

Description

BACKGROUND OF THE INVENTION

The field of the present invention is valves for controlling fluid flow, and more particularly, valves which permit a controlled variable amount of fluid therethrough so as to permit gentle movement of components or the like controlled by such valves.

Numerous valves are known in the art for controlling fluid flow therethrough. As is known to those skilled in the art, each of these different valves has its own characteristics and advantages. These characteristics and advantages result from the constraints imposed by the application for which the valves were originally designed.

In many applications, it is desirable to provide means for permitting extremely fine adjustments to the amount of flow through the valve. One such application is in conjunction with hydraulic components. Oftentimes, it is necessary and important to provide smooth movement of the hydraulic component or components controlled by the operation of the valve. Valves presently available for controlling the flow of incompressible fluids such as hydraulic fluid, suffer a uniform problem in that they do not provide for the efficient and reliable slow or gradual opening and closing of the valves. Such a characteristic is advantageous as it permits the valve to provide a slow or gradual increase or decrease in the amount of fluid flowing through the valve to the components, thereby permitting the components to move in a smooth and shock-free manner.

US-A-2 354 960 discloses a valve for rotating fluid flow as defined in the prior art portion of claim 1. As compared therewith the present invention, as defined in claim 1, provides for a gradual and progressive control of the piston means throughout the rotational movement of the rotary cam member with two oppositely acting piston means being simultaneously movable in opposite directions through the same increments so as to provide extremely smooth, gradual and well-controlled valve movement providing for good control of fluid flow through inlet-outlet ports connecting with the point of use.

Preferably an accurate signal indicative of the position of the rotary cam member can be achieved from a rotary potentiometer connected to be simultaneously movable and drivable with the rotary cam member. In order to provide a steady control without unnecessary control movements an electric control circuit for the valve will be responsive to input signals to cause operation of the motor such that a signal voltage change of at least a predetermined value is required to initiate motor actuation.

Brief Description of the Drawings

Figure 1 shows a prospective schematic view of a system for controlling movement of a boom mounted on a truck bed, on which the present invention might be utilised;

Figure 2 shows a prospective view of the passageways in the preferred embodiment of the present invention;

Figure 3 shows a top view of the preferred embodiment of the present invention;

Figure 4 is a cross-sectional view taken substantially along line for 4-4 of Figure 3;

Figure 5 is an electrical schematic diagram of the preferred embodiment of the circuitry controlling the operation of the preferred embodiment of the present invention; and

Figures 6 and 7 are schematic prospective views of two of the flow patterns possible through the preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention may be utilized in any application where finely controlled fluid flow through a valve is desirable or necessary. The preferred embodiment of the present invention shall be described in connection with hydraulic components but, as will be understood by those skilled in the art, may be utilized in connection with any fluid flow, especially any flow of substantially incompressible fluid which controls the movement of hydraulic components or the like.

As illustrated in Figure 1, the present invention may be used to control the movement of a boom 10 mounted to the bed of the truck 12. In such an application, two valves of the present invention are used to control flow to the four hydraulic cylinders 14A-D, respectively. One valve of the present invention controls flow to the cylinders which adjust movement of the boom mounting structure forward and rearward; the other controlling movements of the boom mounting structure port and starboard directions. In such applications, it is desirable to maintain the boom mounting structure 16 substantially along the vertical.

One method known in the art for determining whether a boom mounting structure 16 is substantially vertically aligned is to suspend a pendulum 18 from a not-shown universal joint within the boom mounting structure 16. Unwanted vibrations of the pendulum 18 are prevented by mounting the pendulum 18 in a container of viscous fluid 20, also suspended within the boom mounting structure 16. Four not-shown micro switches or contact switches provide a signal when the pendulum 18 moves out

of alignment with the vertical. The valves of the present invention use such signals in order to control hydraulic fluid flow into the cylinders 14 A-D which control the position of the boom mounting structure 16.

Referring to Figures 2-4 and 6-7, the valve includes a valve body 22 and a valve base 23, each having passageways 24 therethrough. Pistons 26 are positioned within the passageways 24 and arranged to selectively open or close those passageways 24 in response to an actuation means 50. For purposes of example, in a four-way valve of the present invention fluid flows through the passageways 24 and enters and exits through ports as indicated by the solid line arrows in Figure 2. In addition, pistons 26 positioned in the passageways 24 move as a result of applied force (as described herein) in the direction of the broken line arrows.

Although illustrated herein as a four-way valve, as will be understood by those skilled in the art, the present invention may be configured as a two-way or three-way valve. In addition, as will be understood by those skilled in the art, the present invention may also be configured as an open center valve. As such, no limitations other than those imposed in the appended claims should be inferred from the following description of the preferred embodiment of the invention as a four way closed center valve.

Returning to Figures 2-4 and 6-7, the preferred embodiment of the present invention includes a fluid supply port 28, a fluid return port 30 and two inlet-outlet ports 32 and 34, respectively. The valve pistons 26 include an elliptical head 36, a connection shaft 38 and a plug member 40. The plug member 40 is preferably substantially frusto-conically shaped. A seal member 42 is positioned in the valve body 22 so as to cooperatively interact with the plug member 40 of each valve piston 26. As will be understood to those skilled in the art, the seal members 42 may be constructed from a hardened material or a resilient material. Additional seal members 44 are provided so as to ensure a complete seal is provided between the valve body 22 and the valve base 23.

The pistons 26 are biased in a first direction through a resilient biasing member. In the preferred embodiment, the resilient biasing member includes a compression spring 46 extending between the valve piston heads 36 and spring spacer means 48. The amount of biasing exerted on the piston 26 may be varied by changing the length of the spring spacer means 48. The spring spacer means 48 is constructed with an aperture so as to permit fluid to pass through the adjacent passageways 24. It should be kept in mind that although alternative biasing means may be used in place of the spring member 46, it is necessary to have a biasing

means which will permit fluid flow through the passageways 24. Actuation of the valve pistons 26 against the biasing means acts to unseat the plug members 40 from their corresponding seal members 42, thereby opening the corresponding passageways 24.

Actuation of the pistons 26 is accomplished by an actuation means 50 acting on the piston head 36. In the preferred embodiment, the actuation means 50 includes a pair of pivot posts 52 secured to the valve body 22. An actuation cam 56 is mounted to each of the pivot posts 52 through bearings 60. Each actuation cam 56 has a tapered or inclined actuation surface 62. A single or a pair of washers 64 are positioned between a wobble plate 66 and the sloped actuation surface 62 of each actuation cam 56. The washers 64 are constructed so as to have a low friction value and, may, for example, be coated with a semi-permanent lubricant such as that marketed under the trademark TEFLON. The actuation surface 62 of each actuation cam 56 acts on two of the four pistons 26 provided in each four-way valve.

In the preferred embodiment, the actuation cams 56 are driven in tandem by two electric motors 68 through a continuous chain 70 and a sprocket 54 connected to each actuation cam 56 through centering adjustment screws or the like 58. The amount of actuation of the pistons 26 may be determined by an actuation monitor which, for example, determines the amount of rotation of the actuation cams 56. Such angular measurements are preferably accomplished by a potentiometer 72 driven by the continuous chain 70 through a sprocket 74. It is desirable to provide such an actuation monitor as it permits interactive control of the valve.

In the preferred embodiment, the electric motors 68, the potentiometer 72 and the circuit board 76 containing the electrical components which comprise the preferred circuitry of the present invention are connected to the valve body 22 and the valve base 23 by a mounting plate 78 at one end and screws 80 or the like at the other end. Spacers 82 are constructed for example from a material such as nylon, should be positioned between the circuit board 76 and the valve body 22 or base 23 in order to avoid malfunctions of the present valve through electrical short circuits or the like.

Where the present valve is utilized in conjunction with a system such as a boom mounted on the bed of a truck 12, it is necessary to provide electrical circuitry so as to enable the device to operate based on receipt of the above-discussed pendulum signals. As shown in Figure 5, there is included a simple electrical circuit for receiving and responding to the signals from the pendulum apparatus described above. This schematic diagram illus-

trates the electric motors 84, the rotary potentiometer 86, a relay coil 88, transistors 90, numerous resistors 92 having different values, and fuses 94. An additional relay 96 is provided for connecting the circuit to the hanging pendulum 18 or the like.

In the preferred embodiment of the circuit illustrated in Figure 5, the fuses 94 are GMA 1 Amp fast blow fuses. In addition, the potentiometer 86 is a 25K Ohm linear taper potentiometer. Alternatively, a potentiometer having resistance values ranging from 10K to 500K Ohms may be used. Finally, twelve Volt direct current motors are used in the preferred embodiment of the present invention.

The two resistors 92 indicated by R_B and R_C have been chosen due to the characteristic of the preferred embodiment, where full valve open is accomplished when the actuation cam 56 has rotated through approximately 90 degrees. As will be understood by those skilled in the art, different values of R_B and R_C may be utilized where a different turning angle is desired for full valve open. Similarly, the value of R_A may be varied in order to vary the reset center detent width. The center detent width or zone is in essence the electrical tolerance of the integrated circuit. If a voltage change of less than the magnitude of the detent zone value is received, the integrated circuit, used as a window comparator, will not produce any voltage differential to the motor. Only where the voltage differential presented to the window comparator is above the value of the center detent zone will the motor actuate in such a direction so as to attempt to match the voltage differential presented. For example, where a positive voltage differential is provided the motors, in response to this voltage differential, will rotate in a first direction, e.g. the clockwise direction. Alternatively, where a negative voltage potential is placed across the motors, the motors will respond by rotating in the opposite direction, e.g. the counter-clockwise direction. Naturally, where any of the electrical components are mounted to the portion of the printed circuit board which is directly adjacent to the mounting bracket 78, the valve body 22 or valve base 23, such electrical component should be mounted through non-conductive means such not-shown nylon screws or the like or metal fasteners fully insulated from the circuit.

Having fully described the structure, its operation will now be described in reference to the figures. As stated above, the preferred embodiment of the present invention is configured as a four way closed-center valve for controlling two hydraulic cylinders 14A and 14C arranged to position a boom mounting structure 16 on the bed of the truck 12. So configured, the two hydraulic cylinders 14A and C must be arranged so as to control movement of the boom mounting structure 16 in

either the truck forward or rearward direction (i.e. to the left and right in Figure 1) or the truck starboard and port directions (i.e. to the truck left and right).

Figure 6 illustrates the situation where it is desired to charge cylinder C while simultaneously discharging cylinder A. In order to accomplish this, the actuation cams 56 are rotated in a first direction (e.g. clockwise) so that the tapered actuation surfaces 62 gradually provide a downward force on two of the four piston heads 36. These forces are illustrated in Figure 6 by the downward broken line arrows. This downward force acts against the upward force of the biasing spring members 46 and unseats the plug member 40 from its corresponding seal member 42, thereby opening the corresponding passageway 24.

The upward force of the biasing spring members 46 maintains the other two pistons 26 of the four-way valve in the closed position as does the system fluid pressure which adds sealing force to the non-actuated pistons. The upward forces are illustrated in Figure 6 by the upward broken line arrows. As such, pressurized fluid is allowed to flow to cylinder C while fluid is allowed to return from cylinder A as illustrated by the solid line arrows in Figure 6. The rate at which fluid is provided to cylinder C and returned from cylinder A is controlled by the amount of rotation of the actuation cams 56. The gradual taper or slope of the actuation surface 62 permits excellent control of the amount of opening and closing of each of the pistons 26.

Alternatively, as illustrated in Figure 7, it may be desirable to provide pressurized fluid to cylinder A while permitting fluid to return from cylinder C. Similar to that described in connection with Figure 6 above, rotation of the actuation cams 56 in the opposite direction of that rotated in the situation illustrated in Figure 6 (e.g. counterclockwise), provides a downward force on the various pistons as illustrated by the broken arrows in Figure 7 so as to permit fluid to flow through the passageways and along the course illustrated by the solid line arrow. Again, regulation of fluid flow in this direction may be easily controlled due to the gradual taper or slope of the actuation surface 62 of the actuation cams 56, thereby permitting gradual opening and closing of the valve passageways 24 by sealing or unsealing the plug ends 40 of the pistons 26 from their corresponding seal members 42.

Claims

1. A valve for regulating fluid flow comprising a fluid supply port (28), a fluid return port (30), a pair of inlet-outlet ports (32,34), a plurality of passageways (24) providing communication



trates the electric motors 84, the rotary potentiometer 86, a relay coil 88, transistors 90, numerous resistors 92 having different values, and fuses 94. An additional relay 96 is provided for connecting the circuit to the hanging pendulum 18 or the like.

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The two resistors 92 indicated by R_B and R_C have been chosen due to the characteristic of the preferred embodiment, where full valve open is accomplished when the actuation cam 56 has rotated through approximately 90 degrees. As will be understood by those skilled in the art, different values of R_B and R_C may be utilized where a different turning angle is desired for full valve open. Similarly, the value of R_A may be varied in order to vary the reset center detent width. The center detent width or zone is in essence the electrical tolerance of the integrated circuit. If a voltage change of less than the magnitude of the detent zone value is received, the integrated circuit, used as a window comparator, will not produce any voltage differential to the motor. Only where the voltage differential presented to the window comparator is above the value of the center detent zone will the motor actuate in such a direction so as to attempt to match the voltage differential presented. For example, where a positive voltage differential is provided the motors, in response to this voltage differential, will rotate in a first direction, e.g. the clockwise direction. Alternatively, where a negative voltage potential is placed across the motors, the motors will respond by rotating in the opposite direction, e.g. the counter-clockwise direction. Naturally, where any of the electrical components are mounted to the portion of the printed circuit board which is directly adjacent to the mounting bracket 78, the valve body 22 or valve base 23, such electrical component should be mounted through non-conductive means such not-shown nylon screws or the like or metal fasteners fully insulated from the circuit.

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Alternatively, as illustrated in Figure 7, it may be desirable to provide pressurized fluid to cylinder A while permitting fluid to return from cylinder C. Similar to that described in connection with Figure 6 above, rotation of the actuation cams 56 in the opposite direction of that rotated in the situation illustrated in Figure 6 (e.g. counterclockwise), provides a downward force on the various pistons as illustrated by the broken arrows in Figure 7 so as to permit fluid to flow through the passageways and along the course illustrated by the solid line arrow. Again, regulation of fluid flow in this direction may be easily controlled due to the gradual taper or slope of the actuation surface 62 of the actuation cams 56, thereby permitting gradual opening and closing of the valve passageways 24 by sealing or unsealing the plug ends 40 of the pistons 26 from their corresponding seal members 42.

Claims

1. A valve for regulating fluid flow comprising a fluid supply port (28), a fluid return port (30), a pair of inlet-outlet ports (32,34), a plurality of passageways (24) providing communication



between the supply, return and inlet-outlet ports, a pair of piston means (26) axially movable in said passageways to regulate flow through the respective inlet-outlet ports (32,34), and a rotary cam member (56) rotatable about an axis parallel to the axial movement of the piston means (26) to control the position of the piston means to regulate fluid flow, characterised in that the rotary cam member (56) comprises an inclined wobble plate (66) whereby the respective piston means (26) are simultaneously gradually and equally movable in opposite directions responsive to rotation of said cam member (56).

2. A valve according to claim 1, wherein the rotary cam member (56) is rotatable by an electric drive motor (68) which simultaneously rotates a rotary potentiometer (72), the position of which is indicative of the position of the rotary cam member (56), the potentiometer being included in an electric control circuit for said motor.
3. A valve according to claim 2, wherein the electric control circuit is responsive to input signals to cause operation of said motor and is such that a signal voltage change of at least a predetermined value is required to initiate actuation of said motor.
4. A valve according to any preceding claim, wherein two pairs of piston means (26) are provided, each pair being controlled by a rotary cam member individual thereto, means (70) being provided for rotating the cam members (56) in synchronism with each other.
5. A valve according to claim 4, wherein a chain drive (70) is provided from an electric drive motor (68) to the cam members.
6. A valve according to claim 5, where appendant to claim 2, wherein two drive motors (68) are provided engaging the drive chain (70), said drive chain also engaging the rotary potentiometer (72).
7. A valve according to any preceding claim, wherein low friction means (62,64) are provided between the cam member (56) and the piston means (26).
8. A valve according to any preceding claim, wherein each piston means (26) has a frustoconical valve plug (40) thereon cooperable in a closed position with a seal (42) in the passageway in which the piston means is

mounted, each piston means being spring-biased towards its valve closed position and into engagement with said wobble plate.

- 5 9. A valve according to claim 1, wherein the ports are provided in a valve body (22) with the passageways (24) in the valve body comprising a first passageway communicating with the fluid supply port (28), a second passageway communicating with the fluid return port (30), third and fourth passageways each communicating with a respective one of said inlet-outlet ports (32,34), and fifth, sixth, seventh and eighth passageways substantially parallel one with the other, the fifth and sixth passageways providing communication between first and second passageways and third passageway, respectively, and said seventh and eighth passageways providing communication between said first and second passageways and said fourth passageway, respectively; wherein four of said piston means (26) are provided, one each in the fifth, sixth, seventh and eighth passageways; and wherein two rotary cam members (56) are provided, one controlling actuation of the piston means (26) in the fifth and seventh passageways and the other controlling actuation of the piston means in sixth and eighth passageways, means (72) being provided precisely to determine the amount of and direction of rotation of the cam members.
10. A valve according to claim 9, wherein the means to determine the amount and direction of rotation of the cam members comprises a rotary potentiometer (72).
11. A moveable boom system comprising a hydraulically positionable support (16), means (20) for sensing the orientation of the support, and the valve as claimed in any preceding claim, responsive to signals from said sensing means to control flow of hydraulic fluid to and from hydraulic cylinders (14a-d) for positioning the support.

Revendications

1. Vanne pour régler la circulation d'un fluide, comportant une lumière d'alimentation en fluide (28), une lumière de retour de fluide (30), une paire de lumières d'admission-refoulement (32, 34), une pluralité de passages (24) mettant en communication les lumières d'alimentation, de retour et d'admission-refoulement, une paire de moyens de piston (26) pouvant se déplacer dans une direction axiale dans lesdits passages pour régler respectivement l'écoulement



à travers les lumières d'admission-refoulement (32, 34) et un élément de came rotatif (56) pouvant être mis en rotation autour d'un axe parallèle au déplacement axial des moyens de piston (26) pour commander la position des moyens de piston afin de régler la circulation du fluide, caractérisé en ce que l'élément de came rotatif (56) comporte une plaque à flottement inclinée (66) au moyen de laquelle les moyens de piston respectifs (26) sont simultanément, graduellement et également mobiles dans des directions opposées en réponse à la rotation dudit élément de came (56).

2. Vanne selon la revendication 1, dans laquelle l'élément de came rotatif (56) peut être entraîné en rotation par un moteur d'entraînement électrique (68) qui entraîne en rotation simultanément un potentiomètre rotatif (72), dont la position donne une indication de la position de l'élément de came rotatif (56), le potentiomètre étant incorporé à un circuit de commande électrique dudit moteur.

3. Vanne selon la revendication 2, dans laquelle le circuit de commande électrique est sensible aux signaux d'entrée pour entraîner le fonctionnement dudit moteur et est tel qu'une variation de la tension du signal d'au moins une valeur prédéterminée est nécessaire pour initier l'actionnement dudit moteur.

4. Vanne selon l'une quelconque des revendications précédentes, dans laquelle deux paires de moyens de piston (26) sont prévues, chaque paire étant commandée par un élément de came rotatif qui lui est attaché individuellement, des moyens (70) étant prévus pour entraîner en rotation les éléments de came (56) en synchronisme les uns par rapport aux autres.

5. Vanne selon la revendication 4, dans laquelle un entraînement par chaîne (70) est prévu à partir du moteur d'entraînement électrique (68) vers les éléments de came.

6. Vanne selon la revendication 5, lorsqu'elle dépend de la revendication 2, dans laquelle deux moteurs d'entraînement (68) sont prévus en prise avec la chaîne d'entraînement (70), ladite chaîne d'entraînement étant aussi en prise avec le potentiomètre rotatif (72).

7. Vanne selon l'une quelconque des revendications précédentes, dans laquelle des moyens à frottement doux (62, 64) sont prévus entre les éléments de came (56) et les moyens de piston (26).

8. Vanne selon l'une quelconque des revendications précédentes, dans laquelle chaque moyen de piston (26) comporte un pointeau de vanne tronconique (40) qui coopère en position fermée avec un joint d'étanchéité (42) dans le passage dans lequel le moyen de piston est monté, chaque moyen de piston étant poussé par ressort vers sa position de vanne fermée et en prise avec ladite plaque flottante.

9. Vanne selon la revendication 1, dans laquelle les lumières sont prévues dans un corps de vanne (22) dans lequel sont ménagés des passages comportant un premier passage qui communique avec la lumière d'alimentation en fluide (28), un deuxième passage qui communique avec la lumière de retour de fluide (30), des troisième et quatrième passages communiquant chacun respectivement avec l'une desdites lumières d'admission-refoulement (32, 34) et des cinquième, sixième, septième et huitième passages sensiblement parallèles entre eux, les cinquième et sixième passages mettant en communication respectivement les premier et deuxième passages et le troisième passage, et lesdits septième et huitième passages mettant en communication respectivement lesdits premier et deuxième passages et ledit quatrième passage ; dans lequel quatre desdits moyens de piston (26) sont prévus chacun respectivement dans les cinquième, sixième, septième et huitième passages ; et dans lequel deux éléments de came rotatifs (56) sont prévus, l'un commandant l'actionnement des moyens de piston (26) dans les cinquième et septième passages et l'autre commandant l'actionnement des moyens de piston dans les sixième et huitième passages, des moyens (72) étant prévus avec précision pour déterminer l'étendue et le sens de la rotation des éléments de came.

10. Vanne selon la revendication 9, dans laquelle les moyens prévus pour déterminer l'étendue et le sens de la rotation des éléments de came comportent un potentiomètre rotatif (72).

11. Système de flèche mobile, comportant un support pouvant être positionné hydrauliquement (16), des moyens (20) pour détecter l'orientation du support, et la vanne telle que définie dans l'une quelconque des revendications pré-



cédentes, qui est sensible aux signaux provenant desdits moyens de détection pour commander la circulation du fluide hydraulique depuis et vers des vérins hydrauliques (14a à 14d) pour positionner le support.

Patentansprüche

1. Ventil zum Regulieren eines Fluidflusses, umfassend eine Fluidversorgungsöffnung (28) eine Fluidrückführungsöffnung (30), ein Paar Einlaß-Auslaß-öffnungen (32,34), eine Mehrzahl von Kanälen (24), die für eine Verbindung zwischen den Versorgungs-, Rückführungs- und Einlaß-Auslaß-öffnungen sorgen, ein Paar axial in den Kanälen bewegliche Kolbenmittel (26) zum Regulieren des Flusses durch die entsprechenden Einlaß-Auslaß-öffnungen (32,34), und ein um eine zur Achse der axialen Bewegung der Kolbenmittel (26) parallele Achse drehbares Drehnockenbauteil (56) zum Steuern der Position der Kolbenmittel um den Fluidfluß zu regulieren, dadurch gekennzeichnet, daß das Drehnockenbauteil (56) eine geneigte Taumelscheibe (66) aufweist, wodurch die entsprechenden Kolbenmittel (26) als Reaktion auf eine Drehung des Drehnockenbauteils (56) fortschreitend und gleichmäßig gleichzeitig in entgegengesetzte Richtungen beweglich sind. 5
2. Ventil nach Anspruch 1, dadurch gekennzeichnet, daß das Drehnockenbauteil (56) durch einen elektrischen Antriebsmotor (68) drehbar ist, der gleichzeitig ein Drehpotentiometer (72) dreht, dessen Position die Position des Drehnockenbauteils (56) anzeigt, wobei das Potentiometer Teil eines elektrischen Regelkreises zum Ansteuern des Motors ist. 10
3. Ventil nach Anspruch 2, dadurch gekennzeichnet, daß der elektrische Regelkreis auf Eingangssignale reagiert, um ein Arbeiten des Motors zu bewirken und so ausgelegt ist, daß eine Signalspannungsänderung von mindestens einem vorbestimmten Wert nötig ist, um eine Bewegung des Motors auszulösen. 15
4. Ventil nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß es zwei Paar Kolbenmittel (26) aufweist, wobei jedes Paar von einem ihm zugeordneten Drehnockenbauteil gesteuert wird, und wobei es Mittel (70) zum zueinander synchronen Drehen der Nockenbauteile (56) aufweist. 20
5. Ventil nach Anspruch 4, dadurch gekennzeichnet, daß es einen Kettentrieb (70) von einem elektrischen Antriebsmotor (68) zu den Nockenbauteilen aufweist. 25
6. Ventil nach Anspruch 5, sofern von Anspruch 2 abhängig, dadurch gekennzeichnet, daß es zwei mit der Antriebskette (70) in Eingriff stehende Antriebsmotoren (68) aufweist, wobei die Antriebskette auch mit dem Drehpotentiometer in Eingriff steht. 30
7. Ventil nach einem der vorhergehenden Ansprüche, gekennzeichnet durch Mittel mit niedriger Reibung (62,64) zwischen dem Nockenbauteil (56) und dem Kolbenmittel (26). 35
8. Ventil nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß auf jedem Kolbenmittel (26) ein kegelstumpfförmigen Ventilverschluß (40) angeordnet ist, der in einer geschlossenen Position mit einer Dichtung (42) im Kanal in dem das Kolbenmittel montiert ist, zusammenwirken kann, wobei jedes Kolbenmittel federnd in Richtung seiner "Ventil geschlossen" Position und in Eingriff mit der Taumelscheibe beaufschlagt ist. 40
9. Ventil nach Anspruch 1, dadurch gekennzeichnet, daß es die Öffnungen in einem Ventilkörper (22) aufweist, wobei die Kanäle (24) in dem Ventilkörper einen ersten, mit der Fluidversorgungsöffnung (28) in Verbindung stehenden Kanal, einen zweiten, mit der Fluidrückführungsöffnung (30) in Verbindung stehenden Kanal, dritte und vierte Kanäle, die jeweils mit einem entsprechenden der Einlaß-Auslaß-öffnungen (32,34) in Verbindung stehen, und im wesentlichen zueinander parallele fünfte, sechste, siebte und achte Kanäle umfassen, wobei der fünfte und sechste Kanal jeweils für eine Verbindung der ersten und zweiten Kanäle mit dem dritten Kanal und der siebte und achte Kanal jeweils für eine Verbindung des ersten und zweiten Kanals mit dem vierten Kanal sorgen, umfassen, daß es vier der Kolbenmittel(26) aufweist, jeweils eines in den fünften, sechsten, siebten und achten Kanälen, und daß es zwei Drehnockenbauteile (56) aufweist, wovon das eine die Betätigung der Kolbenmittel im fünften und siebten Kanal und das andere die Betätigung der Kolbenmittel im sechsten und achten Kanal steuert, wobei es Mittel zum präzisen Bestimmen des Betrags und der Richtung der Drehung der Nockenbauteile aufweist. 45



10. Ventil nach Anspruch 9, dadurch gekennzeichnet, daß die Mittel zum Bestimmen des Betrags und der Richtung der Drehung der Nockenbauteile ein Drehpotentiometer (72) aufweisen.

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11. Bewegliches Galgensystem, umfassend eine hydraulisch positionierbare Halterung (16), Sensoren (20) zum Ermitteln der Orientierung der Halterung, und das Ventil nach einem der vorhergehenden Ansprüche, das auf Signale der Sensoren reagiert, um den Fluß von Hydraulikflüssigkeit zu und von Hydraulikzylindern (14A-D) zum Positionieren der Halterung zu steuern.

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