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(54) **Electromagnetic actuator parallel actuation serial sustaining driving circuit**

(57) The present invention is a kind of switch device for the control of two or above two electromagnetic actuator, for driving coil such as electromagnetic brake, electromagnetic clutch, electromagnetic switch, electromagnetic relay, and electromagnetic valve, etc. to perform parallel actuation, so as to generate better electro-

magnetic actuation power, and through the control of switch device, take driving coil switch into serial connection state to reduce the electrical current of driving coil, but still maintain the operation of electrical actuation in order to save electricity and reduce the heat generated by electromagnetic actuator.

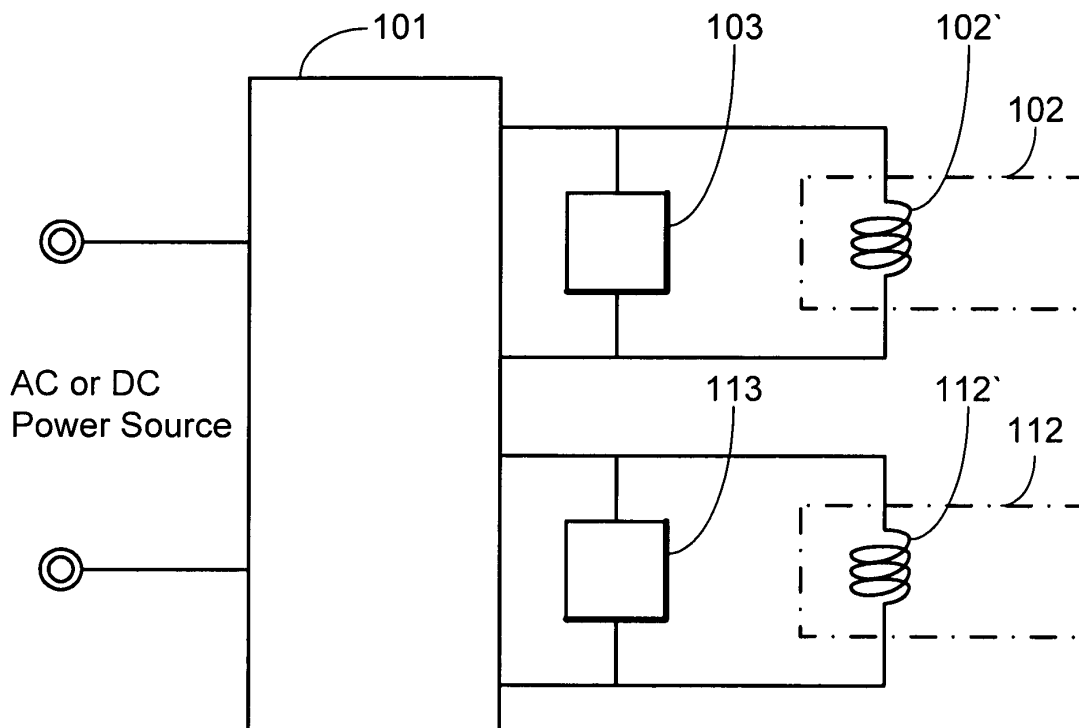


Fig 1

Description

BACKGROUND OF THE INVENTION

(a) Field of the Invention

[0001] The present invention is to use two or above two electromagnetic actuators generating electromagnetic effect through electrical current excited coil, through the control of switch device, for the control of two or above two excitation coils for parallel actuation and then switch to series connection to maintain electrically actuated operation.

(b) Description of the Prior Art:

[0002] Conventionally using two or above two electromagnetic actuators generating electromagnetic effect through electrical current excited coil, where each set of excitation coil usually actuates and sustains electrically actuated operation is presenting parallel state, where the excitation current required is larger is its drawback.

SUMMARY OF THE INVENTION

[0003] The present invention is a kind of switch device for the control of two or above two electromagnetic actuators, for driving coil such as electromagnetic brake, electromagnetic clutch, electromagnetic switch, electromagnetic relay, and electromagnetic valve, etc. to perform parallel actuation, so as to generate better electromagnetic actuation power, and through the control of switch device, take driving coil switch into serial connection to reduce the electrical current of driving coil, but still maintain the operation of electrical actuation in order to save electricity and reduce the heat generated by the electromagnetic actuator.

[0004] As after serial connection of excitation coil it is still required to maintain the electromagnetic actuator device presenting under the operation of electrical actuator, therefore the electromagnetic actuation device applicable to the present invention must have the characteristic of maintaining electrically actuating operation after the excitation coil switched to serial connection state.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]

Fig. 1 is a circuit block chart of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0006] The present excitation actuator parallel actuation serial sustaining driving circuit is focusing at two or above two electromagnetic actuators with excitation coil, such as electromagnetic brake, electromagnetic clutch,

electromagnetic switch, electromagnetic relay, or electromagnetic valve, etc., through the control of switch device, using the excitation coil for parallel actuation and serial sustaining operation in order to save electrical energy.

[0007] Two of the above electromagnetic actuator devices are used as preferred embodiment and described below:

[0008] Fig. 1 illustrates the circuit block chart of the present invention, essentially comprised of:

-- Switch device 101: mechanical or electrical switches, relay, electromagnetic switch or solid state switch component, operated by human power, or mechanical power, or fluid power, or electrical energy; using alternating or direct electrical current energy to deliver to excitation coils 102' and 112' of at least two electromagnetic actuators 102 and 112, or for cutting off electricity operation;

Said switch device can be used for the operation of switching, so that the excitation coils of at least two electromagnetic actuators can be first to perform parallel actuation and then switched to serial connection state, and during serial connection the electromagnetic actuator still could maintain the operation of electrical actuation;

-- Electromagnetic actuators 102 and 112: consist of at least two electromagnetic brakes, electromagnetic clutches, electromagnetic switches, electromagnetic relays, and electromagnetic valves with AC or DC electrical power excitation coil, the electromagnetic actuators has the basic characteristic of sustaining of electrical actuating operation while the excitation coils 102' and 112' are in serial connection;

-- Capacitors 103 and 113: matched AC or DC capacitor or other storage and discharging component based on the specification of electromagnetic actuator, for assistance of excitation coils 102' and 112' of electromagnetic actuator in sustaining the stable operation when switch device 101 is switching between series or parallel connection to excitation coils 102' and 112'. Such capacitor can either be installed or not installed based on the need.

[0009] The operation of the embodiment of Fig. 1 is described as below:

If VA is the normal minimum actuation voltage of the excitation coil of electromagnetic actuators 102 and 112, VH is the holding voltage of normal minimum sustaining electrical actuating characteristics for electromagnetic actuators 102 and 112. If taking the two electromagnetic actuators 102 and 112 of the preferred embodiment in Fig. 1 installed with the excitation coil of the same excitation actuator as example, the suitable working conditions of the excitation coil of the electromagnetic actuator are: Minimum actuation voltage VA of the excitation coil $< 2 \times \text{min-}$

imum electromagnetic actuation state holding voltage VH.

[0010] In the practical application, this electromagnetic actuator parallel actuation serial sustaining driving circuit, the two or above two electromagnetic actuators installed can be formed by the same or different electromagnetic actuators.

[0011] The previously stated capacitor connected to excitation coils 102' and 112' in parallel when in use of DC electrical energy for driving excitation coils also can use flying wheel diode for replacement of capacitors or mixed in use; when in use of AC electrical energy for driving excitation coils, it is also possible to be replaced by the short circuit conducting ring or short circuit shielded windings.

[0012] In summary, this electromagnetic actuator parallel actuation serial sustaining driving circuit can use the excitation coil of the electromagnetic actuator for parallel state actuation in order to obtain better actuation response characters and control to switch excitation coil as serial connection so as to sustain electromagnetic actuation as the operation of electrical actuation with energy savings as characteristics.

Claims

1. A kind of electromagnetic actuator parallel actuation serial sustaining driving circuit, for the switch device controlling two or above two electromagnetic actuators, for driving coils such as electromagnetic brake, electromagnetic clutch, electromagnetic switch, electromagnetic relay, and electromagnetic valve, etc. to perform parallel actuation in order to generate better electromagnetic actuation power, then through the control of switch device the driving coil is switched into serial connection for the reduction of electrical current in the driving coil but still maintain the operation of electrical actuation in order to save electrical energy and reduce the heat generated by the electromagnetic actuator; the major components include:

-- switch device (101): mechanical or electrical switches, relay, electromagnetic switch or solid state switch component, operated by human power, or mechanical power, or fluid power, or electrical energy; using alternating or direct electrical current energy to deliver to excitation coils (102', 112') of at least two electromagnetic actuators (102, 112), or for cutting off electricity operation;
Said switch device can be used for the operation of switching, so that the excitation coils of at least two electromagnetic actuators can be first to perform parallel actuation and then switched to serial connection state, and during serial connection

tion the electromagnetic actuator still could maintain the operation of electrical actuation;
-- electromagnetic actuators (102, 112): consist of at least two electromagnetic brakes, electromagnetic clutches, electromagnetic switches, electromagnetic relays, and electromagnetic valves with AC or DC electrical power excitation coil, the electromagnetic actuators has the basic characteristic of sustaining of electrical actuating operation while the excitation coils (102', 112') are in serial connection;
-- capacitors (103, 113): matched AC or DC capacitor or other storage and discharging component based on the specification of electromagnetic actuator, for assistance of excitation coils (102', 112') of electromagnetic actuator (102, 112) in sustaining the stable operation when switch device (101) is switching between series or parallel connection to excitation coils; such capacitor can either be installed or not installed based on the need.

2. The electromagnetic actuator parallel actuation serial sustaining driving circuit as claimed in Claim 1, wherein the two or above two electromagnetic actuators installed can be formed by the same or different electromagnetic actuators.

3. The electromagnetic actuator parallel actuation serial sustaining driving circuit as claimed in Claim 1, wherein the capacitor connected in parallel with excitation coils (102', 112') when using direct electrical current energy for driving excitation coils also can use flying wheel diode to replace capacitor or use in mixture; in using alternating electrical current energy for driving excitation coils also can use short circuit conducting ring or short circuit shielded winding as replacement.

4. An electromagnetic parallel actuation/serial sustaining drive circuit comprising a switch device (101) for controlling electric current delivery to the excitation coils (102', 112') of at least two electromagnetic actuators (102, 112) so that the excitation coils can perform parallel actuation and then be switched to serial connection, and capacitors (103, 113) for assisting the excitation coils to sustain stable operation when the switch device switches between serial and parallel connection to the excitation coils.

5. An electromagnetic parallel actuation/serial sustaining drive circuit comprising a switch device (101) for controlling electric current delivery to the excitation coils (102', 112') of at least two electromagnetic actuators (102, 112) so that the excitation coils can perform parallel actuation and then be switched to serial connection, and means for assisting the excitation coils to sustain stable operation when the

switch device switches between serial and parallel connection to the excitation coils.

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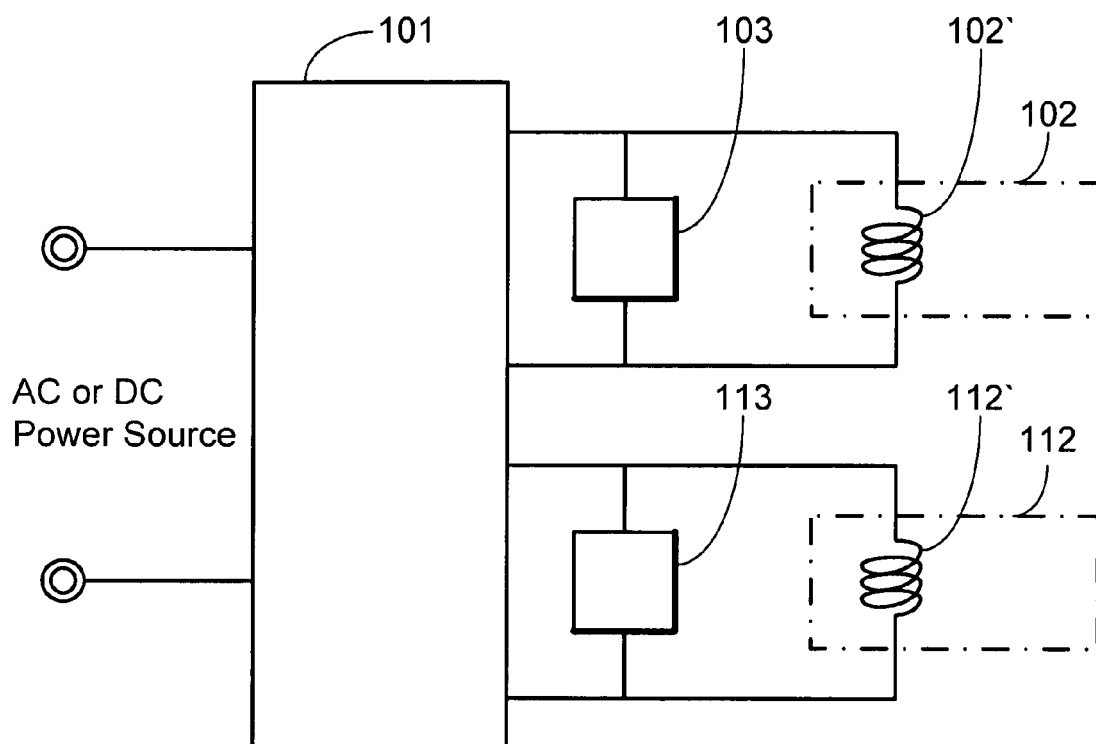


Fig 1



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 25 4879

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 043 990 A (LILLQUIST ARVID E) 10 July 1962 (1962-07-10) * the whole document *	1-5	INV. H01F7/18
X	DE 26 23 684 A1 (SIEMENS AG) 1 December 1977 (1977-12-01) * the whole document *	1-5	
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A	US 3 947 220 A (DIETZ GERALD EDWARD) 30 March 1976 (1976-03-30) * column 4, lines 16-27 * * column 7, lines 9-12; figure 1 * * column 9, lines 5-10,39-42; figure 2 *	1,3,4	TECHNICAL FIELDS SEARCHED (IPC) H01F H01H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 23 May 2008	Examiner Teske, Ekkehard
CATEGORY OF CITED DOCUMENTS 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 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 & : member of the same patent family, corresponding document			

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

EP 07 25 4879

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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23-05-2008

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