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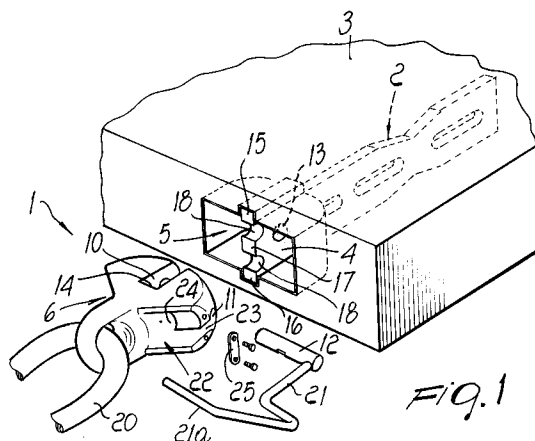
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(54) **Device for lifting prefabricated components, particularly made of concrete or the like.**

(57) The device has a plate (2), arranged in a plane substantially parallel to the lifting direction, to be embedded in the component (3), except for an end (4) which can be accommodated in a recess (5) formed in the component (3) and can be accessed from outside. The device also has a handle (6), a portion of which is insertable in the recess (5) and provided with a notch (10) in which the end (4) of the plate (2) can be accommodated. A seat (11) is formed in the body of the handle (6), extends substantially at right angles with respect to the notch (10) and accommodates a latch (12) slideable along the axis of the seat (11) to engage or disengage a hole (13) which is formed in the end (4) of the plate (2) and can be arranged in the notch (10) of the handle (6) in alignment with the seat (11). The end (4) of the plate (2) is furthermore shaped so as to couple to the bottom (14) of the correspondingly shaped notch (10).

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The present invention relates to a device for lifting prefabricated components, particularly made of concrete or the like.

As is known, various kinds of devices are used for lifting concrete components; such devices can be grouped into three main categories, according to the element to be embedded in the concrete in order to form an engagement point for the element which performs the lifting action.

Devices are in fact known which are based on the use of shaped tubular bodies, to be embedded in the concrete, and of a pin to be inserted in the shaped cavity defined by the tubular body in order to couple the component to a lifting machine.

Hand-made and industrially-manufactured devices are also known which use a rod or nail, to be embedded in the component, and a hook or clamp, which is connected to the lifting machine and can engage the rod or nail protruding from the component or accommodated in an appropriate recess.

Lifting devices belonging to these two first categories very often have the drawback that the element embedded in the concrete protrudes from said concrete and thus must be removed by cutting after use. In the other cases, the recess in which the end of the element anchored in the concrete is accommodated is large, with problems as regards the aesthetics of the component, due to the shape of the element which performs the lifting action and has to be inserted in said recess.

Furthermore, with devices of this type there are very often difficulties in positioning the element to be anchored in the concrete during production, as well as a certain difficulty in performing the correct engagement of said element on the part of the element which must perform the lifting action.

Lifting devices are also known which have a plate to be anchored in the component except for one end, which is in any case kept within the volume occupied by the component by providing a recess in the body of the component at said end. This end of the plate is crossed by a hole in which it is possible to insert a curved latch accommodated in a toroidal seat formed in a handle partially insertable in said recess. The toroidal seat is interrupted by a radial notch in which the end of the plate is insertable in order to engage it by means of the latch.

These kinds of device are certainly more practical than the types previously described, but they have the drawback of transmitting the lifting force to a small portion of the plate, often deforming it, or compulsorily requiring the use of very thick plates. Deformations or breakages of the component may furthermore occur proximate to the most intensely stressed region of the plate.

Known lifting devices furthermore have no safety systems for preventing the lifting of the

component if engagement of the element anchored in the concrete is defective.

The aim of the present invention is to solve the above described problems by providing a lifting device which is simple and practical to use, achieves a better distribution of the forces exchanged between the lifting element and the element anchored in the component, so as to safeguard the integrity of said component even if it has low strength.

Within the scope of this aim, an object of the present invention is to provide a lifting device which makes component engagement operations extremely simple and rapid.

Another object of the present invention is to provide a lifting device which offers adequate assurances of safety against accidental disengagement of the component during lifting.

A further object of the present invention is to provide a lifting device which can be manufactured at competitive costs with respect to known lifting devices.

This aim, these objects and others which will become apparent hereinafter are achieved by a device for lifting prefabricated components, particularly made of concrete or the like, which comprises a plate, arranged in a plane which is substantially parallel to the lifting direction, for embedding in a component except for an end which can be accommodated in a recess defined in said component and can be accessed from outside, and a lifting handle insertable in said recess and provided with engagement means which can be coupled to said end of the plate, characterized in that said handle has, on its portion insertable in said recess, a notch for receiving said end of the plate, a seat being formed in the body of said handle, said seat intersecting said notch substantially at right angles and slideably accommodating a latch longitudinally movable along said seat from a disengagement position, in which it does not affect said notch, to an engagement position, in which it crosses said notch, a through hole being formed in said end of the plate, having an axis which is substantially perpendicular to the plane of arrangement of the plate and being arrangeable in alignment with said seat by inserting said end of the plate in said notch, said end of the plate having, on a side thereof positionable facing the bottom of said notch, two end protrusions and at least one intermediate protrusion forming a support for the bottom of said notch and alternated with depressions engageable by raised portions which protrude from the bottom of said notch.

Further characteristics and advantages of the present invention will become apparent from the description of a preferred but not exclusive embodiment of the lifting device according to the

invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is an exploded perspective view of the device according to the present invention, with the handle;

figure 2 is a sectional view of the portion of the component which is affected by the device, taken at right angles to the plane of arrangement of the plate;

figure 3 is a sectional view of the coupling between the handle and the plate, taken on a plane at right angles to the plane of arrangement of the plate and with the component omitted for the sake of greater clarity;

figure 4 is a lateral elevation view of the handle engaged with the plate;

figures 5 to 7 are views of the steps of the lifting of a component with the device according to the present invention;

figure 8 is a sectional view of a detail of figure 3, taken along the axis VIII-VIII;

figures 9 and 10 are respectively a front elevation view and a lateral elevation view of a different embodiment of the plate;

figures 11 and 12 are respectively a front elevation view and a lateral elevation view of another embodiment of the plate.

With reference to the above figures, the device according to the present invention, generally designated by the reference numeral 1, comprises a plate 2, to be embedded in a component 3 except for an end 4 which can be accommodated in a recess 5 appropriately formed in the component 3 and accessible from outside, and a lifting handle 6, insertable in the recess 5 and provided with engagement means coupleable to the end 4 of the plate 2.

The plate 2 is meant to be embedded in the component 3 during the manufacture of said component, and is placed so that it is arranged on a plane which is parallel to the lifting direction. For example, if the component is constituted by a panel, the plate 2 is placed at right angles to the two larger faces of the panel, proximate to one side of the panel in which the recess 5 is formed.

The plate 2 has an elongated shape and is preferably obtained by blanking from a steel sheet in a per se known manner.

The end 4 of the plate is wider than the remaining part of the plate body and blends with the remaining part by means of two inclined portions 7a and 7b. The remaining part of the plate body has an intermediate neck 8 along its width and a series of slots 9 which are elongated in the direction of the longitudinal extension of the plate and anchor the plate within the component 3. In the case of reinforced concrete components, the slots 9 are filled by the concrete during the casting of

the component and may also be crossed by reinforcement rods of the component.

The handle 6 is substantially constituted by a metal block in which the side meant to be inserted in the recess 5 is rounded so as to facilitate its insertion. A notch 10, suitable to receive the end 4 of the plate 2, is formed in the portion of the handle 6 to be inserted in the recess 5.

A substantially cylindrical seat 11 is formed in the body of the handle 6, crosses the notch 10 at right angles and axially slideably accommodates a latch 12 which is also substantially cylindrical.

The latch 12 is movable longitudinally along the seat 11 to pass from a disengagement position, in which it is arranged outside the notch 10, to an engagement position, in which it crosses said notch 10 so as to engage a through hole 13 formed in the portion of the end 4 of the plate 2 to be inserted in the notch 10. The through hole 13 has an axis substantially perpendicular to the plane of arrangement of the plate 2 and can be aligned with the seat 11 by inserting the end 4 of the plate 2 in the notch 10.

Furthermore, the side of the plate to be directed toward the bottom 14 of the notch 10 is provided with two end protrusions, respectively 15 and 16, and with at least one intermediate protrusion 17, all of which form a supporting surface for the bottom 14 of the notch 10 and are mutually separated by depressions 18 engageable by raised portions 19 protruding from the bottom 14 of the notch 10. In practice, the particular shape of the end 4 of the plate 2 and of the bottom 14 of the notch 10 produces a coupling between the plate 2 and the handle 6 which limits relative movements between these two elements during lifting, so that the surface over which forces are exchanged between the handle and the plate, particularly during the first lifting step, is considerably larger than that of known lifting devices using a plate anchored in the component. In this manner, the extent of the local stresses to which the end 4 of the plate is subjected is modest, thus avoiding deformations of the plate which might cause cracks or breakages of the component and without requiring any oversizing of the thickness of the plate.

Conveniently, the ends of the protrusions 15, 16 and 17 are all arranged in a same plane which is substantially at right angles to the longitudinal extension of the plate, and the depressions 18 have a rounded bottom; the end of the raised portions 19 protruding from the bottom of the notch 10 of the handle 6 is also correspondingly rounded.

Figures 9 and 10 illustrate a different embodiment of the plate, now designated by the reference numeral 40, which, instead of providing for a fully planar extension of said plate, has, at the end of said plate which is opposite to the one which can

engage the handle 6, a portion 41 which is folded so as to form a plane which is inclined with respect to the plane of arrangement of the remaining part of the plate 40. Preferably, the inclination angle of the portion 41 with respect to the remaining part of the plate is substantially 45°. The same reference numerals have been maintained for the other elements of the plate 40 which correspond to the elements of the plate shown in the preceding figures.

Figures 11 and 12 illustrate another embodiment of the plate, now designated by the reference numeral 42, which has, starting from the end opposite to the end which can engage the handle 6, two portions 43 and 44 which are curved so as to form arcs with mutually opposite concavities. In this case, too, the other elements of the plate which correspond to the elements already described and illustrated with reference to the plate shown in figures 1 to 8 have been designated by the same reference numerals.

Again with reference to the plate 42 shown in figures 11 and 12, the intermediate protrusion 17 protrudes with respect to the plane of arrangement of the two end protrusions 15 and 16. In this case, the bottom 14 of the notch 10 of the handle is shaped correspondingly.

The portion of the handle 6 which remains outside the recess 5 is associated with a lifting ring 20 which, during the initial step of the lifting operation, is rotatable with respect to the handle 6 about an axis which is substantially parallel to the axis of the seat 11.

The latch 12 has, proximate to the end opposite to the end for insertion in the seat 11, an arm 21 which extends transversely to the axis of the seat 11 and is partially accommodated in a groove 22 formed in the body of the handle and connected to the seat 11.

More particularly, the groove 22 has a first portion 23 extending on a plane passing through the axis of the seat 11, and a second portion 24, containing the arm 21 when the latch 12 is in an engagement position and extending on a plane which is substantially perpendicular to the axis of the seat 11, so as to allow a rotation of the arm 21, and thus of the latch 12, in said plate at right angles to the axis of the seat 11 so as to trace an arc which is delimited by the extension of the second portion 24 of the groove 22. The rotation of the arm 21 in the portion 24 of the groove 22 causes the transfer of the latch 12 from a free position, in which the arm 21 is aligned with the first portion 23 of the groove 22 and thus allows axial sliding of the latch 12 along the seat 11, to an axial locking position, in which the arm 21 is angularly offset with respect to the first portion 23 within the second portion 24, so as to prevent axial

sliding of the latch 12.

Advantageously, the lifting device according to the present invention is provided with first safety means which oppose the lifting of the handle if the latch 12 is shifted along the seat 11 with respect to the correct engagement position.

Said first safety means comprise an end portion 21a of the arm 21 which extends substantially parallel to the axis of the seat 11 beyond the region where the handle 6 is connected to the ring 20, so that the ring 20, during the initial lifting step, strikes the portion 21a if the latch 12 is not in the above described axial locking position. More particularly, when the latch 12 is in the axial locking position, or when the arm 21 is in the second portion 24 of the groove 22 and is angularly offset with respect to the first portion 23, the end portion 21a of the arm 21 is spaced from the ring 20 in the lifting direction, so that the ring 20 is rotatable with respect to the handle 6 without interfering with the end portion 21a. Vice versa, when the latch 12 is not in the axial locking position but is in any case in the second portion 24 of the groove 22, the ring 20, during the initial lifting step, strikes the end portion 21a, causing the partial rotation of the latch 12 so as to move said latch into the axial locking position. Finally, if the latch 12 is shifted longitudinally along the seat 11 with respect to the position for correct engagement with the plate 2, the ring 20 strikes the end portion 21a without causing the rotation of the latch 12, which is prevented by the fact that the arm 21 is not at the second portion 24 of the groove 22. In this case, contact of the ring 20 against the portion 21a of the arm 21 is detected by the operators, who interrupt the lifting operations.

Conveniently, in order to avoid the total extraction of the latch 12 from the seat 11 there are retention means constituted by a plate 25 fixed to the handle 6 and closing the end of the groove 22 which is directed outwards.

Conveniently, means are provided for retaining the latch 12 in the axial locking position. Said retention means comprise a ball 26 or another presser element which protrudes with an end portion from a passage 27 formed in one of the sides of the second portion 24 of the groove 22 in the position of the arm 21 corresponding to the axial locking position of the latch 12. The ball 26 is pressed by a spring 28 accommodated in the passage 27 against a seat 29 which is shaped correspondingly and is formed on the side of the arm 21 directed toward the passage 27.

The engagement of the ball 26 in the seat 29 indicates, by means of a clicking noise which can be perceived by whoever actuates the latch 12, that said latch has reached the correct axial locking position.

In addition to the above described safety means, the lifting device according to the present invention is provided with additional safety means acting on the latch 12 to move it or keep it in the axial locking position. Said additional safety means are constituted by a flattened region 30 which affects an axial portion of the lateral surface of the latch 12, which is arranged at the notch 10 and is directed toward the bottom 14 of said notch 10 when the latch 12 is in the correct engagement and axial locking position. The flattened region 30 is coupleable to a flat portion 13a of the profile of the through hole 13 which affects the portion of said hole directed toward the bottom 14 of the handle 6 which is coupled to the plate 2. The coupling of the flattened region 30 with the flat portion 13a of the through hole 13 prevents the occurrence, during lifting, of rotations or translatory movements of the latch 12. Furthermore, if the latch 12 is slightly rotated with respect to the correct axial locking position when lifting begins, the coupling of the flattened region 30 with the flat portion 13a automatically causes a partial rotation of the latch 12 about the axis of the seat 11, moving it into the correct axial locking position.

The lifting device according to the present invention furthermore comprises a disposable box-like body 31 which can be fitted around the end 4 of the plate 2 prior to the manufacture of the component 3 so as to form the recess 5. Said box-like body 31, having a bottom in which a passage 32 for the plate 2 is formed, is provided, on its side directed towards the outside of the component 3, with a lid 33 which is removed after manufacturing the component and can be reused. The box-like body 31 is fitted onto the plate 2 starting from the end which is opposite to the end 3 until its bottom engages the inclined portions 7a and 7b which blend the end 4 with the remaining part of the plate.

The operation of the device according to the present invention is as follows.

In order to lift a component 3 inside which the plate 2 has been arranged beforehand, as described, the handle 6 is inserted in the recess 5, after checking that the latch 12 is in a disengagement position, so that the end 4 of the plate 2 correctly enters the notch 10, moving the through hole 13 into alignment with the seat 11. At this point the latch 12 is pushed manually, by acting on the arm 21 which protrudes from the recess 5, along the seat 11 so as to move it into the position for engagement with the through hole 13 and is then rotated about its own axis, moving the arm 21 inside the second portion 24 of the groove 22, so as to cause its axial locking.

In this manner the plate 2 is engaged with the handle 6 and the component 3 can be lifted.

If the latch 12 should accidentally rotate about its own axis prior to the beginning of the lifting operation, despite the retaining action performed by the ball 26 which engages the seat 29, the coupling of the flattened region 30 of the latch 12 with the flat portion 13a of the through hole 13, as well as the action of the ring 20 on the end portion 21a of the arm 21, returns the latch to the correct axial locking position.

In practice it has been observed that the lifting device according to the present invention fully achieves the intended aim and objects since, by obtaining a better distribution of the forces exchanged between the lifting handle and the plate anchored in the component, it allows to use thinner plates while nonetheless avoiding excessive deformations of said plates as well as cracks or damage to the component.

A further advantage of the device according to the present invention is that it offers adequate safety against lifting in the absence of correct engagement between the plate and the handle.

The device thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the dimensions, may be any according to the requirements and the state of the art.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Device for lifting prefabricated components, particularly made of concrete or the like, comprising a plate, arranged in a plane which is substantially parallel to the lifting direction, for embedding in a component except for an end which can be accommodated in a recess formed in said component and accessible from outside, and a lifting handle which can be inserted in said recess and is provided with engagement means which can be coupled to said end of the plate, characterized in that said handle has, on its portion which can be inserted in said recess, a notch for receiving said end of the plate, a seat being formed in the body of said handle, said seat intersecting said notch substantially at right angles and slideably accommodating a latch, longitudinally

movable along said seat from a disengagement position, in which it does not affect said notch, to an engagement position, in which it crosses said notch, a through hole being formed in said end of the plate, having an axis which is substantially perpendicular to the plane of arrangement of the plate and being arrangeable in alignment with said seat by inserting said end of the plate in said notch, said end of the plate having, on a side thereof to be directed toward the bottom of said notch, two end protrusions and at least one intermediate protrusion forming a support for the bottom of said notch and alternated with depressions engageable by raised portions protruding from the bottom of said notch.

2. Device according to claim 1, characterized in that it comprises first safety means which oppose the lifting of said handle when said latch is shifted along said seat with respect to said engagement position.
3. Device according to claims 1 and 2, characterized in that a lifting ring is associated with the portion of said handle which is meant to remain outside said recess, said ring being rotatable with respect to said handle about an axis which is substantially parallel to the longitudinal axis of said seat.
4. Device according to one or more of the preceding claims, characterized in that said latch has, proximate to the end opposite to the end for insertion in said seat, an arm extending transversely with respect to the extension of said seat and partially accommodated in a groove connected to said seat and having a first portion, extending on a plane which passes through the axis of said seat, and a second portion, containing said arm when said latch is in said engagement position and extending on a plane which is substantially perpendicular to the axis of said seat for a rotation of said arm and of said latch about an arc which is delimited by the extension of said second portion of the groove for transferring said latch from a free position, in which said arm is aligned with said first portion of the groove, to an axial locking position, in which said arm is in said second portion of the groove which is angularly offset with respect to said first portion, or vice versa.
5. Device according to one or more of the preceding claims, characterized in that said first safety means comprise an end portion of said arm of the latch which extends substantially

parallel to the axis of said seat beyond the region for connecting said ring to said handle for an interference of said ring with said arm which is directed so as to cause the transfer of said latch from said free position to said axial locking position when lifting begins.

6. Device according to one or more of the preceding claims, characterized in that said handle is provided with means for retaining said latch in said axial locking position.
7. Device according to one or more of the preceding claims, characterized in that it comprises second safety means acting on said latch for its transfer to, or retention in, said axial locking position.
8. Device according to one or more of the preceding claims, characterized in that said second safety means comprise a flattened region which affects an axial portion of the lateral surface of said latch and is directed toward the bottom of said notch with said latch in said axial locking position, said flattened region being associable with a flat portion of the profile of said through hole which affects a portion of said through hole directed toward the bottom of said handle and coupled to said plate.
9. Device according to one or more of the preceding claims, characterized in that said handle is provided with retention means which oppose the axial extraction of said latch from said seat.
10. Device according to one or more of the preceding claims, characterized in that said depressions have a rounded bottom and in that said raised portions are shaped correspondingly.
11. Device according to one or more of the preceding claims, characterized in that the ends of said protrusions which are directed toward said handle are substantially coplanar and form a supporting surface, substantially perpendicular to the longitudinal extension of said plate, for the bottom of said notch of the handle.
12. Device according to one or more of the preceding claims, characterized in that said end of the plate is wider than the remaining part of the plate and is blended therewith by means of two inclined portions.
13. Device according to one or more of the preceding claims, characterized in that said plate

has, in an intermediate region of its longitudinal extension, a neck which narrows along its width.

14. Device according to one or more of the preceding claims, characterized in that said plate has through anchoring slots on its part to be embedded in the concrete. 5

15. Device according to one or more of the preceding claims, characterized in that it comprises a disposable box-like body which can be fitted around said end of the plate prior to the manufacture of the component in order to form said recess. 10
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16. Device according to one or more of the preceding claims, characterized in that said box-like body has, on its side directed toward the outside of the component, a lid which can be removed after manufacture of the component. 20

17. Device according to one or more of the preceding claims, characterized in that said plate has, at its end opposite to the end which can engage said handle, a portion which is folded so as to form a plane which is inclined with respect to the plane of arrangement of the remaining part of said plate. 25
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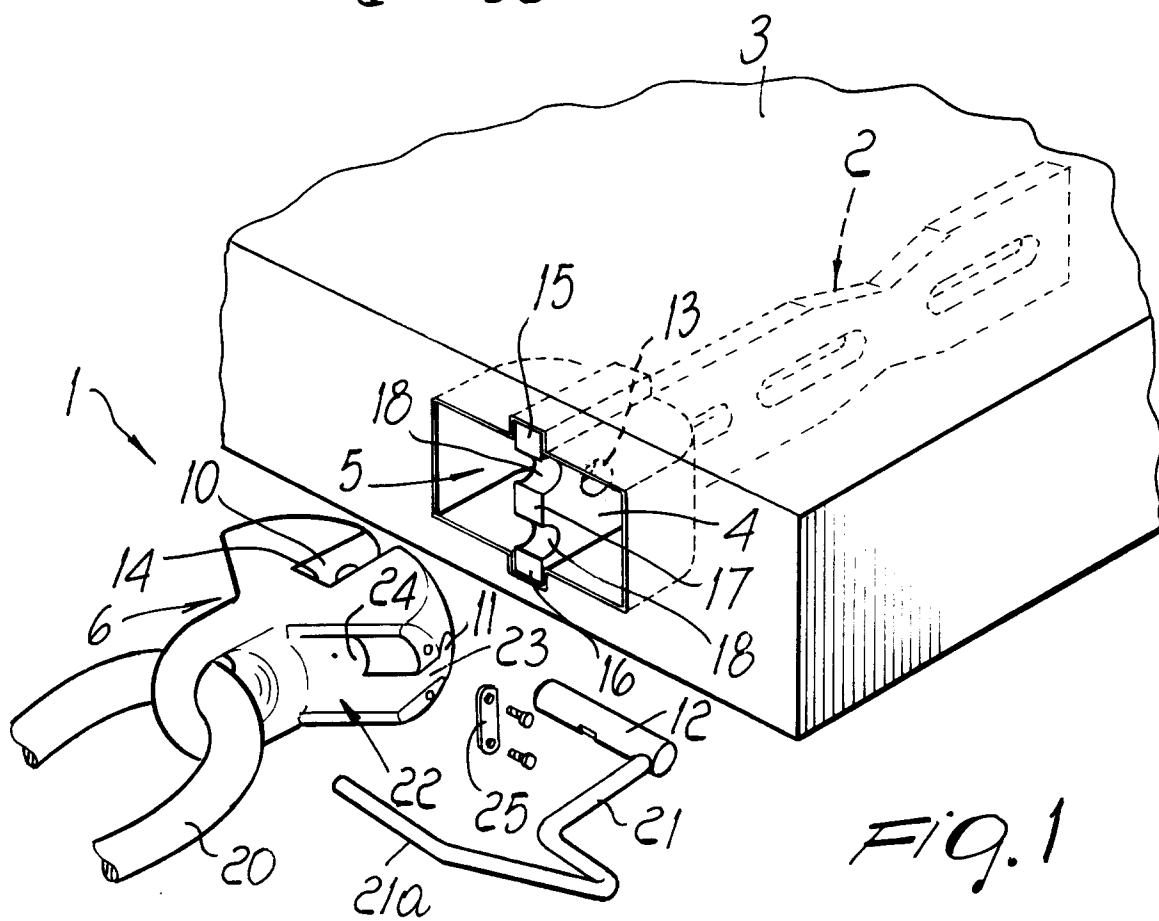
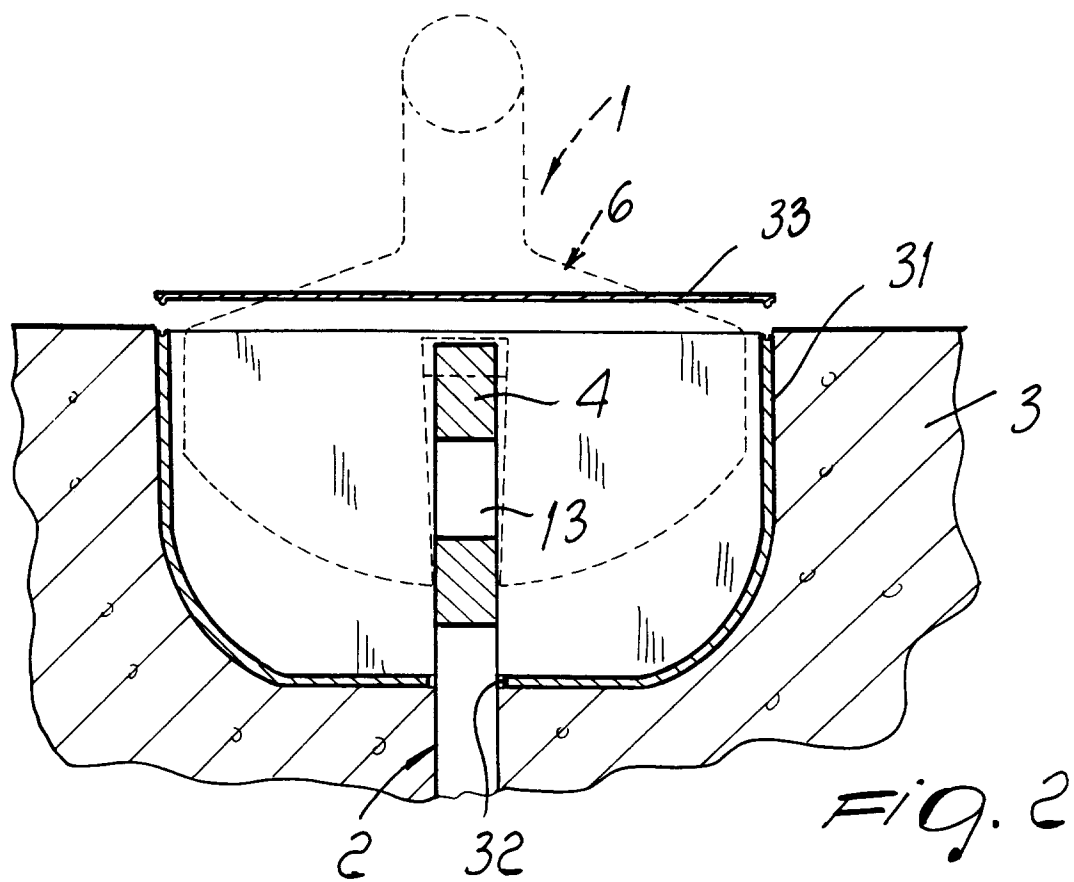
18. Device according to one or more of the preceding claims, characterized in that said plate has, starting from its end opposite to the end which can engage said handle, two portions which are folded so as to form arcs with mutually opposite concavities. 35

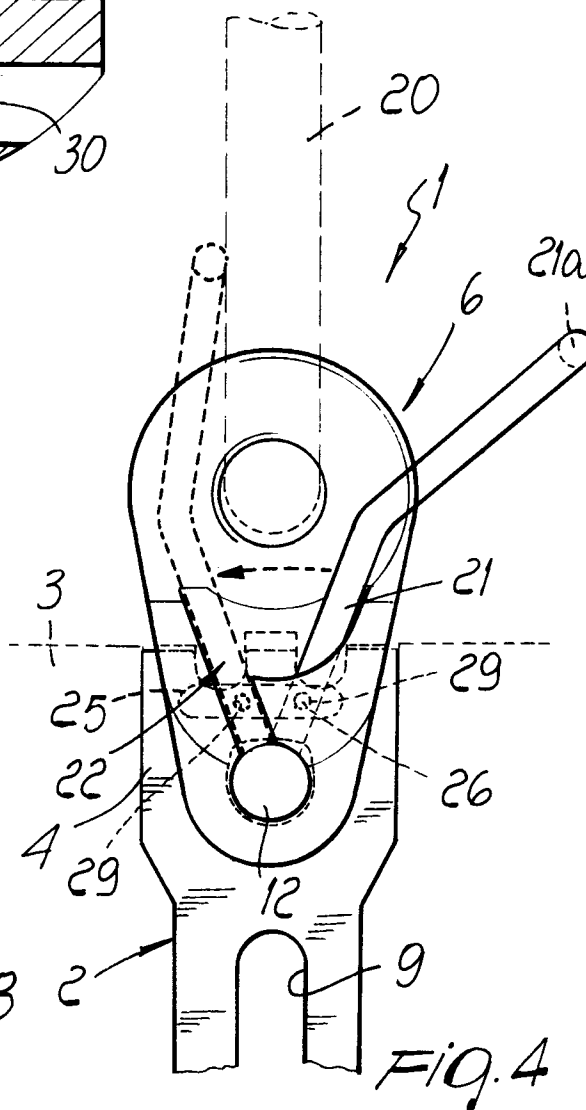
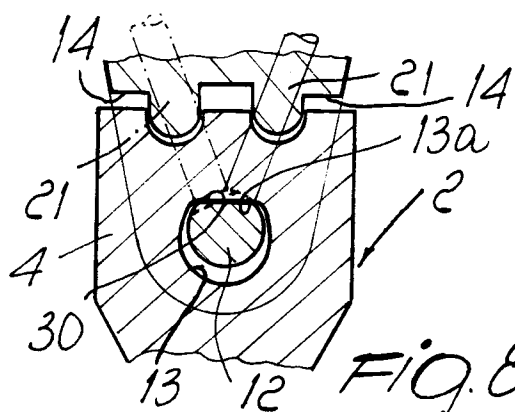
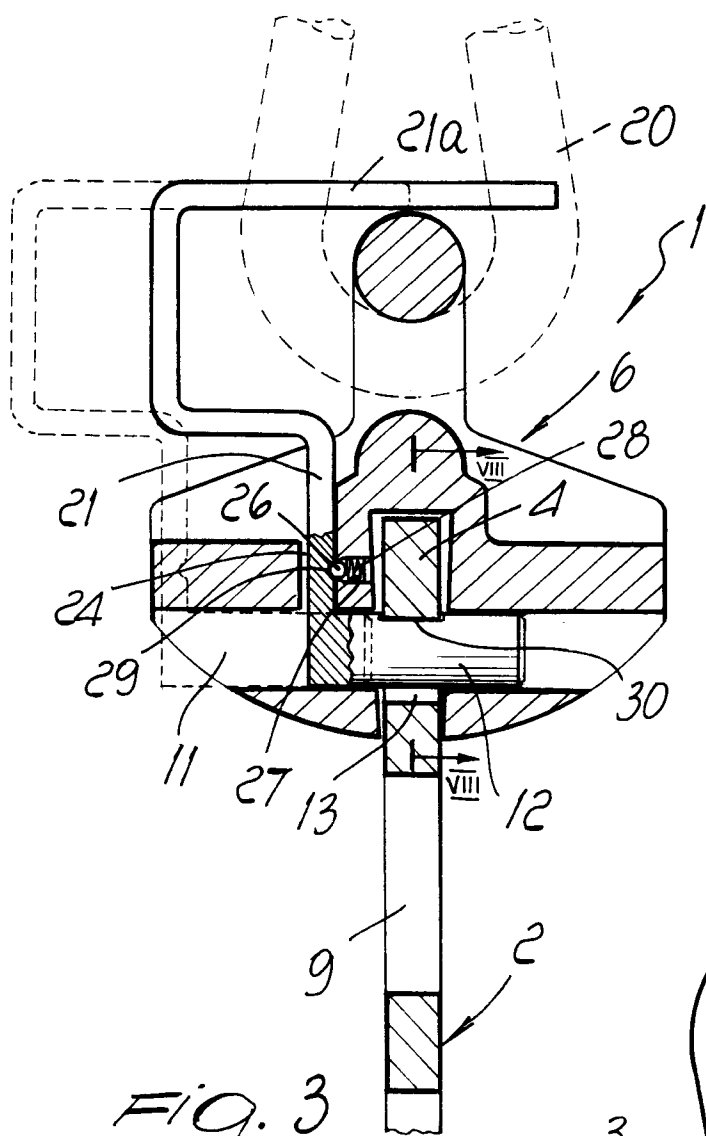
19. Device according to one or more of the preceding claims, characterized in that the intermediate protrusion of said protrusions of the end of the plate meant to engage said handle protrudes with respect to the plane of arrangement of said two end protrusions. 40

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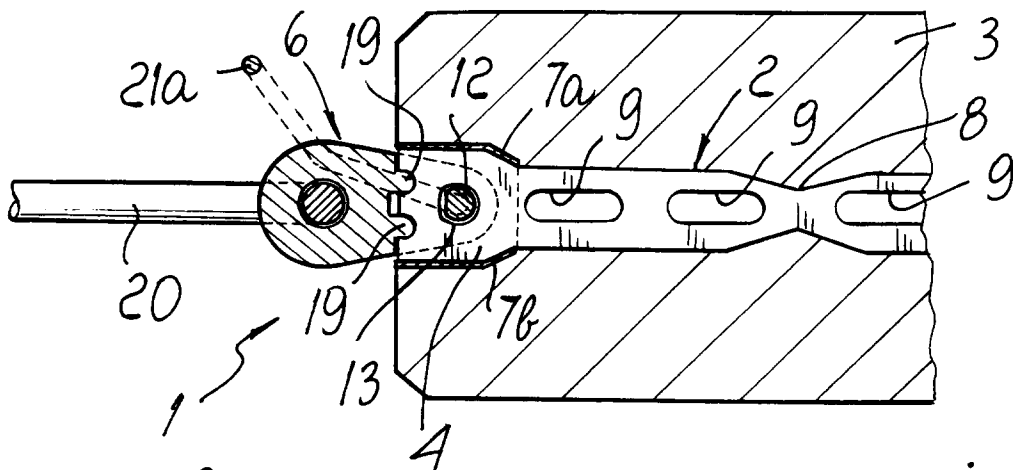


FIG. 5

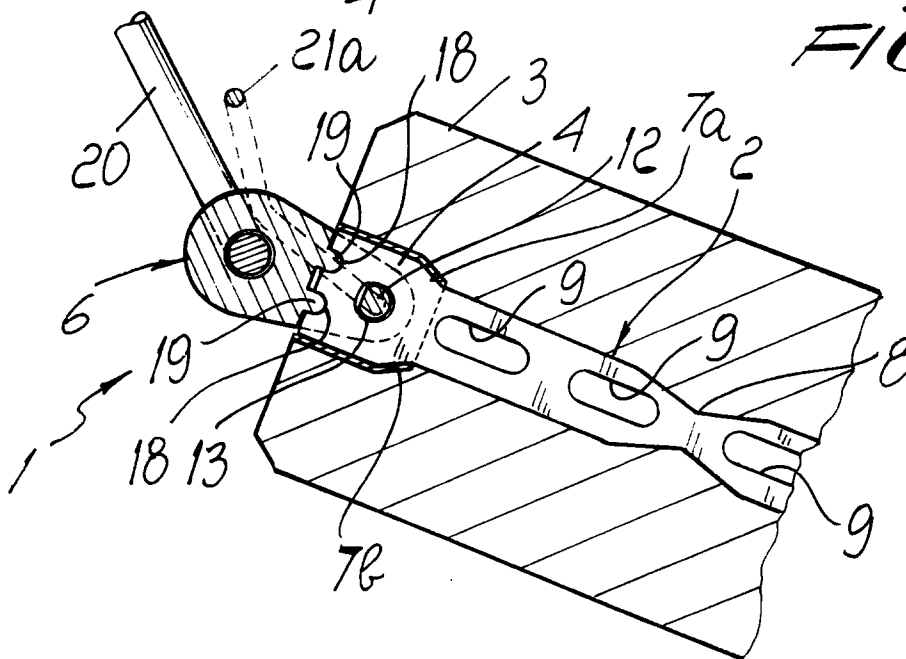


FIG. 6

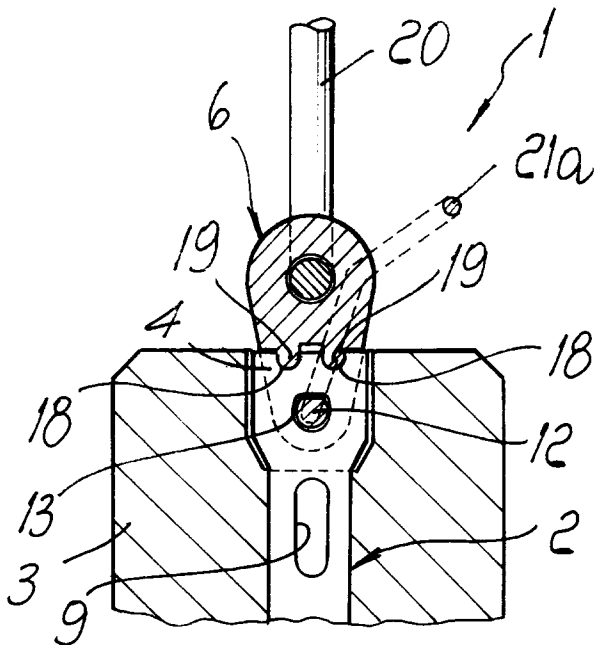


FIG. 7

