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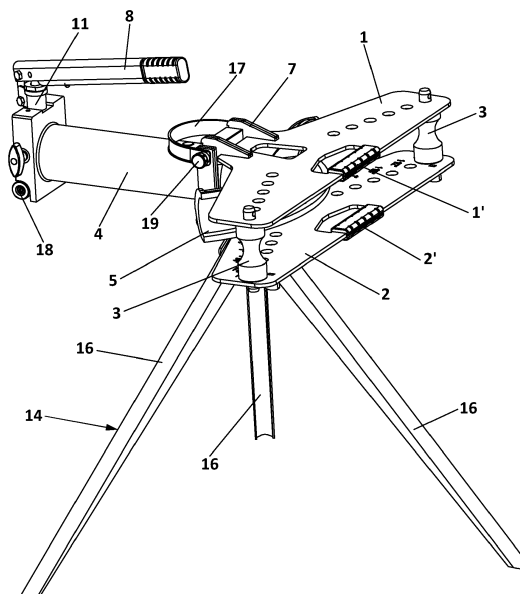
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(54) **Bending machine**

(57) The present invention relates to a pipe bending machine comprising an upper plate (1) and a lower plate (2) between which there are arranged two guide rollers (3) which can be quickly positioned in a plurality of positions, a hydraulic cylinder (4) which can actuate according to an axis of movement (4') associated with a bending die (5) that contacts a pipe, forming a section of said pipe located between the guide rollers (3), where the lower plate (2) is fixed to a base body (12) integral with the hydraulic cylinder (4) by means of lower anchoring ele-

ments (6) consisting of L-shaped flat bars each of which has two anchoring points, keeping the lower plate (2) in a plane parallel to the axis of actuation (4'), whereas the upper plate (1) is fixed to the base body (12) by means of upper anchoring elements (7) consisting of clamps each of which has an anchoring point, keeping the upper plate (1) parallel to the lower plate (2) as a result of it being fixed to the base body (12) and supported on the guide rollers (3) which are in turn supported on the lower plate (2).



**FIG. 3**

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## Description

### Technical Field of the Invention

**[0001]** The present invention relates to a bending machine which has application in the industry of pipe forming machines and allows changing the position of the guide rollers quickly and easily, which at the same time assures a parallel position between the plates and with respect to the axis of movement of the hydraulic cylinder, all this as a result of the anchoring elements for anchoring the plates to said cylinder.

**[0002]** The machine also provides improvements from the viewpoint of making machine manipulation easier for a user who often has to hold the pipe which is being bent at the same time, allowing the rotation of the drive lever without having to move the machine or its axis of movement.

### Background of the Invention

**[0003]** Bending machines used for bending metal pipes as defined in the preamble of Claim 1 are known today. These bending machines can be differentiated primarily between fixed bending machines or installations, such as that described in patent EP2181780, which discloses a machine that can be anchored to the floor in which, by means of a series of gears wheels, power is transmitted to a die producing the bending; and manual machines and devices or machines and devices which can be transported by a user to the place in which they will be used, such as those described in utility models CN2406744U and CN203678956U.

**[0004]** There are several problems within this second group, i.e., manual machines and devices, that are still unresolved. First, according to the diameter of the pipe to be bent, it is necessary to change the position of the guide rollers with respect to the bending die, for which it is necessary to change the position of said guide rollers within the plates with which they are linked. The manipulation of said plates usually results in clearances and misalignments of the plates with respect to the axis of movement of the hydraulic cylinder, which finally leads to poor bending quality.

**[0005]** Likewise and in direct relation with the preceding point, solutions in which the plates are fixed at various points are being used in order to prevent said misalignments. Although said solutions improve the misalignment problems, they make the operation of changing the position of the rollers difficult, insofar as the manipulation of various anchoring means is required for repositioning the plates and the rollers.

**[0006]** On the other hand, when the operator has to keep hold of the pipe by positioning it on one side of the machine, access to the drive lever and the manipulation thereof become difficult.

**[0007]** Finally, the fact that these machines have a considerable weight and that they require being transported

to different worksite or factory locations in which their actuation is required must be considered. Therefore, manipulation by operators as well as placement of the machine in its working position must be improved and made easier to enable manipulating the machine with minimal effort and without needing additional means of transportation or additional lifting means.

**[0008]** Therefore, the state of the art does not disclose a pipe bending machine in which the parallelism between plates and with respect to the axis of movement of the cylinder is maintained throughout the entire bending process and which furthermore allows quickly and easily changing the guide rollers between the different positions, furthermore combining the necessary characteristics of transportability and handling.

### Description of the Invention

**[0009]** The present invention relates to a pipe bending machine as defined in Claim 1 which allows making its handling easier and significantly reducing operation times.

**[0010]** To that end, the machine proposed by the invention comprises a base body integral with a hydraulic cylinder and to which there are anchored an upper plate and a lower plate between which there are arranged two guide rollers which can be positioned in a plurality of positions between said two plates as a result of a plurality of holes arranged at specific distances in both plates. Said hydraulic cylinder has associated therewith at the end of the rod a bending die which is interchangeable depending on the diameter of pipe to be bent, having a curved convex surface intended for contacting the pipe to be bent, such that the chosen die produces the desired bent on the pipe. Therefore, when the hydraulic cylinder moves the bending die against the pipe which is supported on the guide rollers, a section of the pipe located between the guide rollers is formed, pushing against said guide rollers and giving it a bent shape.

**[0011]** As indicated, the lower plate is fixed to the base body integral with the hydraulic cylinder by means of lower anchoring elements consisting of L-shaped flat bars, each of which has two anchoring points keeping the lower plate in a plane parallel to the axis of movement. Both L-shaped flat bars have an open groove which will be associated with two positioning notches arranged in the lower plate, in order to assure that the attachment between them maintains the orthogonal position thereof. Said attachment is secured by means of applying weld beads.

**[0012]** On the other hand, the upper plate is fixed to the base body of the hydraulic cylinder by means of upper anchoring elements consisting of clamps, each of which has an anchoring point keeping said upper plate parallel to the lower plate as a result of it being fixed to the hydraulic cylinder and supported on the guide rollers which are in turn supported on the lower plate. Both clamps have an open groove which will be associated with two

positioning notches arranged in the upper plate, in order to assure that the attachment between them keeps the orthogonal position thereof. Said attachment is secured by means of applying weld beads.

**[0013]** First, correct alignment of the elements of the machine is thereby assured in a simple manner, the plates thus being kept parallel to one another, as well as to the axis of movement of the hydraulic cylinder at all times, given that both are linked to a fixed and sufficiently robust element such as the base body integral with the hydraulic cylinder. Likewise, as a result of the upper anchoring elements linking the upper plate with said base body by means of a bolt, the operation of pivoting the upper plate, repositioning the guide rollers and returning the upper plate to its operating position becomes significantly faster.

**[0014]** Therefore, due to the design of the anchoring elements of the plates with the hydraulic, the parallelism of the plates with the hydraulic cylinder is maintained, the pipe to be bent thus being correctly supported on the guide rollers.

**[0015]** The possibility of the anchoring point of each upper anchoring element coinciding with one of the anchoring points of each lower anchoring element, preferably with the upper anchoring element, is contemplated, such that by coinciding said anchoring the alignment between the plates and the hydraulic cylinder is further assured, in addition to making the disassembly of the lower plate, if necessary, faster.

**[0016]** The bending machine comprising a drive lever located in the hydraulic cylinder at an end opposite the base body is also contemplated. Said drive lever can actuate the hydraulic cylinder by means of rotating the lever with respect to a drive axis contained in a plane parallel to the plates, i.e., by a user moving the drive lever up or down with respect to a horizontal axis. According to the invention, the drive lever can also rotate with respect to an axis of rotation which is perpendicular both to the axis of movement and to the drive axis, i.e., a vertical axis, without this modifying the position of the axis of movement itself.

**[0017]** The machine therefore provides improvements from the viewpoint of machine manipulation, given that a user who is on one side of the machine can rotate the lever to make its actuation easier without having to stretch his/her arm to that end since this is already in a fixed position.

**[0018]** The possibility of the machine comprising an element for supporting the machine on a surface where it is placed is also contemplated, for which said support element comprises an upper projection which can be housed in a hole located in the lower plate. Therefore, the support element is embedded in the body of the machine, being kept fixed by the actual weight of machine, which enables the support element to be easily separated from the body when an operator lifts the machine by manually picking it up. Said support element can consist of a tripod comprising three collapsible legs, for example.

**[0019]** Likewise, to make machine manipulation by an operator easier, the present invention comprising a collapsible handle which is linked to the anchoring bolt fixing the upper plate is contemplated.

**[0020]** The plates comprising handles for manipulation and manual transport by a user, where said handles are located on the front edge of the upper plate and lower plate, is also contemplated.

**[0021]** Providing wheels in the lower part of the end of the hydraulic cylinder opposite the base body is also contemplated to enable moving the machine, once separated from the support element, by pulling on one of the manipulation handles of the plates while said wheels remain in contact with the floor, therefore freeing the user from having to carry the machine in order to move it.

#### Description of the Drawings

**[0022]** To complement the description that is being made and for the purpose of aiding to better understand the features of the invention according to a preferred practical embodiment thereof, a set of drawings is attached as an integral part of said description in which the following is depicted with an illustrative and non-limiting character:

Figure 1 shows a top, rear perspective view of the machine of the invention.

Figure 2 shows a bottom, front perspective view of the machine.

Figure 3 shows a top, front perspective view of the machine.

Figure 4 shows three elevational, plan and profile views of the machine.

Figure 5 shows an exploded view of the lower plate with its respective anchoring elements.

Figure 6 shows an exploded view of the upper plate with its respective anchoring elements.

Figure 7 shows a detail of the base body integral with the hydraulic cylinder and the upper part of the support element.

Figure 8 shows a detail of the lugs defining the rotation stop positions of the drive lever.

Figure 9 shows a perspective view of the support element.

#### Preferred Embodiment of the Invention

**[0023]** In view of the mentioned drawings it can be seen how in one of the possible embodiments of the invention the bending machine proposed by the invention comprises a base body (12) integral with a hydraulic cylinder (4) and to which there are anchored an upper plate (1) and a lower plate (2) between which there are arranged two guide rollers (3) which can be positioned in a plurality of positions between said two plates (1, 2) as a result of a plurality of holes arranged at specific distances in both plates.

**[0024]** Said hydraulic cylinder (4) which can actuate according to an axis of movement (4') has associated therewith at the end of the rod an interchangeable bending die (5), having a curved convex surface intended for contacting the pipe to be bent, such that the chosen bending die (5) produces the desired bent on the pipe. When the hydraulic cylinder (4) moves the bending die (5) against the pipe which is supported on the guide rollers (3), a section of the pipe located between the guide rollers (3) is formed, pushing against said guide rollers (3) and giving it a bent shape.

**[0025]** As seen in Figure 5, the lower plate (2) is fixed to the base body (12) integral with the hydraulic cylinder (4) by means of lower anchoring elements (6) consisting of L-shaped flat bars, each of which has two anchoring points, keeping the lower plate (2) in a plane parallel to the axis of movement (4').

**[0026]** On the other hand, the upper plate (1) is fixed to the base body (12) by means of upper anchoring elements (7) consisting of clamps, each of which has an anchoring point, keeping the upper plate (1) parallel to the lower plate (2) as a result of it being fixed to the base body (12) and supported on the guide rollers (3) which are in turn supported on the lower plate (2).

**[0027]** The L-shaped flat bars (6) are welded to the lower plate (2), and the two clamps (7) are welded to the upper plate (1). As seen in Figures 5 and 6, both the L-shaped flat bars (6) and the clamps (7) have open grooves (6', 7') which are associated with two positioning notches (1'', 2'') arranged both in the upper plate (1) and in the lower plate (2), in order to assure that the attachment between them maintains the orthogonal position thereof.

**[0028]** The attachment between the clamps (7) and the base body (12) by means of a bolt (19) allows pivoting the upper plate (1) on the upper anchoring elements (7), allowing access to the guide rollers (3) and the bending die (5) to adapt the operation to different pipe sizes.

**[0029]** As seen in Figures 3 and 6, the anchoring point of each upper anchoring element (7) coincides with one of the anchoring points of each lower anchoring element (6), specifically with the upper anchoring element, such that by coinciding said anchoring the alignment between the plates and the hydraulic cylinder is further assured.

**[0030]** The bending machine comprises a drive lever (8) located in the hydraulic cylinder at an end opposite the base body (12). Said drive lever (8) can actuate the hydraulic cylinder (4) by means of rotating the lever with respect to a drive axis (9) contained in a plane parallel to the plates (1, 2). As seen in Figure 4, the drive lever (8) can also rotate with respect to an axis of rotation (10) which is perpendicular both to the axis of movement (4') and to the drive axis (9), i.e., a vertical axis, without this modifying the position of the axis of movement (4') itself. This rotation is allowed by means of a bushing (11) made by stamping, as seen in Figure 8, arranged on the hydraulic cylinder (4). The rotation of the drive lever (8) with respect to the axis of rotation (10) is limited between two

limit positions defined by the contact between two lugs (13) of the bushing (11), which is arranged on a recess, and two stop areas located in the hydraulic cylinder (4).

**[0031]** The machine comprises a support element (14) for supporting the machine on a surface, for which said support element (14) comprises an upper projection (15) which can be housed in a hole located in the lower plate (2).

**[0032]** According to a preferred embodiment, the support element (14) consists of a tripod comprising three collapsible legs (16) which can be deployed towards a central position to make transport easier.

**[0033]** Likewise, to make machine manipulation by an operator easier, and essentially to make lifting said machine and corresponding release of the support element (14) easier, the machine comprises a collapsible handle (17) associated with the anchoring bolt (19) fixing the upper plate.

**[0034]** The plates (1, 2) comprising handles (1', 2') for manipulation and manual transport by a user is also contemplated. The handles (1', 2') of the plates (1, 2) can be covered by a plastic material for a better grip and comfort. The main purpose of the handle (1') of the upper plate (1) together with the pivoting handle (17) is to enable lifting/lowering the body from/onto the support element (14) easily. Once the body is disassembled from the tripod (14), both handles (1', 2') of the plates (1, 2) can be used to enable, in relation to the wheels (18) arranged in the lower part of the end of the hydraulic cylinder (4) opposite the base body (12), comfortably moving the body of the bending machine.

**[0035]** In view of this description and set of drawings, the person skilled in the art will understand that the embodiments of the invention which have been described can be combined in many ways within the object of the invention. The invention has been described according to several preferred embodiments thereof, but for the person skilled in the art it will be obvious that multiple variations can be introduced in said preferred embodiments without exceeding the object of the claimed invention.

## Claims

1. Pipe bending machine comprising a base body (12) integral with a hydraulic cylinder (4) and to which there are anchored an upper plate (1) and a lower plate (2) between which there are arranged two guide rollers (3) which can be positioned in a plurality of positions between said two plates (1, 2), said hydraulic cylinder (4) being able to actuate according to an axis of movement (4') being associated with the end of the rod of the hydraulic cylinder (4), a bending die (5) thereby forming a section of a pipe located between the guide rollers (3), pushing against said guide rollers (3) and giving it a bent shape, **characterized in that** the lower plate (2) is fixed to the base body (12) integral with the hydraulic

cylinder (4) by means of lower anchoring elements (6) consisting of L-shaped flat bars, each of which has two anchoring points, keeping the lower plate (2) in a plane parallel to the axis of movement (4'), whereas the upper plate (1) is fixed to the base body (12) of the hydraulic cylinder (4) by means of upper anchoring elements (7) consisting of clamps with an anchoring point, such that the anchoring point of each upper anchoring element (7) coincides with the upper anchoring point of each lower anchoring element (6).

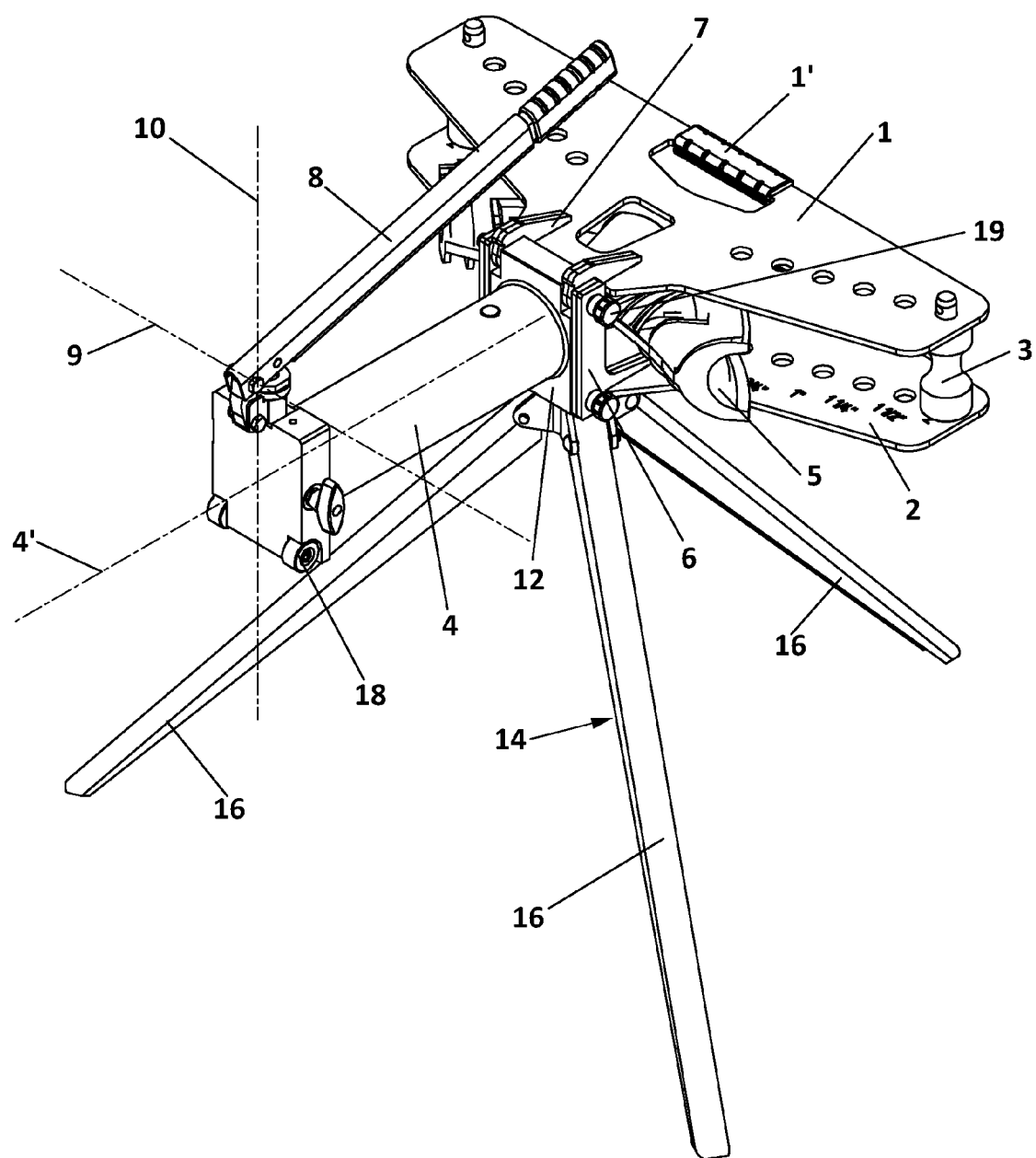
2. Pipe bending machine according to claim 1, wherein each upper anchoring element (7) and each lower anchoring element has an open groove (6', 7').
3. Pipe bending machine according to any of the preceding claims, wherein both the upper plate (1) and the lower plate (2) have positioning notches (1", 2").
4. Pipe bending machine according to any of the preceding claims, wherein:

- the upper anchoring elements (7) are attached to the upper plate (1) by the attachment of the open grooves (6') and the positioning notches (1")
- the lower anchoring elements (6) are attached to the lower plate (2) by the attachment of the open grooves (7') and the positioning notches (2")
- the attachment of the upper anchoring elements (7) and lower anchoring elements (6) to the upper plate (1) and lower plate (2) is by means of welding.

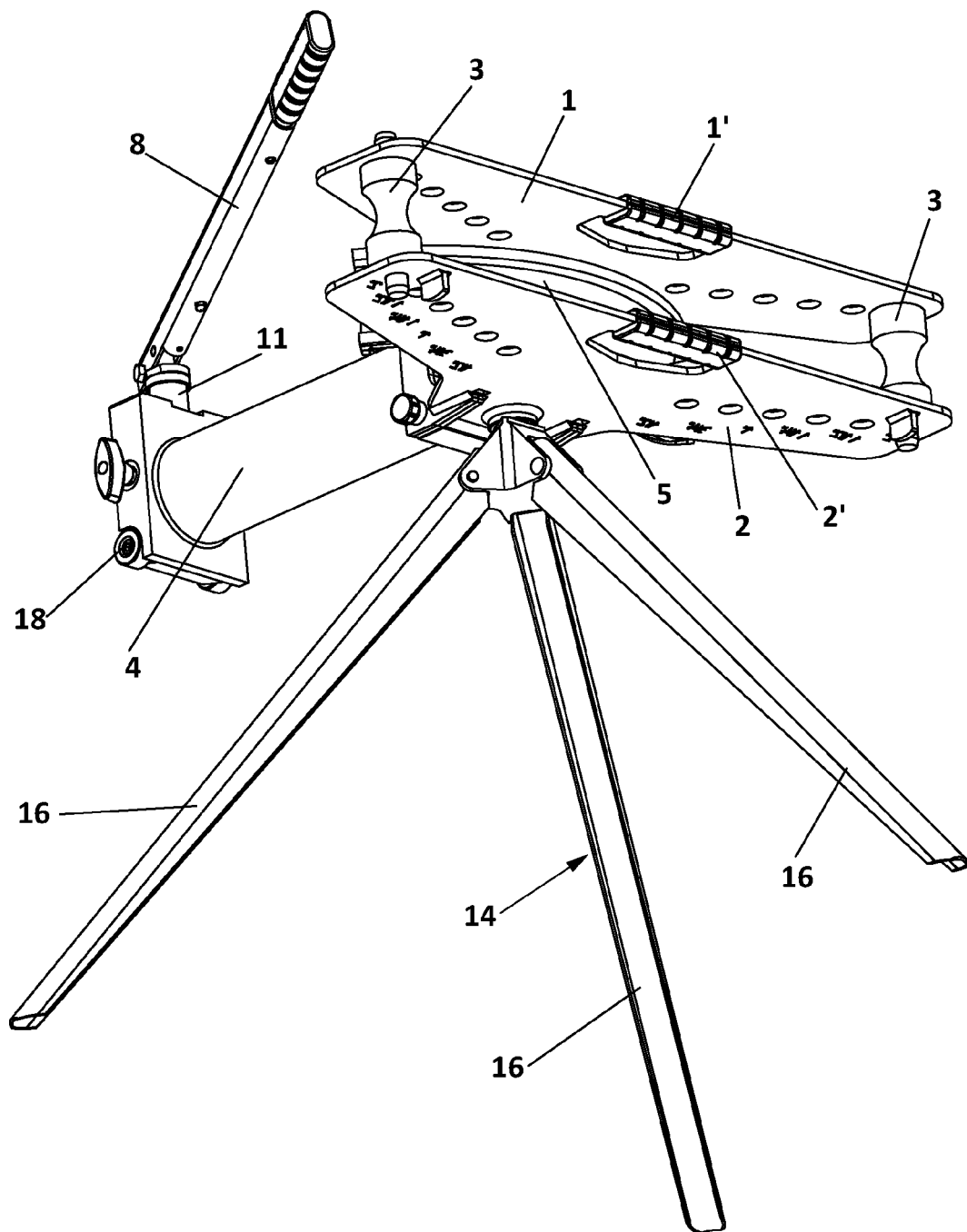
5. Pipe bending machine according to any of the preceding claims, comprising a drive lever (8) which is located in the hydraulic cylinder (4) at an end opposite the base body (12) and can actuate the hydraulic cylinder (4) by means of rotating the lever with respect to a drive axis (9) contained in a plane parallel to the plates (1, 2), where the drive lever (8) can also rotate with respect to an axis of rotation (10) which is perpendicular both to the axis of movement (4') and to the drive axis (9).
6. Pipe bending machine according to claim 5, wherein the rotation of the drive lever (8) with respect to the axis of rotation (10) is limited between two limit positions defined by the contact between two lugs (13) of a bushing (11), which is arranged on a recess, and two stop areas located in the hydraulic cylinder (4).
7. Pipe bending machine according to any of the preceding claims, comprising a support element (14) for supporting the machine on a surface, for which said

support element (14) comprises an upper projection (15) which can be housed in a hole located in the lower plate (2).

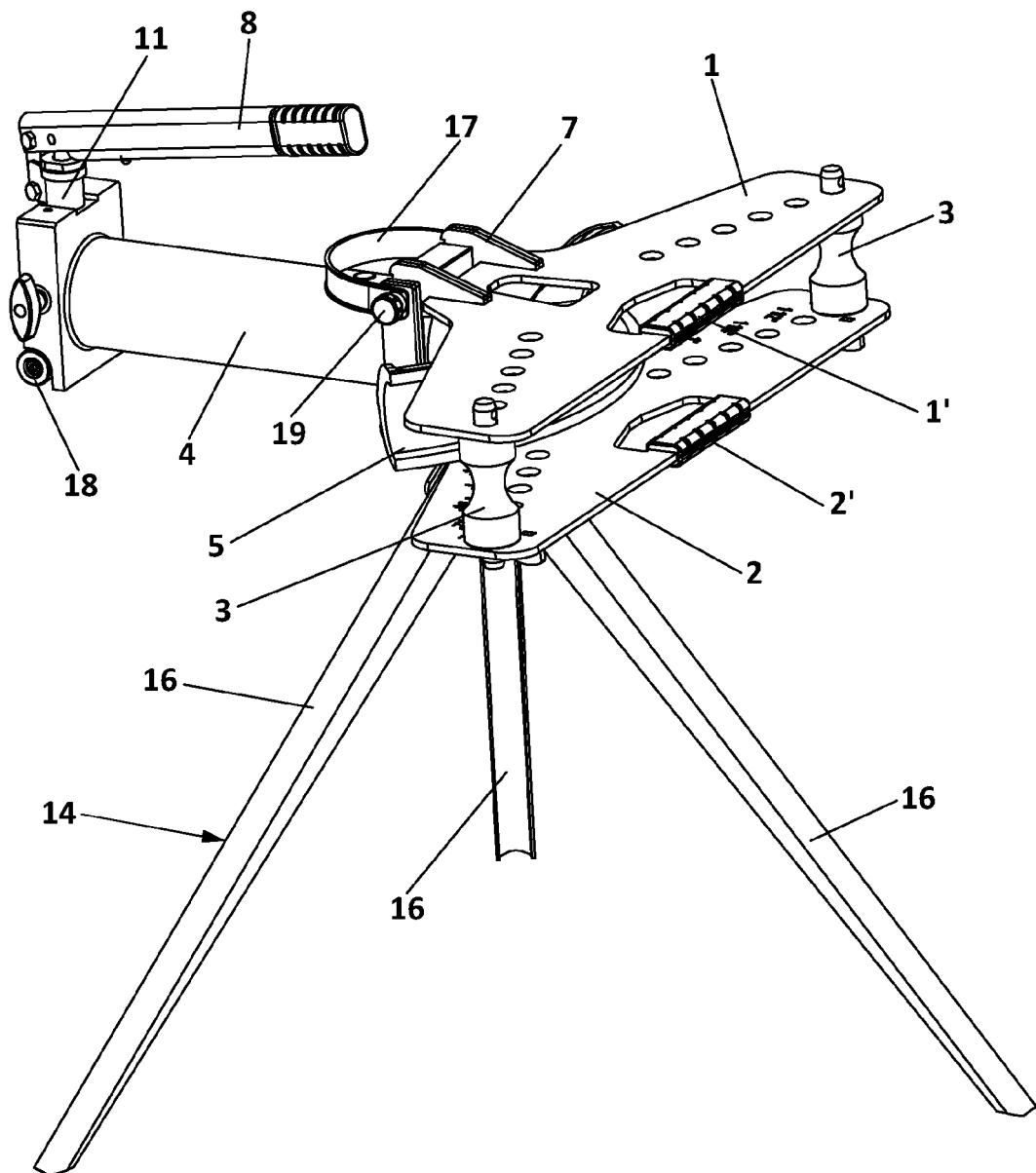
8. Pipe bending machine according to claim 7, wherein the support element (14) consists of a tripod comprising three collapsible legs (16).
9. Pipe bending machine according to any of the preceding claims, comprising a collapsible handle (17) which is associated with a bolt (19) fixing the upper plate (1) to the base body (12).
10. Pipe bending machine according to any of the preceding claims, wherein the plates (1, 2) comprise handles (1', 2').
11. Pipe bending machine according to any of the preceding claims, wherein wheels (18) are arranged in the lower part of the end of the hydraulic cylinder (4) opposite the base body (12).



**FIG. 1**

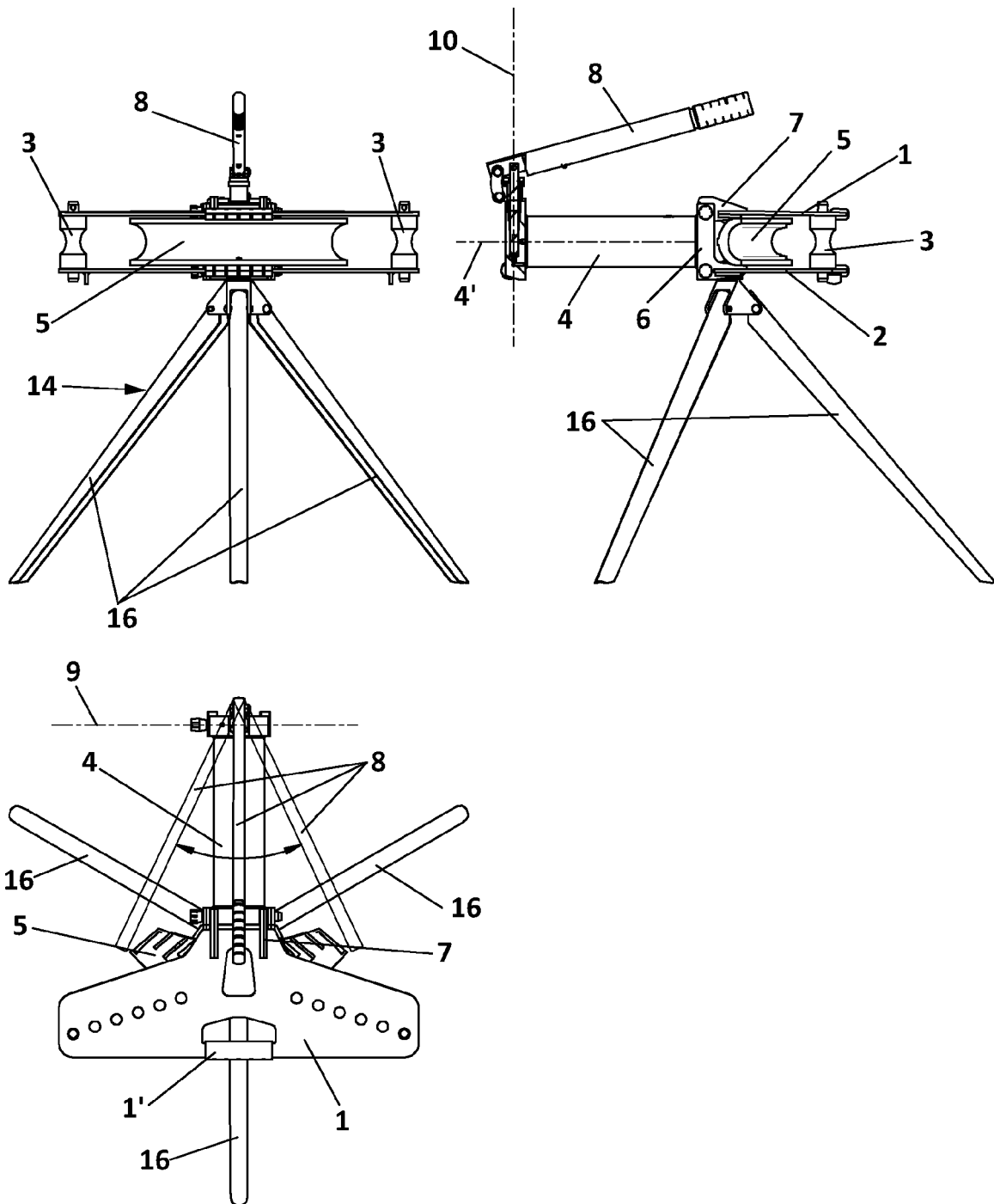


**FIG. 2**

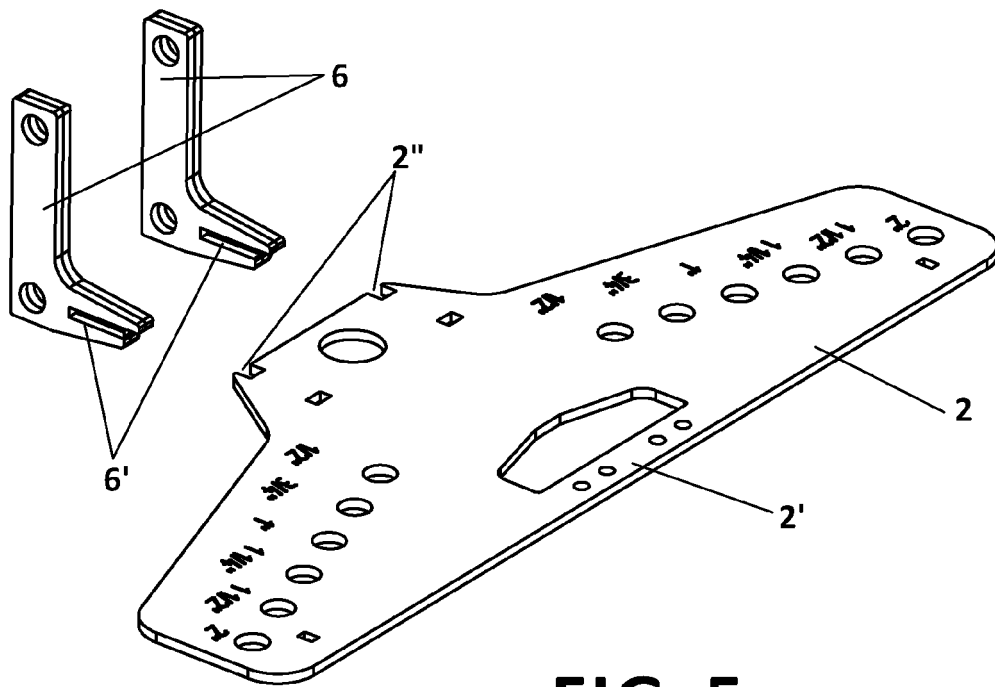


**FIG. 3**

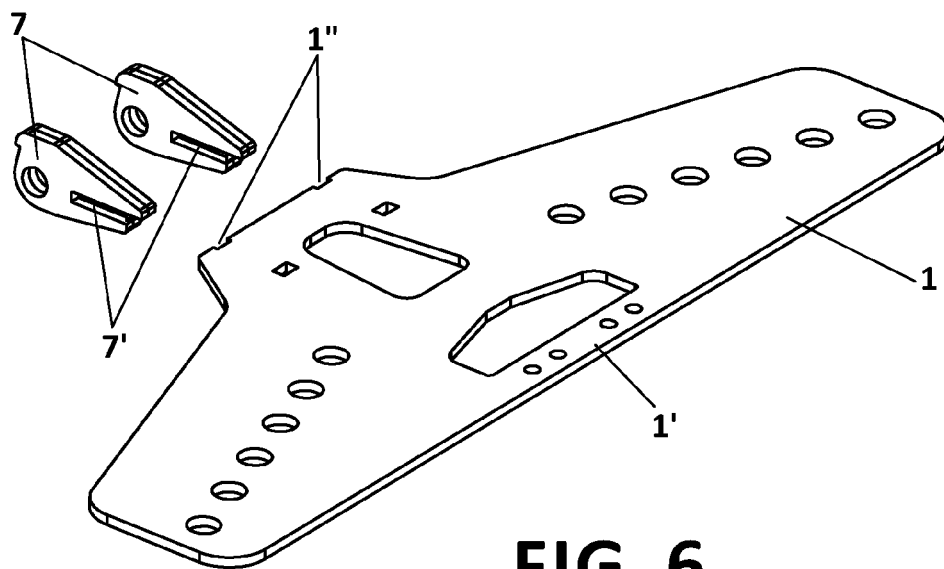




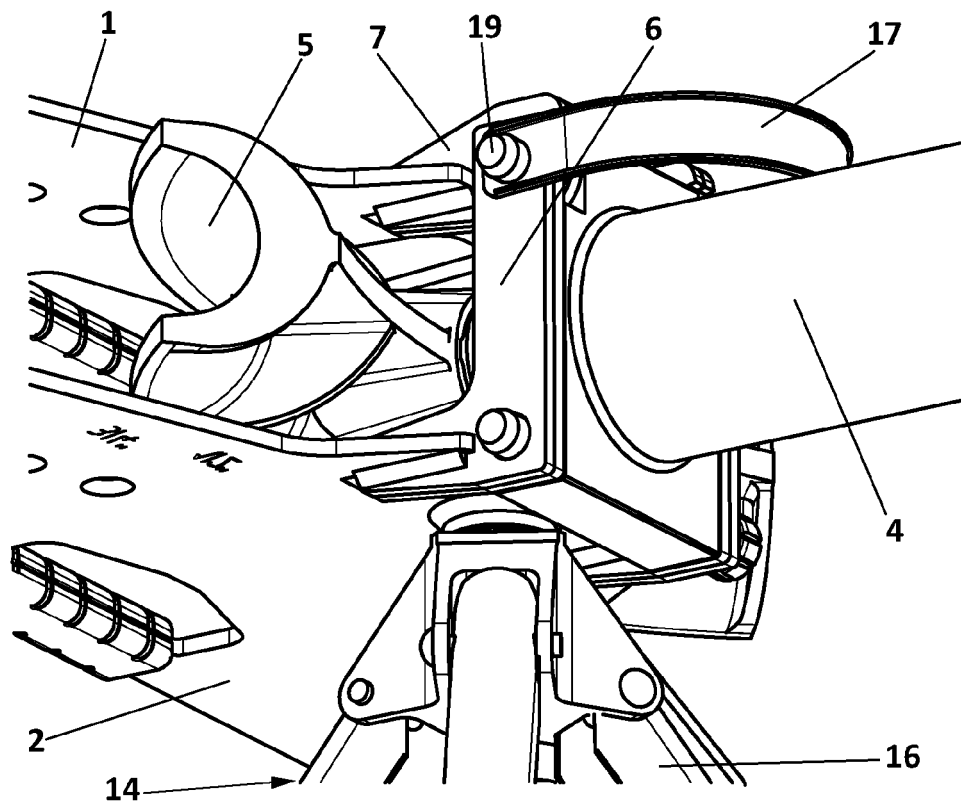
**FIG. 4**



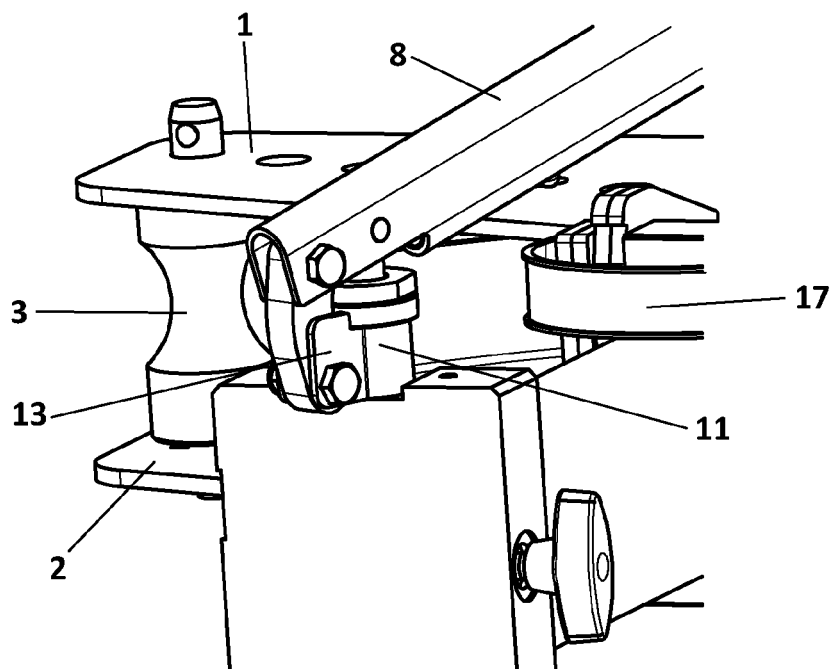
**FIG. 5**



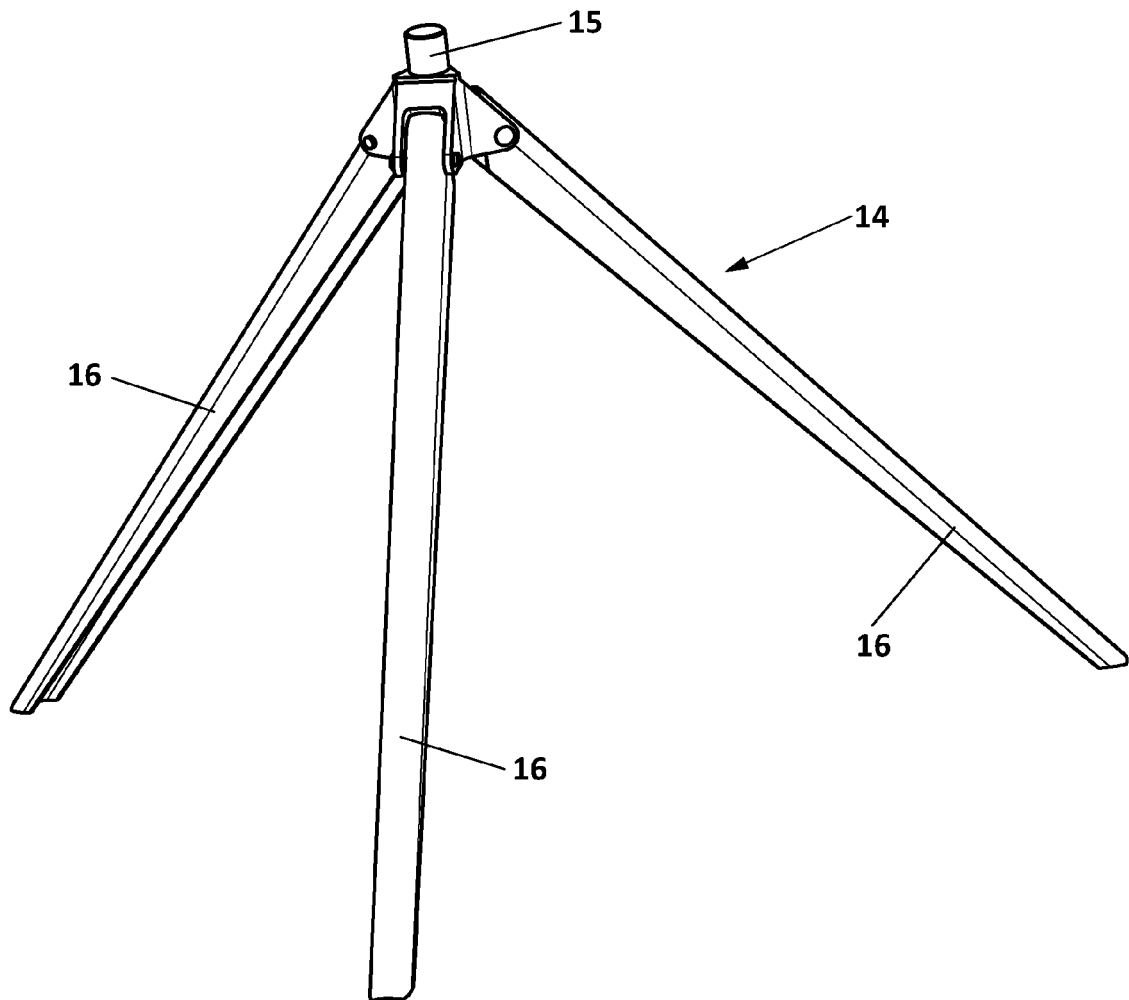
**FIG. 6**



**FIG. 7**



**FIG. 8**



**FIG. 9**



## EUROPEAN SEARCH REPORT

Application Number  
EP 14 38 2340

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 February 2015	Examiner Knecht, Frank
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**REFERENCES CITED IN THE DESCRIPTION**

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