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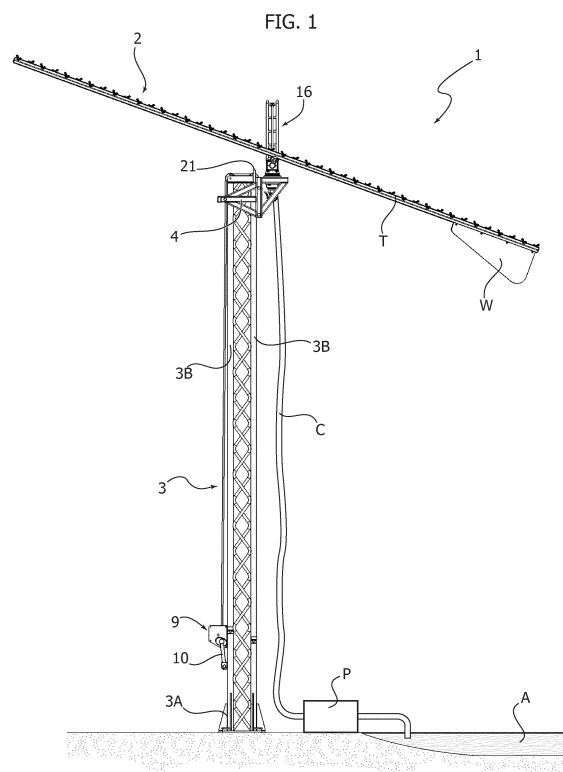
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(54) **Vaporizing device for dispersing water in the air**

(57) A vaporizing device for use in dispersing water in the air comprises a tower-like supporting structure (3) on which there is rotatably mounted a distributing structure (2) for dispensing vaporized jets of water. The distributing structure (2) comprises a plurality of dispensing tubes (T) which are parallel to, and spaced apart from, each other, these tubes being carried in a rack-like fashion by a supporting tubular cross-member (13) rotatably mounted around a vertical axis (7) on a platform (6) carried by the tower-like structure (3). The dispensing tubes (T) are provided with a plurality of dispensing nozzles (U) oriented along different directions and distributing along each dispensing tube (T). Each dispensing nozzle (U) is for receiving water under pressure fed by a pump which draws water from a basin, through a path defined within the supporting tubular cross-member (13) and within each dispensing tube (T). The rotatable distributing structure (2) includes one or more planar surfaces (W) shaped and arranged for automatically orienting the distributing structure (2) in the wind, so that the dispensing tubes (T) extend substantially along the wind direction, thus favouring the dispersion of the vaporized jets in the air. In a preferred example, the platform (6) is carried by a carriage (4) vertically guided along the tower-like structure (3) and movable between an operative raised position and a lowered position, in which maintenance operations can be carried out. The device comprises a self-centering system including a fixed cam member (21) which causes the tubular cross-member (13) to rotate around its articulation axis (7) when this cross-member is in a position which would interfere with the tower-like structure (3) during lowering of the platform (6).



Description

Field of the invention

[0001] The present invention relates to devices and apparatus which can be used for draining water from water basins. In various industries, such as in mining, in the oil industry, in power plants or also in the food industry, there is the problem of the disposal of large quantities of water. Increasingly strict regulations encourage the provision of methods for draining and disposing water used in industrial processes which comply with environmental requirements to a high degree.

Object of the invention

[0002] In view of solving this problem, an ideal solution appears to be that of dispersing waters through vaporization in the air. The object of the present invention is that of providing a device which exploits this principle in a simple, efficient and inexpensive way.

Summary of the invention

[0003] In view of achieving this object, the invention provides a vaporizing device which can be used for dispersing water in the air, characterized in that it comprises:

- a tower-like supporting structure,
- a distributing structure, for dispensing vaporized water jets, which is rotatably mounted around a vertical axis on said tower-like structure,
- wherein said distributing structure comprises a plurality of dispensing tubes which are parallel to, and spaced apart from, each other, said tubes being carried in a rack-like fashion by a supporting tubular cross-member which is rotatably mounted around said vertical axis on said tower-like structure,
- wherein said dispensing tubes are provided with a plurality of dispensing nozzles oriented along different directions and distributed along each dispensing tube,
- wherein each dispensing nozzle is for receiving water under pressure through a path defined within said supporting tubular cross-member and within each dispensing tube, and
- wherein said distributing structure includes one or more planar surfaces shaped and arranged so as to automatically orient said rotatable distributing structure in the wind direction, so that the dispensing tubes extend substantially along the wind direction, thus favouring dispersion of the vaporized jets in the air.

[0004] In the preferred embodiment, the above mentioned planar surfaces which automatically orient the dispensing tubes in the wind direction are carried at one end of one or more dispensing tubes.

[0005] In the above mentioned preferred embodiment, moreover, the dispensing tubes are arranged in a theoretical common plane which is inclined with respect to a horizontal plane by an angle between 0° and 45° and preferably between 10° and 30°. Due to this feature, the interference between the jet ejected by each vaporizing nozzle and the jets ejected by the adjacent nozzles is further decreased, which increases the efficiency in dispersion of the vaporized jets in the air.

[0006] According to a further preferred feature, the cross-member supporting the dispensing tubes is rotatably mounted on a platform carried by a carriage which is vertically movable on the tower-like structure between an operative raised position and a lowered position, which makes maintenance operations easier.

[0007] In an exemplary embodiment, the vertical movement of the carriage is driven manually by means of a hand winch on which a cable for lifting the carriage is wound, this cable being engaged on pulleys carried by the tower-like structure.

[0008] Moreover, also according to a preferred feature, there is provided a self-centering system constituted by a guiding member arranged at the top of the tower-like structure, this guiding member being adapted to engage the supporting cross-member when the vertically movable platform is lowered, in order to automatically cause the cross-member to rotate towards a position where it does not interfere with the tower-like structure during lowering of the platform.

Brief description of the drawings

[0009] Further features and advantages of the invention will become apparent from the following description with reference to the annexed drawings, given purely by way of non-limiting example, in which:

- figure 1 is a side elevational view of a preferred embodiment of a vaporizing device according to the invention,
- figure 2 is a plan view of the device of figure 1,
- figure 3 is a front elevational view of the device of figure 1,
- figure 4 is a perspective view of the distributing structure forming part of the device according to the invention,
- figure 5 is a view at an enlarged scale of a detail of figure 1,
- figure 5A shows a detail of figure 5 in a further enlarged scale,
- figure 6 shows the hand winch forming part of the device of figure 1,
- figure 7 shows a further detail at an enlarged scale, which shows the self-centering system forming part of the device according to the invention,
- figure 8 is a cross-sectional view taken along line VIII-VIII of figure 7,
- figure 9 is a cross-sectional view of a dispensing tube

- forming part of the device of the invention,
- figure 10 shows one of the nozzle-carrying units provided on each dispensing tube, and
- figure 11 is a view of a nozzle, partially in cross-section.

Description of a preferred embodiment

[0010] In the drawings, reference numeral 1 designates a preferred embodiment of the device according to the invention. Device 1 is to be used in open air, in areas where there is the need of draining basins formed by waters which are used in industrial processes, such as in the mining industry. In figure 1 there is diagrammatically illustrated a water basin A which is drained by drawing water from basin A through a pump P which feeds the water in a pipe C connected to the distributing system forming part of device 1. The details of pump P are not described herein, since this pump can be of any known type and does not fall, taken alone, within the scope of the present invention.

[0011] Device 1 is able of dispersing the water flow fed to pipe C in the air through a distributing system 2, described in detail in the following, which is mounted upon a tower-like supporting structure 3.

[0012] In the illustrated example, the tower-like supporting structure 3 is constituted by a metal tower having a base 3A anchored to the ground and a height which in an actual exemplary embodiment was about 6.0 meters.

[0013] On the tower-like structure 3 there is mounted a vertically movable carriage 4 having freely rotatable wheels 5 which are guided on uprights 3B of the tower-like structure 3 (see figure 5).

[0014] Carriage 4 carries a platform 6 on which the distributing structure 2 is rotatably mounted around a vertical axis 7 (figures 5, 5A) by means of a wheel-like bearing 8.

[0015] Due to this arrangement, the platform 6 carrying the distributing structure 2 is vertically movable along with carriage 4 along the tower-like supporting structure 3 between a raised operative position (shown in figures 1, 3) and a lowered position, in which maintenance operations on the distributing structure 2 are made easier.

[0016] The vertical movement of carriage 4 is driven by means of a winch 9 (figures 5, 6) which can be operated manually by a crank 10. Winch 9 comprises a drum 9a for winding and unwinding a lifting cable 11 connected to the structure of carriage 4 and engaged on pulleys 12 freely rotatably mounted at the top of the tower-like structure 3. Naturally, with winch 9 there are associated safety means, of any known type, adapted to hold the winch in the position in which it is left after any operation. Also the structure of winch 9 can be made in any known way. In particular, according to conventional art, there is provided a gear transmission between the axis 9b of crank 10 and axis 9c of drum 9a (see figure 6) for reducing the force which must be applied by the operator. There are further provided stop means of any known type (not shown) both

on the tower-like structure 3 and carriage 4, which cooperate with each other to define the raised position and the lowered position of the distributing structure 2. One may provide that these stop means are such as to enable an adjustment of the above mentioned end positions of the carriage.

[0017] The distributing structure 2 is generally illustrated in figure 4. It comprises a supporting cross-member 13, arranged horizontally, which is centrally mounted rotatably around the vertical axis 7 on the platform 6, through the bearing 8 (figure 5A). To this end, under the cross-member 13 there is rigidly connected a plate 130 (figure 5A) which is rotatably mounted on the platform 6 through the bearing 8.

[0018] Cross-member 13 supports a plurality of dispensing tubes T which are parallel to, and spaced apart from, each other (figure 4), each tube being centrally secured to the cross-member 13 and extending orthogonally thereto, in a rack-like fashion.

[0019] In the preferred embodiment which is shown herein, the dispensing tubes T are arranged in a theoretical common plane which is inclined with respect to the horizontal plane by an angle between 0° and 45°, and preferably between 10° and 30° (see figure 1). In an actual embodiment this angle was 20°.

[0020] The tubular cross-member 13 fulfils the structural function of supporting the dispensing tubes T, and also acts as an inlet manifold for the flow of water under pressure coming from pipe C and headed towards the dispensing tubes T. The inner passage of the tubular cross-member 13 is therefore in communication both with the inner cavities of the dispensing tubes T, and with a connecting member 14 (figure 5A) for connection to pipe C. This connecting member 14 communicates to the inner passage of the tubular cross-member 13 through a rotatable coupling (not shown) of any known type, provided centrally through bearing 8, and through a vertical branch-off tube 131 of cross-member 13 (figure 5A) which is arranged through plate 130.

[0021] Also with reference to the specific illustrated example, the supporting cross-member 13 carrying the dispensing tube T is provided with an auxiliary supporting structure 15 (figure 4) including a central upright 16 projecting upwardly from the central portion of cross-member 13, and a pair of tie-cables 17 connecting the top of upright 16 to two rings 18 secured around the cross-member 13 adjacent to the ends thereof, so as to aid cross-member 13 in supporting the weight of the dispensing tubes T.

[0022] With reference to figures 9, 10 each dispensing tube T has a hollow cross-section (which is of quadrangular shape in the illustrated example) and carries a plurality of nozzle-carrying units 19 onto two of its faces, distributed throughout its longitudinal extension. Each unit 19 includes a tubular connecting member 190 communicating with the inner passage of tube T and having an axis 190a orthogonal to the longitudinal axis of tube T. Each connecting member 190 communicates with a

collector 191, whose axis 191 a is orthogonal to axis 190a. From the ends of collector 191 there project two nozzles U whose axes are orthogonal to the axis 191 a of the collector, according to orientations which are different from each other.

[0023] Figure 11 shows a cross-section of a single nozzle U having a dispensing hole 20 of predetermined reduced diameter.

[0024] The efficiency in vaporizing the water fed to each nozzle U depends from the water feeding pressure and the diameter of the dispensing hole 20. For a determined pressure value, vaporization increases if diameter of the dispensing hole 20 decreases. However there are technological limits to the possibility of minimizing the dimension of the above mentioned hole. In an actual exemplary embodiment, the dispensing hole 20 of each dispensing nozzle U had a diameter of 0.5 mm. and the pressure of the supplied water was 20 bars.

[0025] According to a further important feature of the invention, with the dispensing structure D there are associated planar vertical surfaces W (figures 1, 4) serving for automatically orienting the rotatable distributing structure 2 in the wind direction, holding the dispensing tubes T parallel to the wind direction. In the illustrated example, surfaces W are carried at the lowermost ends of the two dispensing tubes T which are arranged at the two side ends of the array of tubes T (see figure 4).

[0026] In operation, the flow of water under pressure generated by pump P reaches the vertical branch-off tube 131 (figure 5A) through pipe C and the rotatable coupling associated with bearing 8. From branch-off tube 131 water under pressure goes within the tubular cross-member 13 and into the inner passages of all the dispensing tubes. The water under pressure which flows along the tubes from the centre towards the ends thereof is ejected outwardly through nozzles U. The pressure of the feeding water is sufficient for ensuring that it reaches also the nozzles at the ends of tubes T with a pressure sufficient for generating jets of highly vaporized water through the holes 20 of nozzles U, so that water is efficiently dispersed in the air.

[0027] During operation, the structure 2 is automatically oriented in the wind direction, with tubes T parallel to the wind direction, thanks to the planar surfaces W carried by the lowermost ends of the two tubes at the ends of the tube array. Due to this feature, a high efficiency is obtained of the dispersion in the air of the vaporized jets ejected by nozzles U. In particular, the jets ejected by each dispensing tube T do not interfere with the jets ejected by other tubes and are dispersed quickly in the wind. At the same time, the inclination of the plane of the array of tubes T with respect to the horizontal plane provides a further reduction of interference between the vaporized jets ejected by the nozzles of a same dispensing tube T. Finally, the dispersion in the air of the vaporized jets is also rendered more efficient by that the nozzles U carried by each nozzle-carrying unit 19 are oriented along different directions. Ideally, therefore all the vaporized jets

ejected by the nozzles are dispersed along directions parallel to, and spaced apart from, each other, both horizontally and vertically.

[0028] With reference also to figures 1 and 3 when the distributing structure 2 is lowered by means of the winch 9 in order to carry out maintenance operations, it could happen that the cross-member 13 extends along a direction such as to interfere with the tower-like structure 3, as shown in figures 7, 8. In order to avoid this drawback, the device comprises a self-centring system constituted by a fixed cam member 21 carried by the top of the tower-like structure 3, adapted to be engaged by the supporting cross-member 13 when the platform 6 is lowered, in order to automatically cause the cross-member 13 to rotate to a position in which it does not interfere with the tower-like structure 3 during lowering of the platform. In the illustrated example, this cam member is simply a ring 21, arranged in a vertical plane and projecting from the top of the tower-like structure 3. As shown in figures 7, 8, the surface of ring 21 causes cross-member 13 to slide thereon during the lowering movement, thus applying thereto a force which makes it to rotate around its articulation axis 7 to a position in which it does not interfere with the tower-like structure 3 during the lowering operation.

[0029] Naturally, while the principle of the invention remains the same, the details of construction and the embodiments may widely vary with respect to what has been described and illustrated purely by way of example, without departing from the scope of the present invention.

Claims

1. Vaporizing device for use in dispersing water in the air, **characterized in that** it comprises:

- a tower-like structure (3),
- a distributing structure (2) for dispensing vaporized jets of water, rotatably carried around a vertical axis (7) by said tower-like structure (3),
- wherein said distributing structure (2) comprises a plurality of dispensing tubes (T) parallel to, and spaced apart from, each other, said tubes being carried in a rack-like fashion by a supporting tubular cross-member (13) which is rotatably mounted around said vertical axis (7) on said tower-like structure (3),
- wherein said dispensing tubes (T) are provided with a plurality of dispensing nozzles (U) oriented according to different directions and distributed along each dispensing tube (T),
- wherein each dispensing nozzle (U) is for receiving water under pressure through a path defined within said supporting tubular cross-member (13) and within each dispensing tube (T),
- wherein said rotatable distributing structure (2) includes one or more planar surfaces (W) shaped and arranged so as to automatically ori-

ent the rotatable distributing structure (2) in the wind direction, so that the dispensing tubes (T) extend substantially in the wind direction, thus favouring dispersion of the vaporized jets in the air.

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wind, these surfaces being carried by the lowermost ends of the two dispensing tubes (T) located at the two lateral ends of the array of dispensing tubes (T).

2. Vaporizing device according to claim 1, **characterized in that** said dispensing tubes (T) are arranged in a common plane inclined with respect to a horizontal plane by an angle between 0° and 45°, and preferably between 10° and 30°. 10

3. Vaporizing device according to claim 1 or 2, **characterized in that** the supporting tubular cross-member (13) is rotatably mounted on a platform (6) carried by a carriage (4) which is vertically guided on the tower-like structure (3) between a raised, operative, position and a lowered position, in which maintenance operations can be carried out. 15
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4. Vaporizing device according to claim 3, **characterized in that** it comprises means for driving the vertical movement of the carriage (4) including a winch (9) for winding a lifting cable (11) connected to the structure of the carriage (4) and engaged on pulleys (12) carried by the tower-like structure (3). 25

5. Vaporizing device according to claim 3, **characterized in that** it comprises a self-centering device (21) for automatically orienting the supporting tubular cross-member (13) in a position in which it does not interfere with the tower-like structure (3) when said carriage (4) is lowered, this self-centering device comprising a fixed cam member (21) carried by the top of the tower-like structure (3) and adapted to be engaged by said tubular cross-member (13) when the carriage (4) is lowered, to cause a rotation of the tubular cross-member (13) around its articulation axis (7) towards a position in which it does not interfere with the tower-like structure (3) during the lowering operation. 30
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6. Vaporizing device according to claim 1 or 2, **characterized in that** each dispensing tube (T) carries a plurality of nozzle-carrying units (19) distributed along two faces of the tube (T) and each including a tubular connecting member (190) orthogonal to the axis of tube (T) and communicating with the inner passage of the tube (T), a collector (191) communicating with the connecting member (190) and extending transversally to the axis (190a) of the connecting member (190) and two nozzles (U) extending orthogonally to the axis (191 a) of the collector (191), along two different directions. 45
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7. Vaporizing device according to claim 2, **characterized in that** there are provided two planar surfaces (W) for orienting the distributing structure (2) in the

FIG. 1

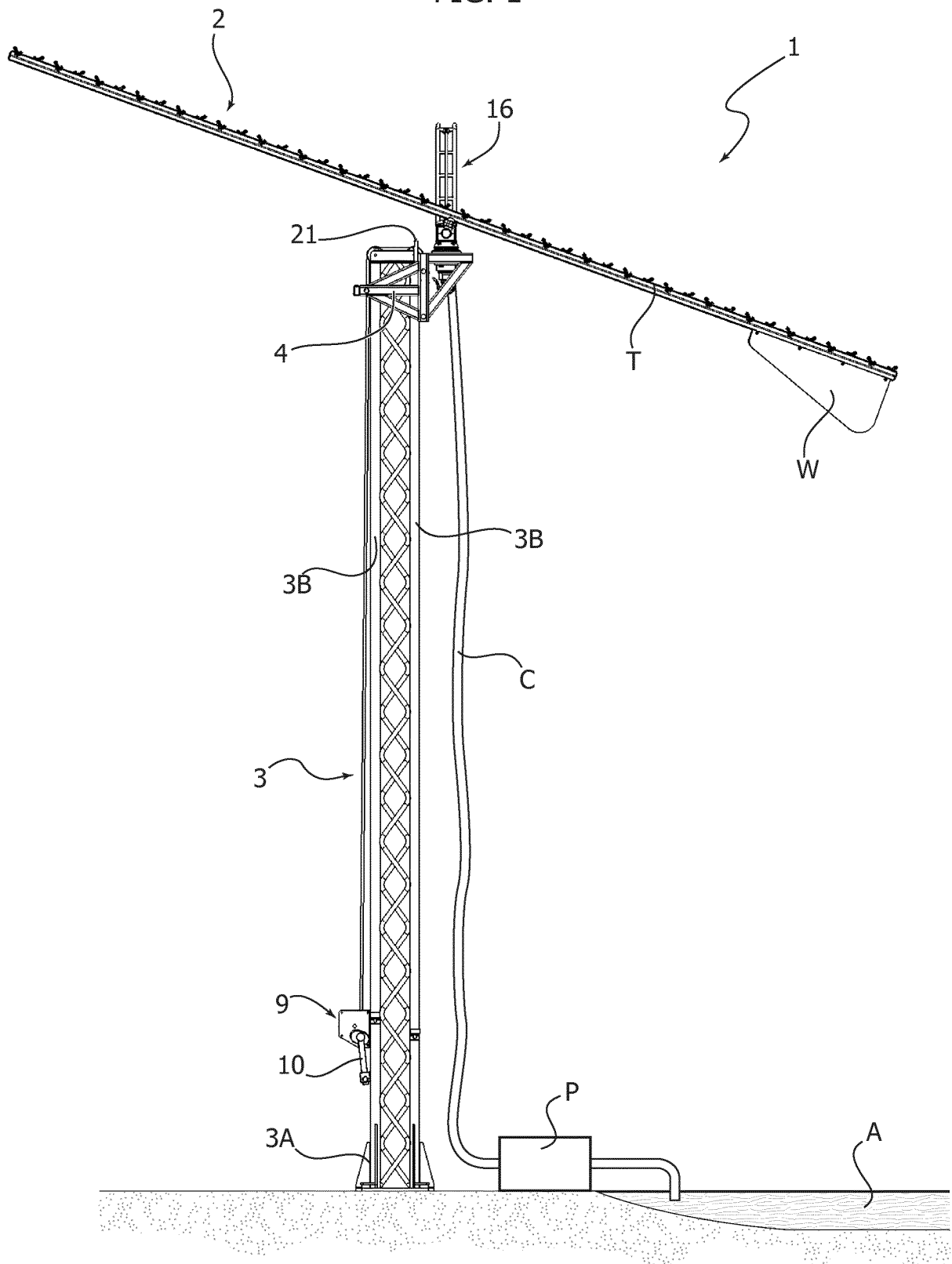


FIG. 2

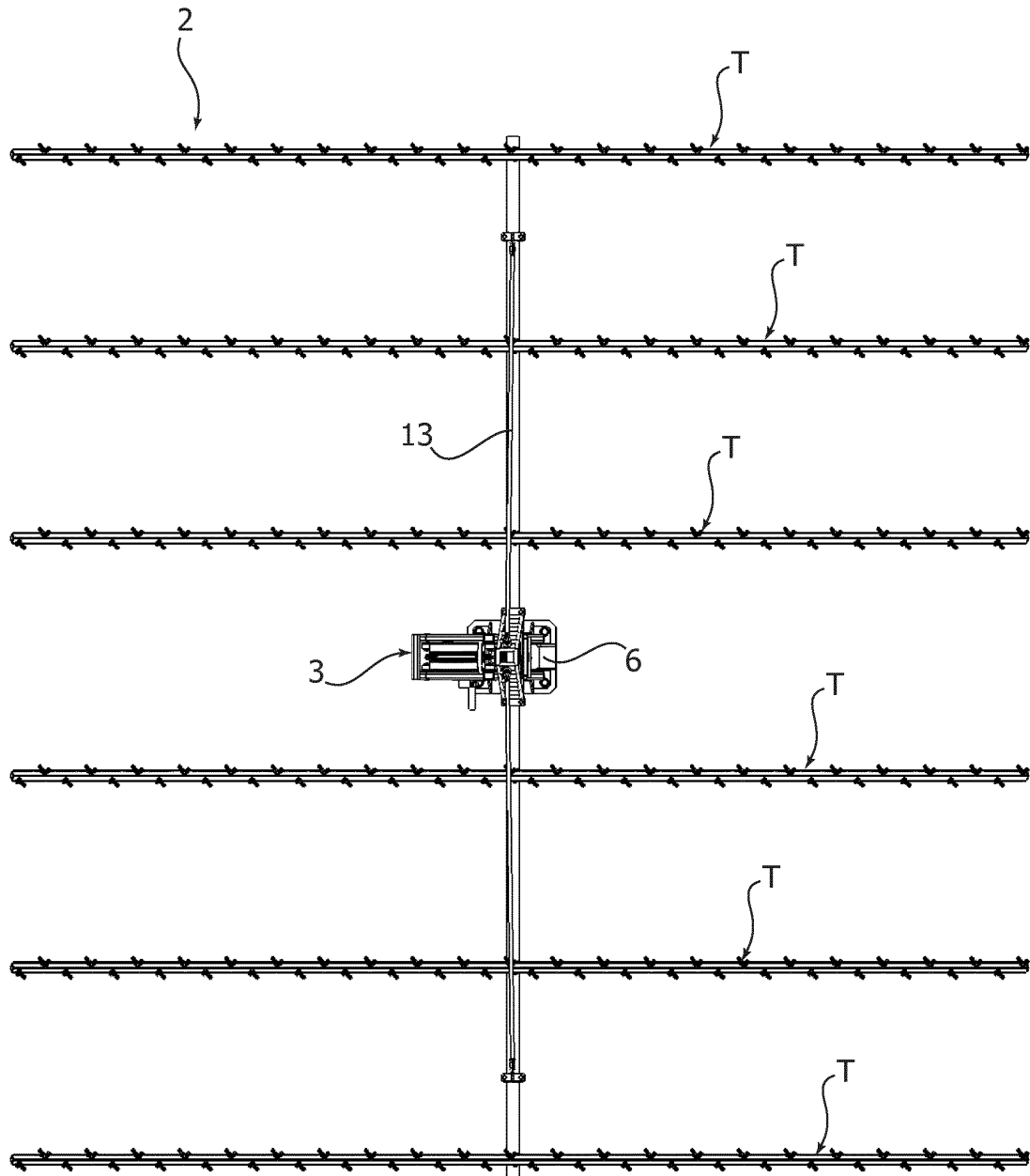


FIG. 3

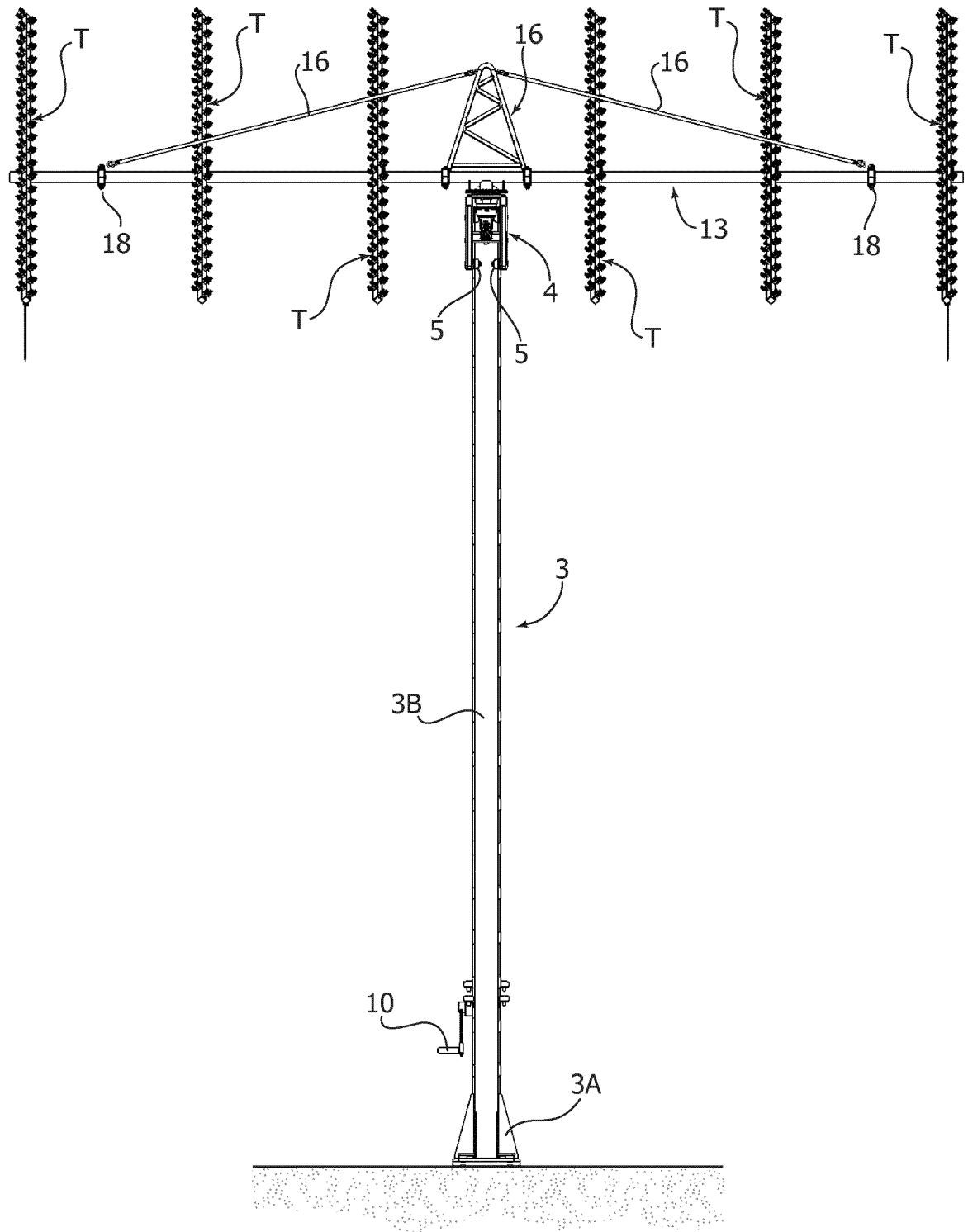
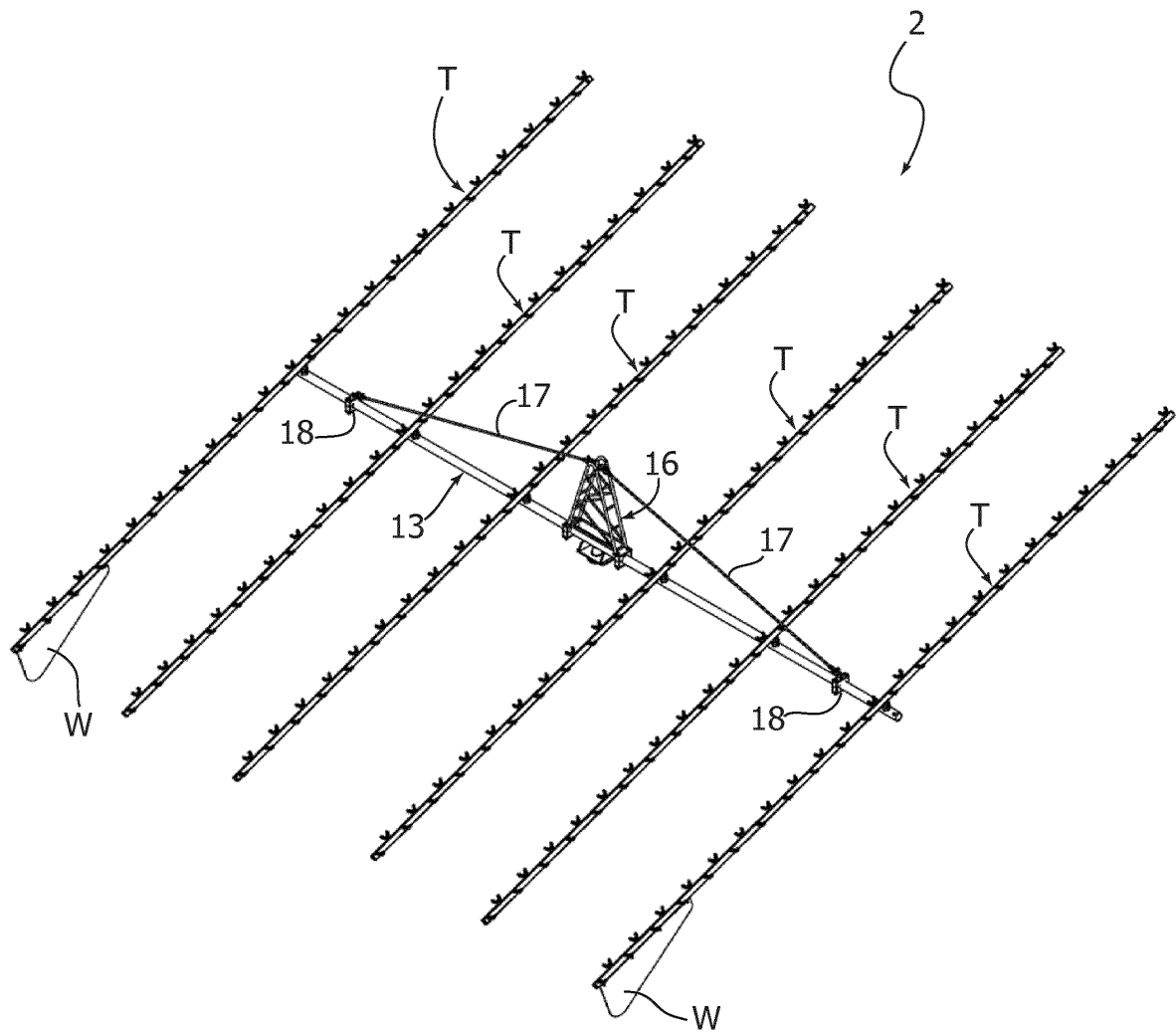


FIG. 4



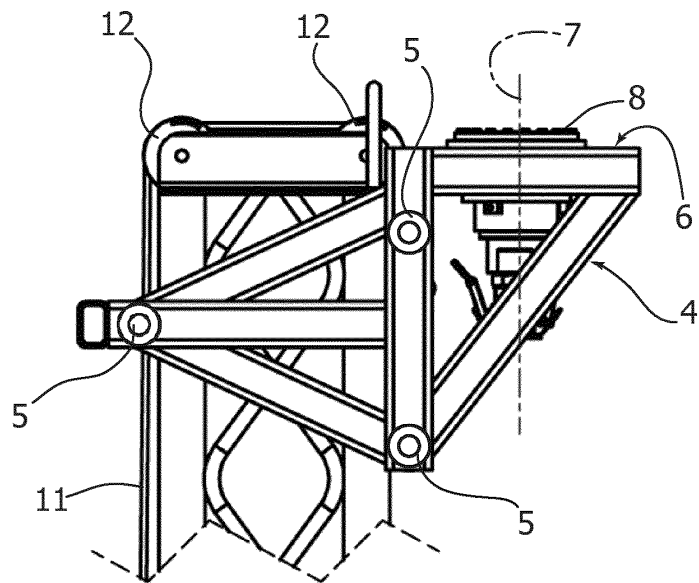


FIG. 5

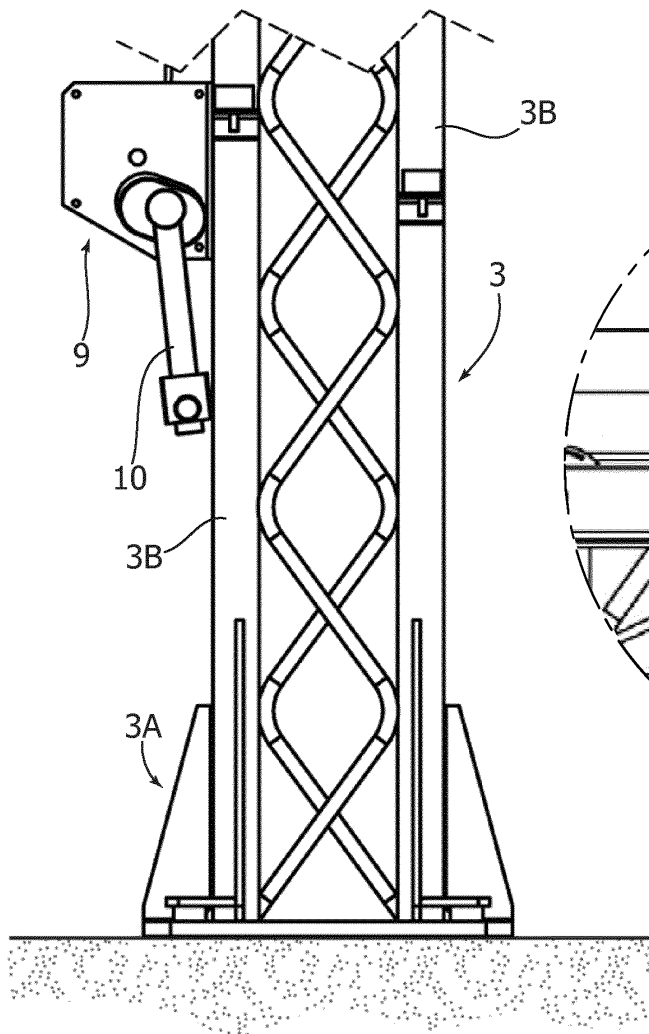


FIG. 5A

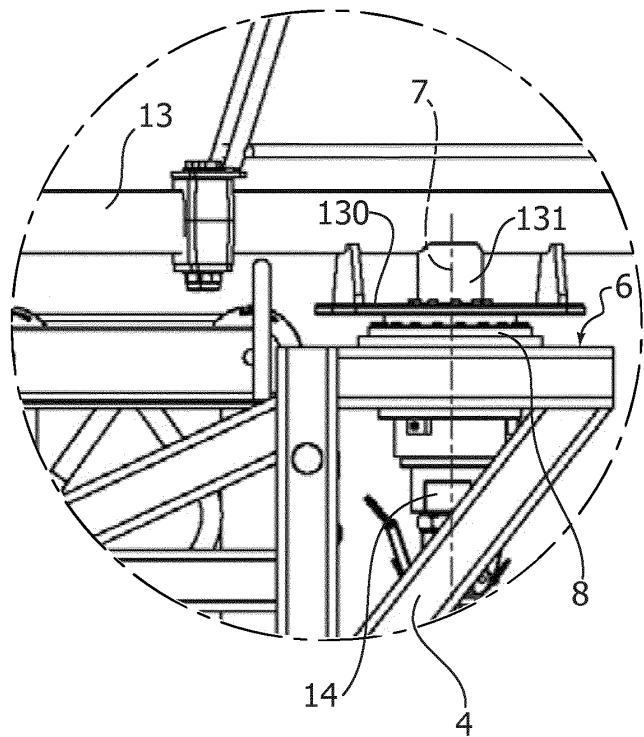


FIG. 6

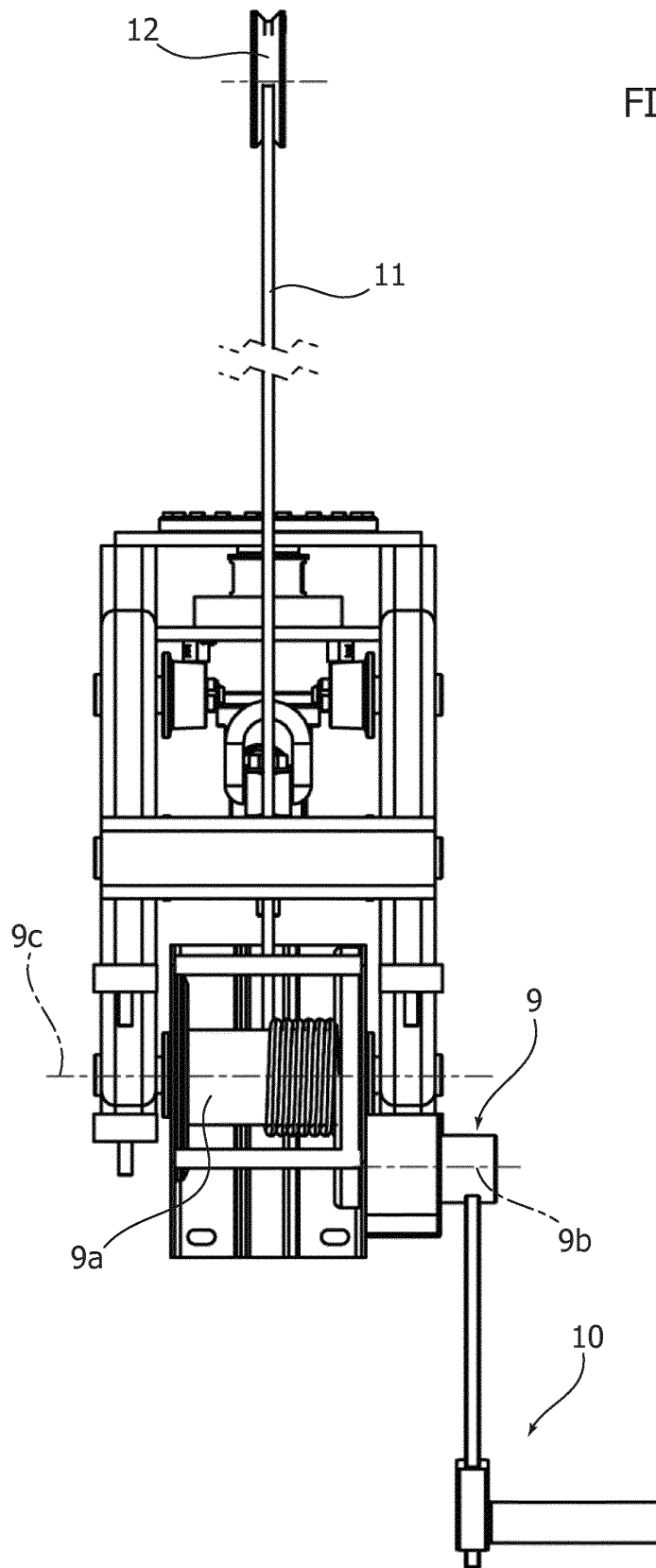


FIG. 7

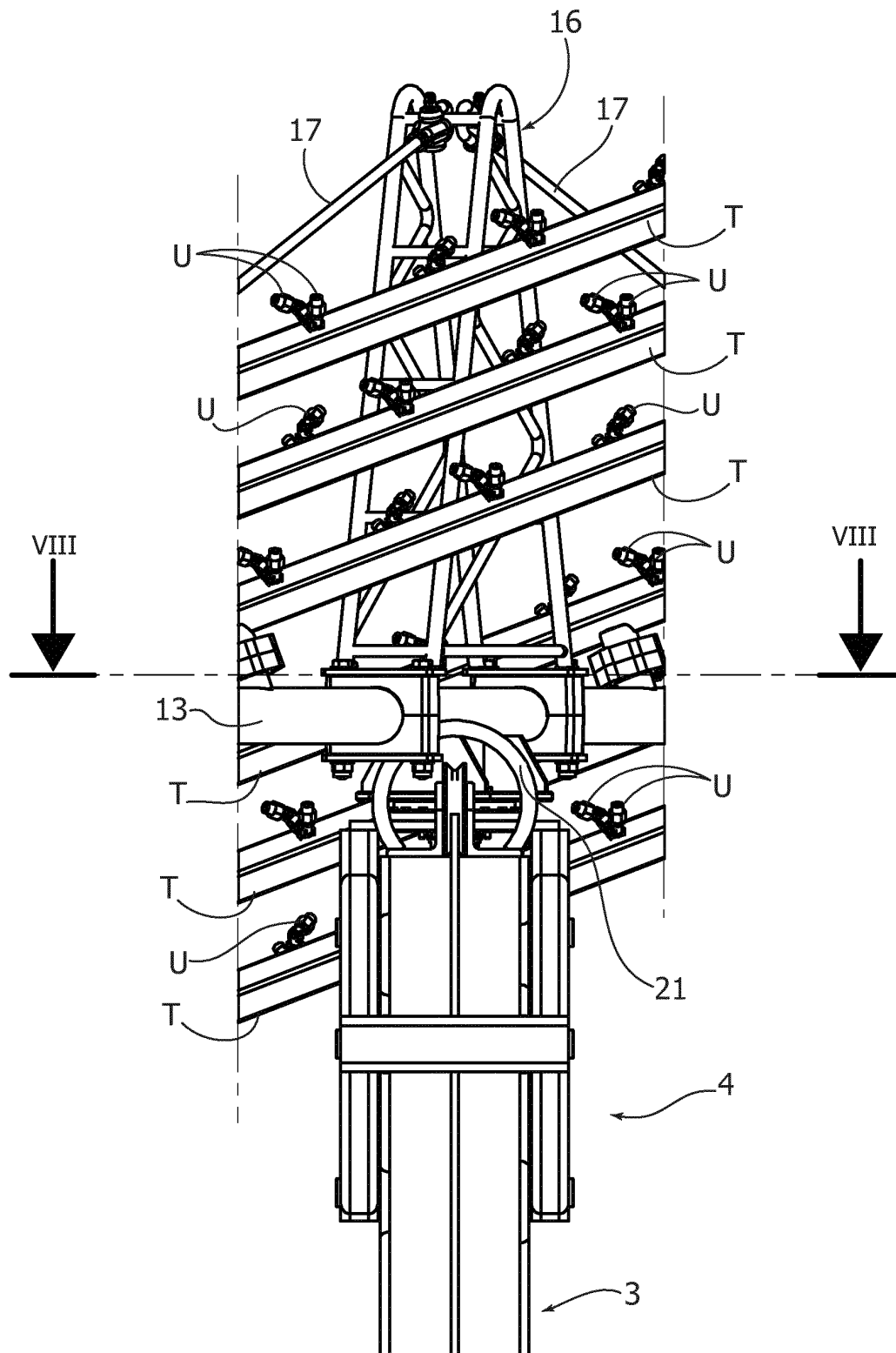


FIG. 8

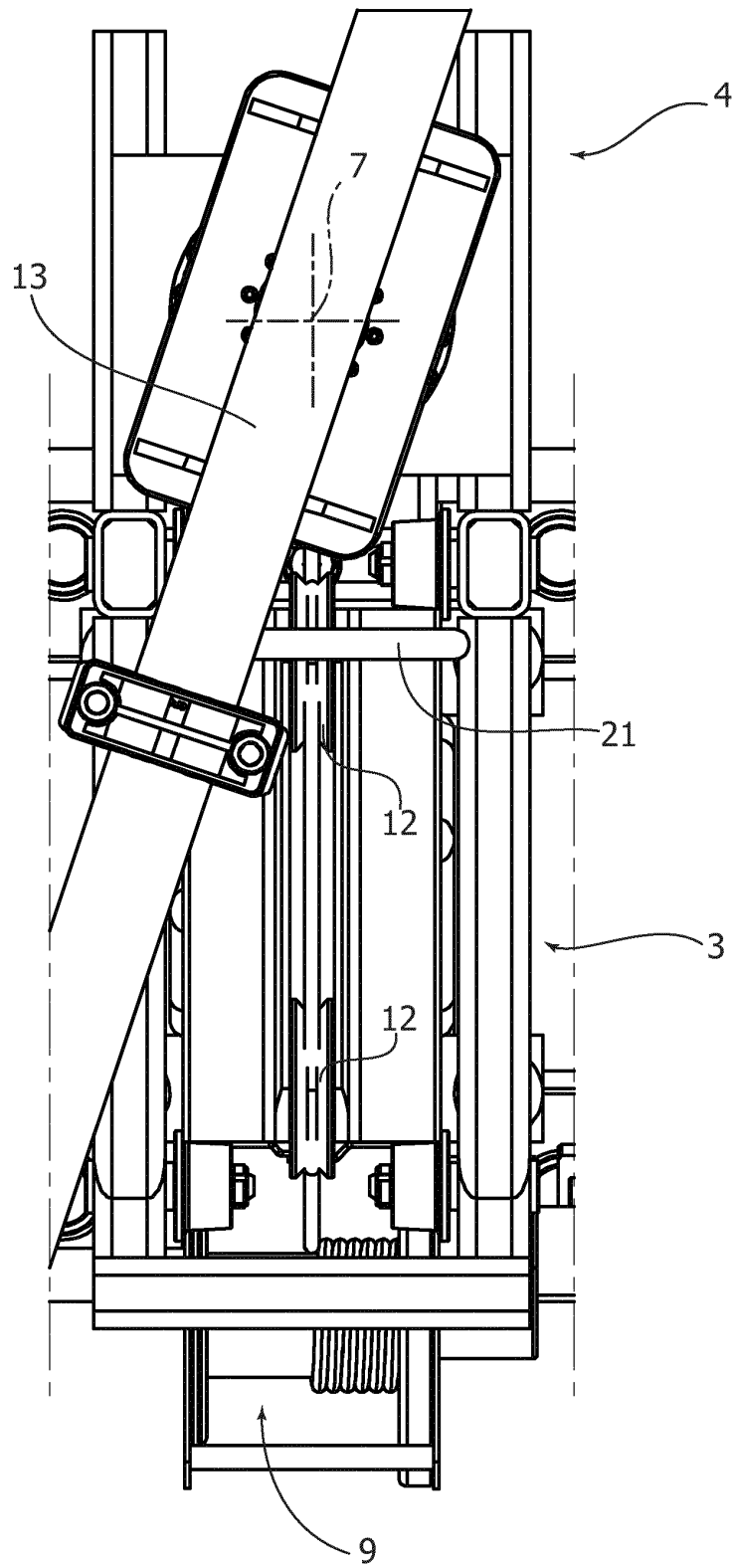
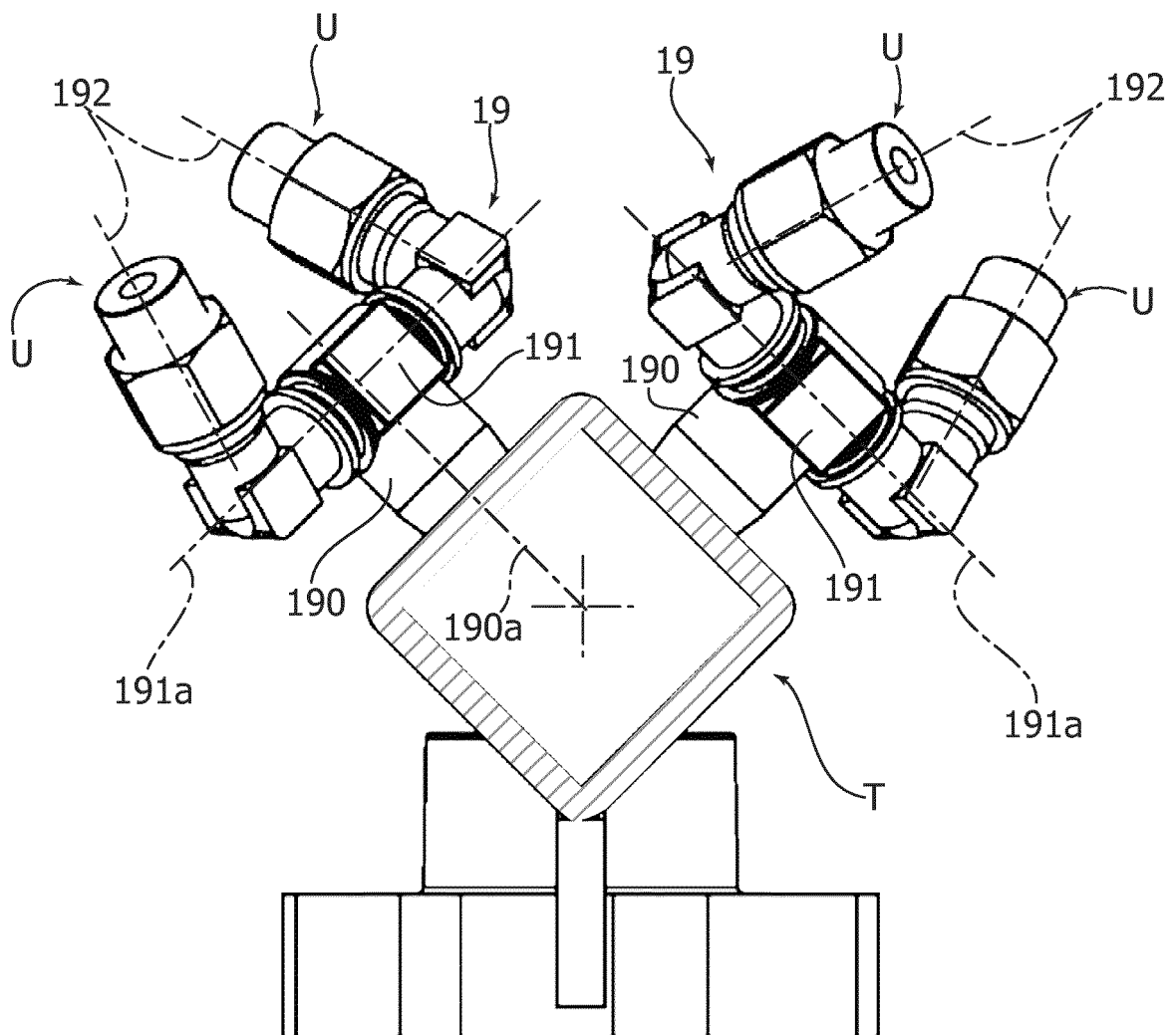
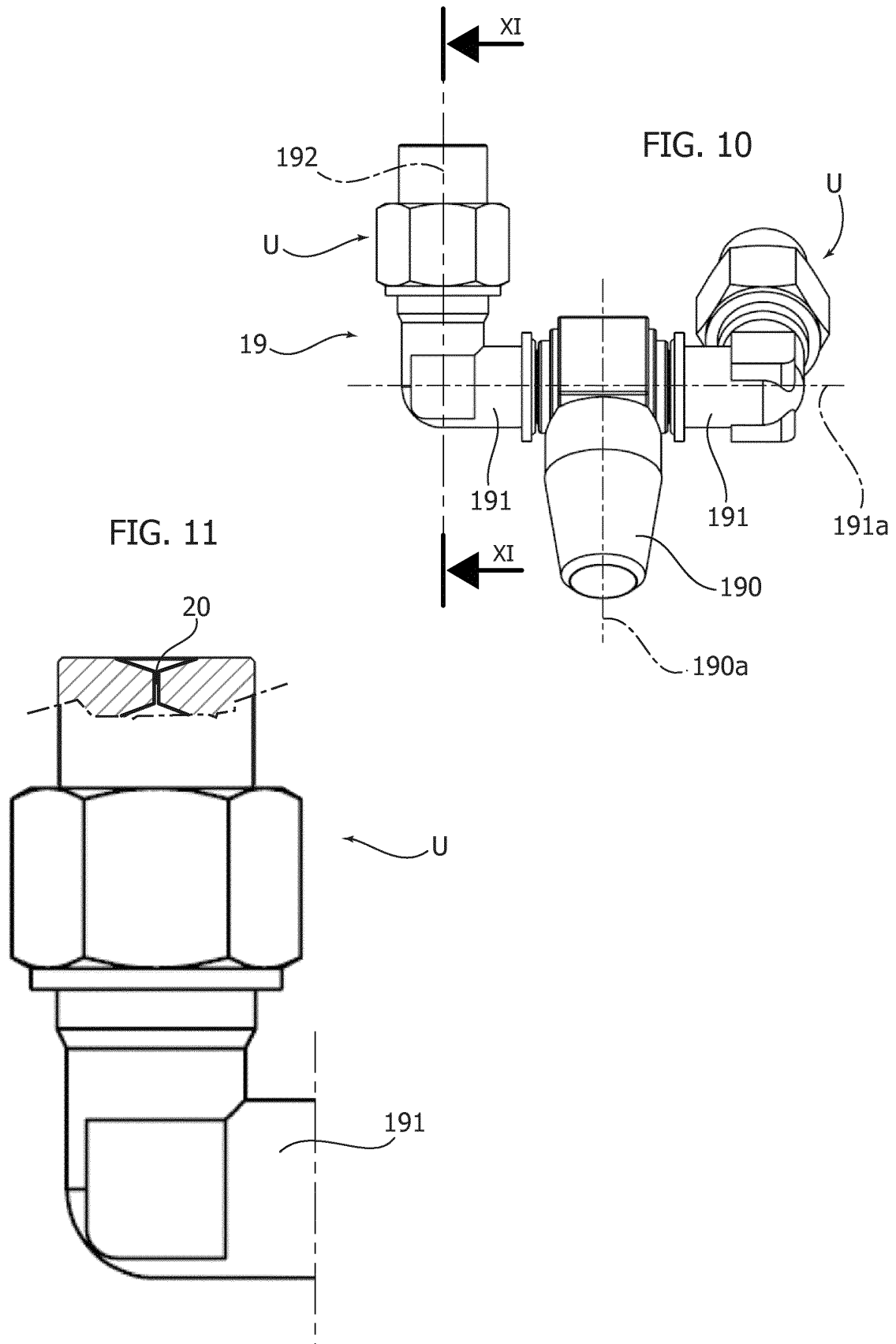


FIG. 9







EUROPEAN SEARCH REPORT

 Application Number
EP 14 16 7398

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The Hague		31 October 2014	Rampelmann, Klaus
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 14 16 7398

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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