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(54) **CONTROL VALVE FOR A HYDRAULIC MOTOR**

STEUERVENTIL EINES HYDROMOTORS

SOUPAPE DE COMMANDE DE MOTEUR HYDRAULIQUE

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(73) Proprietor: **Sauer-Danfoss Holding A/S**
6430 Nordborg (DK)

(72) Inventor: **DIXEN, Carl Christian**
DK-6470 Sydals (DK)

(74) Representative: **Knoblauch, Andreas, Dr.-Ing.**
Schlosserstrasse 23
60322 Frankfurt (DE)

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Description

[0001] The invention concerns a control valve for a hydraulic motor according to the preamble of claim 1.

[0002] Such a control valve is known from DE 44 13 216 C2.

[0003] Another control valve is known from DE 38 02 672 C2. The housing bore has a central annular pump groove connected with a pump connection, having on either side an annular motor groove connected with a motor connection and on the outside of this an annular tank groove connected with a tank connection. The slide has two annular distributor grooves, each arranged in the area of an annular motor groove, from which distributor grooves originate inflow pockets extending in the direction of the annular pump grooves for forming the inflow throttles and return pockets extending in the direction of the annular tank grooves for forming the return throttles. As the inflow throttles and return throttles belonging together close and open synchronously, a deadband occurs - based on the neutral position, in which the inflow pressure increases from a standby value to the required working pressure, and immediately after the deadband a control area occurs, in which both inflow throttle and return throttle are active. This is particularly important, when the motor, at least in one working direction, is loadable by an external force, for example by a crane boom, a lifting platform, a stacker truck etc., in connection with which the return throttle must prevent a too fast lowering.

[0004] However, the known control valve cannot be used, when in the return path a pressure-relief valve is provided, which opens on occurrence of the overpressure and must drain off pressure fluid for as long as it takes to relieve the overpressure. The reason is that in the neutral position of the control valve the return throttle is closed, so that the overpressure fluid cannot flow off. Exactly with the motors being of interest here, which can be loaded by an external force, however, pressure-relief valves are required. When, however, the return throttle is not completely closed, meaning that in the neutral position an opening remains, this leads to a reduction of the working area.

[0005] The task of the invention is to provide a control valve of the kind mentioned in the introduction, which permits a good control and the use of a pressure-relief valve at the same time.

[0006] According to the invention, this task is solved by the features of the characterizing clause of claim 1.

[0007] In this embodiment the return throttle has a characteristic, in which a displacement of the control valve from the neutral position initially causes a closing and subsequently an opening movement. Thus, in the neutral position, pressure fluid drained off by the pressure-relief valve can be lead off to the tank. In spite of this, the return throttle is fully active over the whole control area following the deadband. Since the slide has additional pockets with a limited axial length, which in the neutral position bypass the present connection between annular motor groove and annular tank groove, the normal return pocket is thus supplemented by an additional pocket. The desired characteristic thus occurs from the combined effect of both pockets.

[0008] It is expedient that the return throttle reaches the closed position at a distance from the end of the deadband. Across this distance the return throttle is therefore closed, so that the pressure increase on passing through the deadband is disturbed as little as possible.

[0009] It is also favourable that on moving out of the neutral position the return throttle first closes and then opens again, before the inflow throttle starts opening. As it is difficult to reach the tolerances of a simultaneous opening of return throttle and inflow throttle, the order mentioned is recommended, as the pressure increase does not stop until the inflow throttle is open. In many cases, however, it is also favourable to let the inflow throttle open before the return throttle.

[0010] Additionally it is advantageous that the additional pocket axially overlaps both a return pocket and a load pressure sensing opening and is displaced in relation to both in the circumferential direction. As both pockets and the load pressure sensing opening only need small dimensions, they can be arranged on the slide surface without difficulty.

[0011] In the following the invention is described on the basis of preferred embodiments on the basis of the drawings, showing:

Fig. 1 the opening characteristic of a return throttle and an inflow throttle with a control valve according to the invention

Fig. 2 a section through a constructive embodiment of such a control valve.

[0012] Fig. 1 shows the opening cross section F in mm^2 across the adjustment distance s in mm of the slide of a control valve. The first quadrant Q1 refers to a return throttle, the second quadrant Q2 refers to an inflow throttle. The latter is closed over a deadband c and then opens as shown by the curve Z. The curve for the return throttle, however, comprises two sections R1 and R2. The section R1 shows that the return throttle opens almost simultaneously with the inflow throttle, or rather, at a distance b from the neutral position, that is, temporally shortly before the inflow throttle. According to the section R2 the return throttle is open in the neutral position and closes after passing through a section a of the deadband, so that an adjustment distance section b-a remains, in which the return throttle is completely closed.

[0013] In the neutral position pressure fluid drained off by a pressure relief valve can therefore be lead off to the tank. The normal operation, which starts at the end of the deadband c, remains unchanged, as the return throttle is completely closed at the end of the dead-

band.

[0014] Fig. 2 shows a valve housing 1 with a housing bore 2, in which a slide 3 is axially adjustable. A displacement from the neutral position, for example to the right, as suggested by the arrow s, leads to the diagram in Fig. 1. The control valve made this way is connected in series with a compensation valve 4, which maintains a constant pressure drop at the inflow throttle of the control valve. In stead of this flow control, the control valve can also be part of a pressure control or have another desired function.

[0015] The housing bore 2 has a central annular pump groove 5 connected with a pump connection P. On both sides are annular motor grooves 6 and 7 connected with motor connections A and B, respectively. Further outwards are arranged annular tank grooves 8 and 9 connected with a tank connection T. The slide 3 is provided with two annular distributor grooves 10 and 11, which are arranged in the area of the annular motor grooves 6 and 7. From these originate inflow pockets 12 and 13 directed towards each other, which form inflow throttles 14 and 15 together with the annular pump groove 5. In the direction of the annular tank groove return pockets 16 and 17 are extending, which form return throttles 18 and 19 together with the annular tank grooves 8 and 9. Additional pockets 20 and 21 also belong to the return throttles, which pockets in the neutral position each bypass a connection 22 and 23 between the annular motor groove 6 and the annular tank groove 8 or the annular motor groove 7 and the annular tank groove 9, respectively. The additional pockets 20 and 21 can be provided once or multiple times. Most often, they are distributed evenly on the circumference.

[0016] Fig. 2 also shows the dead zone c, which the slide 3 must pass when leaving the neutral position, before the inflow pocket 12 or 13 reaches the annular pump groove 5. The distance b is the distance to be passed by the slide 3 when leaving the neutral position, before the return pocket 16 or 17 reaches the annular tank groove 8 or 9. The additional pockets 20, 21 can pass a distance a before getting inactive. For example, the values a, b and c can be as follows: a = 1.2 mm, b = 1.4 mm, c = 1.5 mm.

[0017] Further, load pressure sensing openings 24, 25, 26 and 27 are arranged on the slide surface, which, like the return pockets 16 and 17 and the additional pockets 20 and 21, only have a limited extension in the circumferential direction, so that the two pockets and one load pressure sensing opening can be arranged in axial overlapping.

[0018] The pressure-relief valve arranged in the return side motor path can be an independent spring loaded non-return valve, but can also be an additional function of another valve, for example a load retaining valve.

Claims

1. Control valve for a hydraulic motor with a slide (3) extending in a housing bore (2), the slide having on both sides of a neutral position working areas, each allocated to a working direction, in which working areas an inflow throttle (14, 15) and approximately at the same time also a return throttle (18, 19) open after passing through a deadband (c), the return throttle (18, 19) being open in the neutral position and closes on passing through the deadband (c), wherein the housing bore (2) has a central annular pump groove (5) connected with the pump connection (P), having on either side an annular motor groove (6, 7), each connected with a motor connection (A, B), and on the outside of this an annular tank groove (8, 9), each connected with a tank connection, the slide (3) has two annular distributor grooves (10, 11), each arranged in the area of an annular motor groove (6, 7), **characterised in that** from the distributor grooves originate inflow pockets (12, 13) extending in the direction of the annular pump groove (5) to form the inflow throttles (14, 15) and return pockets (16, 17) extending in the direction of the annular tank grooves (8, 9) to form part of the return throttles (18, 19), and that the slide (3) has additional pockets (20, 21) with a limited axial length and belonging to the return throttles (18, 19), which in the neutral position bypass the present connection (22, 23) between annular motor groove (6, 7) and annular tank groove (8, 9) such that the return throttle (18, 19) is open in the neutral position but closes on passing through the deadband.

2. Control valve according to claim 1, **characterised in that** the return throttle (18, 19) reaches the end position at a distance from the end of the deadband.

3. Control valve according to claim 1 or 2, **characterised in that** on moving out of the neutral position the return throttle (18, 19) first closes and then opens again, before the inflow throttle (14, 15) starts opening.

4. Control valve according to one of the claims 1 to 3, **characterised in that** the additional pocket (20,21) axially overlaps both a return pocket (16,17) and a load pressure sensing opening (24,26) and is displaced in relation to both in the circumferential direction.

Patentansprüche

1. Steuerventil für einen hydraulischen Motor, mit einem sich in einer Gehäusebohrung (2) erstreckenden Schieber (3), der zu beiden Seiten einer Neutralstellung je einer Arbeitsrichtung zugeordnete Ar-

beitsbereiche aufweist, in denen nach Durchlaufen eines Totbandes (c) eine Zuflußdrossel (14, 15) und etwa gleichzeitig auch eine Rückflußdrossel (18, 19) öffnet, wobei die Rückflußdrossel (18, 19) in der Neutralstellung geöffnet ist und beim Durchlaufen des Totbandes (c) schließt, wobei die Gehäusebohrung (2) eine mittlere, mit einem Pumpenanschluß (P) verbundene Pumpen-Ringnut (5) aufweist, die auf beiden Seiten eine Motor-Ringnut (6, 7), die jeweils mit einem Motoranschluß (A, B) verbunden ist und außerhalb von dieser eine Behälter-Ringnut (8, 9) aufweist, die jeweils mit einem Behälter-Anschluß verbunden ist, wobei der Schieber (3) zwei Verteiler-Ringnuten (10, 11) aufweist, die jeweils in dem Bereich einer Motor-Ringnut (6, 7) angeordnet sind, **dadurch gekennzeichnet, daß** von den Verteilernuten zur Bildung der Zuflußdrosseln (14, 15) sich in Richtung auf die Pumpen-Ringnut (5) erstreckende Zuflußtaschen (12, 13) und zur Bildung eines Teils der Rückflußdrosseln (18, 19) sich in Richtung auf die Behälter-Ringnut (8, 9) erstrekkende Rückflußtaschen (16, 17) ausgehen, und daß der Schieber (3) Zusatztaschen (20, 21) von begrenzter axialer Länge aufweist, die zu den Rückflußdrosseln (18, 19) gehören, wobei die Zusatztaschen (20, 21) in der Neutralstellung den vorhandenen Bund (22, 23) zwischen Motor-Ringnut (6, 7) und Behälter-Ringnut (8, 9) überbrücken, so daß die Rückflußdrossel (18, 19) in der Neutralstellung geöffnet ist, aber beim Durchlaufen des Totbandes schließt.

2. Steuerventil nach Anspruch 1, **dadurch gekennzeichnet, daß** die Rückflußdrossel (18, 19) die Schließstellung mit einem Abstand vom Ende des Totbandes erreicht.

3. Steuerventil nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** bei der Bewegung aus der Neutralstellung heraus die Rückflußdrossel (18, 19) erst schließt und dann wieder öffnet, bevor die Zuflußdrossel (14, 15) zu öffnen beginnt.

4. Steuerventil nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß** die Zusatztasche (20, 21) sowohl eine Rückflußtasche (16, 17) als auch eine Lastdruckfühlöffnung (24, 26) axial überlappt und gegenüber beiden in Umfangsrichtung versetzt ist.

Revendications

1. Soupape de commande pour un moteur hydraulique avec un tiroir (3) s'étendant dans un alésage de logement (2), le tiroir comportant des zones de travail de deux côtés d'une position neutre, chacune étant affectée à une direction de travail, zones de travail dans lesquelles un étrangleur d'arrivée (14,15) et approximativement en même temps également un étrangleur de retour (18,19) sont ouverts après avoir traversé une bande morte (c), l'étrangleur de retour (18,19) étant ouvert dans la position neutre et se ferme lors de la traversée de la bande morte (c), soupape de commande dans laquelle l'alésage de logement (2) présente une gorge de pompe annulaire centrale (5) connectée au raccord de pompe (P), comportant de chaque côté une gorge de moteur annulaire (6,7), chacune étant raccordée au raccordement moteur (A,B), et sur l'extérieur de celui-ci, une gorge de réservoir annulaire (8,9), chacune étant raccordée à un raccord de réservoir, le tiroir (3) présente deux gorges de distributeur annulaires (10,11), chacune étant disposée dans la zone d'une gorge de moteur annulaire (6,7), **caractérisée en ce qu'**à partir des gorges de distributeur sont créées des poches d'arrivée (12,13) s'étendant dans la direction de la gorge de pompe annulaire (5) pour former les étrangleurs d'entrée (14,15) et des poches de retour (16,17) s'étendant dans la direction des gorges de réservoir annulaire (8,9) pour former une partie des étrangleurs de retour (18,19), et **en ce que** le tiroir (3) comporte des poches supplémentaires (20,21) avec une longueur axiale limitée et appartenant aux étrangleurs de retour (18,19) qui, dans la position neutre, évitent le présent raccordement (22,23) entre la gorge de moteur annulaire (6,7) et la gorge de réservoir annulaire (8,9) de telle sorte que l'étrangleur de retour (18,19) est ouvert dans la position neutre, mais se ferme en traversant la bande morte.

2. Soupape de commande selon la revendication 1, **caractérisée en ce que** l'étrangleur de retour (18,19) atteint la position d'extrémité à une certaine distance à partir de l'extrémité de la bande morte.

3. Soupape de commande selon la revendication 1 ou 2, **caractérisée en ce qu'**en quittant la position neutre, l'étrangleur de retour (18,19) se ferme d'abord, puis s'ouvre de nouveau, avant que l'étrangleur d'arrivée (14,15) ne commence à s'ouvrir.

4. Soupape de commande selon l'une des revendications 1 à 3, **caractérisée en ce que** la poche supplémentaire (20, 21), chevauche axialement à la fois une poche de retour (16,17) et une ouverture de détection de pression de charge (24,26) et est déplacée par rapport aux deux dans la direction circonférentielle.

Fig.1

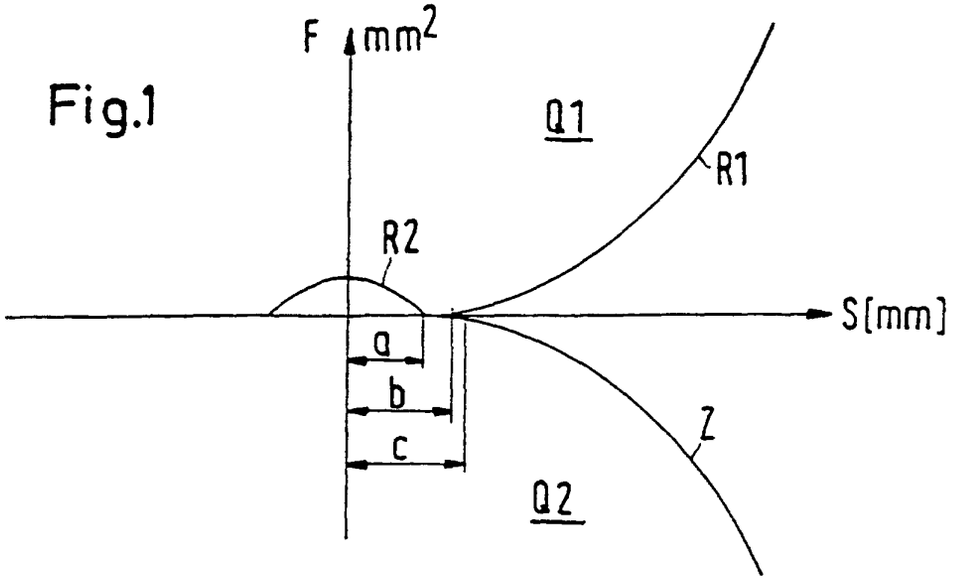
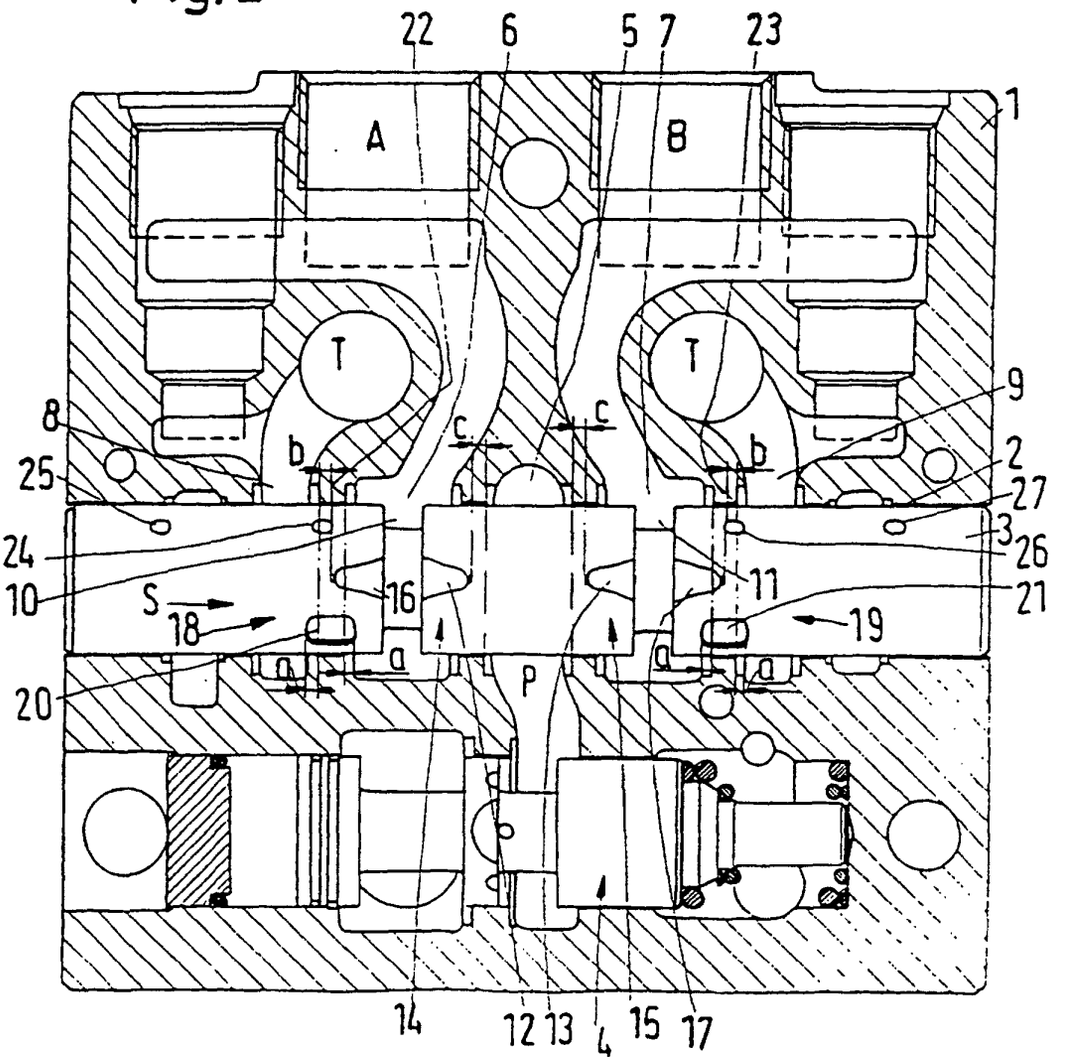

F
mm2
Q1
R1
R2
S[mm]
a
b
c
Z
Q2

Fig. 2


22
6
5
7
23
1
A
B
T
T
9
8
c
c
b
b
2
25
27
24
3
26
10
S
16
11
21
18
19
a
a
a
a
20
P
14
12
13
4
15
17