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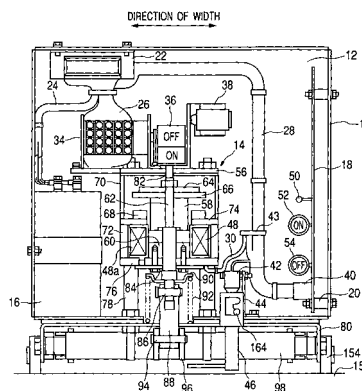
- Fujita, Yasunobu, Hitachi, Ltd., Int. Prop. Gp  
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(54) Solenoid-operated switching device and control device for electromagnet

(57) The present invention permits a configuration for workability enhancement by mounting an electromagnet 14 under the center of a casing 10, mounting a capacitor 16 and a control circuit board 18 on either side of the electromagnet 14, mounting an auxiliary contact 34, an indicator plate 36, and a counter 38 over the electromagnet 14, attaching the auxiliary contact 34, indicator plate 36, and counter 38 to a plate 56 to make them integral with the electromagnet 14, and rendering the capacitor 16 and control circuit board 18 removable from the front.

FIG. 1





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# EUROPEAN SEARCH REPORT

Application Number  
EP 03 02 4535

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 4 533 972 A (OHASHI TAKEO) 6 August 1985 (1985-08-06) * column 4, line 59 - column 5, line 8; figure 5 * * column 2, lines 53-58 * -----	1,2,6	H01F7/18 H01H47/00 H01H51/22 H01H51/27 H01H50/16 H01F7/08
Y	EP 1 225 609 A (HITACHI ENG SERVICE ; HITACHI LTD (JP)) 24 July 2002 (2002-07-24) * paragraph [0071]; figure 13 * * paragraphs [0025], [0069] - [0071], [0073]; figures 1-12 * -----	1,2,6	
Y	EP 1 128 409 A (HITACHI LTD) 29 August 2001 (2001-08-29) * paragraphs [0031], [0033], [0035]; figures 5,6 * * paragraphs [0042] - [0046]; figures 10,11 * -----	1,2,6	
A	DE 26 25 400 A (DANFOSS AS) 8 December 1977 (1977-12-08) * page 9, lines 11-17; figure 1 * * page 11, line 29 - page 12, line 7; figure 2 * -----	1,2	TECHNICAL FIELDS SEARCHED (Int.Cl.7)  H01F H01H
A	US 6 233 129 B1 (BAUMG AUML RTL ULRICH ET AL) 15 May 2001 (2001-05-15) * column 2, lines 31-42; figure 1 * * column 3, line 57 - column 4, line 3; figure 2 * -----	1,2	
A	EP 0 376 715 A (ISUZU MOTORS LTD) 4 July 1990 (1990-07-04) * abstract; figure 1 * * column 3, lines 7-20 * -----	1,2	
<del>The present search report has been drawn up for all claims</del>			
Place of search <b>Munich</b>		Date of completion of the search <b>6 February 2004</b>	Examiner <b>Reder, M</b>
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... &amp; : member of the same patent family, corresponding document</p>			

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#### CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

#### LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-10



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LACK OF UNITY OF INVENTION  
SHEET B

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-10

Switching device in which an electromagnetic relay is powered by a capacitor and in which the direction of the current from the capacitor through the coil of the relay coil is controlled by a control circuit, the driving force of the relay armature is transmitted to the switch via a shaft and a link mechanism, capacitor and control circuit board are mounted separately from the electromagnet of the relay.

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2. claims: 11-22

Control device for an electromagnet, upon "open" and "close" commands currents with opposite directions through coil of electromagnet are established, current upon "open" command from capacitor, control device comprises selector relays.

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3. claims: 23-29

Switching device in which an electromagnetic relay is powered by a capacitor and in which the direction of the current through the coil of the relay coil is controlled by a control circuit, the driving force of the relay armature is transmitted to the switch via a shaft and a link mechanism, a bypass is formed between part of the "open" command and a power supply for the control circuit via a resistor.

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4. claims: 30-33

Switching device with an electromagnetic relay, the driving force of the relay armature is transmitted to the switch via a shaft and a link mechanism, an iron cover encloses the relay coil and is part of the magnetic circuit, the iron cover has the shape of an oval cylinder.

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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06-02-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4533972 A	06-08-1985	JP 1674792 C	26-06-1992
		JP 3038689 B	11-06-1991
		JP 58121521 A	19-07-1983
		DE 3378176 D1	10-11-1988
		DE 3382454 D1	12-12-1991
		EP 0083996 A2	20-07-1983
		EP 0212677 A2	04-03-1987
EP 1225609 A	24-07-2002	CN 1366312 A	28-08-2002
		EP 1225609 A2	24-07-2002
		JP 2002289430 A	04-10-2002
		US 2002093408 A1	18-07-2002
EP 1128409 A	29-08-2001	JP 2001237118 A	31-08-2001
		CN 1310459 A	29-08-2001
		EP 1128409 A2	29-08-2001
		US 2001017288 A1	30-08-2001
DE 2625400 A	08-12-1977	DE 2625400 A1	08-12-1977
		DK 245277 A	06-12-1977
		FR 2353944 A1	30-12-1977
		SE 7706460 A	06-12-1977
US 6233129 B1	15-05-2001	DE 19507936 A1	05-09-1996
		WO 9626569 A1	29-08-1996
		DE 59600436 D1	17-09-1998
		EP 0811266 A1	10-12-1997
		IN 186608 A1	13-10-2001
EP 0376715 A	04-07-1990	JP 1893944 C	26-12-1994
		JP 2181006 A	13-07-1990
		JP 6021530 B	23-03-1994
		DE 68913703 D1	14-04-1994
		DE 68913703 T2	16-06-1994
		EP 0376715 A2	04-07-1990
		US 4972810 A	27-11-1990