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(54) **LEVEL GAUGE FOR THE LAYING OF SCREEDS, SELF-LEVELLING FLUID BASES AND THE LIKE**

(57) Level gauge (P) for laying self-levelling screeds, comprising a supporting tripod (1), a vertical rod (2) capable of sliding alternatively with respect to the tripod, and provided, in correspondence of its lower end, with a horizontal plate (20), stop means (3, 30) suitable for locking the sliding of the rod (2) in any position which can be selected by the user according to the height to be attributed to the plate (20) with respect to the ground.

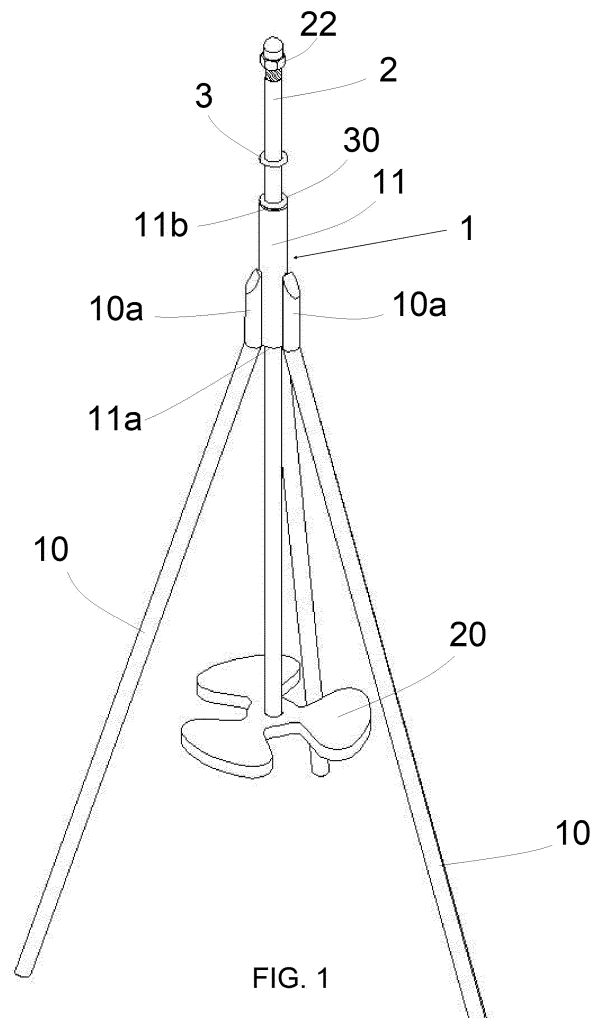


FIG. 1

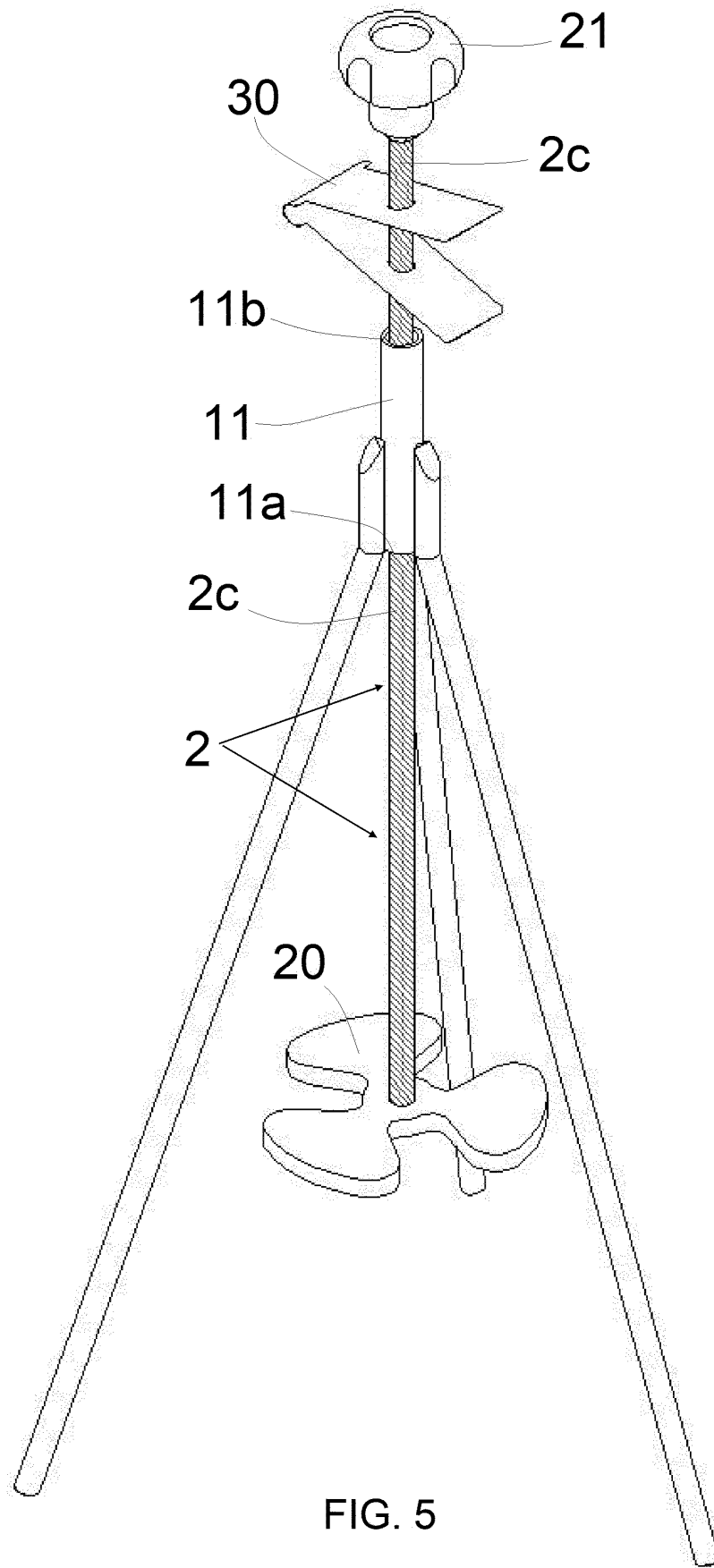


FIG. 5

## Description

**[0001]** The present invention relates to a level gauge for self-levelling screeds or the like.

**[0002]** In the building industry it is often necessary to lay fluid products for the realization of self-levelling screeds, filling bases or self-compacting concrete castings.

**[0003]** In these cases it is necessary to be certain that the surface of such a self-levelling screed is perfectly horizontal, despite the fact that perhaps the base on which it is laid does not ensure such a condition.

**[0004]** It should be considered that it is necessary to reproduce the same horizontal level of the flooring in all rooms; this is another reason why it is necessary to use fixed or removable references to indicate to the operator the height to be respected during the laying of the various materials that make up the different layers of a flooring.

**[0005]** Bubble levels, communicating tubes and, more recently, laser systems are currently used to create said references according to the level of a flooring.

**[0006]** In order to fix the reference by means of said laser systems, a horizontal laser beam is projected in the area where the screed is to be laid at a predetermined level (conventionally 100 cm).

**[0007]** The horizontal laser beam becomes the reference for the realization of the horizontal surface of the underlying screed or base in parallel direction relative to the laser beam; in view of the above, the surface of the screed must remain at the same vertical distance from the laser reference in all its points.

**[0008]** The vertical distance must be measured between the laser beam and the horizontal plates, which can be adjusted in height, provided in a series of level gauge arranged on the base on which the screed is to be laid.

**[0009]** In the most popular embodiment, the level gauges consist in a tripod provided with three very thin legs, wherein the respective horizontal plate slides between the three legs of the tripod, it being supported and controlled by a slidable vertical rod suitable for being used to accurately set the height assumed by the plate from time to time relative to said laser reference.

**[0010]** The operators in charge of realizing the screed must first arrange a plurality of set level gauges on the base and then adjust the height of the respective horizontal plates, in such a way that all plates are perfectly aligned in horizontal position at the same operating height.

**[0011]** Now the casting of the fluid material can be carried out, which must be interrupted as soon as the upper surface of the casting has exactly reached the same level occupied by the plates of the various level gauges.

**[0012]** Before the casting sets, it is necessary to remove all level gauges in such a way that the fluid material is re-compacted spontaneously, filling the voids left by the thin legs of the level gauges.

**[0013]** Such a technology is impaired by some rather

significant drawbacks.

**[0014]** In fact, it must be considered that a traditional level gauge comprises a tripod structure, which is vaguely similar to a stand, which is provided at the top with a sturdy horizontal metal plate with triangular shape, from whose three vertices three perpendicular rods protrude downwards, acting as support feet of a similar structure.

**[0015]** Said plate is centrally provided with a threaded collar, or a nut, with a vertical axis wherein a threaded rod can slide alternately, supporting at the bottom a horizontal plate with a circular profile; the function of said plate being to indicate the height to be reached by the surface of the fluid material suitable for forming the desired screed.

**[0016]** A knob is provided at the top of the threaded rod, which is used by the operator to screw or unscrew the rod relative to said threaded collar, consequently lowering or raising the respective horizontal plate until the latter reaches the preset operating height.

**[0017]** Such a traditional level gauge has a precarious stability, which is evident when the level gauge is in operating position. This depends on the fact that the level gauge has a rather high center of gravity, especially because of the provision of said heavy metal plate arranged at the top of the three supporting legs.

**[0018]** In case of a side impact of small entity, such a level gauge can easily tip to the ground, losing its operating position and completely failing to perform its function.

**[0019]** In an attempt to contrast the risk of tipping over that affects the traditional level gauges, in some models, the operators in charge of their installation will stick the supporting legs into the base whereon the screed is to successively realized.

**[0020]** However, such a choice proves to be totally inadvisable because in the case of solid materials, it is practically impossible to stick the legs of the level gauges into the ground. On the contrary, in the case of soft materials, the legs of the level gauges may damage the layers of thermal and/or acoustic insulation material and the vapor barriers that may be arranged on the base and must be integrally preserved in order to perform their function.

**[0021]** A typical drawback of such a kind of level gauges relates to the fact that they provide for said helical coupling between the threaded collar or the nut of the horizontal triangular plate and the vertical threaded rod that supports the horizontal plate. During use, in fact, said cooperating threads may be uncontrollably clogged by the material in fluid state suitable for forming the screed or eventually a concrete surface.

**[0022]** In fact, the practical experience has shown that often, during the casting process, the fluid material is uncontrollably splashed and deposited on the rod of the level gauge, easily generating friction or even a seizure, so as to make difficult, if not impossible, the further alternative sliding of the rod relative to the collar provided in said triangular plate.

**[0023]** The provision of such a helical coupling impairs a traditional level gauge also during the adjustment of the respective horizontal plate. Such an adjustment must be performed by manually operating the knob provided at the top of the vertical rod that supports the plate.

**[0024]** In order to perform such an adjustment it is often necessary to impose a high number of revolutions on the vertically-sliding rod and sometimes it may be necessary to make very different adjustments between one level gauge and the other with respect to the starting conditions; in view of the above, it appears evident that the consequence will be a considerable waste of time and physical energy for the operator in charge.

**[0025]** Moreover, since the level gauges are arranged on the flooring, it is evident that the operator in charge of adjusting the height of said horizontal plate is forced to bend over or even kneel down in order to reach the adjustment knob.

**[0026]** In both cases the operator will be forced to assume a posture that is not particularly comfortable, nor natural, which could easily result in harmful physical conditions, especially in the case of a recurrent use of such level gauges.

**[0027]** A further drawback that is typical of the use of a traditional level gauge depends on the fact that the horizontal plate suitable for establishing the height to be reached by the material in fluid state has a rather small surface, both in diameter and thickness.

**[0028]** For these reasons the plate tends to be scarcely visible when it is partially covered by the fluid material that has reached its operating height.

**[0029]** Such a poor visibility complicates the task of the operator who has to decide to interrupt the casting of material in fluid state at the precise moment when the operator becomes aware of the fact that the material has reached a level that is perfectly corresponding to the height of the various plates of a plurality of similar level gauges.

**[0030]** Another inconvenience of the traditional technology is manifested every time several specimens of the level gauge are to be transported, handled during use, or stored in the warehouse before they are sold or when they are not used.

**[0031]** In particular, the fact that such a level gauge is provided with said wide triangular plate at the top of its substantially conical structure prevents the possibility of compacting several specimens of the level gauge, thus requiring a larger space and a higher effort for the operator during the use and the continuous handling for the execution of the daily work.

**[0032]** The purpose of the present invention is to provide a new level gauge that is characterized by a higher stability in the operating position and a greater resistance against the tendency to accidental tipping over.

**[0033]** Such a purpose has been achieved because of the fact that, in spite of being provided with three supporting legs, the new level gauge adopts a pyramidal profile and therefore renounces the adoption of the tra-

ditional horizontal plate towards which the supporting legs of the traditional level gauges converge and which also supports the threaded collar or the nut whereon the rod suitable for supporting the horizontal plate that acts as a reference for the upper surface of the screed is slidably engaged.

**[0034]** As already mentioned, the heavy triangular plate contributed to considerably raise the center of gravity of the level gauge and prevented the desirable compacting of several specimens of such a device.

**[0035]** A similar critical observation led to the fact that the new level gauge renounces the adoption of such a horizontal plate and provides instead for the three legs to converge and be welded in correspondence to a simple tube with vertical axis, effectively suitable for cooperating with the sliding rod that inferiorly supports the necessary horizontal plate, as illustrated below in this description.

**[0036]** Furthermore, the new level gauge also solves the further drawback typical of the traditional technology that provided for the helical coupling between the threaded collar supported by the triangular plate and the threaded plate-holding rod.

**[0037]** It has already been said, in fact, that if such a helical coupling allowed to exactly set the operating height of the plate supported by the threaded rod, on the other hand it easily risked to be jeopardized in the moment in which one and/or the other of the two cooperating threads were uncontrollably invaded by the fluid material during the casting process, after a few working sessions.

**[0038]** For this reason, according to a preferred embodiment of the new level gauge, the vertical tube and the respective sliding rod have smooth walls, in such a way to prevent any undesirable intermediate accumulation of the fluid material.

**[0039]** In order to allow the sliding rod to firmly assume any desired position with respect to the tube (which obviously corresponds to the height that is intended to be assigned to the respective plate from time to time), a stop means is provided in an intermediate position between the tube and the rod.

**[0040]** Such a stop means - preferably an O-ring - operates in such a way as to prevent the uncontrolled downward sliding of the plate-holding rod by mere gravity, but does not prevent the rod from descending or ascending when the operator exerts an adequate force on the rod.

**[0041]** A further purpose of the present invention is to ensure a higher stability and a better visibility to the plate used for setting the height of the screed and at the same time, to improve the general mode of use of the level gauge according to the present invention.

**[0042]** These advantageous results were obtained by providing such a plate with a rather large surface, an adequate weight to improve its center of gravity, and a clover or helical profile comprising three radial lobes that are regularly spaced by means of as many radial notches.

**[0043]** The three wide radial lobes not only have the capacity to make the plate easily visible even when the plate is half-submerged by the fluid material, but one or

the other of them can be used as a point of application of a percussion force exerted from above in order to cause the calibrated downward sliding of the rod and bring the plate to the desired operating height.

**[0044]** Preferably, such a percussion force can be exerted by means of a graduated rod of considerable length (normally equal to the conventional 100 centimeters added to the thickness given to the subsequent working operations to be performed on the flooring), whose first advantage is to allow the operator in charge of adjusting the operating height of the plate to perform such an operation from an ergonomic upright position, i.e. without the need to bend over or kneel down as it occurs with the traditional technology.

**[0045]** On the other hand, during the exertion of the percussion force on the clover-shaped plate, the graduated rod can be advantageously guided by the laser beam used as a horizontal reference, in such a condition that the operator in charge of such an operation can be absolutely certain of bringing the plates of all the level gauges disposed in the room to exactly the same height.

**[0046]** The clover-shaped profile of the plate of the level gauge according to the invention is also advantageous for other reasons.

**[0047]** In fact, such a plate does not interfere with the upper sections of the three legs of the level gauge that are externally welded on the tube, when the respective sliding rod is to be raised to the maximum position relative to the tube; This is due to the fact that, in such a condition, the upper sections of the three legs are arranged inside the three radial notches of the clover-shaped plate, thus allowing a wider movement of the plate, while reducing its total height, in favor of the greater stability of the level gauge.

**[0048]** Additionally, the decision to give a similar clover-shaped profile to the plate is also fundamental in order to be able to stack several specimens of the new device on top of the other, or to place them in close contact side by side.

**[0049]** Such a compacting mode is made possible by the fact that the three radial notches provided in the clover-shaped plate of each specimen of the level gauge can accommodate the rod of an inferior or superior specimen placed in adjacent position.

**[0050]** For greater explanatory clarity the description of the invention continues with reference to the attached drawings, having only illustrative and not limiting value, in which:

- Fig. 1 is a perspective view illustrating a first embodiment of the level gauge according to the invention;
- Fig. 2 is an exploded view of the level gauge of Fig. 1;
- Fig. 3 is a perspective view illustrating a second embodiment of the level gauge;
- Fig. 4 is an exploded view of the level gauge of Fig. 3;
- Fig. 5 is a perspective view of a third embodiment of the level gauge.

**[0051]** With particular reference to Figs. 1 and 2, the level gauge (P) according to the invention comprises a metal tripod (1) and a metal rod (2).

**[0052]** The metal tripod (1) comprises three supporting legs (10) which converge at the top of a cylindrical tube (11) with vertical axis internally provided with smooth walls. The upper ends (10a) of the legs are externally fixed on the tube (11) at regular 120° intervals.

**[0053]** The metal rod (2) has a circular section and smooth outer walls. The lower end (2a) of the metal rod (2) is inserted into a central hole (20c) of a plate (20) lying on a plane orthogonal to the longitudinal axis of the rod (2).

**[0054]** The rod (2) is suitable for being inserted in the tube (11) of the tripod (1), with possibility of alternative sliding.

**[0055]** The tube (11) has a lower opening (11a) and an upper end (11b). The upper end (2b) of the rod (2) is inserted into the lower opening (11a) of the tube (11). In such a way the upper end (2a) of the rod (2) is positioned at a higher height than the upper end (11b) of the tube (11), whereas the plate (20) is disposed in horizontal position under the lower opening (11a) of the tube (11), between the legs (10) of the tripod (1).

**[0056]** The plate (20) has a profile that is substantially shaped like a clover or a helix with three blades, having three radial lobes (20a) and three notches (20b).

**[0057]** The radial lobes (20a) have a profile that is substantially shaped like a drop with a tapered portion converging toward the center of the plate (20), and a wider portion in peripheral position.

**[0058]** The notches (20b) of the plate (20) have a profile such as to accommodate the legs (10) of the tripod (1), when the rod (2) has been raised to its maximum position, in a condition whereby the plate (20) is brought to a height slightly below that occupied by the lower opening (11a) of the tube (11).

**[0059]** The rod is provided with an actuation means (21, 33) mounted in its upper end (2b). The actuation means may be a knob (21) or a faceted tip (22).

**[0060]** After coupling the tripod (1) and the rod (2), the knob (21) is mounted in the upper end of the rod (2) for an easier actuation of the rod.

**[0061]** The rod (2) inserted in the tube (11) of the tripod (1) is subject to the force of gravity which would make it slide downwards uncontrollably. In order to avoid such a downward sliding of the rod, a height-adjustable stop means (3, 30) is provided, which allows the rod (2) to stably maintain the height assigned to it from time to time, as illustrated below in this description.

**[0062]** After describing the configuration of the level gauge (P) according to the invention, this description continues with an illustration of the operating procedures.

**[0063]** As already mentioned, the operators in charge of realizing a self-levelling screed must place several level gauges (P) in upright position on the base of the room wherein the fluid mass of the screed is to be poured.

**[0064]** Normally, a level gauge (P) is disposed every

3 square meters of the room to be paved. In such an initial condition, the rod (2) must be disposed in its "highest starting position", in correspondence of which the respective plate (20) occupies the maximum attainable height.

**[0065]** Such a stable initial positioning of the rod (2) can be ensured by means of suitable stop means (3) which will be described in detail below.

**[0066]** Successively, the operators must create a horizontal reference by means of a laser beam (or possibly by means of an alternative device) projected at the conventional height that is higher than the height of said level gauges (P). Using the laser beam, it is possible to determine the vertical distance at which all the plates (20) of the level gauges (P) are to be arranged.

**[0067]** This ensures that the plates (20) of the various level gauges (P) are all disposed at the same height, which will be the height exactly reached by the surface of the self-levelling screed that will be poured in the room where the level gauges (P) are installed.

**[0068]** In order to adjust the vertical position of each one of the plates (20) of the various level gauges (P), the operator will have to exploit the capacity of alternative sliding of the rod (2) relative to the tube (11) of the tripod (1).

**[0069]** When it is necessary to slide the rod (2) downwards and the operator does not want to have to bend over to reach the knob (21), the operator can choose to adjust the descending travel of the rod (2) of the various level gauges (P) by means of a graduated rod, checking, for each level gauge (P), the correct vertical distance that the respective plate (20) must assume with respect to said horizontal reference given by the laser beam.

**[0070]** In such a case, in fact, while comfortably standing in upright position, the operator can place the lower end of the rod on one of the lobes (20a) of the plate (20), and then push the plate (20) down by means of small percussions performed with the rod, in such a way to obtain a downward sliding of the rod (2), and therefore a lowering of the height of the respective plate (20) to the desired point, which can be detected in real time thanks to the cooperation between the laser beam and the graduated rod.

**[0071]** In the embodiment shown in Figs. 1 and 2, the stop means (friction) consists of an O-ring (3) that is inserted along the rod (2). The O-ring (3) is of such a diameter that it can tighten the rod (2) tightly, without being prevented from sliding along the rod (2) as a result of an energetic manual intervention by the operator.

**[0072]** When positioning the various level gauges (P) in the room, the operator must select a relatively high position of the rod (2) with respect to the tripod (1), considering the height that will have to be occupied by the plate (20) at the end of the adjustment. Then the operator must slide the O-ring (3) along the rod (2) until it is stopped against the upper end (11b) of the tube (11) of the tripod (1), thus being sure that the rod (2) will not slide further, in an uncontrolled way, towards the ground, thanks to

the interference of the O-ring (3) against the upper end (11b) of the tube (11).

**[0073]** In order to make such a technology more efficient, preferably, a second O-ring (3a), which is identical to the first O-ring (3), is placed in correspondence of the upper end (11b) of the tube (11), so as to act as a real stop point against the first O-ring (3) that is slidingly inserted along the rod (2), as shown in Fig. 1.

**[0074]** In the second embodiment of the invention shown in Figs. 3 and 4, the stop means of stop consists of a leaf spring (30) having a "V"-shaped section, comprising an upper branch (31) and a lower branch (32) connected by a rib (33). The branches (31, 32) have holes (31a, 32a) wherein the upper end (2b) of the rod (2) is to be inserted.

**[0075]** In such a condition, the spring (30) can cooperate with the rod (2) in two alternative ways, depending on whether the spring (30) assumes a compressed position, favored by an appropriate manual intervention by the operator, or whether it spontaneously maintains its natural divaricated position (as shown in Fig. 3).

**[0076]** During the compression of the spring (30), the two branches (31, 32) are brought into a substantially parallel position in which the respective holes (31a, 32a) assume a substantially horizontal position, in such a way that the spring (30) can slide freely along the rod (2).

**[0077]** On the contrary, in the second case, when the two branches (31, 32) of the spring are in a divaricated position, the two holes (31a, 32a) are in a substantially inclined position and create an energetic interference on the rod (2), preventing the spring (30) from sliding along the rod (2).

**[0078]** The practical use of the spring (30) requires the operator to select the exact operating position of the rod (2) with respect to the tripod (1), depending on the height to be assigned to the plate (20). Then the operator must compress the spring (30) to enable its sliding along the rod (2), until the lower wing (32) of the spring (30) comes into contact with the upper end (11b) of the tube (11) of the tripod (1).

**[0079]** At this point the operator must release the compression force on the spring (30), in such a way that the spring (30) spontaneously returns to the divaricated position that prevents any further sliding along the rod (2) and, basically, keeps the rod (2) at the previously selected operating height.

**[0080]** The stopping of the rod (2) with respect to the tube (11) is generated by the interference between the lower branch (32) of the spring (30) and the upper end (11b) of the tube (11) of the tripod (1). According to an additional embodiment of the level gauge (P), the rod (2) has an external thread (2a) in order to carry out a fine adjustment of the height of the plate (20). In this way, the operator can hold the knob (21) and rotate the rod (2) downwards or upwards inside the two holes (31a, 32a) of the spring (30), until the plate (20) is brought to the preset height with millimetric precision.

**[0081]** Due to the provision of the rod (2) with external

thread (2a), the level gauge (P) is preferred to the level gauges that are currently on the market for the fact that it exploits the precision of the screw adjustment of the rod (2), without the risk to expose the rod, which has come in contact with the splashes of mortar, to a friction and seizure as the rods of the traditional level gauges that cooperate with nuts and threaded collars.

**[0082]** In fact, the spring (30) of the level gauge according to the invention grips the threaded rod (2) by means of its holes (31a, 32a), which, however, having a very small thickness (equal to 0.5 mm.) do not risk clogging and therefore allow the rod (2) to rotate freely, to the point of facilitating a rotation of the rod due to their ability to automatically clean the surface from the mortar splashed on it.

## Claims

1. Level gauge (P) comprising:
  - a tripod (1) with three legs (10) arranged in upward-converging position,
  - a tube (11) of cylindrical tubular shape, supported in a vertical position by upper portions of the legs (10),
  - a rod (2) of cylindrical shape slidingly mounted in a vertical position,
  - a plate (20) mounted in a lower end (2a) of the rod,
  - an actuation means (21, 22) mounted at an upper end (2b) of the rod in order to move the rod, so that the plate (20) is positioned at a predetermined height above the ground, and
  - a stop means (3, 30) mounted in the rod (2) and manually movable to be positioned in a stop position, wherein it abuts against an upper end (11b) of the tube (11), when the plate (20) supported by the rod has reached a desired height above the ground.
2. The level gauge (P) according to claim 1, wherein said plate (20) has a profile shaped like a clover or a helix, and comprises three lobes (20a) of triangular shape and three radial notches (20b) wherein the legs (10) of the tripod (1) are arranged.
3. The level gauge (P) according to claim 2, wherein said plate (20) is centrally provided with a hole (20c) suitable for accommodating the lower end (2a) of the rod (2).
4. The level gauge (P) according to any one of the preceding claims, wherein said actuation means of the rod (2) comprises a knob (21).
5. The level gauge (P) according to any one of claims 1 to 3, wherein said actuation means of the rod (2)

comprises a faceted tip (22).

6. The level gauge (P) according to any one of the preceding claims, wherein said stop means comprises an O-ring (3) tightly mounted on the rod (2) and capable of sliding along the rod (2).
7. The level gauge (P) according to any one of claims 1 to 5, wherein said stop means comprises a leaf spring (30) having a "V"-shaped section, comprising an upper branch (31) and a lower branch (32) connected by a rib (33); wherein said branches (31, 32) are provided with respective holes (31a, 32a) wherein the upper end (2b) of the rod (2) is inserted, wherein the rod (20) can slide freely in said holes (31a, 32a) of the spring only when the spring (30) is compressed to position the branches (31, 32) in a substantially parallel arrangement.
8. The level gauge (P) according to claim 7, wherein said rod (2) is provided with an external thread (2a) suitable for realizing a coupling with said holes (31a, 32a) of the spring (30).

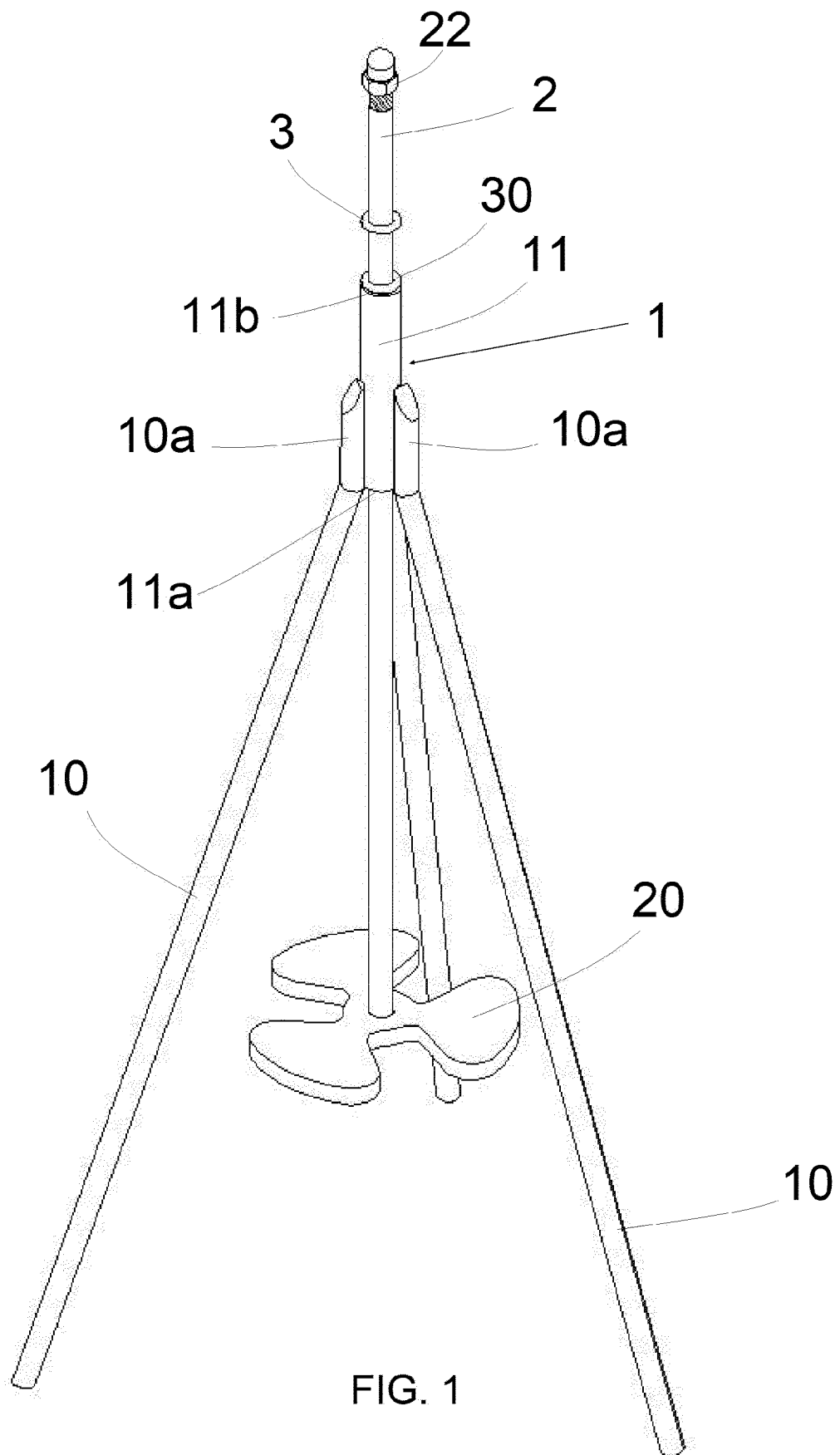
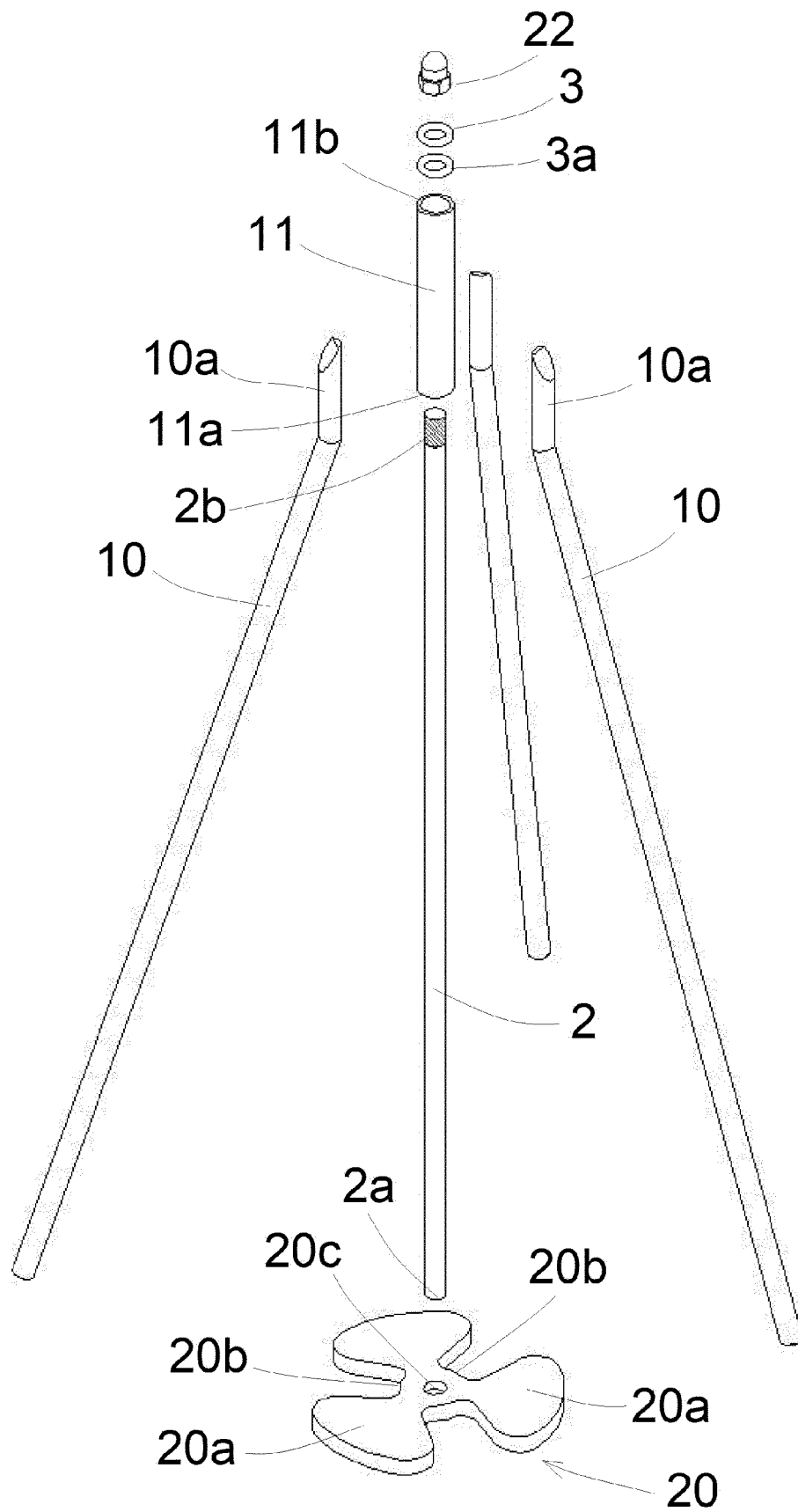
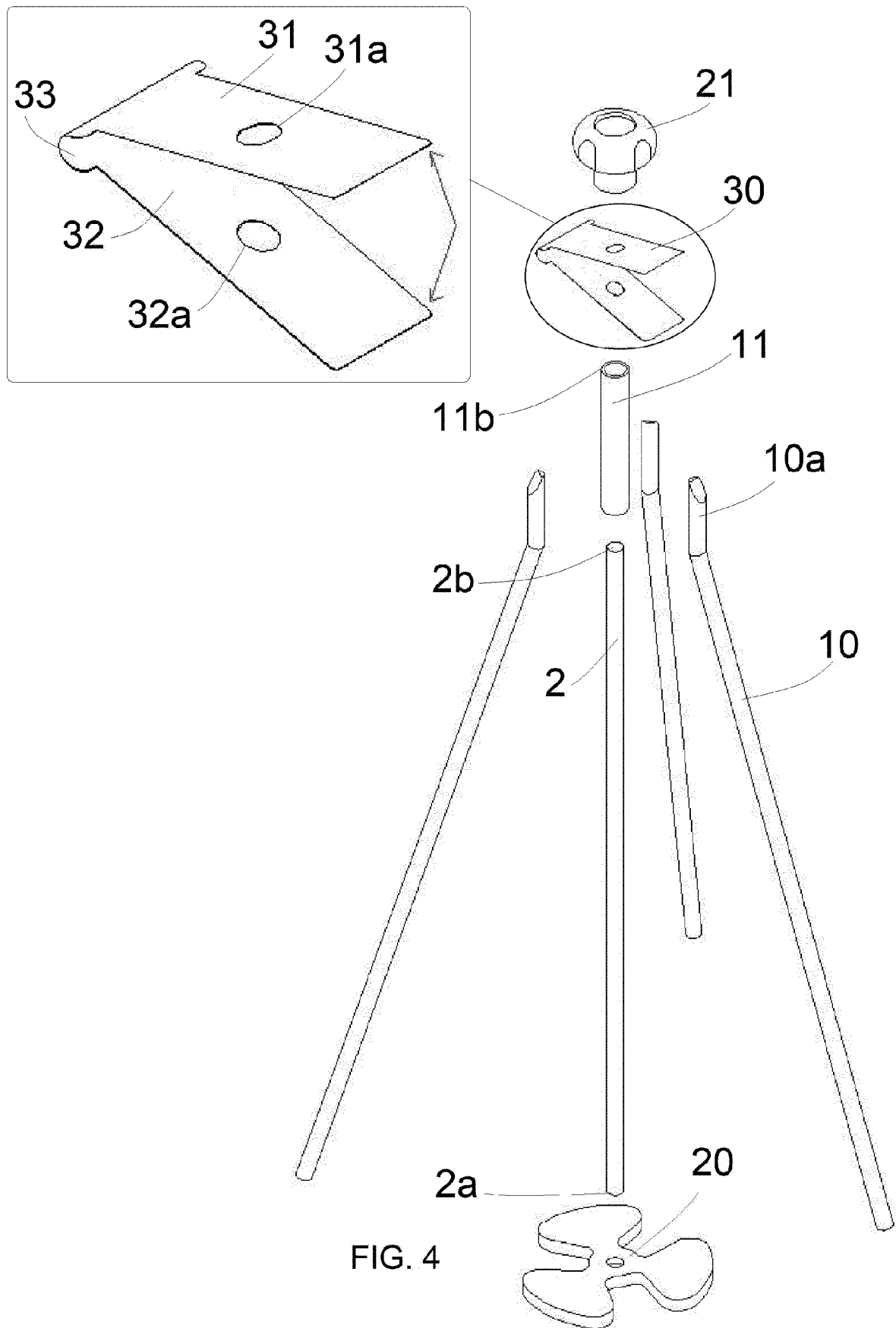
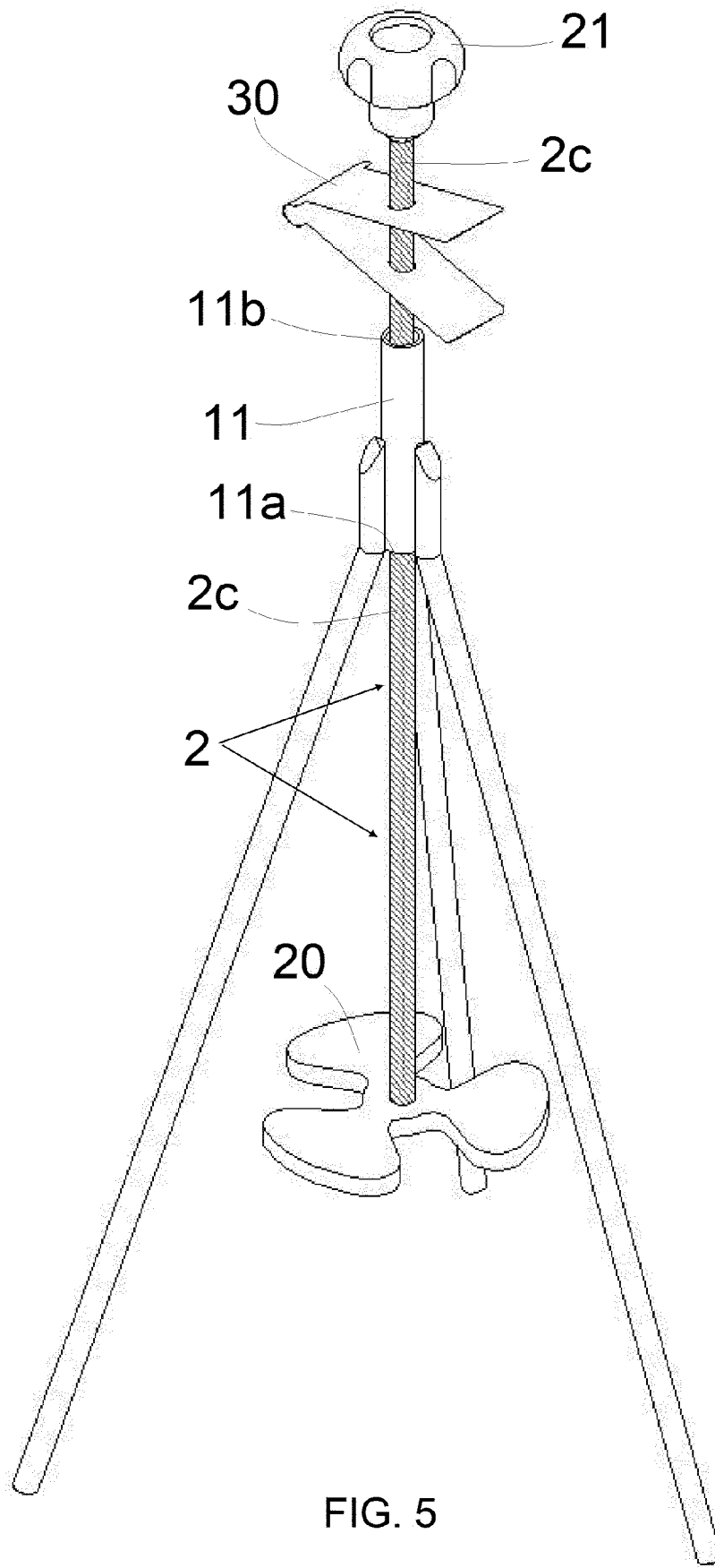


FIG. 1







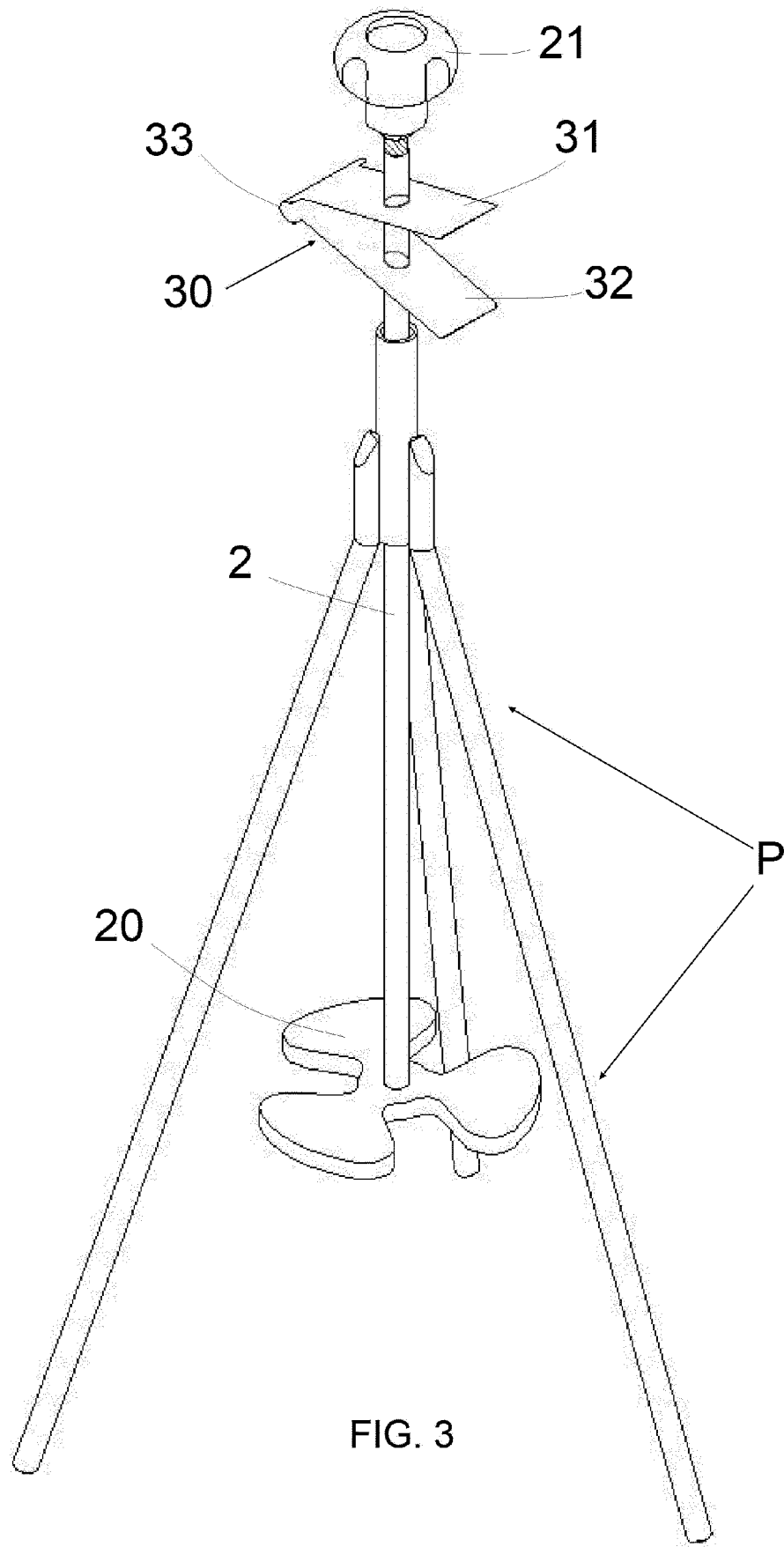


FIG. 3



## EUROPEAN SEARCH REPORT

Application Number

EP 22 16 5137

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EPO FORM 1503 03.82 (P04C01)

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                             |                                                                                                                                                                                                                                                                                       |                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                               | Relevant to claim                                                                                                                                                                                                                                                                     | CLASSIFICATION OF THE APPLICATION (IPC)    |
| X                                                                                                                                                                                                                                                      | JP H06 167113 A (MUROBOSHI AKIRA [JP])<br>14 June 1994 (1994-06-14)                                         | 1, 4-8                                                                                                                                                                                                                                                                                | INV.<br>E04F21/24<br>E04G21/10<br>G01C5/00 |
| A                                                                                                                                                                                                                                                      | * paragraphs [0001], [0005] *<br>* figure 1 *                                                               | 2, 3                                                                                                                                                                                                                                                                                  |                                            |
| A                                                                                                                                                                                                                                                      | JP S61 266910 A (TAIHEI KOGYO KK [JP])<br>26 November 1986 (1986-11-26)<br>* figures 1-3 *                  | 1-8                                                                                                                                                                                                                                                                                   |                                            |
| A                                                                                                                                                                                                                                                      | FR 2 644 820 A1 (LESUEUR DANIEL [FR])<br>28 September 1990 (1990-09-28)<br>* figures 1, 3 *                 | 1-8                                                                                                                                                                                                                                                                                   |                                            |
| A                                                                                                                                                                                                                                                      | JP H06 294212 A (MIZOGUCHI KOMUTEN KK [JP])<br>21 October 1994 (1994-10-21)<br>* figures 1, 2 *             | 1-8                                                                                                                                                                                                                                                                                   |                                            |
| A                                                                                                                                                                                                                                                      | WO 2017/146380 A1 (JEON DAE WOO [KR]; JEON HO HYUNG [KR])<br>31 August 2017 (2017-08-31)<br>* figures 1-5 * | 1-8                                                                                                                                                                                                                                                                                   | TECHNICAL FIELDS SEARCHED (IPC)            |
|                                                                                                                                                                                                                                                        |                                                                                                             |                                                                                                                                                                                                                                                                                       | E04F<br>G01C<br>E04G                       |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                             |                                                                                                                                                                                                                                                                                       |                                            |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                       |                                                                                                             | Date of completion of the search<br><b>30 August 2022</b>                                                                                                                                                                                                                             | Examiner<br><b>Arsac England, Sally</b>    |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                             | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                            |

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

EP 22 16 5137

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

30-08-2022

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                        | Publication<br>date                    |
|-------------------------------------------|---------------------|---------------------------------------------------|----------------------------------------|
| <b>JP H06167113 A</b>                     | <b>14-06-1994</b>   | <b>JP 3177791 B2</b><br><b>JP H06167113 A</b>     | <b>18-06-2001</b><br><b>14-06-1994</b> |
| <b>JP S61266910 A</b>                     | <b>26-11-1986</b>   | <b>JP H0469728 B2</b><br><b>JP S61266910 A</b>    | <b>09-11-1992</b><br><b>26-11-1986</b> |
| <b>FR 2644820 A1</b>                      | <b>28-09-1990</b>   | <b>NONE</b>                                       |                                        |
| <b>JP H06294212 A</b>                     | <b>21-10-1994</b>   | <b>JP H0816398 B2</b><br><b>JP H06294212 A</b>    | <b>21-02-1996</b><br><b>21-10-1994</b> |
| <b>WO 2017146380 A1</b>                   | <b>31-08-2017</b>   | <b>KR 101771343 B1</b><br><b>WO 2017146380 A1</b> | <b>30-08-2017</b><br><b>31-08-2017</b> |