(11) Application No. AU 2003255475 B2

(19) AUSTRALIAN PATENT OFFICE

(54) Title

Progressive distributor comprising displaceable pistons

(51)[6] International Patent Classification(s)

F16N 25/02 (2006.01) 20060101AFI2005100

F16N 25/02 8BMEP

PCT/EP2003/009337

(21) Application No: 2003255475 (22) Application Date: 2003.08.22

(87) WIPO No: WO04/051136

(30) Priority Data

(31) Number	(32) Date	(33) Country
202 18 625.3	2002.12.02	DE

(43) Publication Date : 2004.06.23

(43) Publication Journal Date : 2004.07.29

(71) Applicant(s)

Lincoln GmbH

(72) Inventor(s)

Paluncic, Zdravko

(74) Agent/Attorney

Collison & Co, 117 King William Street, Adelaide, SA, 5000

(56) Related Art

EP 0152901 A

US 3459278 A

US 3086614 A

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
17. Juni 2004 (17.06.2004)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2004/051136 A1

(51) Internationale Patentklassifikation[7]: F16N 25/02

(21) Internationales Aktenzeichen: PCT/EP2003/009337

(22) Internationales Anmeldedatum:
22. August 2003 (22.08.2003)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
202 18 625.3 2. Dezember 2002 (02.12.2002) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **LINCOLN GMBH & CO. KG** [DE/DE]; Heinrich-Hertz-Strasse 2-8, 69190 Walldorf (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: **PALUNCIC, Zdravko** [DE/DE]; Buchenstrasse 44, 67067 Ludwigshafen (DE).

(74) Anwalt: **KEIL & SCHAAFHAUSEN**; Cronstettenstrasse 66, 60322 Frankfurt am Main (DE).

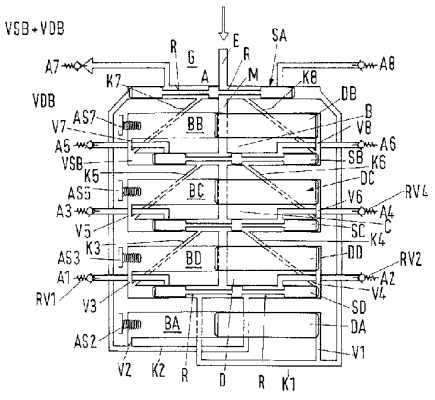
(81) Bestimmungsstaaten *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Bestimmungsstaaten *(regional)*: ARIPO-Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Fortsetzung auf der nächsten Seite]

(54) Title: PROGRESSIVE DISTRIBUTOR COMPRISING DISPLACEABLE PISTONS

(54) Bezeichnung: PROGRESSIVVERTEILER MIT VERSCHIEBBAREN KOLBEN



(57) Abstract: The invention relates to a progressive distributor comprising three or more control pistons (SA to SD), each of which can be displaced in a respective housing bore (A to D) of a distributor housing (G). According to the invention, said pistons are depressed alternately into their two final positions in the corresponding housing bore (A to D) by a pressurised lubricant, which is supplied via a housing inlet (E), whereby a specific quantity of said lubricant (VSA to VSD) is delivered by means of an outlet (A1 to A8) on a respective front face. The outlet leads from one of two annular grooves (R) of the housing bore (A to D) of the respective preceding control piston (SA to SD). The control pistons (SA to SD) are controlled sequentially by the lubricant as a result of the two respective annular grooves (R) in such a way that the following control piston (SA to SD) can only be displaced by the lubricant, if the piston displacement of the preceding control piston (SA to SD) has been fully or nearly completed. The invention is characterised in that the housing bores (A to D) are connected to the inlet (E) by means of a central bore (M), a respective channel (K1 to K8) connecting an annular groove (R) of the housing bore (A to D) of the preceding control piston (SA to SD) to the front face of the respective housing bore (A to D) of the following control piston (SA to SD), whereby for all but one (SD) of the control pistons, the annular groove (R) and the front face lie on the same side, but for said one control piston (SD) the annular groove (R) and the front face lie on opposite sides. A respective connection channel (V1 to V8) interconnects the respective front faces of all or at least several housing bores (A to D) with a front face of the respective corresponding bore (BA to BD) of a metering piston (DA to DD) that can be displaced back and forth by the lubricant between two stops (AS1 to AS8), one of said stops being axially displaceable and/or interchangeable. The displacement resistance of each metering piston (DA to DD) that is allocated to a respective control piston (SA to SD) is less than the displacement resistance of the respective following control piston (SA to SD).

[Fortsetzung auf der nächsten Seite]

WO 2004/051136 A1

eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI-Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Veröffentlicht:
— *mit internationalem Recherchenbericht*

(57) **Zusammenfassung:** Die Erfindung bezieht sich auf einen Progressivverteiler mit drei oder mehr je in einer Gehäusebohrung (A bis D) eines Verteilergehäuses (G) verschiebbaren Steuerkolben (SA bis SD), welche jeweils unter Abgabe einer bestimmten Schmierstoffmenge (VSA bis VSD) über einen je stirnseitigen Auslass (A1 bis A8), welcher über je einen von zwei Ringnuten (R) der Gehäusebohrung (A bis D) des jeweils vorhergehenden Steuerkolbens (SA bis SD) geführt ist, von dem über einen Gehäuseeinlass (E) unter Druck zugeführten Schmierstoff abwechselnd in ihre beiden Endstellung in der zugehörigen Gehäusebohrung (A bis D) gedrückt werden, wobei die Steuerkolben (SA bis SD) aufgrund der je zwei Ringnuten (R) aufeinander folgend von dem Schmierstoff so gesteuert werden, dass der nächste Steuerkolben (SA bis SD) erst dann von dem Schmierstoff verschoben werden kann, wenn die Kolbenbewegung des vorangegangenen Steuerkolbens (SA bis SD) ganz oder nahezu abgeschlossen ist, wobei die Gehäusebohrungen (A bis D) über eine Mittelbohrung (M) mit dem Einlass (E) verbunden sind, wobei je ein Kanal (K1 bis K8) eine Ringnut (R) der jeweiligen Gehäusebohrung (A bis D) des vorhergehenden Steuerkolbens (SA bis SD) mit der Stirnseite der jeweiligen Gehäusebohrung (A bis D) des nachfolgenden Steuerkolbens (SA bis SD) verbindet, und zwar bis auf einen Steuerkolben (SD) bei auf der gleichen Seite liegender Ringnut (R) und Stirnseite, bei dem einen Steuerkolben (SD) jedoch bei auf unterschiedlicher Seite liegender Ringnut (R) und Stirnseite, wobei jeweils ein Verbindungskanal (V1 bis V8) die jeweiligen Stirnseiten aller oder wenigstens mehrerer Gehäusebohrungen (A bis D) mit einer Stirnseite der jeweils zugeordneten Bohrung (BA bis BD) eines zwischen zwei Anschlägen (AS1 bis AS8), von welchen wenigstens einer axial verstellbar und/oder austauschbar ist, von dem Schmierstoff hin und her beweglichen Dosierkolbens (DA bis DD) miteinander verbindet und wobei der Verschiebewiderstand des jeweiligen einem Steuerkolben (SA bis SD) zugeordneten Dosierkolbens (DA bis DD) kleiner ist als der Verschiebewiderstand des jeweils nachfolgenden Steuerkolbens (SA bis SD).

2003255475 04 Jun 2009

Description

[0001] The invention relates to a progressive distributor having three or more control pistons, each being displaceable in a respective housing bore of a distributor housing, and each of which, upon delivery of a specific quantity of lubricant through an outlet which is located on a front face and in each case leads from one of two annular grooves of the housing bore of the respective preceding control piston, is alternately pressed, by the lubricant supplied under pressure through a housing inlet, into its two end positions in the respective housing bore, said control pistons, as a result of the two annular grooves, being successively controlled by the lubricant in such a way that the next control piston can only be displaced by the lubricant when the displacement of the preceding control piston has been completed or almost completed, and said housing bores being connected to the inlet via a central bore, a channel in each case connecting an annular groove of the respective housing bore of the preceding control piston to the front end of the respective housing bore of the following control piston, that is to say, except for in the case of one control piston, with the annular groove and the front end being located on the same side, but in the case of the one control piston with the annular groove and the front end being located on different sides.

[0002] A progressive distributor of this type is known from DE 34 05 690 C2. In order to provide such a progressive distributor with additional functions and thus make it suitable for new applications and particularly for use even in those cases where machines have to be lubricated using very small quantities or where some lubrication sites have to be lubricated frequently and others for instance only daily, weekly or monthly, it is proposed that in each case a connecting channel connect the respective front ends of at least one housing bore, but not all the housing bores, to a front end of the bore of an additional cylinder, in which an additional piston is disposed in such a way that it can be moved back and forth by the lubricant between two stops, in which case at least one piston must work against a respective outlet pressure which is greater than the outlet pressure, against which the additional piston is working, and in which case, for generating the greater outlet pressure, an overflow valve or a check valve with counter-

pressure is associated with the corresponding outlets. In an alternative solution, instead of the arrangement of the overflow valves or check valves with counter-pressure, the additional piston can have at least one circumferential groove which only frees up an outlet of a piston in the two end positions of the additional piston. With such progressive distributors, when the particular piston to whose housing bore the additional cylinder is connected is moved from one side to the other by pressure applied to one end face, not only does the outlet associated with said piston deliver the quantity of lubricant displaced by the opposite end face of this piston, but also, owing to displacement of the additional piston from one end position to the opposite end position, it delivers an additional quantity of lubricant corresponding to the free volume of the additional cylinder. With one solution, the displacement cylinder of the individual pistons pauses until the entire contents of the additional cylinder have been emptied, since at least one of these other pistons should be displaced against an outlet pressure which is greater than the outlet pressure which the additional piston has to overcome taking into account friction losses. With the other solution, the additional piston blocks the outlet necessary for continuation of the displacement cycle of the pistons until the additional piston has been displaced from its one end position to the other end position and its circumferential groove frees up the outlet necessary for continuation of the displacement cycle. The first solution variant has the advantage that the piston can be varied with continuous stroke. The second solution variant has the advantage that it functions reliably with all pressure ratios, since it does not depend on an increased counter-pressure at at least two opposite outlets of a piston. In both cases, the progressive distributor functions with the one additional cylinder as a hydraulic time element, the time delay for the continuation of the displacement cycle being determinable or determined by the volume of the additional cylinder.

[0003] It is the objective of the present invention to propose a structurally inexpensive and functionally reliable progressive distributor with which different volumes of lubricant can be delivered from all or at least a number of its outlets.

[0004] With a progressive distributor of the above type, this objective is achieved for instance as a result of the fact that a connecting channel in each case connects the respective front ends of all or at least a number of housing bores to a front end of the respective associated bore of a dosing piston which can be moved back and forth by the

2003255475 04 Jun 2009

lubricant between two stops, at least one of which is adjustable in axial direction and/or is exchangeable, and as a result of the fact that the resistance to displacement of the particular dosing piston associated with a control piston is less than the resistance to displacement of the respective following control piston.

[0005] The resistance to displacement of the respective dosing piston is also advantageously less than the resistance to displacement of its associated control piston.

[0006] A determining factor for the resistance to displacement of the dosing piston is its end face acted upon by lubricant pressure and consequently also the cross-section of the bores in which the dosing pistons are displaceable. In particular, however, the resistance to displacement of the respective dosing piston can be regulated by means of an O-ring arrangement and/or an adjustment in respect of its fitting in its bores.

[0007] A structurally favourable arrangement of the innovative progressive distributor can be achieved if the respective dosing piston lies parallel to its associated control piston and is located on the side of the distributor housing associated with the inlet, that is to say with the exception of one control piston which is located closest to the inlet and whose dosing piston is located furthest away from said inlet.

[0008] For simple operation, it is advantageous if the stops are disposed on a front face of the distributor housing directly adjacent to the exit ports of the associated outlet.

[0009] Moreover, the specific arrangement is such that, in opposite front faces of the distributor housing, in each case every second outlet, every second associated stop and every associated housing bore for the control pistons are respectively disposed in one of three rows in such a way that the related distributor housing, outlets and housing bores for the control pistons are located directly adjacent to one another.

[0010] So as to prevent undesirable return flow and/or soiling of the progressive distributor, a check valve can be assigned to each of the exit ports of the outlets.

[0011] Further objectives, features, advantages and possible applications of the invention will be made apparent in the following description of working examples, with reference

2003255475 04 Jun 2009

being made to the drawings. All the described and/or illustrated features, both separately and in any combination, constitute the subject matter of the invention, and this irrespective of their combination in individual claims or when referring back to preceding claims.

[0012] The drawings are as follows:

Fig. 1 shows a schematic section of one form of a progressive distributor embodying the invention, and

Fig. 2 is a schematic view of a front face of the distributor housing.

[0013] The working example illustrated in Fig. 1 relates to a progressive distributor with a distributor housing G, in which, in four housing bores A to D, four control pistons SA to SD can be moved back and forth by the lubricant supplied via the inlet E to a central bore M, for example by a pump which is not represented. Eight outlets A1 to A8 (four on each side) are associated with the housing bores A to D or control pistons SA to SD. Each control piston SA to SD has two annular grooves R spaced apart from one another in axial direction. The respective front ends of the housing bores A to D are in flow communication, via channels K1 to K8, with the annular groove R of the corresponding control pistons SA to SD of the respective preceding housing bore A to D. For the uppermost three housing bores A to C, the region of the annular groove R and the front end of the following housing bore D are located on the same side of the central longitudinal plane (extending perpendicular to the plane of the drawing and running from top to bottom). However, the housing bore D of the lowest control piston SD is in flow communication via channels K1 and K2 in the region of the annular groove R with the front end of the housing bore A of the uppermost control piston SA located opposite in relation to said central longitudinal plane. The outlets A1 to A8 in each case function via the housing bore A to D and the annular groove R of the respective preceding control piston SA to SD. The housing bores A to D all communicate via the central bore M with the inlet E. This leads to the control pistons SA to SD being alternately pressed into the two end positions in their respective housing bore A to D as a result of the action of supplied lubricant on one end face and the delivery of a specific volume of lubricant VSA to VSD via one of the outlets A1 to A8 on the other side. The respective following

2003255475 04 Jun 2009

control piston SA to SD can only be displaced by the pressure of the lubricant when the displacement of the preceding control piston SA to SD has been completed or almost completed.

[0014] In each case, a connecting channel V1 to V8 connects the respective front ends of the housing bores A to D to a front end of the respective associated bore BA to BD with two end stops AS1 to AS8, of which in each case at least one is adjustable in axial direction and/or is exchangeable. In the bores BA to BD, one of the dosing pistons BA to BD can in each case be moved back and forth by the lubricant between the stops AS1 to AS8. The resistance to displacement of the respective dosing piston DA to DD associated with a control piston SA to SD is then less than the resistance to displacement of the respective following control piston SA to SD. Furthermore, the resistance to displacement of the respective dosing piston DA to DD is less than the resistance to displacement of its associated control piston SA to SD. The resistance to displacement of the respective dosing piston DA to DD is achieved in the illustrated case by means of an adjustment in its fitting in the associated bore BA to BD, the respective dosing piston DA to DD having a larger effective end face than the respective associated control piston SA to SD.

[0015] The resistance to displacement can also be regulated by means of an O-ring arrangement on the respective dosing piston DA to DD.

[0016] In the illustrated working example, the respective dosing piston DA to DD is axially parallel to its associated control piston SA to SD and is provided on the side of the distributor housing associated with the inlet E, that is to say with the exception of one control piston SA, which is located closest to the inlet E and whose dosing piston DA is located furthest away from said inlet E.

[0017] As can be seen from Fig. 2, every second outlet A1 to A8, every second associated stop AS1 to AS8 and every opening of the associated housing bores A to D for the control pistons SA to SD are disposed in each case in one of three rows in opposite front faces of the distributor housing G, in such a way that the related outlets A1 to A8, stops AS1 to AS8 and housing bores A to D for the control pistons SA to SD are located directly adjacent to one another for ease of operation.

2003255475 04 Jun 2009

[0018] It can be seen from Fig. 1 that a check valve RV1 to RV8 can be assigned to each exit port of the outlets A1 to A8.

[0019] When, for example with the position of control pistons SA to SD and dosing pistons DA to DD as represented in Fig. 1, lubricant is introduced via the inlet E into the central bore M, this arrives, via the right-hand annular groove R of the control piston SA and the channel K8, at the right-hand end face of the control piston SB and, via the connecting channel V8, at the right-hand end face of the dosing piston DB, the two pistons consequently being driven towards the left in their respective bores B and BB. Owing to the connecting channel V7, the respective displaced volume of lubricant VSB and VDB is delivered to the outlet A7 via the channel K7 and the left-hand annular groove R of the control piston SA. As is made clear in the drawing, the volume of lubricant VDB which can be displaced by the dosing piston DB is determined by the changeable axial position of the stop AS7 and is therefore variable.

[0020] When both the control piston SB and the dosing piston DB have been displaced as far as possible towards the left, the same working cycle is continued with displacement of the control piston SC and dosing piston DC via the corresponding annular groove of the next control piston SB and the channel K6, and so on. Owing to switching of the channels K1 and K2 to the annular groove R of the control piston SD located on the opposite side, the movements of all pistons are reversed as soon as all the control pistons SA to SD and dosing pistons DA to DD have been displaced towards the left in the drawing, etc.

[0021] It goes without saying that an adjustable stop can also be provided on the right-hand side of the illustrated bores BA to BD for the dosing pistons DA to DD so as to provide on this side too a variable displaced volume of lubricant.

2003255475 04 Jun 2009

List of reference numerals

[0022]

A to D	Housing bores for control pistons SA to SD
A1 to A8	Outlets
AS1 to AS8	Stops
BA to BD	Bores of the dosing pistons DA to DD
DA to DD	Dosing pistons
E	Inlet
G	Distributor housing
K1 to K8	Channels
M	Central bore
R	Annular grooves
RV1 to RV8	Check valve
SA to SD	Control pistons
V1 to V8	Connecting channels
VDA to VDD	Volume of lubricant (dosing piston)
VSA to VSD	Volume of lubricant (control piston)

COMS ID No: ARCS-237129 Received by IP Australia: Time (H:m) 17:12 Date (Y-M-d) 2009-06-03

2003255475 04 Jun 2009

Patent Claims

1. A progressive distributor having three or more control pistons (SA to SD), each being displaceable in a respective housing bore (A to D) of a distributor housing (G) and each of which, upon delivery of a specific quantity of lubricant (VSA to VSD) through an outlet (A1 to A8) which is located on a respective front face and in each case leads from one of two annular grooves (R) of the housing bore (A to D) of the respective preceding control piston (SA to SD), is alternately pressed, by the lubricant supplied under pressure through a housing inlet (E), into its two end positions in the respective housing bore (A to D), said control pistons (SA to SD) being successively controlled by the lubricant, owing to the two annular grooves (R), in such a way that the next control piston (SA to SD) can only be displaced by the lubricant when displacement of the preceding control piston (SA to SD) has been completed or almost completed, and said housing bores (A to D) being connected to the inlet (E) via a central bore (M), a channel (K1 to K8) in each case connecting an annular groove (R) of the respective housing bore (A to D) of the preceding control piston (SA to SD) to the front end of the respective housing bore (A to D) of the following control piston (SA to SD), that is to say, except for in the case of one control piston (SD), with the annular groove (R) and the front end being located on the same side, but in the case of the one control piston (SD) with the annular groove (R) and the front end being located on different sides, and a respective connecting channel (V1 to V8) interconnecting the respective front ends of all or at least a number of housing bores (A to D) with a front end of the respective associated bore (BA to BD) of a dosing piston (DA to DD) which can be moved back and forth by the lubricant between two stops (AS1 to AS8), of which at least one is adjustable in axial direction and/or is exchangeable, and the resistance to displacement of the respective dosing piston (DA to DD) associated with a control piston (SA to SD) being less than the resistance to displacement of the respective following control piston (SA to SD).

2. A progressive distributor according to Claim 1, **characterized in that** the resistance to displacement of the respective dosing piston (DA to DD) is less than the resistance to displacement of the control piston (SA to SD) associated with it.

COMS ID No: ARCS-237129 Received by IP Australia: Time (H:m) 17:12 Date (Y-M-d) 2009-06-03

2003255475 04 Jun 2009

3. A progressive distributor according to Claim 1 or 2, **characterized in that** the resistance to displacement of the respective dosing piston (DA to DD) is or can be regulated by means of an O-ring arrangement and/or an adjustment in respect of its fitting.

4. A progressive distributor according to Claims 1 to 3, **characterized in that** the respective dosing piston (DA to DD) has a larger effective area than the respective associated control piston (SA to SD).

5. A progressive distributor according to one of Claims 1 to 4, **characterized in that** the respective dosing piston (DA to DD) lies axially parallel to its associated control piston (SA to SB) and is located on the side of the distributor housing (G) associated with the inlet (E), that is to say with the exception of one control piston (SA) which is located closest to the inlet (E) and whose dosing piston (DA) is located furthest away from said inlet (E).

6. A progressive distributor according to one of Claims 1 to 5, **characterized in that** the stops (AS1 to AS8) are disposed on a front face of the distributor housing (G) directly adjacent to the exit ports of the associated outlet (A1 to A8).

7. A progressive distributor according to one of Claims 1 to 7, **characterized in that,** in opposite front faces of the distributor housing (G), in each case every second outlet (A1 to A8), every second associated stop (AS1 to AS8) and every associated housing bore (A to D) for the control pistons (SA to SD) are respectively disposed in one of three rows in such a way that the related outlets (A1 to A8), stops (AS1 to AS8) and housing bores (A to D) for the control pistons (SA to SD) are located directly adjacent to one another.

8. A progressive distributor according to one of Claims 1 to 7, **characterized in that** a check valve (RV1 to RV8) is assigned to each of the exit ports of the outlets (A1 to A8).

COMS ID No: ARCS-237129 Received by IP Australia: Time (H:m) 17:12 Date (Y-M-d) 2009-06-03

1/2

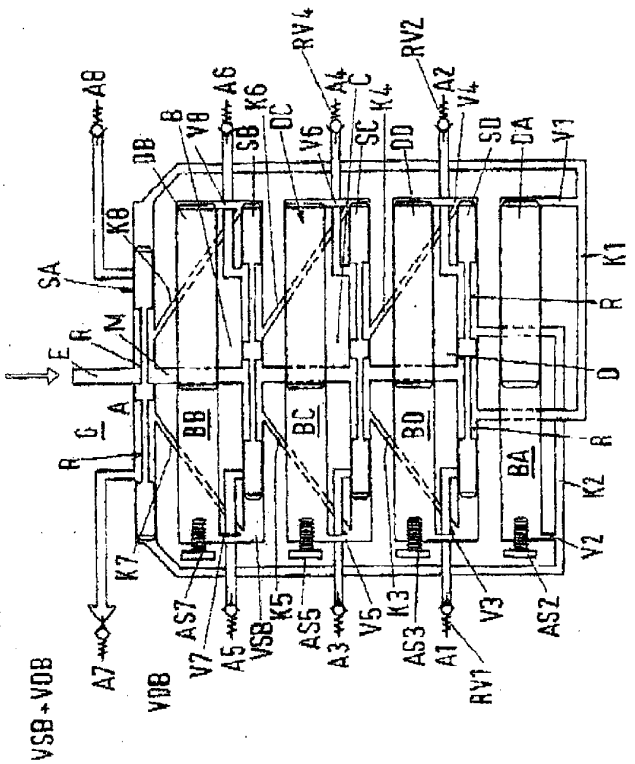

A8
DB
B
V8
A6
K6
DC
V6
A4
C
K4
SC
DD
RV2
A2
V4
SD
DA
V1
K1
R
D
R
K2
V2
BA
BB
BC
BD
SA
R
G
A
R
K8
K7
A7
VSB+VDB
VDB
AS7
V7
A5
VSB
K5
AS5
A3
V5
K3
AS3
A1
RV1
V3
AS2
RV4

Fig.1

Fig.2