Device at a Hydraulic Cylinder

The invention refers to a device at a hydraulic cylinder (1) comprising control bands (15, 18) arranged on piston (2) and piston rod (3), which constitute the controls for the piston and the piston rod in the hydraulic cylinder. The control band (18) for the piston (2) is arranged at the end of the piston next the piston side of the hydraulic cylinder (1) and at least one stray flux channel (20) is provided from the mentioned piston side to discharge at a place past the opposite end of the control band from the piston side of the hydraulic cylinder (1), preferably for connection with its casing surface.
DEVICE AT A HYDRAULIC CYLINDER

Technical area
The present invention relates to a device at a hydraulic cylinder according to the ingress of Claim 1.

Background of the invention
During operation of hydraulic systems, especially within the agricultural machine area, several series-linked hydraulic cylinders are sometimes used to effect simultaneous movements in different parts or sections of the agricultural machine. In such a system, also called a master-slave system, where the piston rod side of a hydraulic cylinder is linked to the piston side of the next hydraulic cylinder etc., problems can arise if all the activated sides in the hydraulic cylinders cannot reach their end position practically simultaneously, i.e. there must be a stray flux to bring about that when for example the piston of the first hydraulic cylinder reaches its end position the second hydraulic cylinder, which has not yet reached its end position, is then also moved to its end position via stray flux from the first hydraulic cylinder. A similar previously known hydraulic cylinder, which is used in a master-slave system, is shown in Fig. 1, where the piston can deviate when the control bands for the piston and the piston rod in the end position come very close to each other and a so-called load effect can arise when the cylinder is carrying a high load or when in certain cases the piston through the often vibratory movement of the machine in the field may orientate itself obliquely and cause the piston to cut into the cylinder pipe.

Aim of the invention
The aim of the present invention is to achieve a device at a hydraulic cylinder that eliminates the above disadvantages.

The aim is achieved through a device which has been given the characteristics presented in Claim 1.
Preferred embodiments of the invention have been given the characteristics presented in the sub-claims.

**Summary of the invention**

By displacing the control band on the piston in accordance with the invention, i.e. at the end of the piston next the piston side of the hydraulic cylinder instead of beside the piston rod, much more reliable and stable control of the piston and piston rod in the cylinder is achieved, where the controls are no longer arranged close to each other, whereby more reliable control of the piston and piston rod in the hydraulic cylinder is achieved. Through in addition boring a control channel from the piston side past the control band on the piston, a stray flux can stream past the control band and into the opening for hydraulic fluid on the piston rod side so that all hydraulic cylinders that are linked together can reach their end position after the first piston in the assemblage has reached its end position. The stray flux channel also has the advantage that the magnitude of the stray flux can be controlled by the size of the channel. This decreases wear on the main seal since the abrasive oil jet at the stray flux channel can be restricted. With better control of the piston, wear on the main seal is also reduced through the play between piston and cylinder pipe becoming more exact since the piston is not brought to deviate.

**Drawing summary**

The invention is described in more detail in the following with reference to the attached drawings which show preferred embodiments:

Fig. 1 shows a partial cross-section through a previously known hydraulic cylinder for an agricultural machine.

Fig. 2 shows a view similar to that in Fig. 1 of a device according to the invention at a hydraulic cylinder.

Fig. 2a shows a detail of Fig. 2 of another embodiment of the stray flux channel.

Fig. 3 shows a perspective view of an agricultural machine, more precisely a harrow, which is provided with hydraulic cylinders with the device according to the invention.
Fig. 4 shows a linkage diagram of the hydraulic cylinders in the agricultural machine in Fig. 3.

Fig. 5 shows a perspective view of an agricultural machine, more precisely a cultivator, which is provided with hydraulic cylinders with the device according to the invention.

Fig. 6 shows a linkage diagram of the hydraulic cylinders in the agricultural machine in Fig. 5.

Description of a preferred embodiment

Fig. 2 shows a device according to the invention at a hydraulic cylinder 1 in an agricultural machine, for example a harrow or a cultivator according to Fig. 3 and Fig. 5 respectively. The hydraulic cylinder 1 has a piston 2 and a piston rod 3 fastened at the piston. The piston 2 is displaceable along a cylinder pipe 4 and a cylinder end-part 5 is screwed fast at the top end 6 of the cylinder pipe 4. A port 8 for hydraulic oil is arranged at end 7 of the cylinder. The piston 2 has an external annular part 9, which at 10 is welded fast at an extension 11 of the piston rod 3. A sealing ring 12 is arranged to prevent internal stray flux which can arise through the weld 10. A sealing ring 13 is arranged between the cylinder end-part 5 and the top end 6 of the cylinder pipe 4.

An annular wiping seal 14 is arranged in a recess in the opposite end of the cylinder end-part 5 from the piston 2, intended for wiping against the piston rod 3. An annular control band 15 for the piston rod 3 is arranged in an annular recess at the end of the cylinder end-part 5 next the piston 2 and makes contact with the piston rod 3. Between the wiping seal 14 and the annular control band 15 an annular Y-seal 16 is arranged in an annular recess in the cylinder end-part 5.

An annular main seal 17 is arranged in a recess in the end of the piston 2 next the piston rod side intended to act as a cylinder ring against the cylinder wall. An annular control band 18 for the piston 2 is arranged in an annular recess in the piston 2 at the end of the piston next the piston side and makes contact with the wall of the cylinder pipe 4. Between the main seal 17 and the annular control band 18 an annular Y-seal or stray flux seal 19 is arranged
in an annular recess in the cylinder wall. At least one bypassing stray flux channel 20 is created in the piston from the piston side of the hydraulic cylinder and runs around the control band 18 for the piston 2 and discharges into the casing surface 21 of the piston, or more precisely at the side of the stray flux seal 19 next the cylinder pipe 4. Fig. 2a shows a variant where the stray flux channel 20 discharges into the opposite side of the stray flux seal 19 from the cylinder pipe 4. The stray flux seal 19 is so placed in a recess in the piston that it acts as a back valve where stray flux from the stray flux channel 20 is only permitted from the piston side towards the port 8. The cylinder pipe 4 has a convexity 22 in connection with the port 8 in order to create a space, which together with a concavity 23 in the casing surface 21 of the piston forms a connection from the piston side of the hydraulic cylinder 1 via channel 20 and the convexity and concavity 22 and 23 resp. to the port 8. This connection is open when the piston is in or at the end position, as shown in Fig. 2, and is closed during the rest of the movement of the piston 2 in the hydraulic cylinder 1. The reason for creating this connection is to transfer the hydraulic pressure on the piston side of the hydraulic piston 1 to the piston side of the next series-linked piston.

By so placing the control band 18 for the piston at the end of the piston 2 next the piston side of the hydraulic cylinder, the outcome is that both control bands 18 and 15 come as far away as possible from each other, especially in the position where the piston has reached its end position towards the end 7 of the cylinder. It is thereby ensured that the piston 2 and the piston rod 3 run more reliably and the risk of deviation of the piston 2 and the piston rod 3 decreases.

Fig. 4 shows a hydraulic linkage diagram where three hydraulic cylinders 1, 12 and 13 are linked in series and so as to interact in a master-slave linkage. The hydraulic cylinders are of the type shown in Fig. 2 where a stray flux, such as described above with reference to the channel 20, is created between the hydraulic cylinders. Fig. 3 shows an agricultural machine, more precisely a harrow 30, where the hydraulic cylinders have been linked in series according to the linkage diagram shown in Fig. 4. A hydraulic tube 31 linked to the hydraulic system of a not shown tractor leads to the piston side of the first hydraulic
cylinder $1_1$ and from the piston rod side of this via a tube $32$ to the piston side of the next hydraulic cylinder $1_2$. From the piston rod side of the hydraulic cylinder $1_2$ a tube $33$ leads to the piston side of the next hydraulic cylinder $1_3$ and from the piston rod side of this a tube $34$ leads back to the hydraulic system of the tractor.

Fig. 7 shows a hydraulic linkage diagram where five hydraulic cylinders $1_4, 1_5, 1_6, 1_7$ and $1_8$ are linked in series and so as to interact in a master-slave linkage. The hydraulic cylinders are of the type shown in Fig. 2 where a stray flux, such as described above with reference to the channel $20$, is created between the hydraulic cylinders. Fig. 5 shows an agricultural machine, more precisely a cultivator $40$, where the hydraulic cylinders have been linked in series according to the linkage diagram shown in Fig. 6. A hydraulic tube $41$ from the hydraulic system of a not shown tractor leads via branch tubes $42$ and $43$ to the piston sides of the first parallel-linked hydraulic cylinders $1_4$ and $1_5$, resp., and from the piston rod sides of these via tubes $44$ and $45$ to the piston sides of the next hydraulic cylinders $1_6$ and $1_7$. From the piston rod sides of the hydraulic cylinders $1_6$ and $1_7$ run two branch tubes $46$ and $47$, which are combined together into one tube $48$, which is connected to the piston side of the next hydraulic cylinder $1_8$ and from the piston rod side of this a tube $49$ leads back to the hydraulic system of the tractor. As shown in Fig. 6, the cylinder volume in cylinder $1_8$ is equal to the cylinder volume of the hydraulic cylinders $1_6$ and $1_7$ since the hydraulic flux through each one of the branch tubes $42$ - $47$ is halved in the hydraulic cylinders $1_4$ - $1_7$ in relation to the hydraulic pressure in the inflow $48$ to the hydraulic cylinder $1_8$.

The invention does not have to be applied on all the cylinders in a circuit but only those that are exposed to high loads, for example the hydraulic cylinder $1_2$ in the harrow in Fig. 3 and the hydraulic cylinders $1_4$ and $1_5$ in the cultivator in Fig. 5. These hydraulic cylinders bear almost the entire machine weight of the resp. machine in the transport position.

Even though with the embodiment described above a channel $20$ is shown bypassing the control band $18$ on the piston $2$, it is possible within the framework of the attached claims to create two or more channels around the periphery of the piston. This can be
advantageous in ensuring operation if one channel becomes blocked by dirt or other particles.

The invention can naturally also be applied on agricultural machines other than those shown in the drawings.

Although one embodiment of the invention has been described above, the device according to the invention can be modified within the framework of the attached claims.
CLAIMS

1. Device at a hydraulic cylinder (1) comprising control bands (15, 18) arranged on piston (2) and piston rod (3), which bands constitute the controls for the piston and the piston rod in the hydraulic cylinder, characterised in that the control band (18) for the piston (2) is arranged at the end of the piston next the piston side of the hydraulic cylinder (1) and at least one stray flux channel (20) is provided from said piston side to discharge at a place past the opposite end of the control band from the piston side of the hydraulic cylinder (1), preferably for connection with its casing surface.

2. Device according to Claim 1, characterised in that the control band (18) for the piston (2) is arranged directly beside the end of the piston next the piston side of the hydraulic cylinder (1).

3. Device according to Claim 1 or 2, characterised in that a stray flux seal (19), which is of such a nature that it can be brought at a predetermined pressure to discharge flux to a port (8) for hydraulic fluid, is arranged on the side of the control band (18) for the piston (2) that is next the piston rod (3).

4. Device according to Claim 3, characterised in that the mentioned stray flux channel (20) discharges at the side of the stray flux seal (19) next the cylinder pipe (4).

5. Device according to Claim 3, characterised in that the mentioned stray flux channel (20) discharges at the opposite side of the stray flux seal (19) from the cylinder pipe (4).

6. Device according to any one of Claims 4 - 5, characterised in that the stray flux channel (20) at the mentioned stray flux seal (19), when the piston (2) has reached
or almost reached its end position in the piston rod side of the hydraulic cylinder (1), is connected to the connection port (8) of the piston rod side.

7. Device according to any one of Claims 4 - 6, characterised in that the seal (19) is adapted at a predetermined pressure to allow stray flux from the piston side of the hydraulic cylinder (1) to the piston rod side, when the piston (2) has reached or almost reached its end position on the piston rod side of the hydraulic cylinder (1).

8. Device according to any one of Claims 1 - 4, characterised in that the device is arranged in a predetermined number of hydraulic cylinders (1₁ - 1₃, 1₄ - 1₈) of an agricultural machine (30 and 40), which hydraulic cylinders are co-linked into a hydraulic cylinder system according to the master-slave principle.
# INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

**IPC:** see extra sheet  
According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC: F15B, F16J**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE, DK, FI, NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

### EPO-INTERNAL, WPI DATA, PAJ

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>DE 2251202 A (AKTIEBOLAGET BAHCO VERKTYG), 10 May 1973 (10.05.1973), page 2, last paragraph; page 3, second paragraph</td>
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Further documents are listed in the continuation of Box C.  
See patent family annex.

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F15B 15/14 (2006.01)
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