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(54) Operating device for simultaneous disconnecting switch

(57) An operating device (40) for operating a simultaneous disconnecting switch (S1), the disconnecting switch being installed on a medium-tension electricity distribution line and comprising electrical contact elements (31, 33) to open and close said electricity distribution line, the disconnecting switch (S1) comprising also an operating rocker arm (B3) mechanically coupled with said contact elements (31, 33) and capable of being manually rotated between a first position and a second position in order to open or close the electricity transmission line by means of the contact elements, characterized in that said operating device comprises motor means (44) that can be operatively connected to said operating rocker arm (B3), electronic control means electrically connected to said motor means (44) to permit their being remote-controlled, the operating rocker arm (B3) being rotable between said first and second position also by means of said motor means.

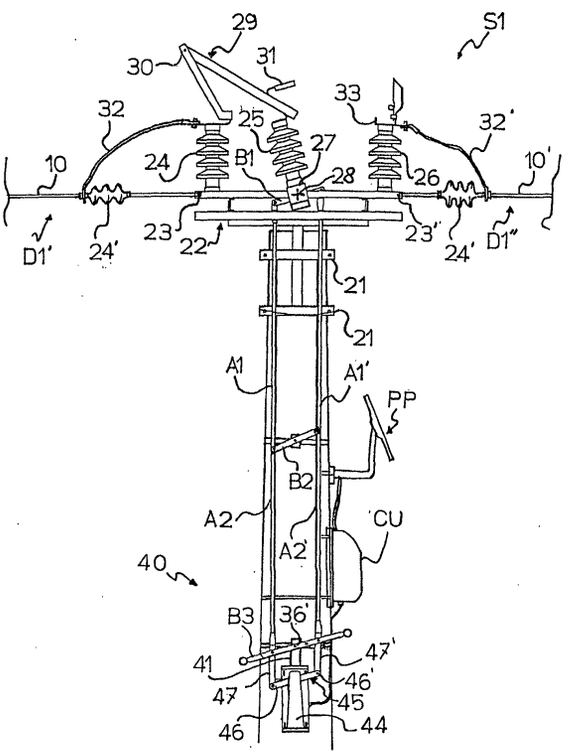

FIG. 4

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Description

[0001] The present invention concerns installations for the distribution of electricity and, more particularly, an operating device for a simultaneous disconnecting switch.

[0002] As is well known, installations for the distribution of electricity comprise overhead distribution lines for alternating current at medium voltages (1 kV - 30 kV). These medium-tension lines, also known as medium-tension backbones, start from the terminal station of high-tension lines and arrive at feeding numerous substations by means of appropriate branch lines. The substations are normally situated in the various consumption centres, represented - for example - by individual industrial users or a group of civil users.

[0003] In the case of civil users, in particular, the substations are commonly used to transform the incoming power from medium to low tension. When the electricity is intended for industrial users, on the other hand, it may happen that transformation is not needed at these substations. In these cases the substation may perform the function of, for example, measuring the power supply for billing purposes.

[0004] Notwithstanding the gradual and continuous evolution of electricity distribution installations and equipment, it is still very common for breakdowns to occur.

[0005] These breakdowns are the cause of inefficiency and poor service and often also of supply interruptions that, be they fleeting or long-lasting, are associated with hardship for the users. In particular, breakdowns located along a medium-tension backbone line and its branches are capable of depriving all the users served by this line of their power supply.

[0006] Following such breakdowns, the electricity supplier or the manager of the line affected by the breakdown must try to locate the damaged equipment as quickly as possible and then either repair or substitute it.

[0007] The phase of identifying the damaged equipment, in particular, may require him to disconnect substantial parts of the medium-tension backbone line repeatedly and sometimes for long periods of time in order to pinpoint the faulty section and then isolate it from the rest of the line.

[0008] The disconnection of such sections is usually performed with the help of circuit breakers that can be opened and closed no matter what the load condition of the line. These circuit breakers, which may be - for example - of the type using sulphur hexafluoride to extinguish the arc drawn upon opening, are very complex and therefore costly and call for frequent and careful maintenance. For this reason circuit breakers are often installed at strategic points that may also at times be far removed from each other (50 - 100 km).

[0009] The switches used for disconnecting branch lines, on the other hand, are typically of the type known as "simultaneous" disconnecting switches, which are operated manually and solely in the absence of load. This means that when such a disconnecting switch has to be operated in order to connect or disconnect a branch line, the section of the medium-tension backbone line to which it is connected must first be taken out of service by means of an appropriate circuit breaker. Since the branch line may be situated at a considerable distance from this circuit breaker, the backbone line section taken out of service may have to be very long.

[0010] The present invention therefore sets out to make available an operating device for a simultaneous disconnecting switch that will be economic, make it possible to shorten the time needed to diagnose / repair breakdowns on an electricity supply line and reduce the risks run by the men who have to carry out the repair operations.

[0011] This aim attained by means of an operating device for a simultaneous disconnecting switch as described in the first claim hereunder.

[0012] Another aim of the present invention is to make available a disconnecting switch as described in Claim 18.

[0013] Further characteristics and advantages of the invention will be more readily understood from the description about to be given of some preferred embodiments thereof, which are to be considered as examples and not limitative in any way, said description making reference to the attached figures, of which:

- Figure 1 shows the schematic layout of a conventional electricity distribution network,
- Figure 2 shows a particular example of a conventional simultaneous disconnecting switch,
- Figure 3 shows a perspective view of an enlarged detail of Figure 2,
- Figure 4 shows an operating device in accordance with the present invention combined with the disconnecting switch of Figure 2,
- Figure 5 shows an enlarged detail of the operating device of Figure 4,
- Figure 6 shows an enlarged detail of the operating device of Figure 4 with the component parts detached from each other.

[0014] Referring to these figures, a preferred embodiment of the operating device in accordance with the invention will now be described as an example.

[0015] Figure 1 shows a schematic layout plan of an electricity distribution network 1. In the example of Figure 1 the network 1 comprises a medium-tension backbone line, indicated by the reference letter L, which is counter-fed, i.e. situated between two primary transformer stations T1 and T2. The line L may be, for example, an overhead three-phase line.

[0016] The stations T1, T2 assure the conversion to a medium voltage of the power carried by the high-tension lines 2, 3. In greater detail, the stations T1 and T2 may step the voltage down from 130 kV to 20 kV.

[0017] By means of its branch lines D1-D4, the medium-voltage backbone line L feeds numerous substations, which in the figure are indicated respectively as ST1-ST4.

[0018] The substations ST1-ST4 are usually situated in the vicinity of consumption centres and, in the present example, assure a further step-down to a low voltage (240 / 380 V) for subsequent distribution of the electricity to the various users.

[0019] In Figure 1 the medium-tension backbone line L is subdivided into four sections L1-L4 by three circuit breakers C1-C3, which may be, for example, sulphur hexafluoride (SF_6) circuit breakers, that make it possible to open or close the line L both in the presence and the absence of a load. Each of the circuit breakers C1-C3 therefore serves to make or break the circuit of the backbone line 4, i.e. to pass or interrupt the operating current, no matter what the load conditions, even in the presence of an overload.

[0020] The circuit breakers C1-C3 are normally provided with appropriate interfaces to permit their being remotely operated.

[0021] It should be noted that the circuit breakers C1-C3 are sophisticated and costly and the distance between two successive circuit breakers may therefore be quite substantial, even greater than 50 km for example. For this reason, the number of branch lines departing from a backbone section delimited by two successive circuit breakers may be rather large (of the order of several tens, for example).

[0022] The branch lines D1, D2, D3, D4 are conventionally provided with respective disconnecting switches S1-S4.

[0023] A disconnecting switch is an item of operating equipment for high and medium voltages and has the function of making possible the physical separation of a part of the circuit (a branch line in this particular example) from the remaining part of the network, but not the function of breaking a circuit while carrying a load. In actual practice, as already mentioned, when a disconnecting switch S1 is to be operated, to disconnect the substation ST1 for example, one first has to make sure that the circuit breakers switches C1 and C2 have been opened, so that the line section L2 is no longer live. The term "operating the disconnecting switch" is to be understood as referring to the operation of changing the state of the disconnecting switch between two possible states, one of which, known as "closed", corresponds to a configuration of the disconnecting switch in which the branch line is closed (or connected) and the other, known as "open", corresponds to a configuration of the disconnecting switch in which the branch line is open (or disconnected).

[0024] Once the branch line D1 has been disconnected, the line section L2 can be reconnected to the network while - for example - the repair or maintenance operations are carried out at the substation ST1.

[0025] Unlike the circuit breakers C2, in accordance with conventional techniques the disconnecting switches are operated manually by personnel at the place where they are installed and the contacts are opened in air. Since these disconnecting switches are extensively used and widely distributed over the territory, it is important that they should have a low cost, for example, much smaller than the cost of the circuit breakers.

[0026] Figure 2 shows a schematic side elevation of a typical simultaneous disconnecting switch S1, conventionally used for disconnecting a branch line D1 from a medium-tension, three-phase backbone distribution line.

[0027] A simultaneous disconnecting switch brings about the opening or closure of a line D1 consisting of several conductors, three conductors for example, in such a way as to interrupt or re-establish the three conductors simultaneously.

[0028] In Figure 2 the disconnecting switch "disconnects" the branch line D1 by dividing it into an upstream part D1' and a downstream part D1". For example, D1' may be the part connected to the main line L and D1" may be the part connected to the distribution substation ST1.

[0029] With a view to simplifying matters, Figure 2 shows only the part of the disconnecting switch S1 that interrupts or re-establishes just one 10, 10' of the three conductors of a branch line D1 of the three-phase type. In greater detail, the disconnecting switch S1 interrupts and re-establishes the conductor 10, 10' by electrically disconnecting the upstream part 10 of said conductor from the downstream part 10' or re-connecting it thereto.

[0030] The disconnecting switch S1 may be fixed, for example, to a steel pole 20 by means of appropriate stirrups 21. Alternatively, the pole 20 may also be a common octagonal pole made of centrifuged reinforced concrete (CRC).

[0031] The disconnecting switch S1 comprises a metal frame 22 of a substantially rectangular shape. The conductors of the branch line D1 are anchored to the frame 22. In the figure the conductor 10, 10' is anchored to the frame 22 at the anchorage points 23, 23'.

[0032] The frame 22 is however electrically insulated from the conductors, in Figure 2, for example, the conductor 10, 10' is insulated from the frame by means of insulators 24'.

[0033] The frame 22 also sustains fixed standoff insulators 24, 26 and the movable standoff insulators 25. The latter are integral with a swivelling arm 27 that develops substantially along its longitudinal axis 28 and is capable of rotating around it.

[0034] For each conductor 10, 10' of the branch line D1, the disconnecting switch also comprises a respective rigid and electrically conducting blade 29 that has a fulcrum at what is more or less its centre point 30. One end of the blade 29 is hinged to the top of respective fixed standoff insulator 24, while its other end is hinged to the top of a respective movable standoff insulator 25. To each blade 29 there is attached a respective contact

element 31 that is electrically connected to the blade; this element will henceforth be referred to as mobile contact element 31.

[0035] The blades are electrically connected to a respective conductor of the line D1. In Figure 2, the blade 29 is electrically connected to the part 10 of the conductor 10, 10' by means of a connecting conductor 32 (a cable, for example).

[0036] Fixed contact elements 33, each such as to form a shape coupling with a respective mobile contact element 31, are attached to the top of a respective fixed insulator 26. The fixed contact elements are electrically connected to respective conductors of the line D1. In Figure 2, the fixed contact element 33 is electrically connected to the part 10' of the conductor 10, 10' by means of a connecting conductor 32'.

[0037] The state of the disconnecting switch as represented in Figure 2 is known as "open" and corresponds to a configuration in which the line 10, 10' is open / interrupted, because there is no electrical continuity between the conductors 10 and 10'.

[0038] The swivelling arm 27, on which there are mounted the movable insulators 25, is coupled with a first transmission rocker arm B1 that can swivel around the axis of rotation 28 of the swivelling arm 27.

[0039] The first transmission rocker arm B1 is hinged by means of cylindrical hinges to a first pair of transmission rods A1 and A1' that terminate on a second transmission rocker arm B2, to which they are attached by means of hinged connections.

[0040] The second transmission rocker arm B2 is also hinge-connected to a second pair of transmission rods A2 and A2' that, in their turn, terminate on an operating rocker arm B3.

[0041] It is also possible for the place of the two pairs of transmission rods, respectively A1, A1' and A2, A2', to be taken by a single pair of transmission rods. In that case there will be no second transmission rocker arm B2.

[0042] The operating rocker arm B3, which is normally longer than the transmission rocker arms B1 and B2, is provided with eyelets 34, 34' at its ends and serves to operate the disconnecting switch, reducing the force that is needed to operate it.

[0043] As will be obvious to a person skilled in the art, when the disconnecting switch of Figure 2 has to be operated, it is sufficient to manually rotate the operating rocker arm B3 around a rotation axis 36 substantially parallel to the longitudinal axis of the swivelling arm 27.

[0044] For example, starting from the configuration represented in Figure 2, which corresponds to a situation in which the line 10, 10' is interrupted, a rotation in a clockwise direction and through an appropriate distance of the operating rocker arm B3 around the axis of rotation 36 will cause the mobile contact elements 31 to become coupled with the respective fixed contact elements 33, thus reestablishing the electrical continuity of the conductor 10, 10' and, more generally, the continuity of the branch line D1, D1'. The configuration of the disconnecting switch S1 in which the mobile contact elements are in contact with the fixed contact elements assures the continuity of the line 10, 10' and corresponds to the state of the disconnecting switch known as "closed".

[0045] When this continuity has again to be interrupted, it is sufficient to rotate the operating rocker arm B3 in the opposite direction, thus bringing the disconnecting switch S1 back into the configuration shown in Figure 2.

[0046] For reasons of safety, the operating rocker arm B3 is usually situated at a certain distance from the ground (3 - 4 m, for example). For this reason, whenever the disconnecting switch S1 is to be operated, the person performing the operation has to avail himself of an insulated rod, known also with the name of "switch hook", provided at its upper end with appropriate means for gripping the rocker arm eyelet, a hook for example.

[0047] When he wants to operate the disconnecting switch S1, the operator has to insert the hook of the insulated rod in one of the two eyelets, according to the direction in which the rocker arm B3 has to be rotated, and then pull the insulated rod downwards.

[0048] An important characteristic of disconnecting switches - like the one shown in Figure 2, for example - is that its state, i.e. whether it is open or closed, has to be made clear in a readily visible manner in order to permit, for example, maintenance intervention on the branch line in conditions of safety.

[0049] Figure 3 shows a perspective view of a detail of the disconnecting switch of Figure 2. It should be noted that in the case of a simultaneous disconnecting switch for a three-phase line the three movable insulators are fixed to a single swivelling arm 27. Consequently, when this arm 27 is swivelled by means of the operating rocker arm B3, the three conductors of a three-phase branch line can be opened / closed in a substantially synchronous manner.

[0050] Referring to Figures 4, 5 and 6, there will now be described an operating device 40 in accordance with the present invention that can be employed with the simultaneous disconnecting switch of Figure 2.

[0051] The operating device 40 is preferably capable of being fixed to the pole 20 on which the disconnecting switch S1 is mounted, halfway up the pole, for example, substantially in the immediate vicinity of the operating rocker arm B3.

[0052] The operating device 40 will preferably comprise means of support that will permit its being fixed to the pole 20. As shown in detail in Figure 5, the means of support include a U-shaped stirrup 41 that can be fixed to the pole by means of preferably metallic fixing bands 42 and a preferably angular shelf 43 that can be removably attached to said U-shaped stirrup 41.

[0053] In a particularly advantageous embodiment the shelf 43 can be attached to the stirrup 41 by fixing means, not shown in the figure, such as to make it possible for the position of the shelf 43 with respect to the

stirrup 41 to be accurately adjusted both in the vertical direction and the horizontal direction. For example, the fixing means may comprise slotted holes or other appropriate adjustment guides.

[0054] The operating device 40 further comprises motor means that are operatively connected to the operating rocker arm B3 of the disconnecting switch and can be fixed to the pole 20 with the help of the means of support. For example, the motor means could be fixed to the angular shelf 43, which thus acts as a support of said means.

[0055] In a preferred embodiment said motor means include an electric motor reducer 44, fed - for example - by direct current at 24 V and with a power of 250 W, and a pair of adjustable electromechanical limit switches (not shown in the figure). Each limit switch has the function of interrupting the rotation movement of the motor reducer in one respective direction. Going into greater detail, in a particularly advantageous embodiment each of the limit switches comprises a pair of electric contact elements, a pair of switches for example. A first switch is used to interrupt the rotation movement upon attainment of the limit stop position, while the other is used to detect the open or closed state of the disconnecting switch in the limit stop position.

[0056] The operating device 40 comprises electronic control means to control and command the motor means 44. For example, the electronic control means may include an electronic control unit, preferably separate from the motor means. In the example of Figure 4, the electronic control unit is installed within an impermeable and shielded box CU fixed to the pole 20.

[0057] The electronic control unit preferably includes timers, remote-control switches and means of command to receive a command signal from an operator who wished to operate the motor means.

[0058] The command means preferably include both means for locally operating the motor means (for example, by means of a pushbutton on a control panel protected by the box CU or a remote control) and a communication interface to operate the motor means from a remote workstation.

[0059] Advantageously, the communication interface will be of the bi-directional type and will also make it possible to transmit to a remote station, by radio for example, information about both the disconnecting switch S1 (for example, whether it is closed or open) and the operating device 40 of the disconnecting switch S1.

[0060] In a particularly advantageous embodiment the interface is such as to receive signals transmitted from a remote station by means of SMS (Short Message Service). Moreover, the interface is such as to transmit o the remote station, still by means of short messages, information about the disconnecting switch and the operating device. To this end, the communication interface preferably comprises a GSM modem, of the dual-band type for example, and a dedicated telephone number is associated with disconnecting switch.

[0061] The operating device 40 also includes power supply means to feed the electronic control unit and, through it, also the motor means.

[0062] In a preferred embodiment, the power supply means include an accumulator (or a set of accumulators), a photovoltaic panel PP and a recharging circuit for the accumulator. Preferably, the photovoltaic panel PP is mounted on the pole 20, while the accumulator is placed in the shielded box CU.

[0063] In a variant embodiment, moreover, the power supply means include, either in substitution of or addition to the photovoltaic panel PP, a voltage reducer (from medium to low voltages) and a rectifier, both used for recharging the accumulator. Preferably the control unit will also be such as to transmit information about the charging state of the accumulator via the communication interface.

[0064] Preferably, the operating device 40 includes also detection means, not shown in the figure, for ascertaining the presence of current or voltage on the line 10, 10', for example, an electric / magnetic field probe. Said detection means are such as to send a signal, the so-called consent signal, to the control unit to inhibit the operation of the disconnecting switch S1 whenever the probe detects the presence of current / voltage.

[0065] Preferably, the control unit is also such as to transmit via the communication interface the information captured by the detection means.

[0066] The motor means are operatively connected to the operating rocker arm B3 by means of mechanical connecting means. In a preferred embodiment, for example, as shown in Figure 5, the mechanical connecting means comprise a pivoting arm 45 and two rigid rods 47, 47' that are substantially parallel with each other.

[0067] The pivoting arm 45 can be operatively connected to the motor means and made to rotate about an axis 36 that is substantially parallel to the rotation axis of the operating rocker arm B3. The rods 47,47', preferably made of metal, make it possible to transmit the motion generated by the motor reducer 44 to the operating rocker arm B3.

[0068] The rods 47,47' have a respective first end that is hinged with the pivoting arm 45, while their respective opposite ends are hinged with the operating rocker arm B3.

[0069] In a preferred embodiment, in particular, the rods 47, 47' are joined to the pivoting arm 45 and the operating rocker arm B3 by means of pins P1, P1', P2, P2' (see Figure 5).

[0070] Preferably, the rods are hinged with their first ends to the operating rocker arm B3 at the same points at which it is hinged with the transmission rods A2, A2' (in Figure 5 with same pins P1, P1').

[0071] In particularly advantageous embodiment the mechanical coupling between the motor means 44 and the operating rocker arm B3 (or, more generally, the mechanical coupling between the motor means and the swivelling arm 27) is a mechanical coupling with clear-

ance.

[0072] A mechanical coupling with some clearance makes it possible to prevent a kickback of the motor reducer to be transmitted to the operating rocker arm B3 or, more generally, the swivelling arm 27 to which the movable insulators 25 are attached. At the same time, however, this coupling must be such as to assure an efficient transmission of the rotation motion of the motor reducer to the operating rocker arm B3 or, more generally, the swivelling arm 27.

[0073] In the embodiment of Figure 6, which is particularly economic and simple to realize, the mechanical coupling with clearance is obtained by means of slotted holes 49, 49', each realized at the second end of a respective rigid rod 47, 47'. The pivoting arm 45 is provided with two circular holes 46, 46' substantially arranged in proximity of its ends and capable of being connected to the slotted holes 49, 49' (by means of the pins P2, P2' shown in Figure 5) to form a connection to the operating rocker arm B3 via the rigid bars 47, 47'.

[0074] In an alternative embodiment the holes 49, 49' of the rigid bars 47, 47' are circular, while the holes 50, 50' are slotted holes.

[0075] In a variant embodiment the coupling with clearance may be obtained by hinging the pivoting arm 45 to guides integral with the rigid rods 47, 47'.

[0076] In a preferred embodiment the rods 47, 47' are substantially of the same size and have a length comprised between 20 cm and 30 cm, and the slotted holes 49, 49' have a length comprised between 1 cm and 3.5 cm, preferably comprised between 1.5 cm and 3 cm.

[0077] With reference to Figure 5, in a particularly advantageous embodiment the U-shaped stirrup 4 not only acts as support for the shelf 43, but is also mechanically coupled to the operating rocker arm B3, though in such a way as not to hinder its rotation. In the example shown in Figure 5, the U-shaped stirrup 41 is provided with a pin 48 on which there is fitted the operating rocker arm B3. The pin 48 acts as centre of rotation of the operating rocker arm B3.

[0078] The manner of functioning of an operating device in accordance with the present invention will now be explained with the help of Figures 4, 5 and 6.

[0079] When the disconnecting switch S1 is to be operated, the control unit receives a signal to open/close the disconnecting switch S1 via the command means. This signal can be a local signal or a signal transmitted from a remote station. If the current detection means signal the presence of current, the opening/closure signal is ignored by the control unit. In the contrary case, however, the motor reducer 44 is activated and fed by the control unit. Due to the activation of the motor reducer, the pivoting arm 45 begins to rotate in a predetermined direction of rotation that depends on whether the disconnecting switch S1 is being closed or opened.

[0080] The pivoting arm 45, in its turn, transmits the rotation movement to operating rocker arm B3 by means of the rigid rods 47, 47'.

[0081] The mechanical coupling with clearance, such as the one obtained - for example - by means of the slotted holes 49, 49' of the rigid rods 49, 49', makes it possible for the movement to be transmitted with, at the most, a small delay of the instant in which the operating rocker arm B3 or, more generally, the swivelling arm 27 begins to rotate under the action of the motive force.

[0082] The rotation terminates when the disconnecting switch S1 attains the "closed" state if the disconnecting switch is operated at a moment when its state is "open". Vice versa, the rotation terminates the disconnecting switch attains the "open" state.

[0083] In this connection, the electro-mechanical limit switches are regulated in such a manner as to interrupt the rotation of the motor reducer 44 when the operating rocker arm B3 reaches a limit stop position corresponding to an open or closed state of the disconnecting switch S1. In a particularly advantageous embodiment the electro-mechanical limit switches are used also for signalling the open or closed state of the disconnecting switch S1 both locally and at the remote station.

[0084] In a preferred embodiment the control unit of the motor reducer, acting through the remote-control switches and the timers, interrupts the power supply of the motor reducer 44 during the operation of the disconnecting switch S1 when the duration of the operation succeeds a predetermined value. If this value is appropriately chosen, the control unit will realize an electronic-controlled limit stop.

[0085] The presence of an electronic-controlled limit stop, apart from the two electro-mechanical limit switches, will also provide a reliable control of the motor reducer and avoid the motor reducer and the disconnecting switch becoming highly stressed in case the electro-mechanical limit switches fail to function.

[0086] At the moment in which the control unit terminates the power supply to the motor reducer, i.e. when the rocker arm B3 reaches one of the two positions in which the disconnecting switch is open or closed, the closed position for example, the motor reducer 44 will suffer a kickback. Experiments have shown that this kickback tends to cause an undesired rotation of the operating rocker arm B3 in the direction opposite to the rotation movement it performs in order to reach the closed position. This undesired rotation is transmitted to the swivelling arm 27 and thus causes the mobile insulators 25 to move away from the fixed insulators 26. This could cause an incomplete coupling of the mobile contact elements 31 with their respective fixed contact elements 33 or even complete lack of contact between them. Similar considerations apply when the disconnecting switch is to be moved into the open position.

[0087] The presence of mechanical coupling with clearance between the motor means 44 and the operating rocker arm B2 (or, more generally, between the motor means and the swivelling arm 27) avoids undesired rotations due to kickbacks being transmitted to the swivelling arm 27 and thus assures that the open and

closed positions of the disconnecting switch S1 will always be fully reached and perfectly maintained. In the embodiment of the device shown in Figure 6 the undesired rotation is absorbed by the slotted holes 49, 49' provided on the rigid rods 47, 47'.

[0088] The operating device 40 of the present invention, which is economic and simple to install, enables the operator to move a disconnecting switch S1 on an electricity distribution line in a rapid and safe manner.

[0089] Advantageously, moreover, the fact that the operating device can be operated both locally and remotely enables him to do so from a control room situated far away, thereby automating and rendering particularly rapid and efficient the phase of locating and isolating failed electrical equipment. In particular, use of a single computer at the remote control room makes it possible to control a large number of disconnecting switches simultaneously and to have information about their state in real time. Referring to Figure 1, the same computer makes it possible to implement programs that, by means of the sequential operation of the circuit breakers C1-C3 and the disconnecting switches S1-S4, will automatically and quickly pinpoint the location of a possible breakdown on a distribution line 1 and then arrange to isolate to enable the repair gang to do its work in safety.

[0090] It should also be noted that an operating device in accordance with the present invention is particularly suitable for being installed without difficulty and in a simple manner on an existing disconnecting switch designed only for manual operation. Advantageously, moreover, in the event of a breakdown of the electronic equipment, the disconnecting switch that has been provided with an operating device in accordance with the present invention can still be operated manually in the same which one operates conventional disconnecting switches designed only for manual operation.

[0091] Among the other advantages it should be noted that the operating device in accordance with the present invention leaves the appearance of a manually operated disconnecting switch practically unchanged and, more particularly, does not require the operating rocker arm B3 to be removed. The latter, thanks to its ends that project beyond the transmission rods and are therefore be readily seen, continues even after the installation of the operating device to discharge its important function of providing a clear and obvious indication of the state of the disconnecting switch. Indeed, especially in conditions of poor visibility (due, for example, to darkness or atmospheric phenomena), it would be difficult for an operator to distinguish the state of the disconnecting switch by observing the position of the fixed and mobile contacts, which - among others - are situated at the top of the pole and therefore at a considerably height above the ground.

[0092] Be it also noted that the use of means for detecting the presence of current/voltage makes it possible - for example- for the breakdown gangs work in conditions of maximum safety, avoiding dangerous situations due to an erroneous "electronic" operation of the disconnecting switch.

[0093] Obviously, when a person skilled in the art has to satisfy contingent and specific needs, he will be able to introduce numerous modifications and variants into the operating device described hereinabove without thereby overstepping the protection limits of the invention as defined by the claims attached hereto.

Claims

1. An operating device (40) for operating a simultaneous disconnecting switch (S1), the disconnecting switch being installed on a medium-tension electricity distribution line and comprising electrical contact elements (31, 33) to open and close said electricity distribution line, the disconnecting switch (S1) comprising also an operating rocker arm (B3) mechanically coupled with said contact elements (31, 33) and capable of being manually rotated between a first position and a second position in order to open or close the electricity distribution line by means of the contact elements, **characterized in that** said operating device comprises motor means (44) that can be operatively connected to said operating rocker arm (B3), electronic control means electrically connected to said motor means (44) to permit their being remote-controlled, the operating rocker arm (B3) being rotable between said first and second position also by means of said motor means.

2. An operating device in accordance with Claim 1, wherein said motor means comprise an electric motor.

3. An operating device in accordance with Claim 2, wherein said motor means comprise a motor reducer (44).

4. An operating device (40) in accordance with Claim 1, comprising also mechanical connection means to connect said operating rocker arm (B3) to said motor means, the mechanical connection means rendering possible a mechanical coupling with clearance between said operating rocker arm (B3) and said motor means.

5. An operating device in accordance with Claim 4, wherein said mechanical connection means include two rigid rods (47, 47'), each comprising a slotted hole (49, 49').

6. An operating device in accordance with Claim 5, wherein the mechanical connection means comprise also a pivoting arm (45) that can be operatively connected to the motor means, and wherein the rods (47, 47') comprise a respective first end hinged

with the pivoting arm (45) and a second respective end, opposite to the first end and hinged with the operating rocker arm (B3), the first end being hinged with the pivoting arm (45) by means of said slotted hole (49, 49').

7. An operating device in accordance with Claim 1, wherein said contact elements (31,33) comprise mobile contact elements (31) fixed to a swivelling arm (27) operatively connectable with said operating rocker arm (B3) by means of transmission rods (A1, A1') and at least one transmission rocker arm (B1).

8. An operating device in accordance with Claim 7, wherein the swivelling arm (27) is can mechanically coupled with said motor means by means of a mechanical coupling with clearance.

9. An operating device in accordance with Claim 1, wherein said disconnecting switch can be fixed to a supporting pole (20) and wherein said device can be fixed to the pole substantially in proximity of the operating rocker arm (B3).

10. An operating device in accordance with Claim 9, comprising supporting means (41, 43) to permit it being fixed to said supporting pole.

11. An operating device in accordance with Claim 1, comprising also means for detecting the presence current or voltage on the electricity line, said means providing also an inhibition signal to the control means to prevent said operating device from operating the disconnecting switch when the presence of voltage or current has been detected.

12. An operating device in accordance with Claim 1, wherein said control means (CU) include means for local operating said motor means and include also a communication interface for receiving signals from a remote station to operate said motor means.

13. An operating device in accordance with Claim 12, wherein said interface is of the bi-directional type and such as to send signals containing information about the state of the disconnecting switch and the operating device to a remote station.

14. An operating device in accordance with Claim 12 or Claim 13, wherein said interface comprises a GSM modem and wherein said signals comprises SMS messages.

15. An operating device in accordance with Claim 1, comprising power supply means to feed the control means and, through them, also the motor means.

16. An operating device in accordance with Claim 15, wherein said power supply means comprise an accumulator, an accumulator recharging circuit and a photovoltaic panel (PP) to recharge the accumulator through said circuit.

17. An operating device in accordance with Claim 15, wherein said power supply means comprise an accumulator, an accumulator recharging circuit, a medium-to-low-tension voltage reducer and a rectifier for recharging the accumulator through said circuit.

18. A three-pole disconnecting switch (S1) for an overhead medium-tension electricity distribution line, including an operating device (40) in accordance with any one of the preceding claims.

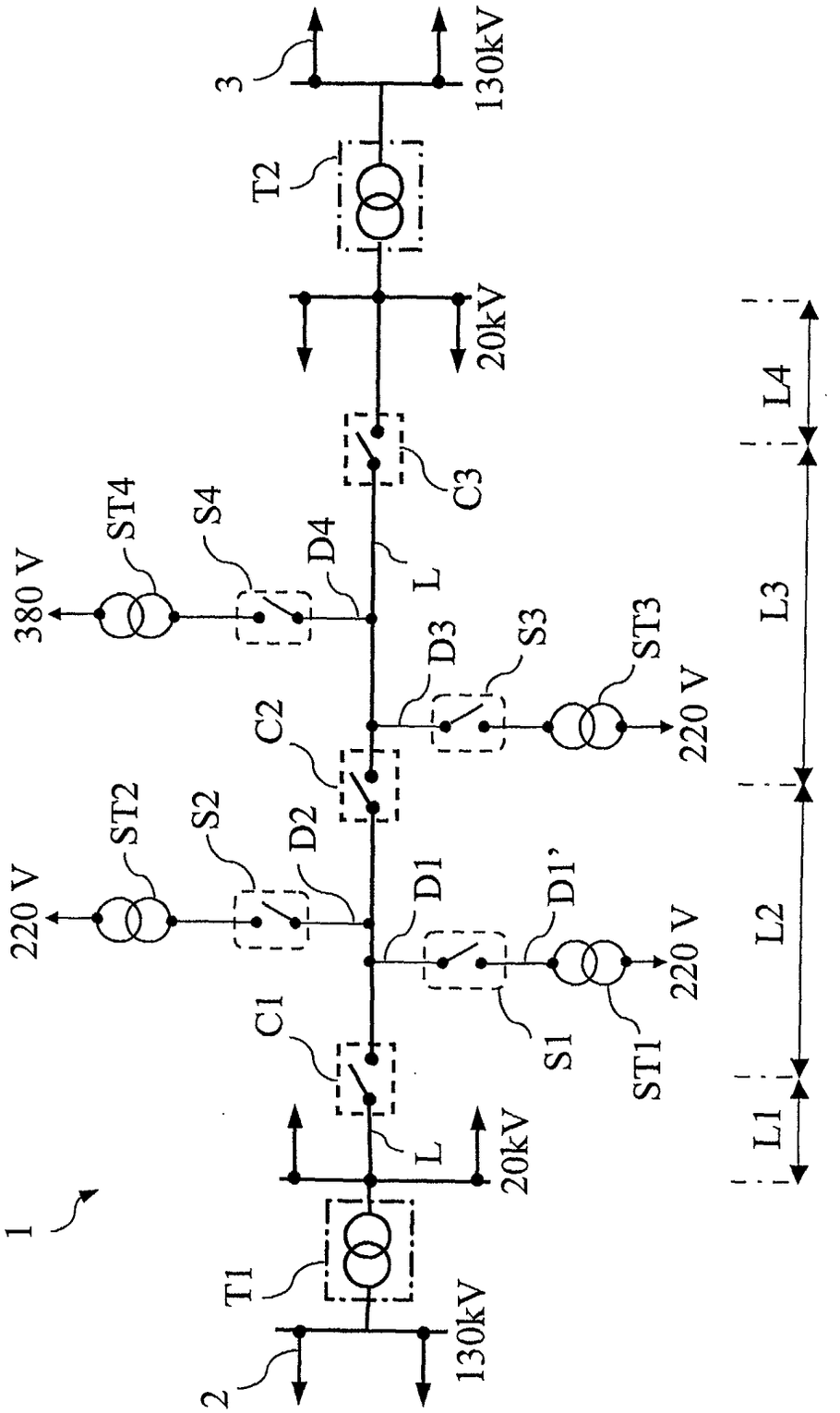
1
2
3
130kV
130kV
T1
T2
20kV
20kV
L
L
C1
C2
C3
D1
D1'
D2
D3
D4
S1
S2
S3
S4
ST1
ST2
ST3
ST4
220 V
220 V
220 V
380 V
L1
L2
L3
L4

FIG. 1

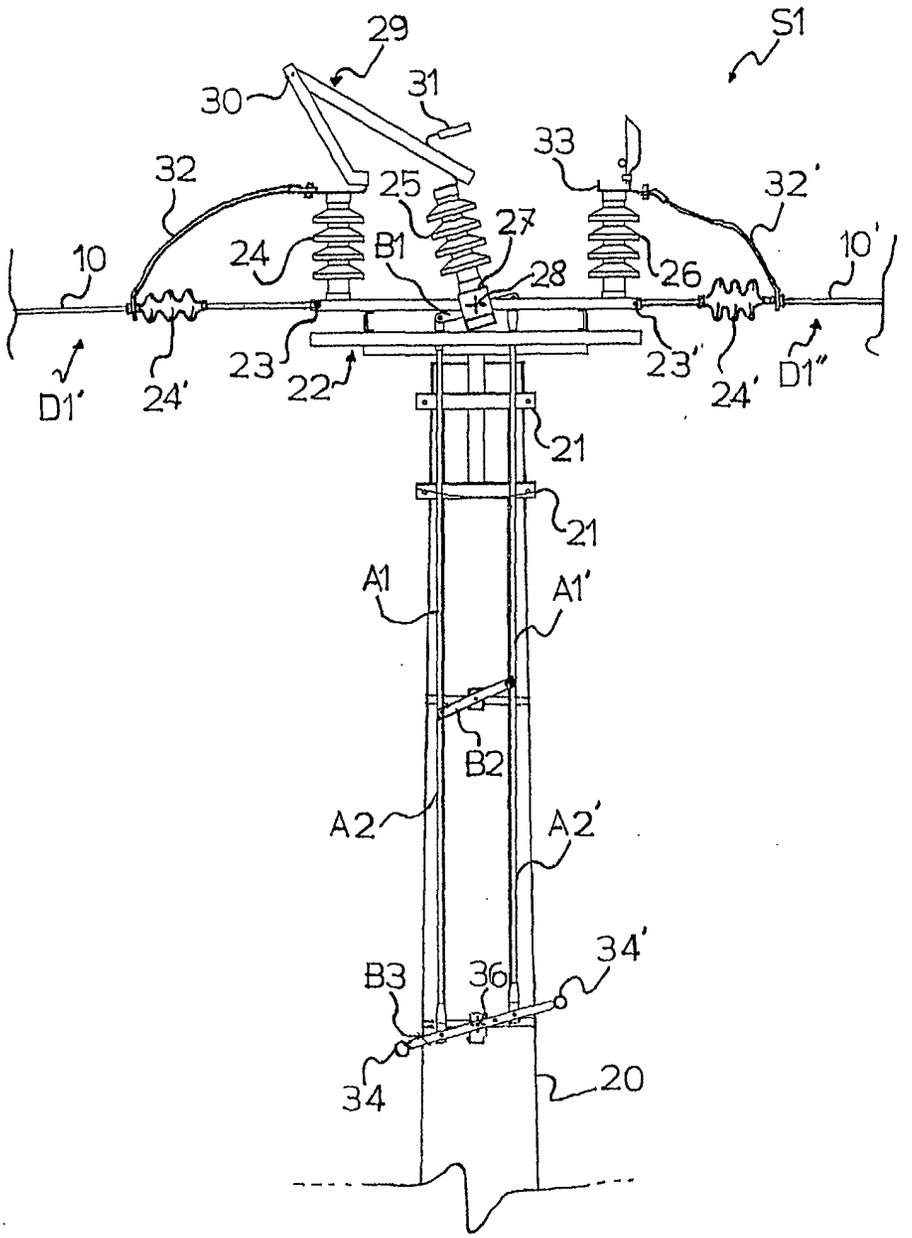
29
S1
30
31
33
32
25
32'
27
10
24
B1
26
10'
28
D1'
24'
23
22
23'
24'
D1"
21
21
A1
A1'
B2
A2
A2'
34'
B3
36
34
20

FIG. 2

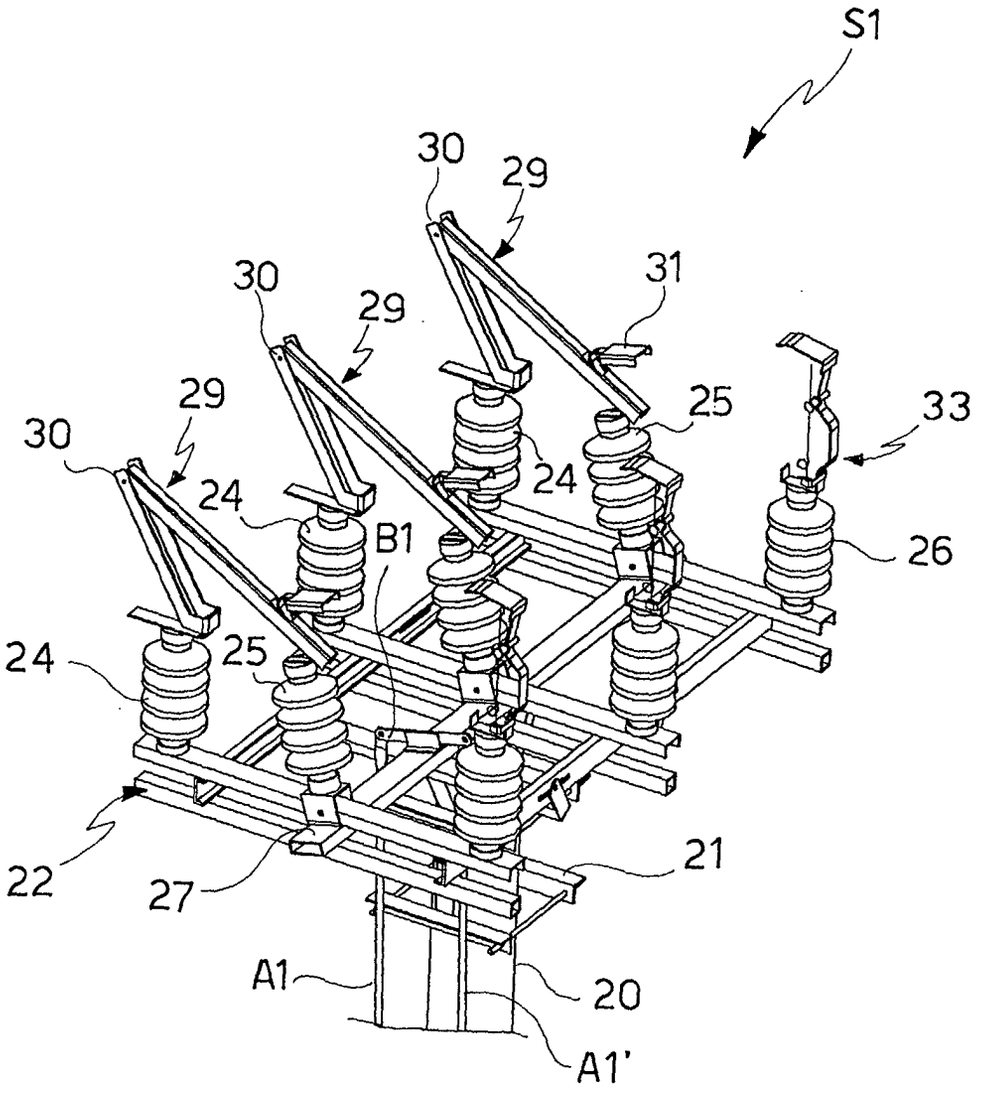

FIG. 3

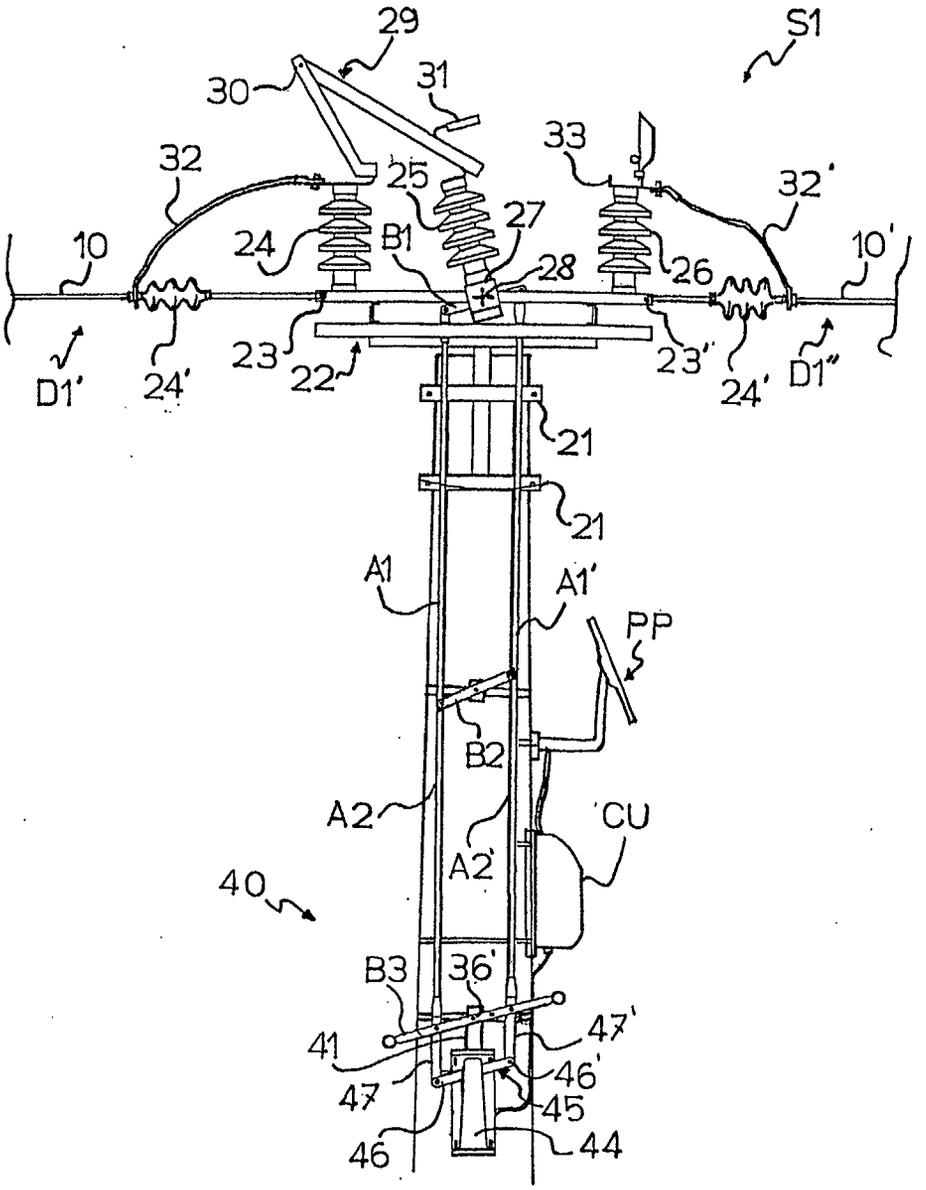
29
S1
30
31
33
32
25
32'
27
10
24
B1
28
26
10'
D1'
24'
23
22
23'
24'
D1"
21
21
A1
A1'
PP
B2
A2
CU
A2'
40
B3
36'
47'
41
46'
47
45
46
44

FIG. 4

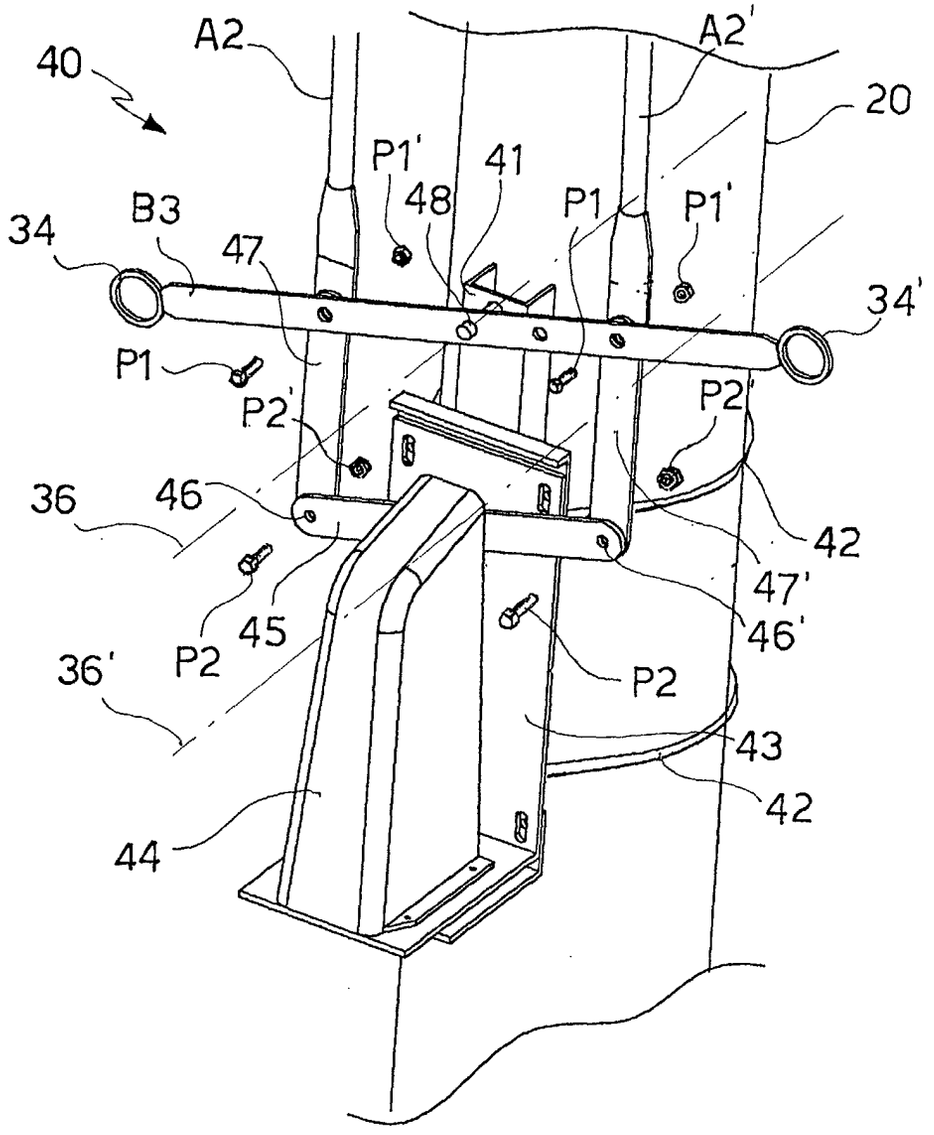
40
A2
A2'
20
P1'
41
48
P1
P1'
B3
34
47
34'
P1
P2'
P2'
36
46
42
47'
46'
45
P2
36'
P2
43
42
44

FIG. 5

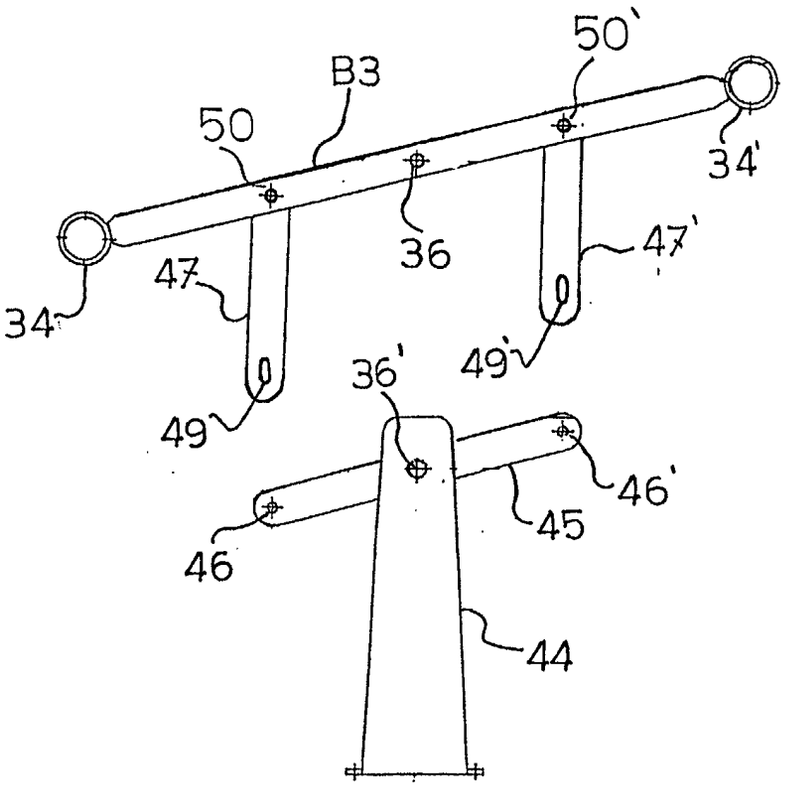

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5696

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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			H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 April 2003	Ruppert, H

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08-04-2003

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