped stand, arranged downstream the conditioning tunnel 2 and supported by the reference surface P.

[0076] The collection means 16 are operatively connected in succession with each of the support belts 4 and are responsible to receive the laminar surfaces treated firstly in the drying tunnel 5 and subsequently in the conditioning tunnel 2.

[0077] In use, the flexible laminar surface, supplied by a paint spray booth, proceeds spread in the direction indicated by the arrow F in figure 1 inside the drying tunnel 5 of the improved equipment 1, where it undergoes a first and massive drying by means of the fans 6.

[0078] Reached the outlet 5a of the drying tunnel 5, the flexible laminar surface meets the cross ramp 9 which eases its passage to the first support belt 4 available, arranged in sloped position and directly drooping in front of the ramp 9 itself.

[0079] The flexible laminar surface remains spread even on the upper surface 4a of the first support belt 4, in a slightly inclined position with respect to a horizontal plane.

[0080] At that point, the control means, through the guide means 7, drive the movement of the first support belt 4, comprising the spread laminar surface, along a stretch of the articulated circuit 8 towards the conditioning tunnel 2, while keeping the first belt 4 in an almost horizontal position.

[0081] When the first support belt 4 in question is ad-

jacent to the conditioning tunnel 2, it is pushed into the lower elementary cell 13 (advancing the longitudinal direction Y_1 from the bottom to the top) of the inner framework 12, where it is temporarily housed so that the laminar surface undergoes the second and final drying operation.

[0082] In the meanwhile, another flexible laminar surface is housed in a second support belt 4 in the same way just described for the first support belt 4 which precedes it.

[0083] Like the first belt 4, even the second belt 4 is driven by the control means, through the actuator means, to the conditioning tunnel 2 and pushed into the same elementary cell 13, which already houses the first belt 4 containing a laminar surface subjected to final drying.

[0084] In doing so, the second belt 4 interferes with the first belt 4, pushing it into the elementary cell 13 adjacent and defined along the longitudinal direction Y_2 , taking the place of the first support belt 4 in the lower elementary cell 13 defined along the longitudinal direction Y_1 .

[0085] In turn, the first support belt 4 is housed in the lower elementary cell 13 defined along the longitudinal direction Y_2 parallel to the longitudinal direction Y_1 .

[0086] This operative sequence is repeated for subsequent flexible laminar surfaces coming from the drying tunnel 5 until all the elementary cells 13 of the conditioning tunnel 2 are gradually filled with a support belt 4 complete with a flexible laminar surface on its upper surface 4a.

[0087] At that moment, the following support belt 4, complete with a flexible laminar surface and defined for the sake of expositive convenience "new cycle" belt, which is conveyed to the conditioning tunnel 2 is pushed into the lower elementary cell 13 along the longitudinal direction Y_1 .

[0088] In this way, the new cycle belt 4 pushes the second belt 4 already housed in the lower elementary cell 13 along the longitudinal direction Y_1 , which in turn pushes outside the conditioning tunnel 2 the first support belt 4 which is inside the conditioning tunnel 2 for the longest time.

[0089] When the new cycle belt 4 is properly housed in the lower elementary cell 13 along the direction Y_1 , the second belt 4 is in the lower elementary cell 13 along the longitudinal direction Y_2 and the first belt 4 is completely outside the conditioning tunnel 2: this means that the phase of final drying of the flexible laminar surface brought by the first support belt 4 has been completed.

[0090] The first belt 4, always in the horizontal position, is driven by the guide means 7 along the articulated circuit 8 to the collection means 16 for sorting.

[0091] The operative cycle described above is repeated for the other support belts 4 yet housed in the conditioning tunnel 2 which are in succession pushed outside the tunnel 2 itself by new support belts 4 entering into the tunnel 2.

[0092] On the basis of what just exposed, it is under-

stood, therefore, that the improved equipment for drying flexible laminar surfaces of the invention reaches the purposes and achieves the advantages mentioned above.

[0093] In execution phase, changes could be made to the equipment of the invention consisting, for example, in a number of support belts different from that one shown in the drawings which follow, this number varying at will starting from one.

[0094] In addition, alternative embodiments of the improved equipment of the invention may exist, in which the adduction means present conformation different from that one described above, provided that it is able to support flexible laminar surfaces in their spread and not suspended position, as it happens, instead, in the current similar equipments.

[0095] Moreover, the drying tunnel may be of a type different from that one shown in the appended drawings, which does not affect the advantage brought by the present invention. It is clear that numerous other variations can be made to the improved equipment in question, without for this reason going out of the novelty principles inherent to the inventive idea here expressed, as it is clear that, in the practical implementation of the invention, materials, shapes and sizes of the details illustrated could be any, depending on the needs, and replaced with others technically equivalent.

Claims

1. Improved equipment (1) for drying flexible laminar surfaces including:
 - a conditioning tunnel (2), suitable to temporarily receive said laminar surfaces treated with liquid agents in order to perform a drying operation of said laminar surfaces;
 - adduction means (3), operatively connected with said conditioning tunnel (2), suitable to transport said laminar surfaces to said conditioning tunnel (2),

characterized in that said adduction means (3) include one or more support belts (4), each of which is provided with an upper surface (4a) suitable to receive temporarily and in spread position one or more of said laminar surfaces, said support belts being operatively connected with actuator means suitable to move each of said support belts (4) inside said conditioning tunnel (2).
2. Equipment (1) as claim 1 **characterized in that** it includes a drying tunnel (5), suitable to insist on a reference surface (P) and temporarily receive said laminar surfaces in order to perform on them a preliminary drying operation, positioned upstream said conditioning tunnel (2) with which is operatively connected through said adduction means (3).
3. Equipment (1) as claim 1) or 2) **characterized in that** it comprises control means electrically connected with said actuator means to adjust the functioning thereof so that said actuators means move each of said support belts (4) from a first position in which is faced to the inlet (5a) of said drying tunnel (5) to a second position in which is contained inside said conditioning tunnel (2).
4. Equipment (1) as claim 2) or 3) **characterized in that** said adduction means (3) comprise guide means (7), operatively connected with said actuators means and supporting said support belts (4), said guide means (7) defining between said drying tunnel (5) and said conditioning tunnel (2) an articulated closed circuit (8) along which said actuators means move said support belts (4).
5. Equipment (1) as claim 4) **characterized in that** it includes a plurality of said support belts (4), arranged one next and consecutive to another on said guide means (7) and having each with a cantilevered first end (4b) and a second end (4c) fixed to said guide means (7)
6. Equipment (1) as any of the claims from 3) to 5) **characterized in that** said upper surface (4a) of each of said support belts (4) defines a plane on which each of said laminar surfaces is spread and which, in said first position, is sloped of an acute angle (α) with respect to a horizontal direction (X).
7. Equipment (1) as any of the claims from 3) to 6) **characterized in that** each of said support belts (4) is connected by transmission means with an engine member and communicates with said drying tunnel (5) through an inclined cross ramp (9), coupled externally with the treatment chamber (10) of said drying tunnel (5) and at said outlet (5a).
8. Equipment (1) as any of the claims from 3) to 7) **characterized in that** said conditioning tunnel (2) includes an outer casing (11) and an inner framework (12) which defines a plurality of elementary cells (13), aligned one with another along one or more longitudinal directions (Y_1, Y_2), each of said cells (13) being suitable to house one of said support belts (4) in said second position.
9. Equipment (1) as claim 8) **characterized in that** said elementary cells (13) are aligned one with another along a first (Y_1) and a second vertical longitudinal direction (Y_2), each of said elementary cells (13) defined on said first direction (Y_1) being side-by-side and horizontally coplanar to one of said elementary cells (13) defined on said second direction (Y_2) with which communicates through lateral openings made in vertical uprights (17) of said inner framework (12).

10. Equipment (1) as claim 8) or 9) **characterized in that** each of said elementary cells (13) defined along said first longitudinal direction (Y_1) is pneumatically insulated and independent from one of said elementary cells (13) defined along second longitudinal direction (Y_2) horizontally flanked to it. 5
11. Equipment (1) as any of the claims from 8) to 10) **characterized in that** said elementary cells (13) of each of said longitudinal directions (Y_1 , Y_2) are mechanically separated and insulated one from each other through horizontal beams (14) of said inner framework (12). 10
12. Equipment (1) as any of the claims from 8) to 11) **characterized in that** each of said elementary cells (13) comprises diffusion means (15), operatively connected with said control means and facing towards the inside of said elementary cells (13), suitable to act on each of said laminar surface to dry it. 15 20
13. Equipment (1) as any of the claims from 2) to 11) **characterized in that** said conditioning tunnel (2) is superiorly connected with said drying tunnel (5). 25
14. Equipment (1) as any of the previous claims **characterized in that** it comprises collection means (16), arranged downstream said conditioning tunnel (2) and operatively connected in succession with each of said support belts (4), suitable to receive and support said laminar surfaces treated in at least said conditioning tunnel (2). 30

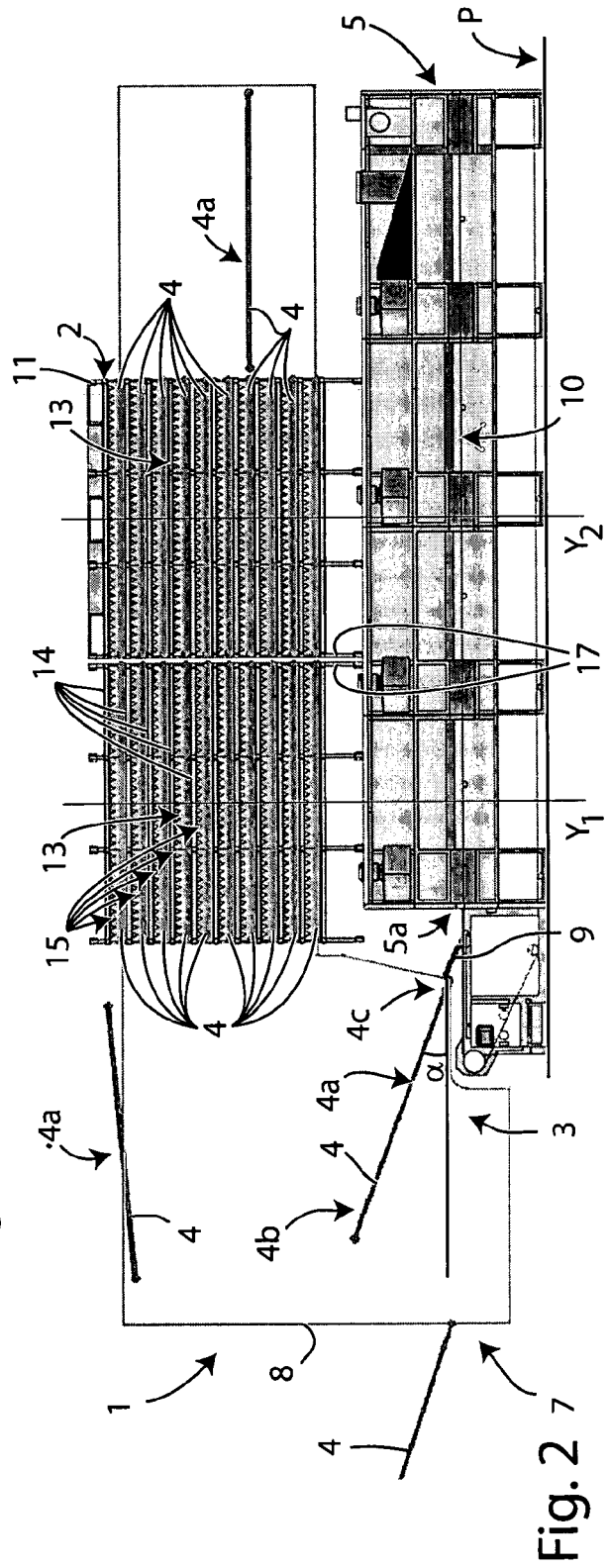
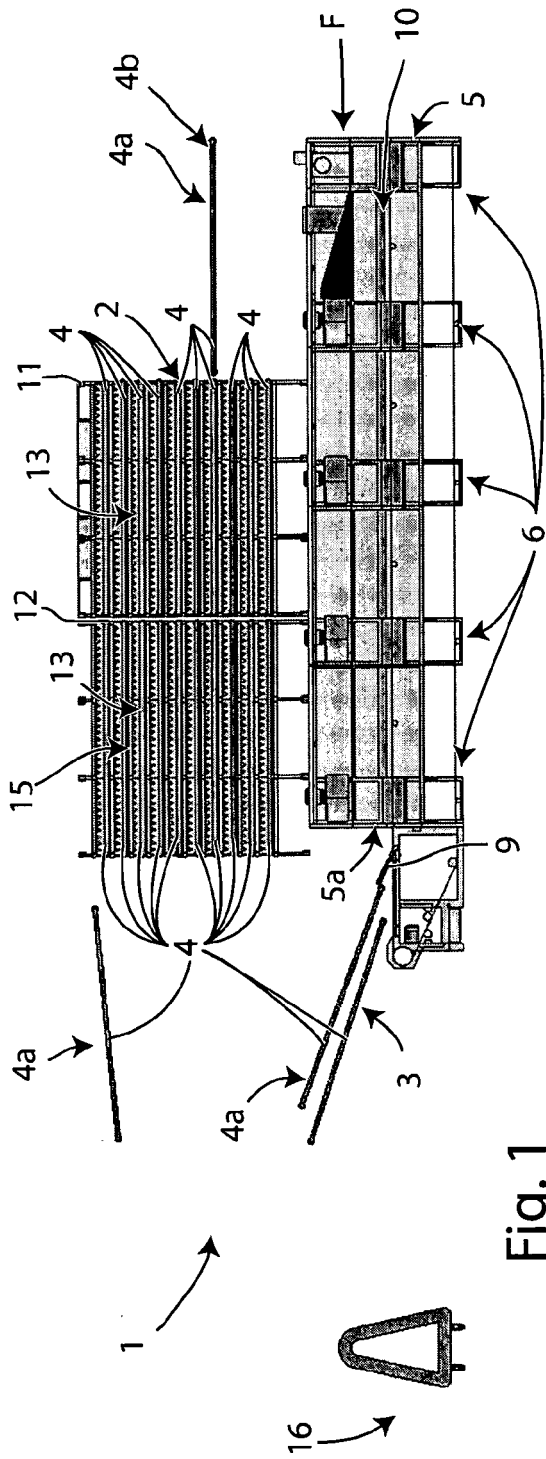
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EUROPEAN SEARCH REPORT

 Application Number
EP 09 42 5476

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Place of search Munich		Date of completion of the search 16 February 2010	Examiner Bichi, Marco
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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