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(71) Applicant (for all designated States except US): ABB AB [SE/SE]; S-721 83 Västerås (SE).					
(72) Inventors; and					
(75) Inventors/Applicants (for US only): LINNARUD, Krister [SE/SE]; Avd. AM, S-721 61 Västerås (SE). WAHRENBERG, Joakim [SE/SE]; Tunbyvägen 36B, S-722 23 Västerås (SE). AXELSSON, Arne [SE/SE]; Skjutbanegatan 13B, S-723 39 Västerås (SE). JOHANSSON, Mats [SE/SE]; Långmårtensgatan 5C, S-722 26 Västerås (SE). BALTZER, Tomas [SE/SE]; Björnbärsgatan 14, S-745 42 Enköping (SE).					
(74) Agent: DR LUDWIG BRANN PATENTBYRÅ AB; Box 17192, S-104 62 Stockholm (SE).					
(54) Title: CONTACTOR					
(57) Abstract					
<p>A contactor having electromagnetically operated contacts, wherein main contacts and connections for power supply are arranged in a bottom area of the contactor and contact control means such as electric magnet and coil are arranged above the main contacts, the contactor having a contactor enclosure (1) being sequentially detachable in two dependent, successive steps through a locking element (24) utilized by both steps, such that in a first step access is provided to the contactor main contacts (5, 6, 7), and in a second step access is provided to the electric magnet and coil (16, 18, 19), said locking element (24) being formed to engage a first (29) and second (31) arresting seat defined in the contactor enclosure (1), the arresting seats being arranged to urge the locking element (24) into engagement with the second arresting seat (31) as the locking element is released from engagement with the first arresting seat (29).</p>					
<p>The diagram illustrates the contactor assembly. It shows a vertical contactor enclosure (1) with a locking element (24) attached to its side. The locking element (24) has a stepped profile. The assembly is shown in two stages of disassembly. In the first stage, the locking element (24) is shown engaged with a first arresting seat (29). In the second stage, the locking element (24) has moved further, causing it to engage with a second arresting seat (31). The main contacts (5, 6, 7) are located at the bottom of the enclosure (1). The electric magnet and coil (16, 18, 19) are located above the main contacts (5, 6, 7). The locking element (24) is shown with a stepped profile, with the first step (29) and second step (31) clearly labeled. The main contacts (5, 6, 7) are shown at the bottom of the enclosure (1). The electric magnet and coil (16, 18, 19) are shown above the main contacts (5, 6, 7). The locking element (24) is shown with a stepped profile, with the first step (29) and second step (31) clearly labeled.</p>					

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Contactor

TECHNICAL FIELD

The present invention relates to a relay or contactor, wherein measures are taken to facilitate assembly and disassembly in installation and maintenance.

5 By way of construction, the inventive contactor also contributes to better security in operation and service. More specifically, the invention suggests a contactor that is structured to permit assembly and disassembly only in a specified sequential operation.

10 Typical contactors of this kind has an electric magnet for non-manual operation of contacts to close and break, respectively, an electric current circuit, e.g. a triple-pole alternating current. Control current is supplied to a coil of the electric magnet, and a magnet movement is employed for closing or breaking the electric circuit. In addition to main contacts, the contactor
15 also has secondary contacts and current connections for the control current, that may be controlled manually or electronically.

Contactors of the kind are employed in industrial applications as motor switches, e.g., and are commonly installed at supply central units to which
20 system current and control current is supplied to feed multiple current consumers. Thus, the central units may receive a large number of electric conductors, so that major caution is required in service operations for maintenance, repairs or for replacing worn out components. Such service may expose technicians and other personnel to a latent risk of injury. Usually,
25 switches for the control power are situated away from the central unit, so that service personnel may not at all times be in complete control of the status of the electric magnet. This situation involves the risk of the system power being unintentionally supplied during service, e.g. when replacing the main contacts of the contactor.

30

In service operations on such installations, it is therefore a desire and a problem to facilitate the work on the contactor, and concurrently to minimize the risk of engagement with electrified circuits.

It is further a desire to reduce the length of service interrupts for maintenance work, by facilitating access to worn out components in replacement works. It is also a desire to minimize the number of separate details needed 5 for assembly and disassembly of the equipment in connection with service operations.

OBJECT OF INVENTION

10 The object of this invention is to meet above said desires, and to solve the problems arising therefrom.

SUMMARY OF THE INVENTION

15 According to the invention, these objects are met in a contactor comprising a contactor enclosure that is sequentially detachable in two successive steps, each step depending from the other. In a first step, the components of the control power circuit as well as the contacts for the system power circuit are unitarily detached in order to permit access to the system power contacts. In 20 said first step, the contacts of the control power circuit are still enclosed by a detachable part of the contactor enclosure. Then, in a second step, access is made to the components of the control power circuit by opening the detachable part of the enclosure. A main feature of the invention is that the two steps for opening the enclosure are both controlled by a number of 25 common locking elements, formed to engage alternative arresting seats for a partial or a complete access to internal components and operative details of the contactor, thereby avoiding an unintentional supply of system power when the contactor enclosure is detached in said first step.

30 The characterizing features of the invention are defined by the independent claim 1, and preferred embodiments are defined in the sub-claims.

DRAWINGS

The inventive contactor is further disclosed below, reference being made to the accompanying drawings illustrating an embodiment of the invention. In

5 the drawings,

Fig. 1 is a sectional view through a contactor along a plane that is parallel to the system power path, the enclosure in fully attached position;

10 Fig. 2 is a sectional view along the plane II-II of fig. 1, and

Fig. 3 is a partial section, illustrating diagrammatically the locking pin in cooperative engagement with the contactor enclosure.

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DETAILED DESCRIPTION

Reference being made to the drawings, showing an example for a contactor 1 that is designed for implementation of the inventive teachings.

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The contactor 1 is an electromagnetic relay operative to control a triple-pole system power current. The operative elements of the contactor 1 are designed to provide better maintenance security and effectiveness, in accordance with this invention. Basically, said contactor 1 comprises connections for system power, contacts, electric magnet, coil and connections for the control power as known per se, and may further include elements for adapting the contactor to a specified application.

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According to the invention there is provided a contactor enclosure comprising three main components: a house 2 permanently incorporated in the system current path, a removable casing 3 accommodated by the house, and a cover 4 that seals the casing.

The contactor house 2 is permanently positioned in the current path through fastening means, not further shown, so that a bottom side of the house is seated on a support structure. Input and output connection means 5,6 are accommodated in the bottom area of the house 2, as best seen in fig.

5 1, for connecting the system power phase conductors to the conductor 1. In the shown embodiment, the connection means 5,6 are two-part elements that are fixedly mounted by screws in the house 2, and may preferably be located in disconnection cells formed in the house 2 and equipped with arc-shielding means.

10

Each pair of connection means 5,6 cooperates with a separate contact 7. The contact 7 is supported to be movable from a circuit breaking position shown in figs. 1 and 2, to a circuit closing position wherein the contact 7 is moved to engagement with the connection means 5,6. The contacts 7 are

15 supported in a circuit breaking bridge 8, that is movable in the house 2 against the force of springs 9. The springs 9 are seated in spring guides 10 extending out from the bottom of the house 2. The breaking bridge 8 is bridge-shaped to reach transversely over the contactor. Shoulders 11, acting as seats for the springs 9, are formed in the bottom surface of the breaking 20 bridge 8. Each contact 7 is supported in a socket 12, extending out from the bottom surface of the breaking bridge, and seated to be biased by a spring (not further shown). Preferably, the socket 12 is integrally formed in the house 2 to provide separate paths for the system power through the contactor 1.

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The breaking bridge 8 is formed with a pair of columns 13,14 extending out from the upper surface of the bridge and passing through slots 15, formed in opposite sides of the casing 3 which is removably attached to the house 2. Between upper ends of the columns 13,14 there is supported an electro-magnet armature 16, resting on seats 17 formed on the columns or in separate carriers, engaging the columns to transfer the armature movement to the breaking bridge and the contacts 7 in a circuit closing motion.

An electromagnet armature having a magnetized core 18 and a coil 19 is arranged in the bottom area of casing 3. Flexible or elastomer inserts 20 may be arranged between the core and the bottom of the casing in order to permit some relative motion there between. Moreover, and not further dis-
5 closed, the house 2, casing 3 and breaking bridge 8 are suitably formed to guide and facilitate the breaking bridge motion between the circuit closing and breaking positions.

10 The breaking bridge 8 with the contacts 7, and the casing 3 with the electromagnet armature, core and coil of the control power circuit, form together an assembly which as a whole is detachable from the contactor 1.

15 The casing 3 has a surrounding wall 21, wherein recesses 22 are formed in each corner of the casing (see fig. 3). Each said recess 22 receives a leg 23 depending from the corners of the cover 4. In attached position, wherein the cover 4 sealingly rests on the upper edge of the surrounding wall 21, the legs 23 bear against the bottom of the casing, in the bottom areas that reach into the recesses. The inventive teachings are not limited to a certain number of legs 23, preferably though, at least two such legs are provided.
20

25 The cover 4 and casing 3 has a common locking element or locking pin 24 that runs through the leg 23. The locking pin 24 comprises a shaft 25, formed in the lower end with a hook 26 that is angled to extend substantially perpendicular from the shaft. A helical spring 27 is supported on the shaft, between said hook 26 and a slotted head 28 formed in the opposite end of the shaft.

30 In the attached position of the contactor enclosure, the locking pin 24 reaches through the cover 4 to engage an arresting seat 29, formed in the housing 2 and cooperating with the hook 26 of the locking pin. The locking pin is spring biased in the arrested position as the helical spring is compressed between the head 28 and a bottom area 30, formed in the lower end of the leg 23. This way, the cover 4, the casing 3 and the house 2 are locked

together by the common locking pin to provide the sealed contactor enclosure 1.

When a twist is applied to the locking pin, the hook 29 is released from the 5 arresting seat 29 of the house 2. Upon this twist, the locking pin is brought to engage a second arresting seat 31, formed on the lower surface of the bottom of casing 3.

Now, the casing 3 and the cover 4 may be detached from the house 2 in order 10 to expose the connection means 5,6 that are accommodated in the bottom area of the house 2. By this first step of detachment, the breaking bridge 8 with contacts 7 as well as the control circuit elements such as electric magnet, coil and supply conductors for control power, will be detached as a unit. The control circuit elements are still enclosed by the walls 15 and bottom of the casing 3 and the cover 4, as the locking pin is in engagement with the second arresting seat formed in the bottom of the casing.

By further twisting the locking pin 24, the hook 26 is released from the arresting seat 31 of the casing 3, and the cover 4 is detachable to permit access 20 to the operative elements of the control circuit in a second step of detachment.

The arresting seats 29 and 31 are formed with elongate apertures 29' and 31', respectively, extending angularly separated in radial directions from the 25 turning center of the locking pin so as to provide a passage for the locking pin through either aperture when rotated to the appropriate position, and when further rotated, to permit passage through the other aperture. In all other turning positions, the locking pin is spring biased to engage the material of the house and casing, respectively. Preferably, the arresting seats will 30 be defined in the material, e.g. through recesses, such that a definite indication of the locking pin's arrested position is provided, and thus an unintentional twisting of the locking pin 24 is prevented. As will be seen from fig. 3 of the drawings, the locking pin is automatically positioned for engage-

ment with the arresting seat 31, when being rotated out of engagement with the arresting seat 29. Preferably, the apertures are oriented in opposite radial directions from the locking pin turning center, even though alternative angular displacement lies within the teachings of the invention.

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Attachment or assembly of the contactor enclosure is achieved by performing the two steps in reversed order. Accordingly, in a first step the cover 4 is attached to the casing 3 by turning the locking pin to engage the second arresting seat 31 of the cover, and successively in a second step the casing, 10 carrying the breaking bridge 8, is attached to the house 2 by turning the locking pin to engage the first arresting seat 29 of the house 2.

Thus, in two sequential and dependant steps, service personnel is alternatively provided access for maintenance of one or both power circuits of the 15 contactor by using a minimum number of locking elements. This is made possible by integrally forming the contactor enclosure with two mutually dependant locking actions. The possibility of unintentionally closing the power circuit when the contactor enclosure is removed for maintenance is thereby eliminated through the specific structure and sequential disassembly of the 20 contactor enclosure. Therefore, the object of invention is met in a contactor that is formed in accordance with the disclosed example of an embodiment, and the attached claims are drafted to include also such modification, that would be perceivable to the man skilled in this technical field when being presented the teachings of the above disclosure.

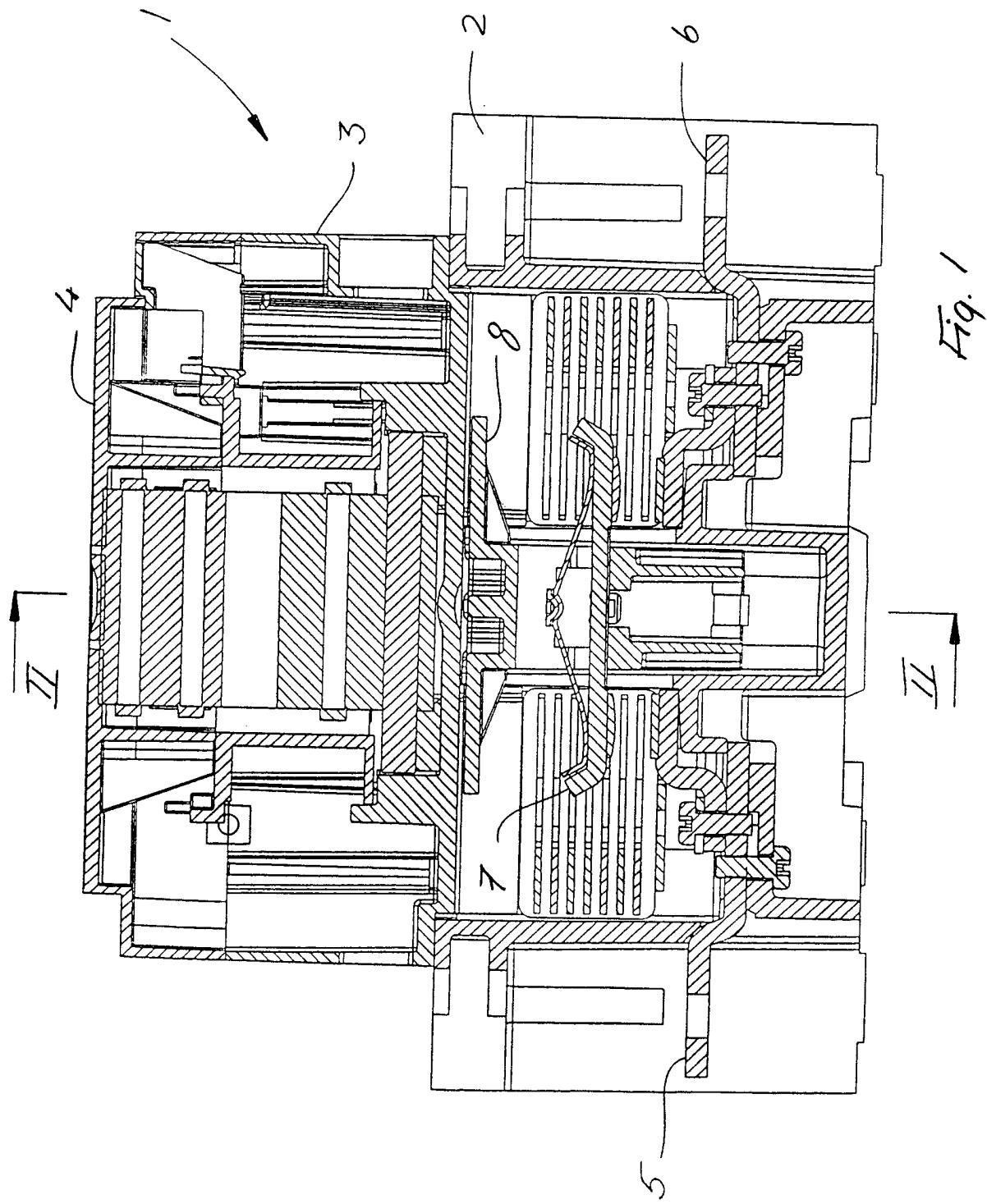
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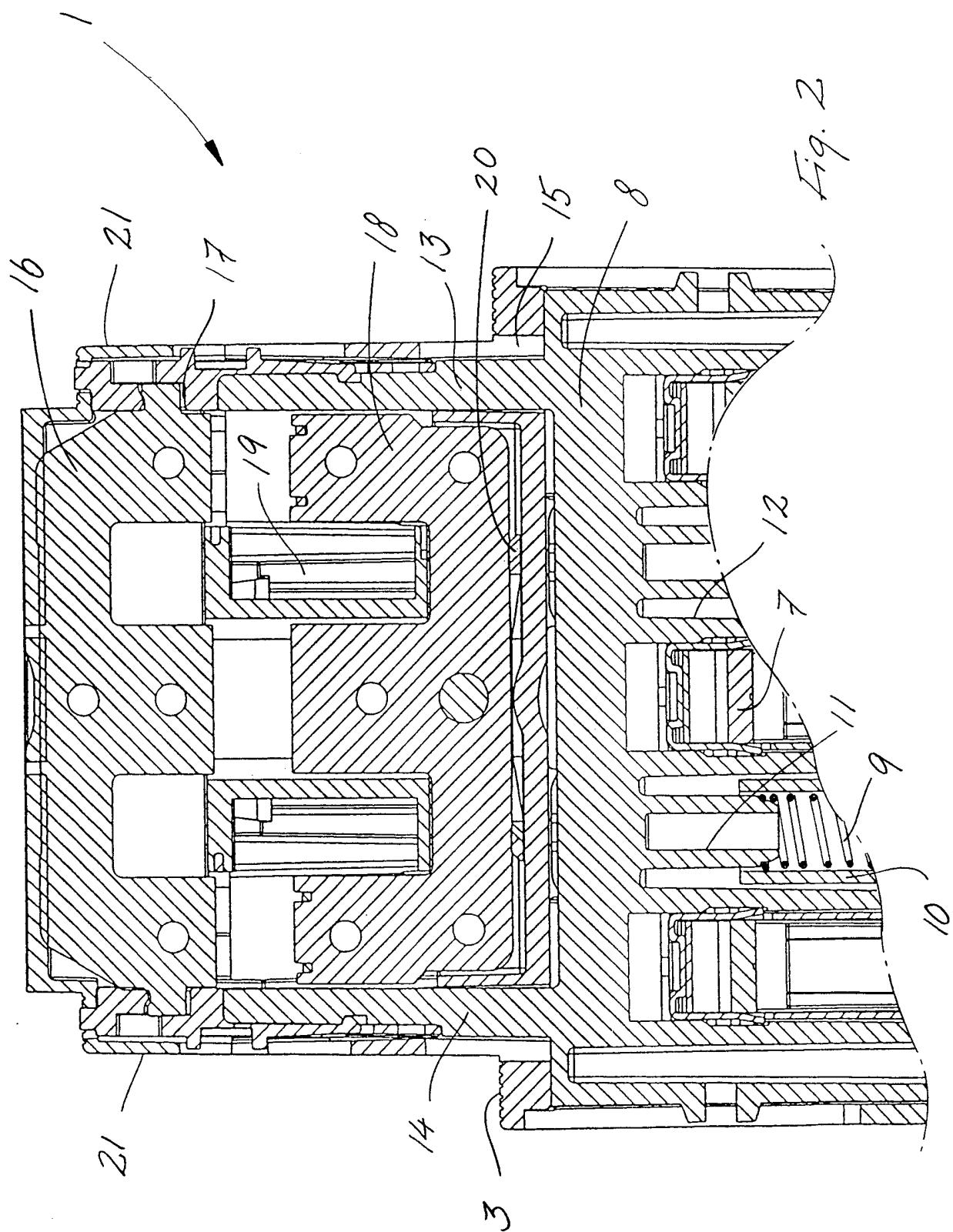
CLAIMS

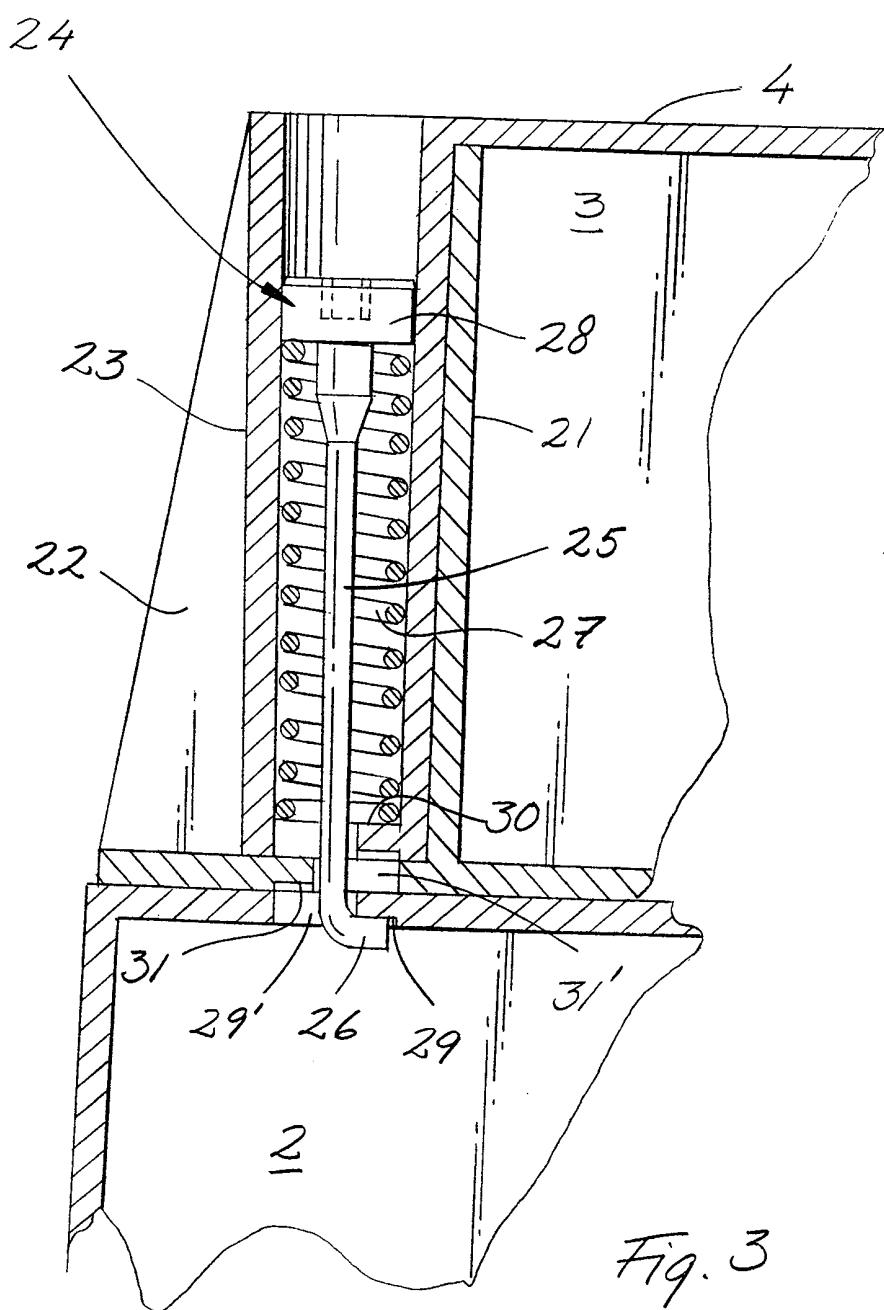
1. A contactor having electromagnetically operated contacts, wherein main contacts and connections for power supply are arranged in a bottom area of the contactor and contact control means such as electric magnet and coil are arranged above the main contacts, characterized by a contactor enclosure (1) being sequentially detachable in two dependent, successive steps through a locking element (24) utilized by both steps, such that in a first step access is provided to the contactor main contacts (5,6,7), and in a second step access is provided to the electric magnet and coil (16,18,19), said locking element (24) being formed to engage a first (29) and second (31) arresting seat defined in the contactor enclosure (1), the arresting seats being arranged to urge the locking element (24) into engagement with the second arresting seat (31) as the locking element is released from engagement with the first arresting seat (29).
2. The contactor of claim 1, comprising a contactor house (2) accommodating connection elements for system power, characterized in that main contacts (7) are joined with the electric magnet and coil (16,18,19) to form a unit that is supported on the house (2) and detachable therefrom, wherein the locking element (24) engages the house (2) in the first arresting seat (29), and engages the detachable unit in the second arresting seat (31).
3. The contactor of any preceding claim, characterized by a locking pin (24) that is biased by a spring (27) load to be urged into engagement with the second arresting seat (31) when released from engagement with the first arresting seat (31).
4. The contactor of claim 3, characterized by a cover (4), sealing the contactor enclosure (1), the locking pin (24) being received in said cover (4) and rotatable in said first step to be released from engagement with the first arresting seat (29) against the action of said spring (27), and ro-

tatable in said second step to be released from engagement with the second arresting seat (31) to where the locking pin is urged through rotation in the first step.

- 5 5. The contactor of claim 3, characterized in that the locking pin (24) comprises a shaft (25), one end of which is formed with an angular hook (26) which is turned to pass an aperture (29') formed in the house (2) when the locking pin is released from engagement with the first arresting seat (29), and turned to pass an aperture (31') formed in the detachable unit 10 (3) when the locking pin is released from engagement with the second arresting seat (31), said apertures (29';31') being extended in angular displacement in separate radial directions from the turning center of the locking pin.
- 15 6. The contactor of claim 5, characterized by the apertures (29';31') being extended in opposite radial directions from the locking pin turning center.
- 20 7. The contactor of claim 2, characterized in that the contacts (7) being supported in a breaking bridge (8), movable relative to the contactor house (2), the breaking bridge (8) being movably received in a casing (3) also accommodating the electric magnet and coil, such that the contacts (7) and the electromagnet form a unit which as a whole is detachable from the contactor house (2).







INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/00054

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H01H 50/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H01F, H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3651437 A (Y. KIYOSHI), 21 March 1972 (21.03.72), figure 2, abstract --	1-7
A	EP 0046921 A2 (BROWN, BOVERI & CIE AKTIENGESELLSCHAFT), 10 March 1982 (10.03.82), figure 1, abstract --	1-7
A	DE 1625369 A (HONEYWELL GMBH), 16 July 1970 (16.07.70), page 3, line 22 - page 9, line 25, figures 1-10 -- -----	1-7

Further documents are listed in the continuation of Box C. See patent family annex.

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 3651437 A	21/03/72	NONE		
EP 0046921 A2	10/03/82	SE 0046921 T3		
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