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(54) **Item of furniture with a switched-mode power supply**

(57) The invention relates to an item of furniture with at least one movable part, an actuator for actuating the movable part, a switched-mode power supply and a motor control unit for the actuator. The switched-mode power supply has a first power outlet with an output voltage which decreases with the current rise and which drops to zero once a nominal current value has been reached.

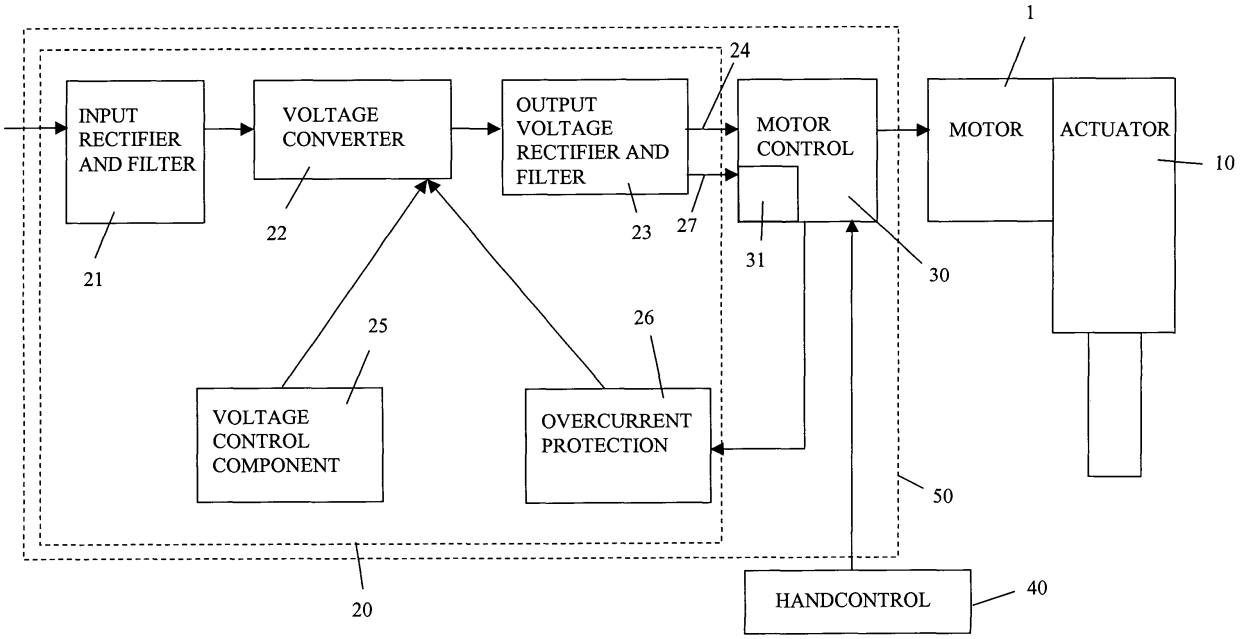

Fig. 1

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Description

[0001] The invention relates to an item of furniture with at least one movable part, an actuator for actuating the movable part, a switched-mode power supply and a motor control unit for the actuator.

[0002] It is known to use a linear DC actuator in items of furniture with at least one movable part, i.e. a relaxation chair or a bed. To provide the DC voltage, an inductive transformer has been used for a long time. However, recently the price of such a transformer has increased drastically due to the fluctuation of the raw materials (steel and copper). In addition, an inductive transformer is heavy and needs much space for its installation.

[0003] In the furniture sector it has also been suggested to use a switched-mode power supply which has a smaller overall dimension and is cheaper than an inductive transformer. Such a switched-power supply, however, has the disadvantage of a higher power consumption than an inductive transformer.

[0004] Therefore, it is an object of the invention to provide an item of furniture with at least one movable part, an actuator for actuating the movable part, a switched-mode power supply and a motor control unit for the actuator which has a reduced power consumption.

[0005] This object is achieved by the feature of claim 1. The item of furniture according to the invention comprises at least one movable part, an actuator for actuating the movable part, a switched-mode power supply and a motor control unit for the actuator. Furthermore, the switched-mode power supply has a first power outlet with an output voltage which decreases with the current rise and which drops to zero once a nominal current value has been reached.

[0006] Usually, a switched-mode power supply produces a constant DC output voltage. However, the actuator of an item of furniture does not need a constant output voltage. What is important is the available current as this current is directly proportional to the torque developed in the motor. Therefore, to provide the necessary current for this specific application, a switched-mode power supply with a constant DC output voltage must supply a very high power (P = V * I), which results in a high power consumption. On the other hand a traditional inductive transformer is capable of supplying an output voltage which decreases with the current rise. This feature limits the total power consumption. The present invention combines the advantages of a switched-mode power supply (cheaper, lighter weight, smaller size) and an inductive transformer (lower power consumption).

[0007] Further embodiments of the invention are the subject matter of the subordinate claims.

[0008] According to a preferred embodiment the switched-mode power supply comprises a voltage control component to regulate the output voltage so that it decreases with the current rise. Furthermore, an overcurrent protection component drops the output voltage to zero once a nominal current value has been reached.

[0009] The small overall dimension of a switched-mode power supply allows an arrangement of the switched-mode power supply and the motor control unit in one common box.

[0010] If the actuator has an electric motor which is driven via relays the switched-mode power supply according to the invention provides a second power outlet which is connected to the relays and which is not limited in its current. Without such a second power outlet, the following situation could happen. Once the nominal current value has been reached the output voltage drops to zero. The zero voltage will open the relay with the effect of disconnecting the load, and therefore the supply will be on again, starting a never ending sequence of On and Off which will destroy either the motor or the power supply. According to the invention, however, the output voltage has been split into two parts, one high power outlet with limited current and a second low power outlet for the relays which will always remain active, even if the first outlet is "Off".

[0011] Further developments and advantages of the invention will be further explained herein below with the aid of the description and the drawings, wherein:

Fig. 1 shows a flow diagram of a switched-mode power supply, a motor control unit and an actuator and

Fig. 2 shows a voltage-current diagram of the switched-mode power supply.

[0012] The diagram shown in Fig. 1 substantially comprises an actuator 10 for actuating a movable part of an item furniture like a reclining chair, a switched-mode power supply 20 and a motor control unit 30.

[0013] The actuator 10 is a linear DC actuator with an electric motor 1.

[0014] The switched-mode power supply 20 substantially comprises an input rectifier and filter 21, a voltage converter 22, and an output voltage rectifier and filter 23 to supply an output voltage via a first power outlet 24. The motor control unit 30 receives the output voltage to control the motor 1 via a manual control 40.

[0015] The switched-mode power supply 20 further comprises a voltage control component 25 to regulate the output voltage so that it decreases with the current rise as shown in Fig. 2. An overcurrent protection component 26 drops the output voltage to zero once a nominal current value IN (here 5,5 A) has been reached. By decreasing the output voltage whilst increasing the current, it is possible to reduce the power consumption. Within the allowable current range the output voltage decreases by at least 10%, preferably more than 20% or even more than 30%. In the example shown in Fig. 2 the output voltage decreases by 50%.

[0016] Due to the small overall dimension of the switched-mode power supply it is possible to arrange the switched-mode power supply 20 and the motor control

unit 30 together in one box 50. The size of the box can be reduced by approximately 50% with respect to an inductive transformer power supply. Furthermore, the weight of the unit can be reduced by about 80%. In addition, the power consumption is lower than usual switched-mode power supply systems and the efficiency of the system is better. In addition, the cost of the unit is no longer linked to the fluctuation in the cost of the raw materials for the transformer and is now cheaper than the transformer version.

[0017] In order to avoid any problems if the motor 1 is driven via relays 31 the switched-mode power supply 20 has a second power outlet 27 which is a low power outlet for the relays which will also remain active even if the output voltage of the first power outlet drops to zero.

Claims

1. Item of furniture with at least one movable part, an actuator (10) for actuating the movable part, a switched-mode power supply (20) and a motor control unit (30) for the actuator,
   characterised in that the switched-mode power supply (20) has a first power outlet (24) with an output voltage which decreases with the current rise and which drops to zero once a nominal current value (IN) has been reached.

2. Item of furniture according to claim 1, **characterised in that** the switched-mode power supply (20) comprises a voltage control component (25) to regulate the output voltage so that it drops with the current rise.

3. Item of furniture according to claim 1, **characterised in that** the switched-mode power supply (20) comprises an overcurrent protection component (26) which drops the output voltage to zero once a nominal current value has been reached

4. Item of furniture according to claim 1, **characterised in that** the switched-mode power supply (20) and the motor control unit (30) are provided together in one box (50).

5. Item of furniture according to claim 1, **characterised in that** the actuator (10) has an electric motor (1) which is driven via relays (31).

6. Item of furniture according to claim 3, **characterised in that** the switched-mode power supply (20) has a second power outlet (27) which is connected to the relays (31) and which is not limited in its current.

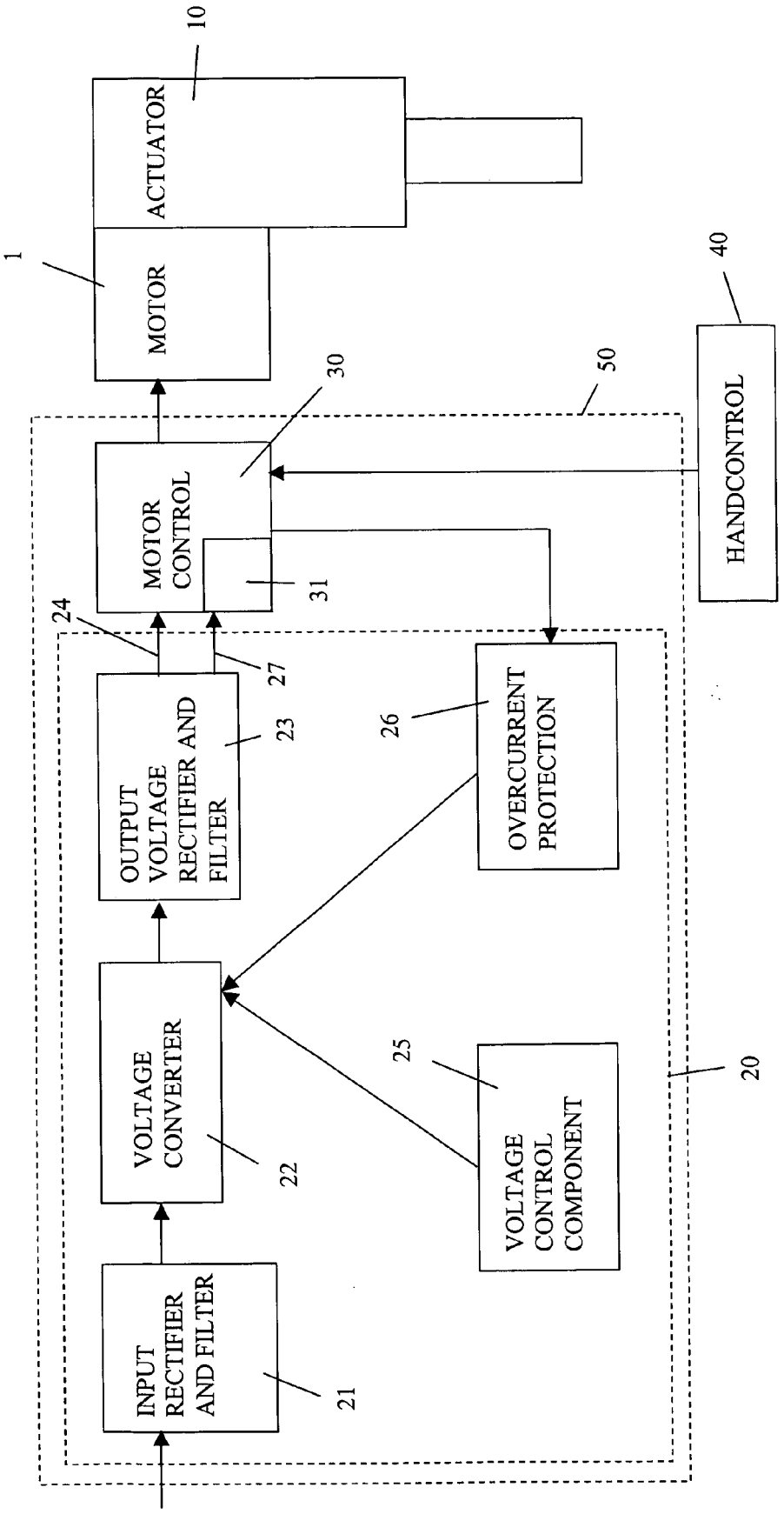
10
ACTUATOR
1
MOTOR
40
HANDCONTROL
30
50
MOTOR CONTROL
31
24
27
OUTPUT VOLTAGE RECTIFIER AND FILTER
23
26
OVERCURRENT PROTECTION
VOLTAGE CONVERTER
22
25
VOLTAGE CONTROL COMPONENT
20
INPUT RECTIFIER AND FILTER
21

Fig. 1

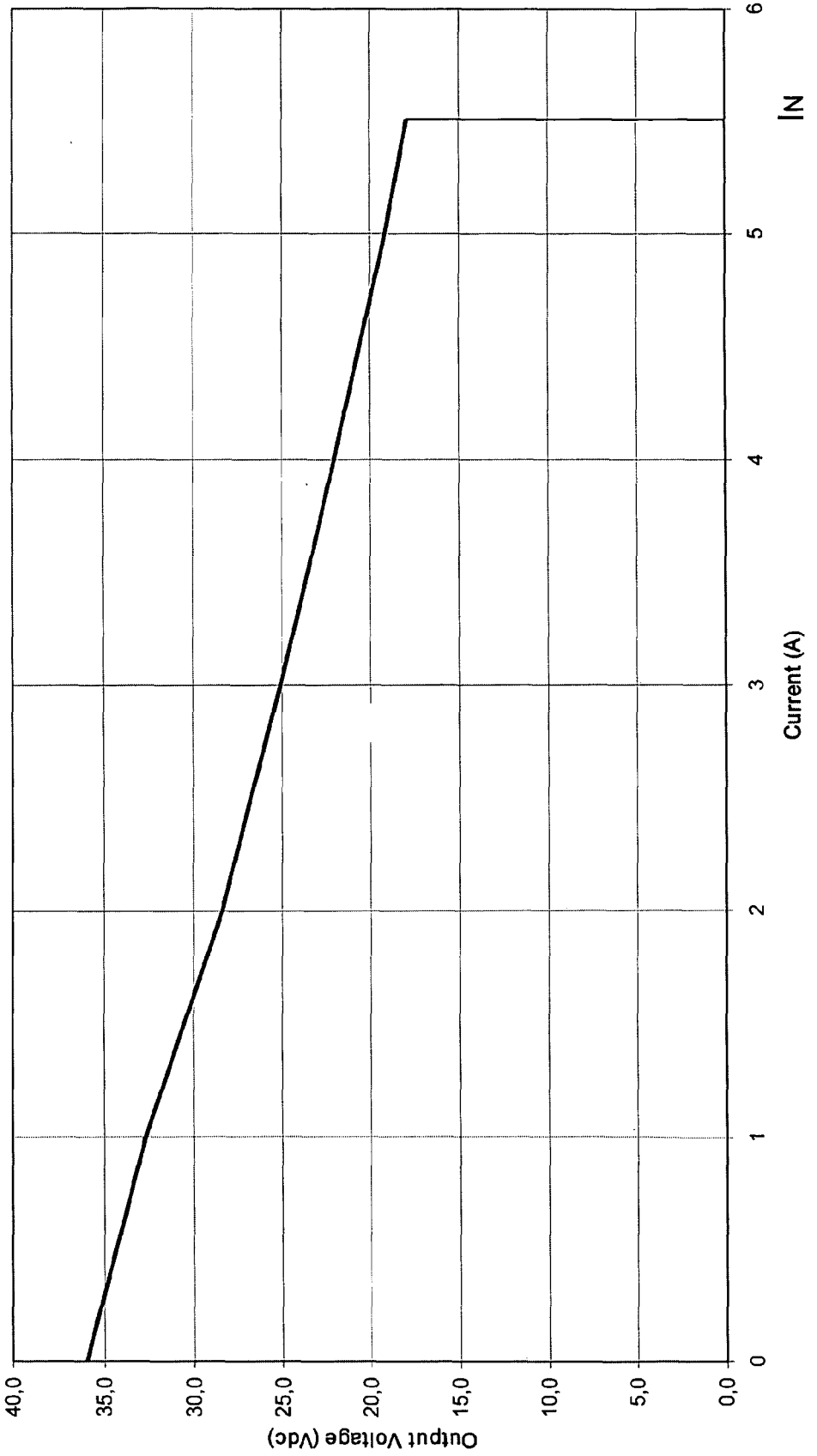
Output Voltage (Vdc)
40,0
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
0
1
2
3
4
5
6
Current (A)
IN

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 00 9253

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 2006/076813 A1 (MOHN MICHAEL E [US] ET AL) 13 April 2006 (2006-04-13) * abstract * * paragraph [0005] * * paragraph [0025] * * figures 3-5 *	1,4	INV. A47C20/04
A	EP 0 651 492 A1 (CIAR SRL [IT]) 3 May 1995 (1995-05-03) * abstract; figures *	1-6	
A	WO 03/002256 A2 (ALMEC ALECTRONIC ASSEMBLY SERV [GB]; PUDDEFOOT STEPHEN [GB]) 9 January 2003 (2003-01-09) * abstract * * page 1 - page 8 * * figures 1-8 *	1-6	

TECHNICAL FIELDS SEARCHED (IPC)

A47C
B60N
H02M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 September 2007	MacCormick, Duncan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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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12-09-2007

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