(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 967 347 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.12.1999 Bulletin 1999/52

(51) Int. Cl.[6]: **E04G 21/14**, E04G 15/04, B66C 1/66

(21) Application number: **99111861.3**

(22) Date of filing: **21.06.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **25.06.1998 IT BG980035**

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(54) Safety anchoring method particularly for lifting concrete slabs, and a coupling device for implementing the method

(57) This safety anchoring method, particularly for lifting concrete slabs, is implemented by providing in their edges (2) a bracket (3) of rectangular cross-section with undercuts for the purpose of anchoring onto it an appropriate lifting device by rotating its bell shaped body (25) through 90°, an anchored position then being stabilized by the descent onto the bell shaped body (25) of an annular oval piece (32) the central oval hole (33) of which mates with an outer conjugate profile (29) of the bell-shaped body (25) and the oval outer perimeter of which mates with a recess (21) present in the slab, the purpose of interposing the oval ring (32) being to confine the angular anchoring position of the device on the bracket (3) to the angular position of the recess (21) present in the slab and hence to fix the orientation between the bell shaped body (25) and the bracket (3) rigid with the slab.

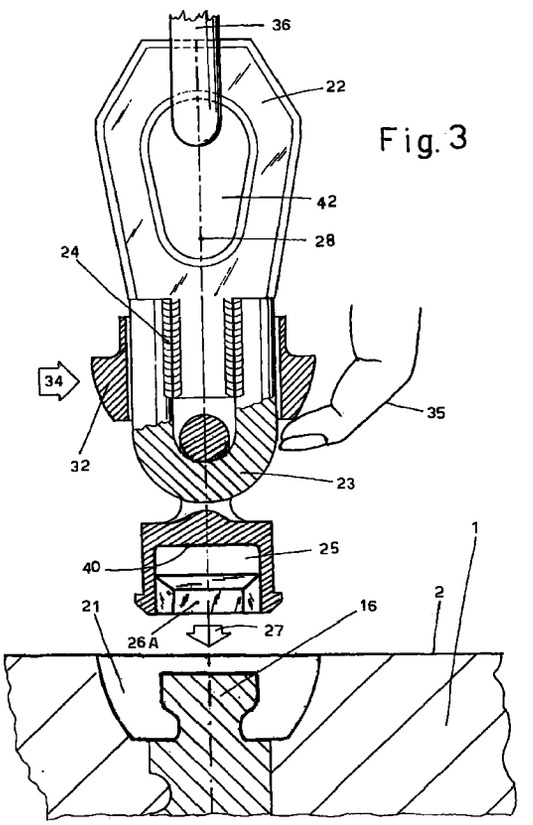


Fig. 3

EP 0 967 347 A1

Description

[0001] This invention relates to a safety anchoring method, particularly for lifting concrete slabs, and to the coupling device for implementing the method.

[0002] There are known to exist many situations in which items weighing many tons have to be lifted by normal or overhead travelling cranes. It is a well-founded rule that anything lifted by a crane must be in no danger of falling to the ground, and this rule becomes particularly rigid when lifting very large and very heavy items. In this respect it is apparent that the damage which could derive from the accidental separation of a large load could be disastrous. A typical situation of this kind is the lifting of large plain concrete slabs and prefabricated reinforced concrete components and walls. In this respect the prefabricated building sector handles enormous weights, which can reach tens of tons. There are also situations in which the items are of small-thickness flat parallelepiped form without projections, to which lifting cables have to be anchored by traditional methods. An example of such items is large concrete panels or walls, which have to have their edges free of projections to be able to fit precisely to each other during installation.

[0003] A known method which solves the problem is based on creating in the edge of the slab a semicircular recess from which there projects, by a distance such as not to pass beyond the edge of the slab, a holed end of a bracket embedded in the concrete. In this recess there is inserted a special implement which hangs from the lifting cable and is lowerly recessed to house the holed projecting end of said bracket and to pass a latch through its hole. This latch is of toroidal shape and slides in an annular seat with an angular mnovement of 90°, operated manually by an external radial stem. This known solution has various drawbacks, including its high cost, possible damage consequent on penetration of sand into the annular slide seat for the latch, and a narrow and deep insertion recess for the implement in which small stones can become accidentally wedged so preventing correct implement location.

[0004] An object of the present invention is to define a safety anchoring method, particularly for lifting concrete slabs, which is available at a cost competitive with the said known method. A further object is to define a method, as stated, which provides absolute safety in operation. A further object is to define a coupling device for implementing the said method, which is particularly functional. A further object is to define a coupling device, as stated, which cannot develop faults even as a result of possible negligence by the operators, who could involuntarily bring it into contact with sand.

[0005] These and further objects will be seen to have been attained on reading the ensuing detailed description, describing a safety anchoring method, particularly for lifting concrete slabs, characterised by providing in their edges a grip of rectangular cross-section with symmetrical undercuts, for the purpose of anchoring onto it an appropriate lifting device by rotating this latter through 90°, said anchoring position then being stabilized by the descent onto the device of an annular oval member. The central oval hole in said member mates with an external conjugate oval profile of a conjugate seat present on the slab. The purpose of interposing the oval ring is to confine the angular anchoring position of the device on the grip to the position of the conjugate seat present on the slab, and hence to fix the orientation between the device and the grip rigid with the slab.

[0006] The invention is illustrated by way of non-limiting example on the accompanying drawings, on which:

Figure 1 is a section through an edge of a concrete slab carrying an embedded bracket joined to a removable impression-forming plug;
Figure 2 is a section similar to Figure 1 in which said plug has been removed to leave its impression in the edge of the slab;
Figure 3 shows the impression of Figure 2 surmounted by a coupling device to be inserted into it for coupling to the bracket;
Figure 4 is a partly sectional view of the device of Figure 3 coupled to the bracket, and hence rotated through 90°;
Figures 5, 6, 7, 8 are conventional views of a constituent part of said coupling device, to be rotated through an angle of 90° about its vertical axis;
Figures 9, 10, 11 are conventional views of a part of ellipsoidal shape conjugate with the impression present in the edge of the slab, this part being manually subjected to vertical movement and having a central hole conjugate with the external section of the body of the part shown in Figures 5, 6, 7, 8;
Figures 12, 13, 14 are three conventional views of the removable impression-forming plug of Figure 1;
Figures 15, 16, 17 are three conventional views of a pin-containing plate provided for stiffening the plug of Figures 12, 13, 14;
Figures 18, 19 are two perpendicular views of the bracket which after being embedded in the slab provides anchorage for the coupling device.

[0007] With reference to said Figure 1, a plain concrete or reinforced concrete product 1 is provided with an edge 2. An example of this product could be a slab, or a prefabricated wall for a house or industrial shed. In this edge there is embedded a steel bracket, of the shape visible from the two perpendicular views shown in Figures 18, 19. This bracket can be formed from a usual rolled section of rectangular cross-section. The shape of this cross-section can be deduced indirectly from the thin line of the slot 4 of Figure 7, which mates with it as explained hereinafter. The bracket 3 has its foot 5 (Figure 19) bent at an angle to improve its grip to the concrete in which it is embedded. The bracket also has holes 41 for the passage of any steel reinforcement

rods 6, 7 (Figure 1) for the slab. The bracket can also have recesses 8 for any cross reinforcements. During the casting process for forming the slab, the top of the bracket is inserted into a deformable or rubber element 9 which encloses it as an exact fit.

[0008] The shape of this rubber element is shown by the three conventional views of Figures 12, 13, 14.

[0009] These views show the presence of teeth 10, 11 which enable the rubber element 9 to engage the undercut grips 12, 13 which have symmetrical oblique surfaces to increase the retention friction.

[0010] A flat surface 14 can also be seen aligned with the edge 2. From the drawings it can be seen that the rubber element 9 has two notches 15 for facilitating the opening-out of the rubber element necessary for inserting into it the grips 12 and 13 of the bracket 3, ie the bracket head 16. These notches could be made on site by a usual knife. The presence of these notches makes the rubber element very deformable, hence in order to stiffen it during casting and to stabilize its retention on the bracket, there is associated with it a very rigid plate 17 of high-strength engineering polymer or of metal. This plate is shown in the three conventional views of Figures 15, 16, 17, and requires the rubber element 9 to be provided with holes 18, 19 and a rectangular recess 20 (Figures 12, 13, 14). The function of the rubber element 9 is to create a geometrically constant and predetermined recess or cavity from which the bracket head 16 projects. The rubber element 9 is then removed as soon as the concrete sets to confine the bracket 3. The rubber element 9 is of disposable type, hence its construction and use could differ from the aforedescribed. For example it could be constructed of expandable polystyrene or another similar resin removable by tearing.

[0011] Following removal of the rubber element 9 from the edge of the slab, a recess 21 remains from which a head 16 projects without passing beyond the edge 2, as shown in Figure 2. In this respect the slabs or the like generally have to be installed with contact between their edges 2, which have therefore to be straight and without projections.

[0012] Figure 3 shows the coupling device in all its parts. A plate 22 provided with a hole 42 lowerly carries a U-shaped element 23 joined thereto by a weld 24. From the element 23 there hangs a bell-shaped body 25 provided with two opposing circumferential teeth 26A, 26B separated by the slot 4 (see Figure 7), to enable the bracket head 16 to be inserted when the bell-shaped body descends onto it with the movement 27. This insertion is possible only when the bell-shaped body 25 is correctly orientated in the horizontal plane, this orientation being such that the rectangular slot 4 of said body matches the likewise rectangular cross-section of the head 16. Correct orientation in said horizontal plane is made possible by the ability to angularly move the entire device about the vertical axis 28 on which it is suspended.

[0013] As can be seen from Figures 5, 6, 7, 8, the outer surface 29 of the bell-shaped body 25 is of elliptical or oval section. This can be better seen by comparison with the circular form of its base 30. The different circularity of the two surfaces 29 and 30 gives rise to a flat ledge 31. This flat ledge forms an abutment on which an interposing piece 32 rests (Figure 3). This piece, shown in Figures 9, 10, 11, has a central hole of oval shape similar to the outer surface 29 of the bell-shaped body 25. This is to enable the two surfaces 29 and 33 to mate and hence predetermine their mutual orientation.

[0014] The interposing piece can slide vertically relative to the body 25. This enables it to attain a position 34 in which it is torsionally released from the body and in which it is retained by the manual retention action of the operator's finger 35.

[0015] Appropriate lugs 39 can be used to allow this action. To achieve coupling, the device is lowered in the direction 27 while holding the interposing piece 32 raised (as shown in Figure 3) until the bracket head 16 has penetrated into the bell-shaped body 25.

[0016] After this, the bell-shaped body 25 is rotated through 90° about the vertical axis 28 (while also holding the plate 22), to hence cause its two circumferential teeth 26A, 26B to engage the undercut grips 12 and 13 present on the head 16 of the bracket 3.

[0017] At the same time, the piece 32 is allowed to descend freely into the recess 21, conjugate with it, which was previously formed in the concrete during the fixing of the bracket 3. This descent has as its aim the insertion of the piece 32 into the conjugate impression or recess 21, but at the same time is also conditional on the oval form of its hole 33 coinciding (ie is properly orientated) with the oval form of the surface 29 of the bell-shaped body 25. Given the smaller size of the low parts compared with the higher parts (as in the case of an inverted cone), initial contact, with partial insertion, takes place between the interposing piece 32 and the central bell-shaped body 25.

[0018] Following this it is easy to determine any further angular movement to be impressed on the bell-shaped body 25 to achieve complete mating between the interposing piece 32 and the recess 21. This complete mating, involving coplanarity between the surface of the edge 2 of the slab 1 and the top flat surface 35 of the interposed element 32, also indicates correct engagement between the teeth 26A, 26B and the grips 12 and 13 of the head 16 of the bracket 3. In this manner the slab 1 is completely coupled to generic suspension means 36, from which it cannot escape. In this respect, for it to escape it would be necessary for the bell-shaped body 26 to rotate through 90° about the vertical axis 28, but this is made impossible by the fact that such rotation would tend to cause the interposed element 32 to rotate, which is prevented by it being seated in the recess 21, which is of oval and hence anti-rotation shape. The mating angles between the various parts are such as to prevent, by virtue of the friction of the sur-

faces involved, any slippage deriving from transverse force components.

[0019] With reference to Figure 3, this is a conceptual representation and hence the axis 28 is indicated as "vertical". In effect this verticality presupposes items positioned with the bracket 3 vertical. However prefabricated concrete slabs or walls are sometimes stacked horizontally. It follows that these have to be coupled on an axis of rotation 28 which is not vertical but horizontal, as is the bracket 3 in such a case. It subsequently becomes vertical when lifted, as the slab is brought into a vertical position. With reference to that stated, it is therefore important to consider that the item illustrated is a slab having its two large surfaces 37, 38 vertical, whereas they may previously lie horizontally, either resting on the ground or superimposed in typical stacks. While the slab is turning upright, a positive locking role is played by the roof 40 provided on the central cavity of the bell-shaped body 25, which can hence additionally engage the flat top of the head 16.

Claims

1. A safety anchoring method, particularly for lifting concrete slabs and walls, characterised by providing in their edges (2) a recess (21) of predetermined shape from which there projects the head (16) of a bracket (3) embedded in the concrete and provided with grips (12, 13) having undercuts for the purpose of anchoring onto the head (16) a bell-shaped body (25) with teeth (26A, 26B) by rotating the bell-shaped body through 90° after inserting the bracket head (16) into it through an appropriate conjugate slot (4), said acquired relative position of anchorage between the bracket head (16) and the bell-shaped body (25) then being stabilized by the descent (27) onto the outside of the bell-shaped body, of an interposing piece (32) having a central anti-rotation hole (33) which mates with the outer surface (29) of the bell-shaped body (25) and having an outer surface which mates with said recess (21) of anti-rotation shape present in the edge (2) of the slab (1), the purpose of interposing the conjugate piece (32) in the recess being to confine the angular anchoring position of the bell-shaped body (25) with its teeth (26A, 26B) engaged in the grips (12, 13) of the head (16) to the angular position of the recess (21), and hence to fix the orientation of the bell-shaped body (25) engaged on the bracket head relative to the head (16) itself, said head being rigid with the recess (21) containing the interposing piece (32) torsionally rigid (28) with the bell-shaped body.

2. A method as claimed in the preceding claim, characterised by a recess (21) formed during the casting of the concrete by an impressing element (9) fixable to the bracket head (16) and positionable with its flat surface (14) aligned with the edge (2) of the slab under construction, said impressing element being constructed of elastic or tearable material to enable it to be removed when the concrete has set, said element being able to be supplemented by a stiffening piece (17) which can be removed for fitting the element to and removing it from the head (16) of the bracket (3).

3. A coupling device for implementing the method claimed in the preceding claims, characterised by a plate (22) secured to usual suspension and lifting means (36) and provided lowerly with a U-shaped element (23) for supporting, by a connection of chain-link type, a bell-shaped body (25) provided with teeth (26A, 26B) and engagable in grips (12, 13) on the head (16) of a bracket (3) by being rotated through 90° following the insertion of said head (16) into the bell-shaped body (25) through an appropriate conjugate slot (4), said bell-shaped body carrying externally an interposing piece (32) with an anti-rotation hole (33) conjugate with an outer surface (29) of the body (25) and with its outer anti-rotation shape torsionally lockable by a recess (21) which houses the interposing piece (32) stably when it has completely mated with the specific surface (29) of the bell-shaped body (25).

4. A device as claimed in the preceding claim, characterised in that an anti-rotation surface (29) on the bell-shaped body and the conjugate hole (33) in the interposing piece (32) are of oval shape.

5. A device as claimed in the preceding claims, characterised in that the outer surface of the interposing piece (32) and the conjugate surface of the recess (21) provided for its housing are of ovoidal shape.

6. A device as claimed in the preceding claims, characterised in that the teeth which engage the bell-shaped body are semi-circular in shape (26A, 26B).

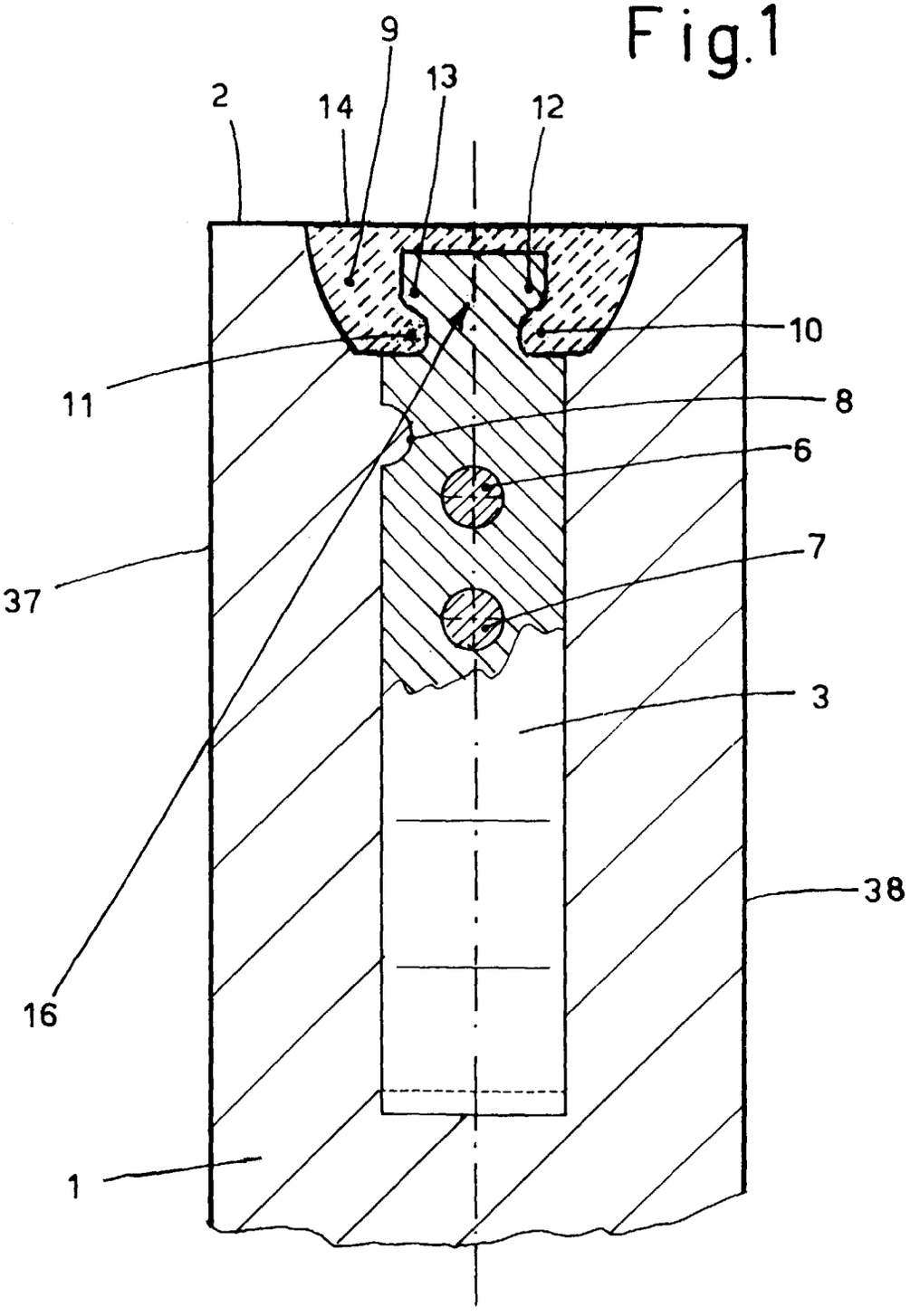
7. A device as claimed in the preceding claims, characterised in that the bell-shaped body (25) has a circular base (30) forming flat ledges (31) with the overlying anti-rotation section (29) which act as a support surface for the interposing piece (32) when in its rest state.

8. A device as claimed in the preceding claims, characterised by comprising, on the bracket head (16), grips (12, 13) having oblique surfaces of engagement with the teeth (26A, 26B) of the bell-shaped body in order to create opposing thrust force components in favour of the retention friction between the engaged parts, which is proportional to the weight of the supported slab (1).

9. A device as claimed in the preceding claims, characterised in that the bracket head has a rectangular cross-section (4).

10. A device as claimed in the preceding claims, characterised by a bracket (3) provided with holes (41) and recesses (8) for housing steel reinforcement rods (6, 7), and an angularly bent anti-extraction foot (5).

Fig.1



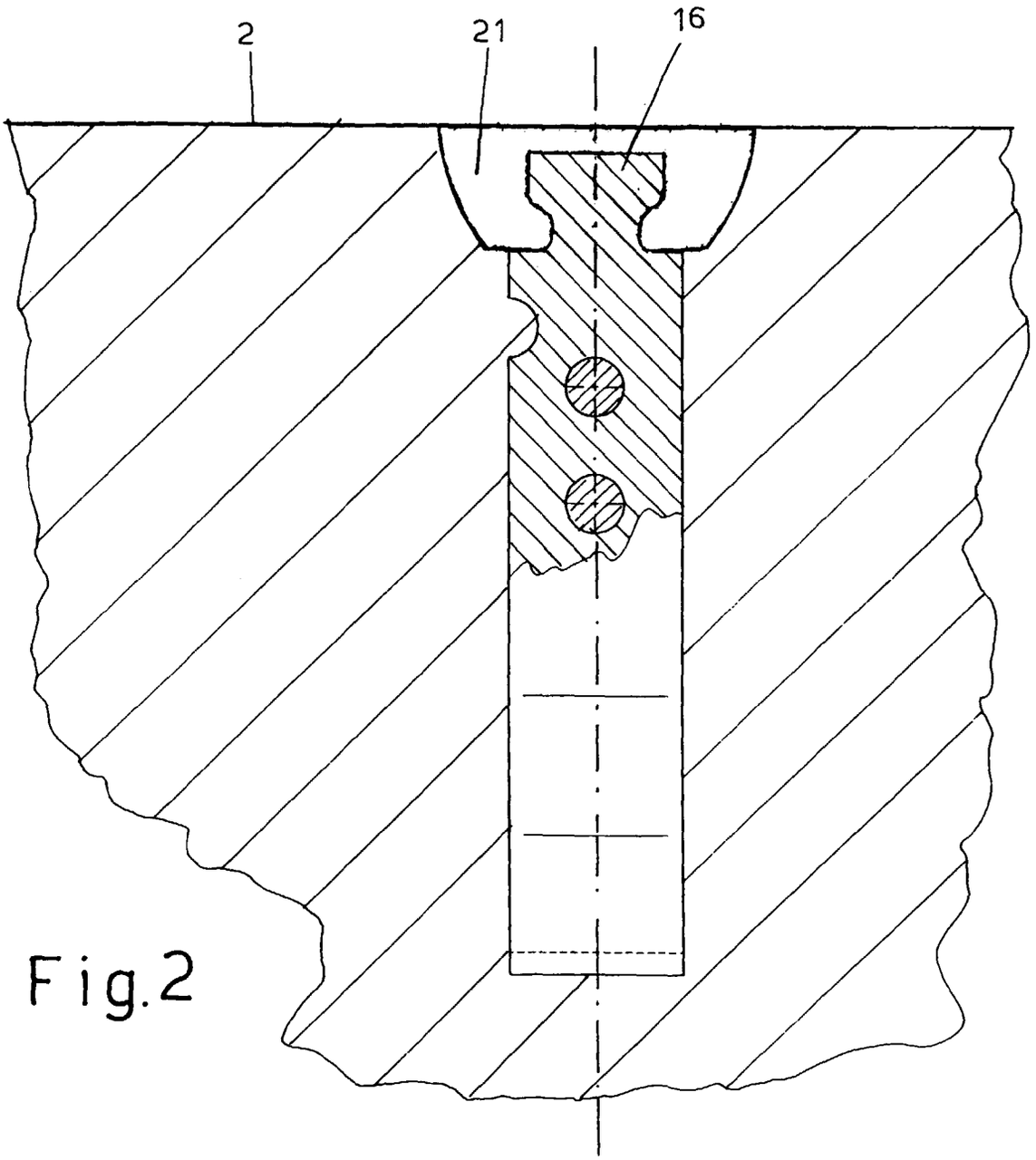


Fig.2

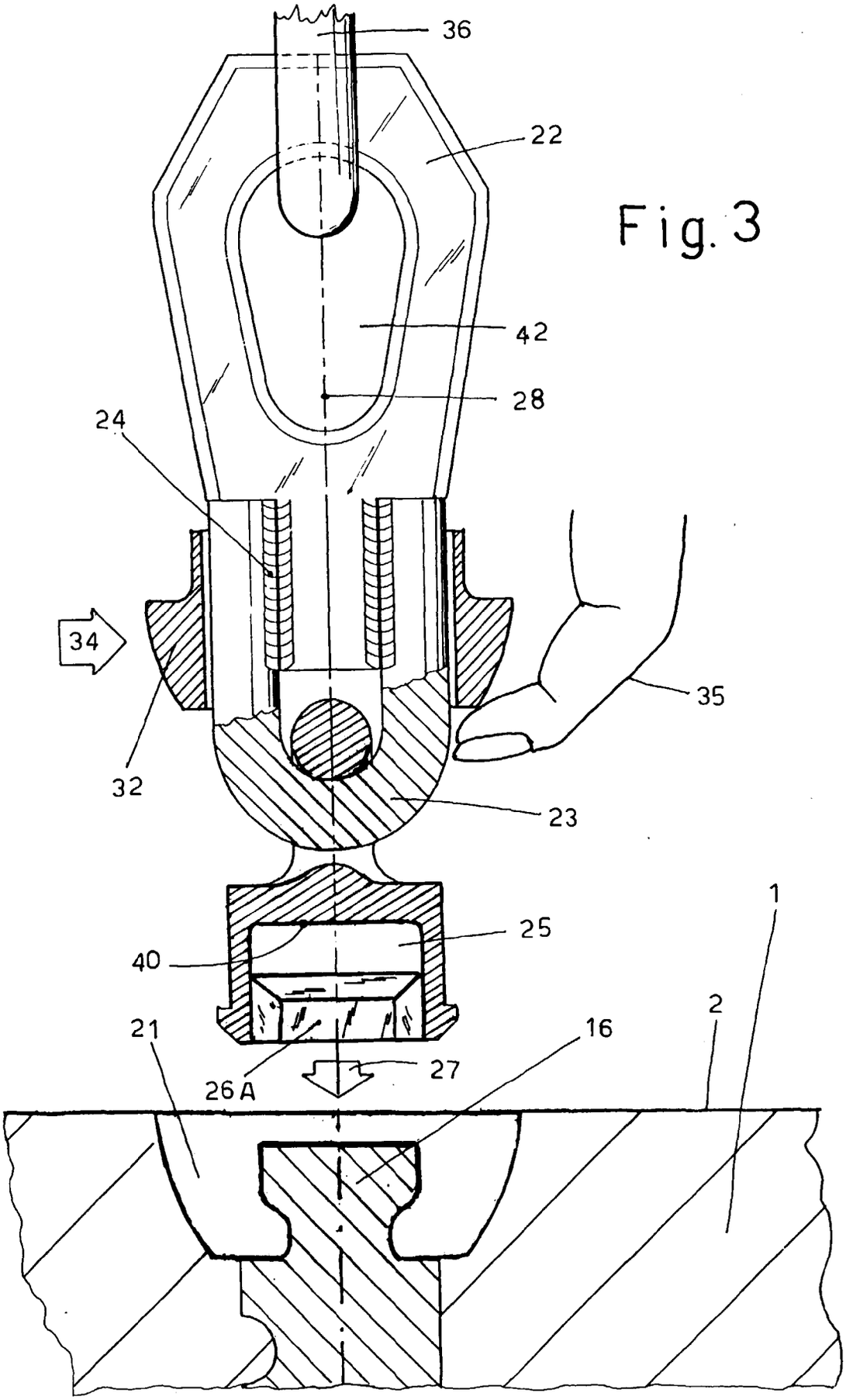
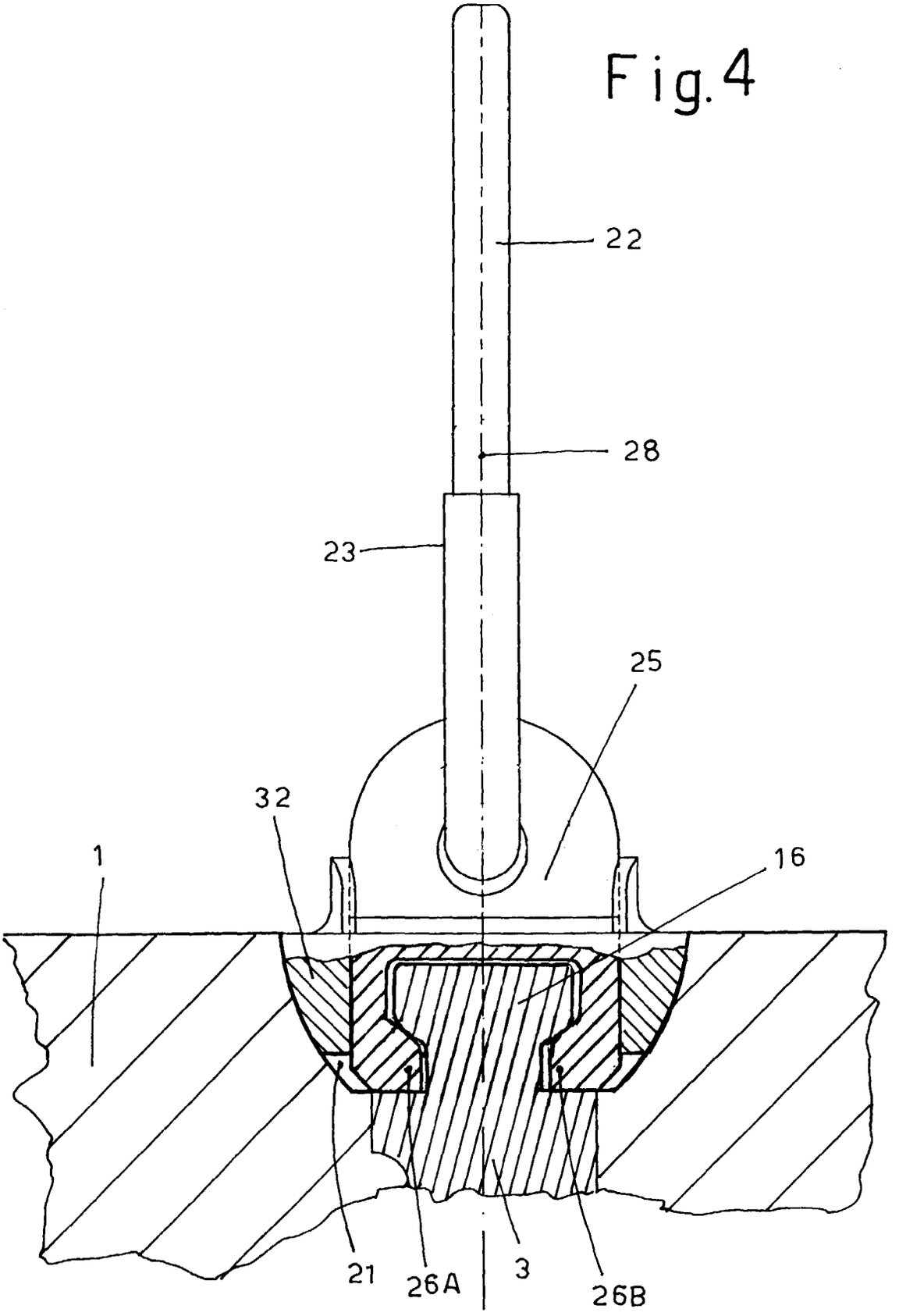


Fig. 3

Fig.4



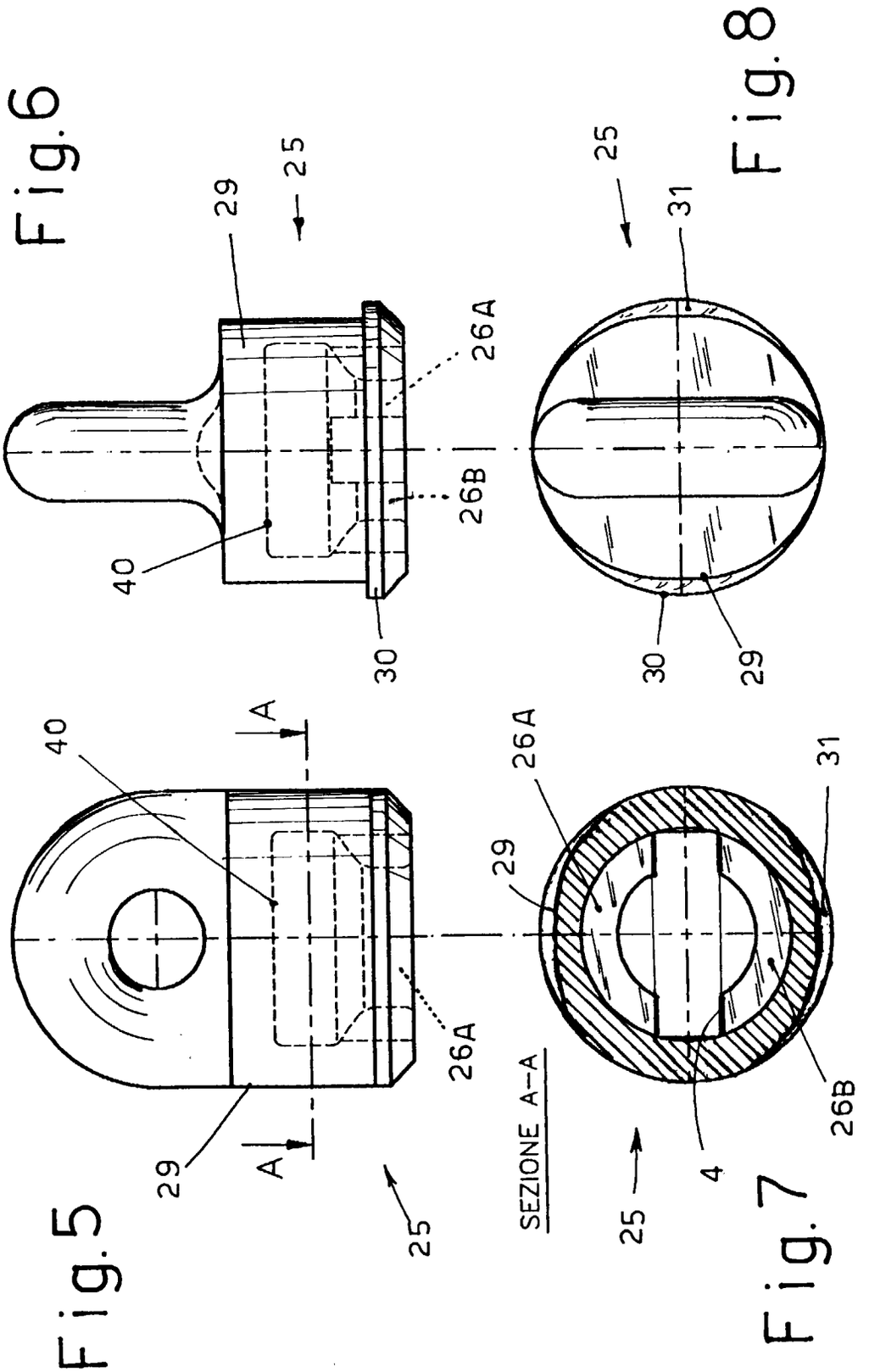


Fig.6
29
25
26A
26B
40
30
Fig.8
25
31
30
29
Fig.5
40
A
A
29
25
26A
Fig.7
26A
29
31
SEZIONE A-A
25
4
26B

Fig.9

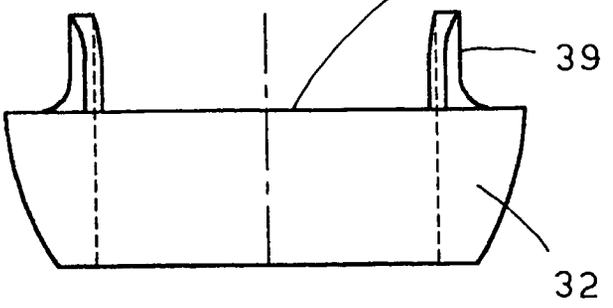
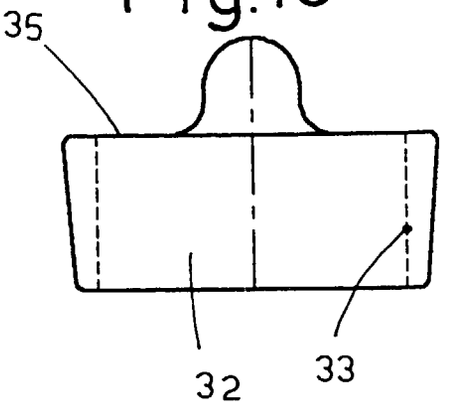


Fig.10



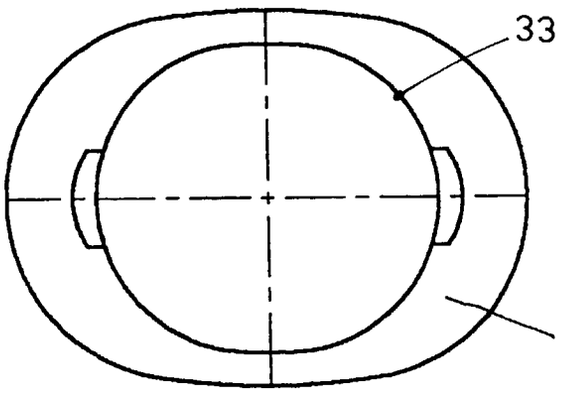


Fig.11

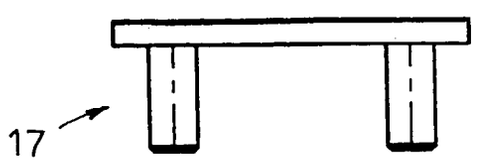


Fig.15

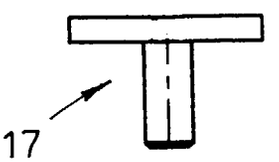


Fig.17

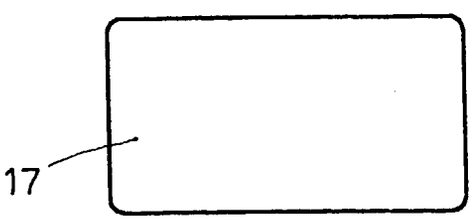


Fig.16

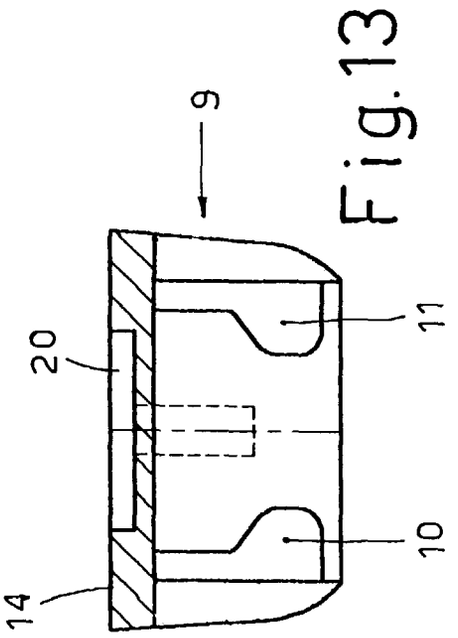


Fig.13

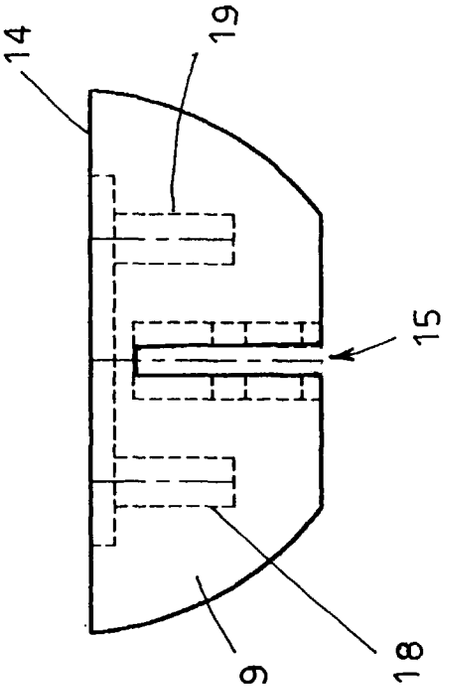


Fig.12

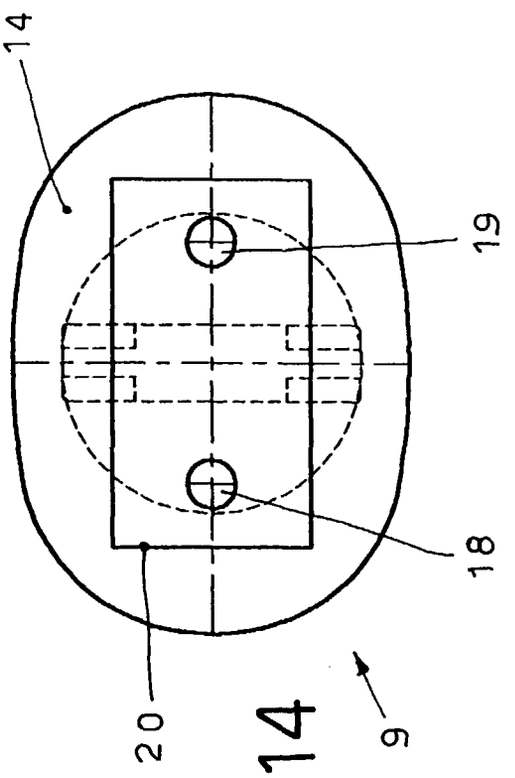


Fig.14

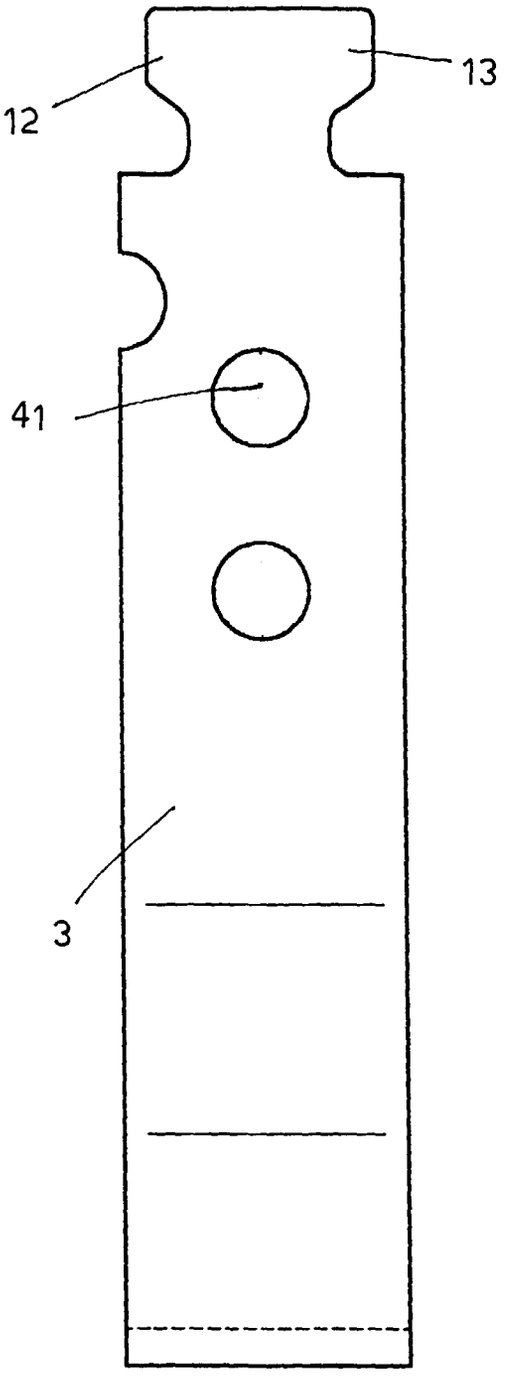


Fig.18

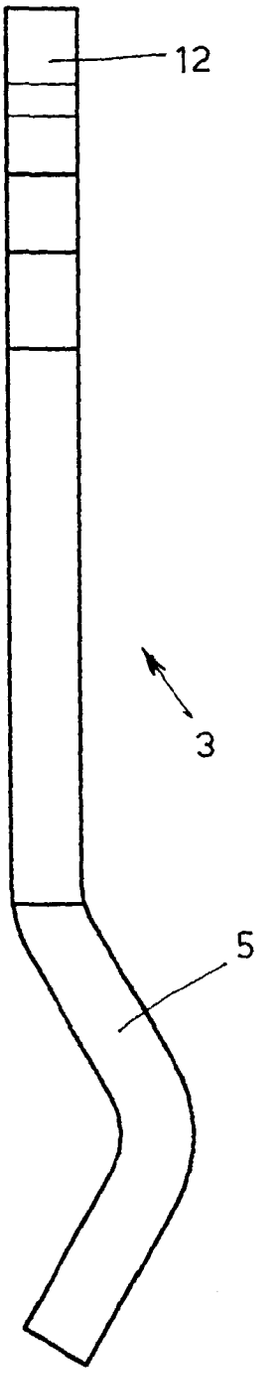


Fig.19

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 11 1861

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			TECHNICAL FIELDS SEARCHED (Int.Cl.6) E04G B66C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 September 1999	Andlauer, D

CATEGORY OF CITED DOCUMENTS

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