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(54) **A quick-clamping battery clamp**

(57) A battery clamp (1) comprises a conductor body (4) and means (5) for clamping onto a battery terminal (2). The conductor body (4) comprises a split ring (6, 7) which can be coupled with the battery terminal (2) and has portions (19, 20) which can be moved towards one another and on which the clamping means (5) act in order to squeeze the split ring (6, 7) and to bring about the clamping of the conductor body (4) onto the battery

terminal (2). The clamp (1) is characterized in that it comprises a lever (21) which can be pivoted between an open position and a closed position and which has a cam (24) operatively associated with the clamping means (5) in order to bring about the clamping of the conductor body (4) onto the battery terminal (2) by pivoting of the lever (21) from the open position to the closed position.

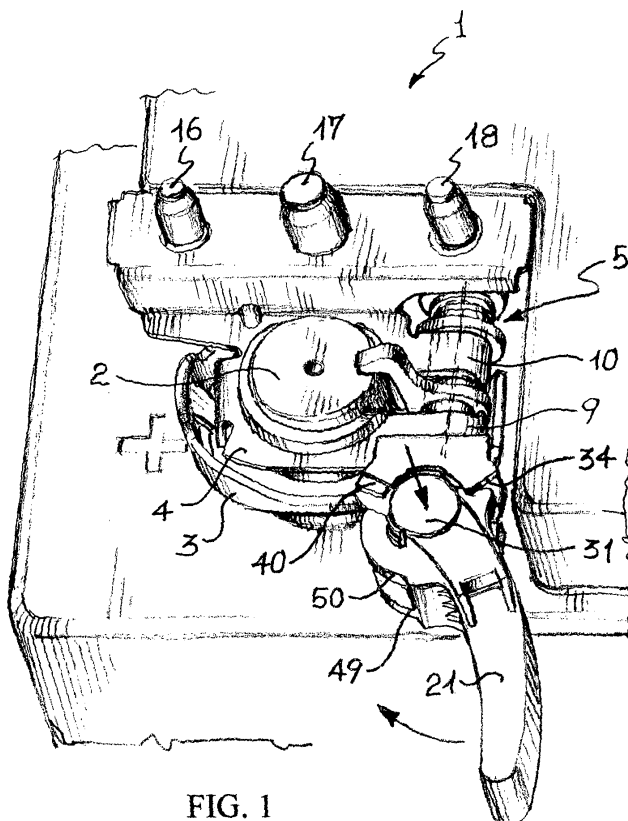


FIG. 1

Description

[0001] The present invention relates to a battery clamp according to the preamble to Claim 1.

[0002] More particularly, the present invention relates to a battery clamp which can be clamped/released quickly and in conditions of safety for the user.

[0003] The clamps that are conventionally used for connecting cable ends to battery terminals or poles are constituted by cast blocks of lead alloy, brass, or other material. There are also pressed clamps which are produced by the bending and punching of a metal plate so as to be lighter and less expensive than cast-block clamps. These clamps are generally U-shaped and have a bolt for clamping the clamp onto the battery terminal.

[0004] A clamp of this type is known, for example, from United States Patent US-4747793.

[0005] However, the above-mentioned clamps are not able to satisfy and reconcile a plurality of requirements such as, for example, adequate mechanical strength, firm clamping onto the battery terminal in the presence of vibrations, high conductivity, easy installation and assembly, etc.

[0006] A particular problem is the tendency of the clamp to rotate on the battery terminal as a result of vibrations and/or during the tightening of the bolt.

[0007] An improved clamp which can prevent this technical problem is described, for example, in European patent application EP-A-809327. This clamp is constituted by a conductor body which is pressed-from a metal plate to form a pair of split rings that can be clamped onto the battery pole or terminal. For this purpose, the rings have a pair of clamping seats for housing a clamping bolt. The clamp also has elements which can prevent rotation of the clamp on the battery terminal.

[0008] The solution proposed in patent application EP-A-809327 thus solves the problem of the rotation of the clamp on the battery terminal but is not adequate in the presence of severe vibrations and/or mechanical stresses.

[0009] The solution described in United States patent US-4747793 is also inadequate in the presence of severe vibrations.

[0010] For example, when the clamp is used on motor vehicles, severe and sudden vibrations and stresses may be imparted to the clamping bolt and may lead to slow but progressive loosening of the bolt.

[0011] Principally, it is useful to point out that the clamps that are currently on-the market, for example, those of the type described above, require an installation operation, that is, an operation to clamp them onto the battery terminal which, although it is not difficult, is at least not easy for the user. The presence of clamping bolts, lock washers, and clamping nuts may in fact be inconvenient for quick clamping/release the clamp.

[0012] Moreover, the presence of removable mechanical members such as bolts, washers, and nuts out-

side the clamp body may lead to the accidental loss of these elements when the clamp is removed for maintenance operations on the battery or for similar operations.

[0013] There is therefore a great need to have available an efficient clamp which can facilitate the quick fitting of the clamp on a battery terminal and its quick removal therefrom.

[0014] The technical problem underlying the present invention is that of providing a battery clamp having structural and functional characteristics such as to satisfy the above-mentioned need and at the same time to prevent the problems discussed with reference to the prior art.

[0015] This problem is solved by the battery clamp according to Claim 1.

[0016] Further characteristics and the advantages of the clamp according to the present invention will become clear from the following description of a preferred embodiment thereof, which is given by way of non-limiting example with reference to the appended drawings, in which:

Figure 1 is a schematic view of a battery clamp according to the present invention with the lever in the open position,

Figure 2 is a schematic view of the battery clamp of Figure 1 with the lever in the closed position,

Figure 3 is a schematic view, sectioned on the line III-III, of the clamp of Figure 2 in a second configuration,

Figure 4 is a schematic view of the clamp of Figure 3 before it is fitted on a battery terminal, and

Figure 5 is an exploded, perspective view of the clamp of Figure 1.

[0017] With reference to the above-mentioned drawings, a battery clamp according to the present invention is generally indicated 1.

[0018] The clamp 1 comprises a support base 3, for example, made of insulating plastics material, a conductor body 4, and means 5 for clamping onto a battery terminal 2.

[0019] The following part of the description will refer to a particular embodiment of the conductor body 4 of the clamp 1.

[0020] The conductor body 4 is produced by punching, coining, and bending from a plate made of brass or another copper alloy with good electrical conductivity and good mechanical strength combined with good malleability.

[0021] Alternatively, the conductor body 4 may be a block of cast alloy, or of another type. Moreover, the base 3 of the clamp 1, the function of which is to support

the conductor body 4, may be omitted.

[0022] It should be noted that, once the base 3 and the conductor body 4 are fitted together, they are restrained relative to one another in known manner, as described, for example, in European patent application EP-A-809327.

[0023] The conductor body 4 comprises a split ring which can be coupled with the battery terminal 2 and has portions that can be moved towards one another.

[0024] The clamping means 5 are arranged to act on the above-mentioned portions which can be moved towards one another in order to squeeze the split ring and thus clamp the conductor body 4 onto the battery terminal 2.

[0025] The following part of the description will refer to a preferred embodiment in which the conductor body 4 comprises a lower split ring 6 and an upper split ring 7, but the present invention is also applicable if the conductor body comprises only one split ring.

[0026] The plate (not shown in the drawings) from which the conductor body 4 is produced by bending is advantageously bent in a manner such that the lower ring 6 is disposed below the upper ring 7, parallel thereto, and in axial alignment therewith.

[0027] According to a preferred embodiment, the lower split ring 6 and the upper split ring 7 are connected to one another by two continuous strips 9, 10 which are separated by a gap of suitable width (Figures 1, 2 and 5) and which define a pair of seatings 19, 20 which can be moved towards one another.

[0028] The clamping means 5 thus act on the seatings 19, 20 in order to squeeze the split rings 6 and 7 so as to clamp the conductor body 4 to the terminal 2.

[0029] The upper ring 7 has an engagement tab 11 to be engaged in an opening 12 formed in an engagement appendage 13 of the lower ring 6.

[0030] The upper ring 7 also has a support bracket 14 which is extended by a support plate 15.

[0031] Holes are formed in the support plate 15 for the insertion of bolts 16, 17, 18 for clamping the ends of an electrical cable (not shown in the drawings).

[0032] The inner edges of the lower ring 6 and of the upper ring 7 are advantageously shaped so as to define a conical contact surface extending downwards as shown in Figures 3 and 4.

[0033] According to a preferred embodiment, the clamping means 5 comprise a tie rod 22 extending predominantly along an axis X-X and housed in the seatings 19, 20.

[0034] The tie rod 22 has an abutment surface 25 which can act on the seating 20 in order to bring about movement of the seatings 19, 20 towards one another or apart, respectively, as a result of opposed axial movements of the tie rod 22.

[0035] The abutment surface 25 advantageously acts on the seating 20 with the interposition of elastic means 27.

[0036] The elastic means 27 preferably take the form

of a helical spring mounted coaxially on the tie rod 22 and interposed between the seating 20 and the abutment surface 25.

[0037] At the end remote from the abutment surface 25, the spring 27 advantageously acts on a washer 28 interposed between the spring 27 and the seating 20. The pressure exerted on the seating 20 by the abutment surface 25 and by the spring 27 is thus distributed over a larger area.

[0038] The battery clamp 1 of the present invention comprises a lever 21 which can pivot between an open position (Figure 1) and a closed position (Figure 2).

[0039] In order to satisfy both the need for mechanical strength and the need for a low cost of the final product, the lever 21 is preferably made of plastics material, for example, polypropylene.

[0040] The lever 21 comprises a portion 24 formed as a cam which is operatively associated with the clamping means 5 in order to bring about the clamping of the conductor body 4 onto the battery terminal 2 by the pivoting of the lever from the open position (Figure 1) to the closed position (Figure 2).

[0041] The tie rod 22 is preferably operatively associated with the cam 24 of the lever 21 in a manner such that a rotation of the cam 24, that is, a pivoting movement of the lever 21, corresponds to a movement of the tie rod 22 having an axial component.

[0042] In particular, the tie rod 22 is associated with the lever 21 by means of a pin 23 extending along an axis Y-Y perpendicular to the axis X-X of the tie rod. The pin 23 is engaged at its opposite ends in corresponding seats 29 of the lever 21 and is engaged in a through-hole 26 of the tie rod 22.

[0043] The hole 26 is advantageously formed in an end portion of the tie rod 22.

[0044] The cam 24 of the lever 21 has a profile 37 that is spaced by a variable distance from the axis Y-Y of the pin 23. The profile 37 acts on a bearing element 35 which is interposed between the lever 21 and the conductor body 4, advantageously in the region of the seating 19 of the conductor body 4. The pressure exerted on the seating 19 by the cam 24 is thus distributed over a larger area.

[0045] The bearing element 35 has a quadrangular through-hole 38 extending along the axis X-X for the insertion of a corresponding quadrangular portion of the tie rod 22.

[0046] The bearing element 35 also has the function of a travel-limit element for the pivoting of the lever 21. For this purpose, the bearing element 35 has two abutment surfaces 45, 46 which can abut corresponding abutment surfaces 47, 48 and 49, 50 of the lever 21.

[0047] When the lever 21 is in the open position (Figure 1), the abutment surface 46 abuts two corresponding abutment surfaces 47, 48 of the lever 21.

[0048] When lever 21 is in the closed position (Figure 2), on the other hand, the abutment surface 45 abuts corresponding abutment surfaces 49, 50 of the lever 21.

[0049] In order to assemble the lever 21 and the tie rod 22, the tie rod 22 is pushed along the axis X-X in the direction indicated by the arrow A in Figure 5 until the hole 26 coincides with the seats 29 of the lever 21. The pin 23 is then inserted in the seats 29 of the lever 21 through the hole 29 which is present in the lower portion of the lever 21 and, finally, the pressure on the tie rod 22 is released. The pin 23 is thus force-fitted in the tie rod 22 but can rotate in the seats 29 of the lever 21. Alternatively, the pin 23 may be able to rotate relative to the through-hole 26 of the tie rod 22 and may be force-fitted in the seats 29 of the lever 21.

[0050] The bearing element 35 has the function not only of an element for distributing the pressure exerted by the cam 24 on the seating 19, but also of a guide element for the pivoting of the lever 21.

[0051] For this purpose, the bearing element 35 is shaped so as to define a concave sliding guide 36 for guiding the lever 21 in its pivoting movement between the closed position and the open position and *vice versa*.

[0052] The sliding guide 36 is advantageously shaped as an arc of a circle having a centre which is offset with a predetermined eccentricity relative to the axis Y-Y of the pin 23. In greater detail, the sliding guide 36 can receive the peripheral profile portion 37 of the cam 24 of the lever 21 in order thus to facilitate and guide the pivoting of the lever 21 about the pin 23.

[0053] According to a preferred embodiment, the clamp 1 comprises first safety means for locking the lever 21 releasably in the open and closed positions, respectively.

[0054] The first safety means advantageously comprise interacting catch elements 33, 34 and recesses 44 formed in the bearing element 35.

[0055] According to a preferred embodiment, the lever 21 comprises a catch element 30 for interacting with or abutting the catch elements 33 and 34 of the bearing element 35 in the open and closed positions, respectively, and for engaging the recess 44 of the bearing element 35 when the lever pivots between the open position (Figure 1) and the closed position (Figure 2).

[0056] In the open position, the catch element 30 of the lever 21 is in abutment with the catch element 33, preventing the lever 21 from being closed accidentally, for example, during transportation to the customer.

[0057] In the closed position, on the other hand, the catch element 30 is in abutment with the catch element 34, preventing accidental opening of the lever 21.

[0058] Alternatively, in the absence of the bearing element 35, the catch elements 33 and 34 may be formed directly in the conductor body 4.

[0059] The catch element 30 of the lever 21 is advantageously mounted on a tab 32 which is elastically yielding along the axis Y-Y. According to a particularly advantageous embodiment, the catch element 30 is mounted in the vicinity of one end of the tab 32.

[0060] To permit easy release of the catch element 30, the tab 32 has a pressure portion 31 which, when acted

on, brings about a elastic deformation of the tab 32 such as to permit the release of the catch element 30 from the catch element 33 or 34, respectively, and to allow the lever 21 to be operated.

[0061] Alternatively, a release push-button may be provided for acting on the tie rod by means of a spring so as to permit operation of the tie rod.

[0062] The catch element 30 of the lever 21 is preferably made of plastics material, for example, polypropylene (PP), PVT, or PET, filled with glass so as to provide sufficient mechanical strength.

[0063] According to a further aspect of the present invention, the clamp 1 comprises second safety means for allowing the clamping means 5 to be operated solely when the clamp 1 is fitted fully on the battery terminal 2.

[0064] In other words, the second safety means constitute a consent system for the clamping of the clamp 1 and have the purpose of preventing the-clamp 1 from being clamped on the terminal 2 incorrectly when the clamp 1 is not fitted perfectly on the terminal 2 or when the clamp 1 is disengaged from the battery terminal 2.

[0065] The second safety means thus prevent accidental closure of the lever 21 when the clamp is in the non-operative position (Figure 3).

[0066] According to a preferred embodiment, the second safety means comprise a safety element 38 associated with the tie rod 22 for pivoting relative thereto about the axis X-X, and a feeler 39. The feeler 39 can be engaged by the battery terminal 2 so as to cause the safety element 38 to pivot between a consent position (Figure 3) in which axial movement of the tie rod 22 is permitted, and a non-consent position (Figure 4) in which axial movement of the tie rod 22 is prevented.

[0067] The safety element 38 preferably comprises elastic means 40 arranged to keep the safety element 38 in the non-consent position (Figure 4) with a predetermined elastic load when the clamp 1 is disengaged from the battery terminal 2.

[0068] The elastic means 40 preferably take the form of a tongue made of elastic material fixed firmly to the safety element 38 and having a free end 43.

[0069] The tie rod 22 advantageously has a projection 41 extending axially along the lateral surface of the tie rod 22. The projection 41 of the tie rod 22 can achieve a form fit with a corresponding through-hole 42 formed in the safety element 38.

[0070] In particular, the hole 42 is arranged angularly at a predetermined reference angle so as to achieve the form fit with the projection 41 of the tie rod 22 solely when the safety element 38 is in the consent position. In this position, the tie rod 22 is free to move axially along the axis X-X and thus to permit the pivoting of the lever 21 bringing about the operation of the means 5 for clamping the conductor body 4 onto the battery terminal 2.

[0071] When the safety element 38 is in the non-consent position, on the other hand, the hole 42 and the projection 41 do not coincide, that is, they are not

aligned along the axis X-X and the sliding of the tie rod 22 along the axis X-X, as well as the pivoting of the lever 21, are prevented.

[0072] For the correct operation of the form-fit system between the hole 42 and the projection 41, the angular position of the projection 41 must be kept constant, that is, the tie rod 22 must be prevented from rotating about the axis X-X.

[0073] In the embodiment described above, the tie rod 22 is prevented from rotating since it is articulated to the lever 21 by means of the pin 23.

[0074] During the operation of the clamp 1, when the clamp 1 is disengaged from the battery terminal 2, the free end 43 of the elastic tongue 40 presses against the lower surface 7a of the upper ring 7 of the conductor body 4. This causes the safety element 38 to pivot about the tie rod 22 towards the lower ring 6 on the rim of which the pivoting of the safety element 38 is stopped. The safety element 38 is thus in the position in which clamping is not permitted (Figure 4) and this position is maintained by the elastic tongue 40.

[0075] As stated above, in this position, the projection 41 of the tie rod 22 does not coincide angularly with the hole 42 in the safety element 38. The pivoting of the lever 21, and hence the operation of the means 5 for clamping the conductor body 4 to the battery terminal 2, are consequently prevented.

[0076] When the clamp 1 is fitted on the battery terminal 2, the battery terminal 2 acts on the feeler 39 of the safety element 38 and causes the element 38 to pivot about the axis X-X. The pivoting of the element 38 stops in a predetermined position which corresponds to the position in which clamping is permitted. In the embodiment of Figure 3, the pivoting stops when the base 3 of the clamp 1 is in contact with the base 2a of the battery terminal 2, that is, when the clamp 1 is correctly fitted on the terminal 2.

[0077] As stated above, in the closed position (Figure 3), the projection 41 of the tie rod 22 coincides with the hole 42 in the safety element 38. The pivoting of the lever 21 and hence the operation of the means 5 for clamping the conductor body 4 on the battery terminal 2 are consequently permitted.

[0078] The operation of the clamp 1 of the present invention is described below, starting from an operative configuration in which the lever 21 is in the open position and the clamp 1 is fitted on the battery terminal 2.

[0079] In order to release the clamp 1, the user exerts a slight pressure, for example, with a finger, on the pressure portion 31 of the tab 32. This brings about a slight bending of the tab 32 which is sufficient to release the catch element 30 from the catch element 33. At this point, the lever 21 can be pivoted from the open position to the closed position. During this pivoting, the catch element 30 slides in the recess 44 of the bearing element 35 and, upon completion of the pivoting of the lever 21, is in abutment with the catch element 34.

[0080] It should be noted that the pressure exerted on

the pressure portion 31 of the tab 32 can be released when the catch element 30 is in engagement with the recess 44.

[0081] In equivalent manner, when the lever 21 is in the closed position, the user acts on the pressure portion 31 of the tab 32 and pivots the lever 21 from the closed position to the open position.

[0082] During the pivoting of the lever 21 from the open position (Figure 1) to the closed position (Figure 2) and vice versa, the cam 24 brings about a movement of the pin 23 having an axial component along the axis X-X, and hence a corresponding movement of the tie rod 22 in which the pin 23 is fitted.

[0083] In particular, during the pivoting of the lever 21 from the open position to the closed position, the cam 24 brings about an increase in the distance between the bearing element 35 and the pin 23 fitted in the hole 26 in the tie rod 22. The abutment surface 25 of the tie rod 22 consequently imparts a compression force to the spring 27 and hence to the seating 20 of the conductor body 4. This brings about a movement of the seatings 19, 20 towards one another with the effect of clamping the conductor body 4 onto the battery terminal 2.

[0084] During the pivoting of the lever 21 from the closed position to the open position, on the other hand, the cam 24 brings about a reduction in the distance between the bearing element 35 and the pin 23. The abutment surface 25 of the tie rod 22 consequently relaxes its action on the spring 27 and hence on the seating 20. This leads to a movement apart of the seatings 19, 20 with the effect of eliminating the clamping force imparted to the battery terminal 2 by the conductor body 4.

[0085] As can be appreciated from the foregoing description, the clamp according to the present invention satisfies the needs and overcomes the problems discussed with reference to the prior art in the introductory part of this description.

[0086] The advantages resulting from the use of the clamp of the present invention lie mainly in the provision of a clamp that can be engaged on the battery terminal and released therefrom quickly, and which maintains a large clamping force.

[0087] Furthermore, the clamp of the present invention can be provided with safety means so that the user can check that the clamp is mounted correctly on the terminal.

[0088] A further advantage is the provision of a system which does not allow the clamp to be fastened when the clamp is not fitted perfectly on the battery terminal.

[0089] This is extremely important not only during transportation of the clamp but, above all, from a safety point of view.

Claims

1. A battery clamp (1) comprising a conductor body (4) and means (5) for clamping onto a battery terminal

- (2), the conductor body (4) comprising a split ring (6, 7) which can be coupled with the battery terminal (2) and has portions (19, 20) which can be moved towards one another, the clamping means (5) acting on the said portions (19, 20) in order to squeeze the split ring (6, 7) and bring about the clamping of the conductor body (4) onto the battery terminal (2), **characterized in that** the battery clamp comprises a lever (21) which can be pivoted between an open position and a closed position, the lever (21) comprising a cam (24) operatively associated with the clamping means (5) in order to bring about the clamping of the conductor body (4) onto the battery terminal (2) by pivoting of the lever (21) from the open position to the closed position.
2. A battery clamp (1) according to Claim 1 in which the clamping means (5) comprise a tie rod (22) operatively associated with the cam (24) so that, for a rotation of the cam (24), there is a corresponding movement of the tie rod (22) having an axial component.
 3. A battery clamp (1) according to Claim 2 in which the tie rod (22) comprises an abutment surface (25) which can act on a first portion (20) of the portions (19, 20) in order to bring about the movement of the portions (19, 20) towards one another or apart, respectively, as a result of opposed axial movements of the tie rod (22).
 4. A battery clamp (1) according to Claim 3 in which the abutment surface (25) acts on the first portion (20) with the interposition of elastic means (27).
 5. A battery clamp (1) according to any one of claims 1 to 4, comprising a bearing element (35) interposed between the lever (21) and the conductor body (4).
 6. A battery clamp (1) according to Claim 5 in which the bearing element (35) is shaped to define a sliding guide (36) for guiding the lever (21) in the pivoting movement between the closed position and the open position and *vice versa*.
 7. A battery clamp (1) according to any one of Claims 1 to 6, comprising first safety means (30, 33, 34, 44) for locking the lever (21) releasably in the open and closed positions, respectively.
 8. A battery clamp (1) according to any one of Claims 5 to 7 in which the safety means comprise catch elements (30, 33, 34) and recesses (44) interacting with one another and formed in the bearing element (35) and in the lever (21).
 9. A battery clamp (1) according to any one of Claims 5 to 8 in which the lever (21) comprises a catch element (30) mounted on a elastically deformable tab (32), the catch element (30) being able to abut the catch elements (33, 34) of the bearing element (35) in the open and closed positions, respectively, and to engage a recess (44) of the bearing element (35) when the lever (21) pivots between the closed position and the open position and *vice versa*.
 10. A battery clamp (1) according to any one of the preceding claims, comprising second safety means (38) for permitting the operation of the clamping means (5) solely when the clamp (1) is fitted fully on the battery terminal (2).
 11. A battery clamp (1) according to Claim 10 in which the second safety means comprise a safety element (38) associated with the tie rod (22) for pivoting relative thereto and having a feeler (39), the battery terminal (2) engaging the feeler (39) in order to pivot the safety element (38) between a consent position in which axial movement of the tie rod is permitted (22) and a non-consent position in which axial movement of the tie rod (22) is prevented.
 12. A battery clamp according to Claim 11 in which the safety element (38) has a window (42) which, in the consent position, can achieve a form fit with a projection (41) extending axially along the tie rod (22).

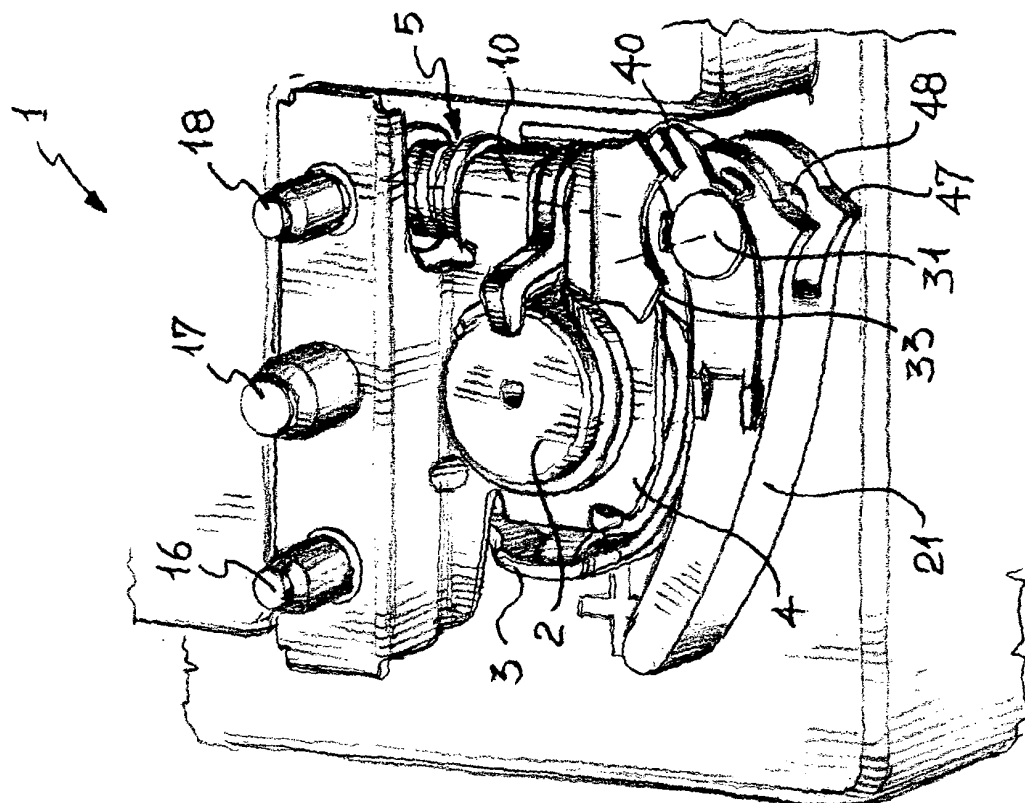


FIG. 2

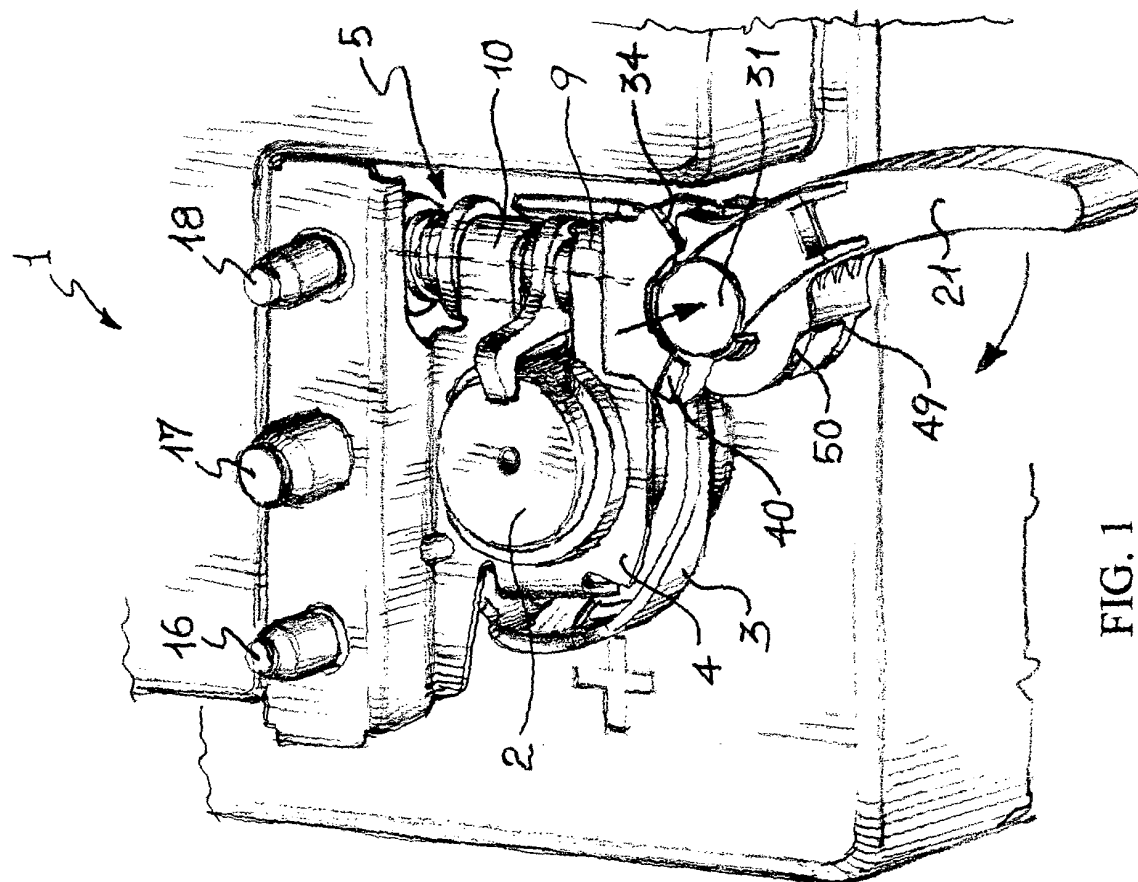


FIG. 1

FIG. 3

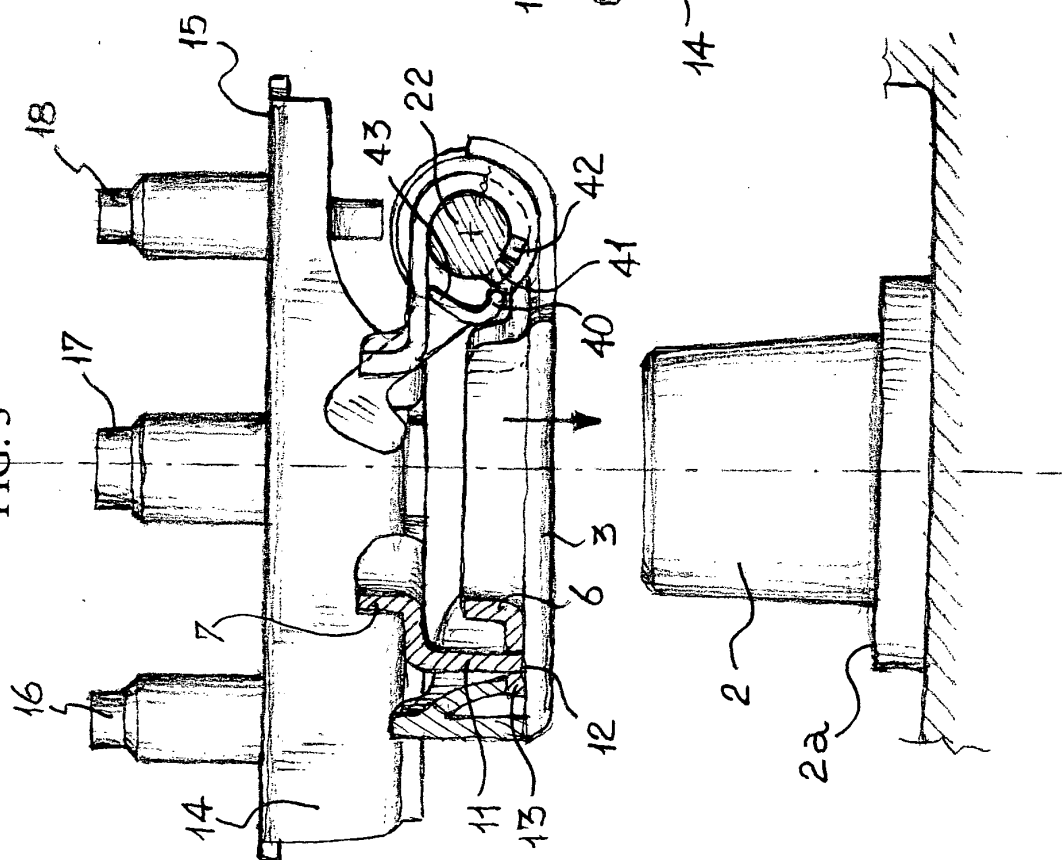
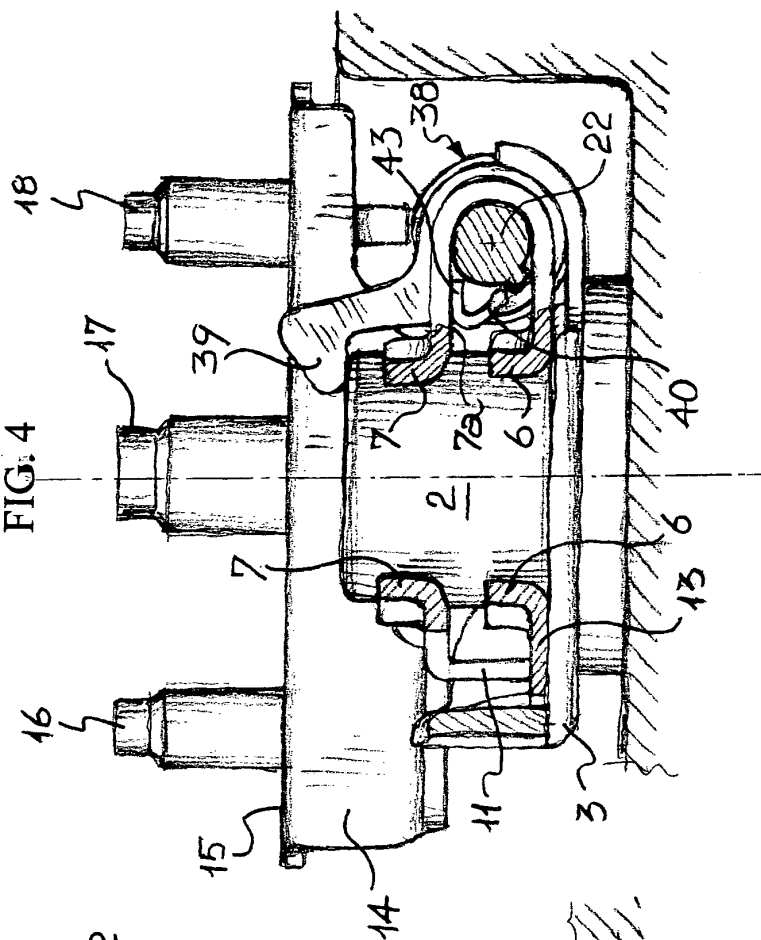


FIG. 4



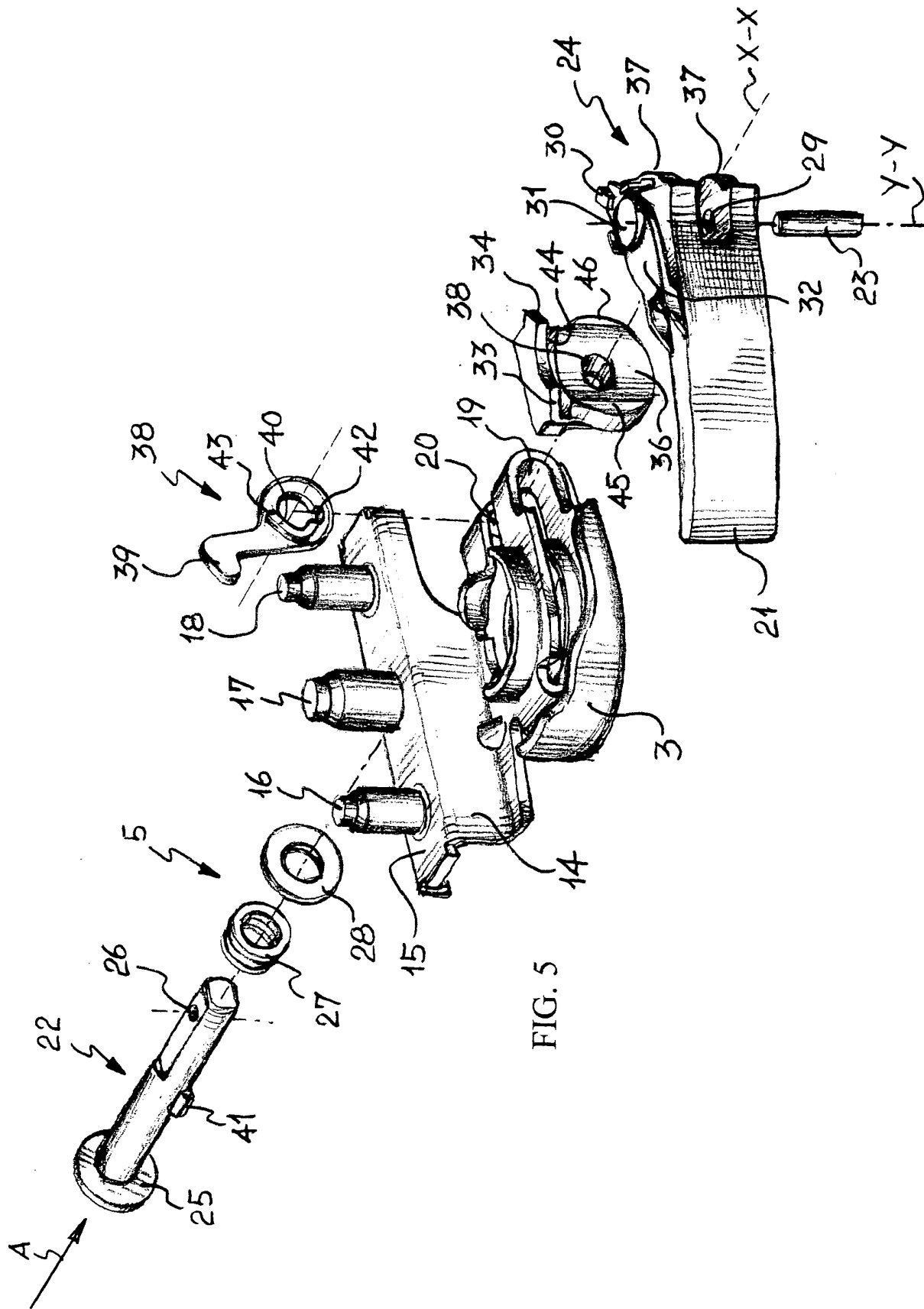


FIG. 5



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5465

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Place of search		Date of completion of the search	Examiner
MUNICH		8 December 2003	Arenz, R
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 03 42 5465

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