



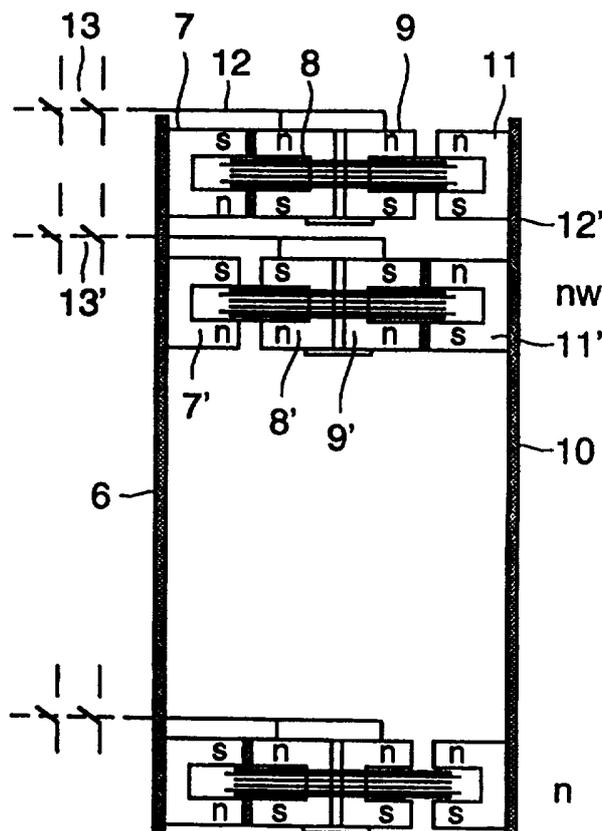
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/SE96/01272 (22) International Filing Date: 8 October 1996 (08.10.96) (30) Priority Data: 9503500-2 9 October 1995 (09.10.95) SE (71) Applicant (for all designated States except US): TELEFON-AKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): ROOS, Sture [SE/SE]; PL 2107, S-760 10 Bergshamra (SE). (74) Agents: BOHLIN, Björn et al.; Telefonaktiebolaget LM Ericsson (publ), Patent and Trademark Dept., S-126 25 Stockholm (SE).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>

(54) Title: A METHOD OF ARRANGING SEVERAL RELAY FUNCTIONS AND A MULTIPLE RELAY ARRANGEMENT CONFIGURED IN ACCORDANCE WITH THE METHOD

(57) Abstract

To reduce the cost of providing a multiple relay arrangement, the arrangement has been constructed with a common fixed part (6) having permanent magnets (7), a common movable part (10) having permanent magnets (11), and fixed coils (9) having magnetically actuatable movable cores (8) connected to a respective contact means (12). By connecting the coils to a source of electric current, the magnetically actuatable cores can be caused to move in one or the other direction, depending on the direction of the current. When wishing to establish an electrical contact through the coupling means (12) of the multiple relay arrangement, current is passed through the coil (9') in one direction and through the remaining coils (9) in the opposite direction. In the contact making state of the arrangement, the core (8') will be repelled by the permanent magnet (7') on the fixed part (6) and attracted by the permanent magnet (11') on the movable part (10) during its movement. The coupling means (12') connected to the core (8') can then be used to connect together telecommunications conductors for instance. Remaining cores (8) are attracted by the fixed permanent magnets (7) and not moved, although the part (10) will be moved away from the fixed part (6) by virtue of the repulsion force acting between the cores (8) and the magnets (11).



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A METHOD OF ARRANGING SEVERAL RELAY FUNCTIONS AND A MULTIPLE
RELAY ARRANGEMENT CONFIGURED IN ACCORDANCE WITH THE METHOD

5 FIELD OF THE INVENTION

The present invention relates to a method of arranging
several relay functions and also to a multiple relay arrange-
ment configured in accordance with the method. So-called
10 multiple relays are used in many fields. One common field of
use is related to telecommunications equipment, in which such
relays are used in large numbers for connecting and discon-
necting pairs of telephone lines, for instance.

15 DESCRIPTION OF THE BACKGROUND ART

Electromechanical components are still used in the field of
telecommunications, and also in other fields, often in the
form of relays, selector switches and like components. Relays
20 can often have multiple functions, for instance test access
functions for line interfaces in a digital telephone station.
These access functions may be of a multiple type where a
plurality of relays having mutually the same function are
mounted on a circuit board. A large number of electromagnets
25 are often used in the provision of these multiple functions,
each of the electromagnets acting on a spring unit or the
like. In constructions in which several relays are collected
on a unit, only the force from the electromagnet or the
electromagnets where an effect is desired is used, said
30 magnets often being only used one at a time. The functions
often involve driving only a few function initiating devices
from many such devices and the large number of electromagnets
included is unnecessarily large, since each electromagnet is
sufficiently strong in itself to carry out a function. Since
35 electromagnets with magnets and coils require space and each
incurs an individual cost, it is important that the electro-
magnets have the smallest possible size and are inexpensive.

Patent Publications SE 129 171, 343 718, 359 194 and CH 46807 disclose multiple relays for telecommunications applications that include permanent magnets which are each solely effective in making or breaking an electric contact.

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DISCLOSURE OF THE INVENTION

With the intention of lowering the cost of providing a so-called multiple relay, there is provided in accordance with the invention a multiple relay arrangement that includes a common fixed part that carries several permanent magnets, a common movable part that carries several permanent magnets, and several fixed coils which are disposed between the common fixed part and the common movable part and which have magnetic-force actuatable and displaceable cores connected with electrical connection elements. When each of the coils carries current, the cores that are actuatable by magnetic forces will either move to a new position or be held in their present position at that point in time, depending on the direction in which current flows through the coil and the polarity of the permanent magnets. When wishing to make electrical contact through an electric contact means on the multiple relay arrangement, the coil is connected so that current will flow therethrough in one direction appropriate thereto and remaining coils are connected so that current will flow in another direction, wherewith all cores will be magnetized. In the contact making position, the core will be repelled by the permanent magnet on the fixed part and attracted by the permanent magnet on the movable part during its movement. Telecommunications conductors, for instance, can then be mutually connected together to the contact means connected to the movable cores. Remaining cores are attracted and held by the fixed permanent magnets, i.e. do not move, whereas the movable part connected to permanent magnets will be actuated and moved away from the fixed part by the repulsion forces acting between the now fixed cores and the permanent magnets of the movable part. All magnetic forces

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coact to move the core which is movable in this case with the repelling force and attraction force for the electric contact making function and displacement of the movable part with permanent magnets and with attraction forces for the excluded switching functions but with repelling forces for displacing the movable part with the permanent magnets and the core connected to this part.

BRIEF DESCRIPTION OF THE DRAWINGS

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Figure 1 shows relays arranged in a row in accordance with a known technique.

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Figure 2 illustrates a multiple relay arrangement according to the invention, without contact means.

Figure 3 illustrates an actuated multiple relay arrangement according to the invention without contact means.

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Figure 4 illustrates an inventive multiple relay arrangement with contact means.

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Figure 5 illustrates an actuated inventive multiple relay arrangement with an activated contact means.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

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Figure 1 illustrates a known technique in which a plurality of relays 1,2...n are arranged in a row in a multiple relay. Each coil 3 is intended to drive a coupling means 4 having its own spring group, the force required in this regard being represented by the force F . Each coil is capable of generating this force, and the force actually available is nxF , where n is the number of coils present, although only the force F is actually required to open or close the switch.

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According to the present invention, several functions have

5 been incorporated in a single unit. In this regard, a multiple relay device 5 includes a common fixed part 6 which can be provided with n number of permanent magnets 7, n numbers of movable cores 8, each of which is able to move in relation to a fixed coil 9 connected, e.g., to the fixed part 6, and a common movable part 10 which is provided with n number of permanent magnets 11; see Figure 2 in this regard (n=...5,6,7..10-40...). The permanent magnets provide a definable so-called home position in which no current is supplied to the circuit. This can be achieved without requiring the use of counter-springs. In certain applications, the permanent magnets can be replaced with electromagnets. The fixed side 6 (M1) having n number of permanent magnets 7 and the movable side 10 (M2) having n number of permanent magnets 11 may be polarized in accordance with Figure 2, wherein all air gaps between cores and magnets will be closed when no current is supplied to the coils.

20 When current is supplied to the circuit containing the coils such as to polarize the cores in accordance with Figure 3, all cores will be attracted by M1 with the exception of the core nw, which is now attracted by M2. The core nw will repel M1 and all other cores will repel M2, therewith using force from all cores. The attraction force between the core nw and M2 is very strong by virtue of the fact that in principle the air gap may be zero. Thus, one or more cores can be caused to coact with respective contact elements with the aid of all other cores, by reversing the polarity of one or more coils.

30 When the current supply is broken, all circuits are assisted in returning the core/cores to its/their home positions. Because the cores in the non-activated circuits do not move, no friction losses are experienced there.

35 Figure 4 illustrates an inventive multiple relay at rest and connected to contact means 12 with open contacts 13 for the connection or disconnection of conductors. Figure 5 shows the

5 nw coil 9' connected to an electric circuit and remaining
coils to another circuit that is oppositely directed to the
former circuit, the core 9' having therewith been moved to
the right in the Figure and having broken the supply of
10 current 13' through its coaction with the contact means 12'.
The core 8' has been moved by the repulsion force of the
fixed permanent magnet 7' and the attraction force of the
movable permanent magnet 11'. Remaining cores 8 have not been
15 moved, since they are attracted by the fixed magnets and
repelled by the movable permanent magnets 11. The combined
magnetic forces have moved the movable part 10 and the core
8' and the contact device 12' connected thereto. The fixed
magnets 7 may be mounted in a row on a fixed frame 6, to
20 which the coils 9 may also be connected. The movable magnets
11 may be arranged in a row on a frame 10 which is movable
in relation to the fixed frame.

The cores 8 and the movable part 10 can be caused to move by
directing current to the fixed coils 9. The core or cores
25 that moves/move will initiate the circuit closing function,
whereas the cores that do not move will not effect a switch-
ing function, i.e. the circuits will remain open but the
repulsion force acting between these cores and the movable
magnets will contribute in moving the contacts in the contact
30 means. A magnetic force $nx f$ from all electromagnets with a
magnetic force f is required to close the current in a
switch, where f can be elected to be much lower than a
corresponding force F for individual electromagnetically
controlled contact devices.

CLAIMS

1. A method of arranging several relay functions for use in telecommunications equipment, for instance, for connecting or disconnecting pairs of telephone lines, **characterized** by arranging a plurality of movable cores between a plurality of fixed magnets and a plurality of commonly disposed movable magnets; supplying electric current to the fixed coils such as to cause each core either to move away from a fixed magnet to a displaced position in relation thereto, so as to remain in its initial position, wherein each core is connected to contact means for connecting or disconnecting conductors.

2. A multiple relay arrangement having a plurality of relay functions for use, e.g., in telecommunications equipment for connecting or disconnecting pairs of telephone lines, **characterized** in that a plurality of movable cores (8) are arranged to act between a plurality of commonly arranged fixed magnets (7) and a plurality of commonly arranged movable magnets (11); in that each core (8) has a fixed coil (9) which when current passes therethrough functions to move said core (8) together with the movable magnet (11) away from a corresponding fixed magnet (7), or causes the core (8) to remain at said corresponding fixed magnet (7) and move a corresponding movable magnet (11), wherein a contact means (12) is connected to the core for the connection or disconnection of a conductor.

3. A multiple relay arrangement according to Claim 2, **characterized** in that the fixed magnets (7) are disposed in a row on a fixed frame (6) to which the coils (9) are also connected; in that the movable magnets (11) are disposed in a row on a frame (10) which is movable in relation to the fixed frame (6); and in that each core is intended to act between a magnet (7) on the fixed frame (6) and a magnet (11) on the movable frame (10).

4. A multiple relay arrangement according to Claim 2, characterized in that the magnets (7, 11) are permanent magnets.

5 5. A multiple relay arrangement according to Claim 2, characterized in that the magnets (7, 11) are electromagnets.

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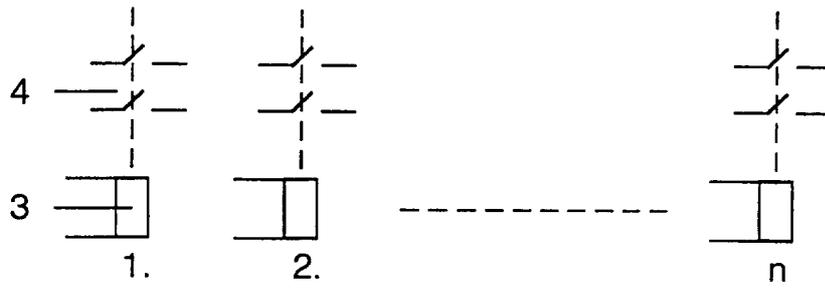


Fig. 1

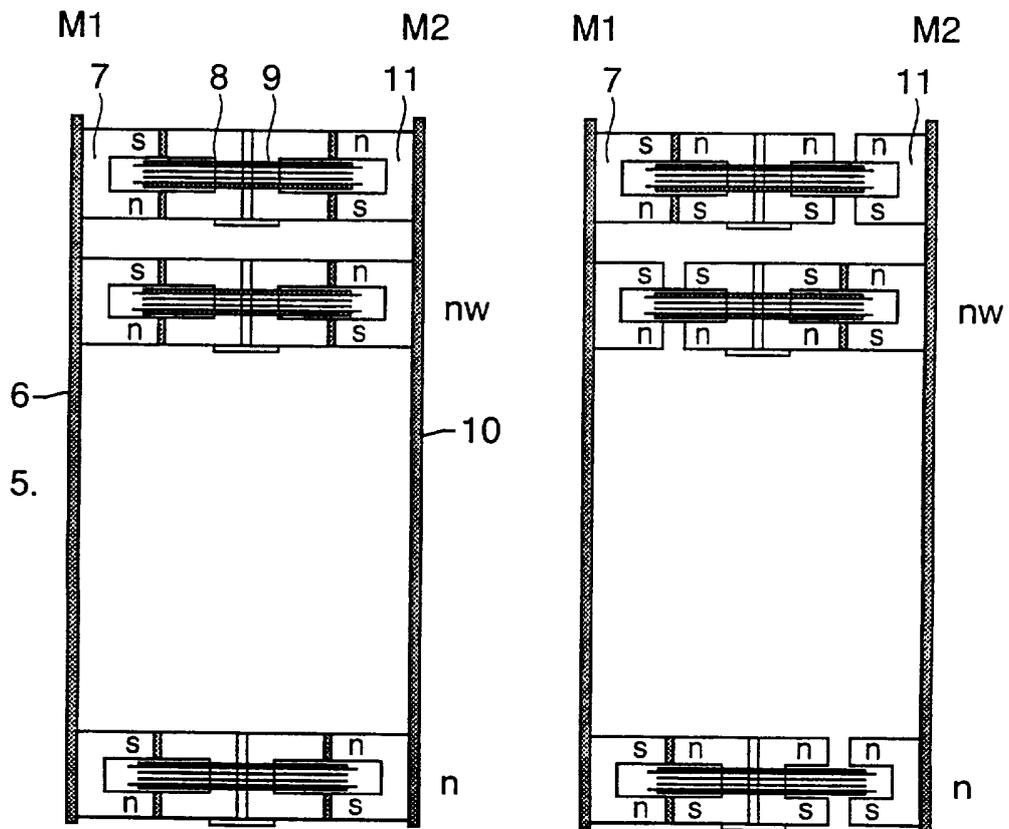


Fig. 2

Fig. 3

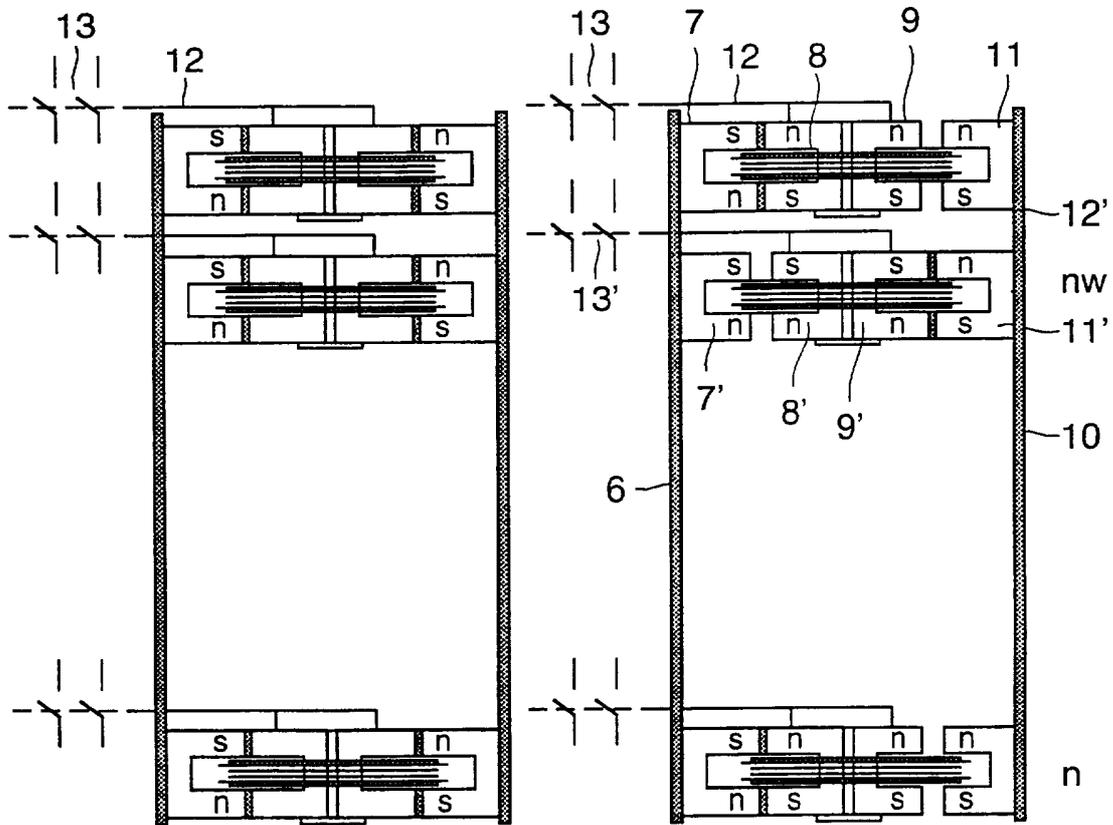


Fig. 4

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 96/01272

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H01H 67/22

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)

IPC6: 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	WO 9403914 A1 (SIVERS IMA AB), 17 February 1994 (17.02.94) -- -----	1-5

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

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
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WO-A1- 9403914	17/02/94	SE-A- 9202320	11/02/94
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