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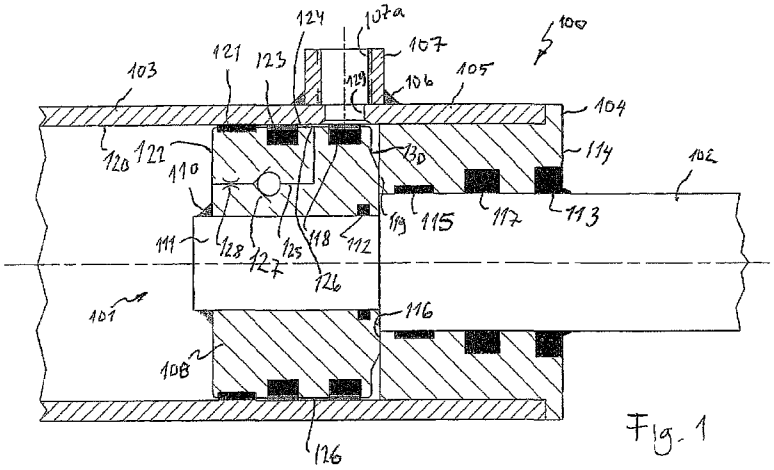

Fig. 1

(57) Abstract: The invention refers to a device at a hydraulic cylinder (100, 200, 300, 400) comprising a cylinder (103, 203, 303, 403), a piston (101, 201, 301, 401), a piston rod (102, 202, 302, 402), control bands (121, 221, 321, 421 and 115, 215, 315, 415) arranged along the casing surface of the piston (126, 226, 326, 426) and along the piston rod and two sealings (118, 218, 318, 418; 123, 223, 323, 423) arranged along the casing surface of the piston, whereby a stray flux channel (125, 225, 325, 425) is provided through the piston extending from a point on the casing surface of the piston leading to a point being in contact with the piston side of the cylinder. A check valve (127, 227, 327, 427) is arranged in direct connection with said stray flux channel (125, 225, 325, 425) which extends from said point on the casing surface of the piston (126, 226, 326, 426) between and at a predetermined distance from said sealings (118, 218, 318, 418; 123, 223, 323, 423) being of the similar kind and located on the piston rod side of said control band.

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DEVICE AT A HYDRAULIC CYLINDER

Technical area

The present invention refers to a device at a hydraulic cylinder according to the pre-characterising portion of Claim 1.

Background to the invention

Such a device at a hydraulic cylinder is known through SE-A-530 030 which displays a leakage through a leakage seal in the form of a Y-seal. This Y-seal, which is connected directly at the cylinder wall, is not optimal since its wear is affected by the piston movement and the seal then loses its sealing function so that it can begin to leak unintentionally at the side of the piston.

During operation of hydraulic systems, especially within the agricultural machine area, several hydraulic cylinders coupled in series are sometimes used to bring about 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 coupled 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 mainly simultaneously, i.e. there must be a leakage flux that means that when for example the piston of the first hydraulic cylinder has reached its end position the next hydraulic cylinder, which has at that time still not reached its end position, via the leakage flux from the first hydraulic cylinder is also brought to its end position. Previously known hydraulic cylinders, which are used in a master-slave system, are shown and described in the above-mentioned SE-A-530 030 and also in SE-A-441 117, wherein a check valve in a duct is connected to a ring-shaped duct with an O-ring seal. With this design the piston must be well fitted in the cylinder without any free play therebetween that can cause unintentional leakage. Therefore this solution does not appear to be practically applicable.

Aim of the invention

The aim of the present invention is to achieve a device at a hydraulic cylinder, which efficiently and simply brings about a reliable leakage flux and thereby an efficient master-slave system.

The aim is achieved through a device that 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 arranging in direct connection to the leakage duct a separate check valve of known type, i.e. a check valve that is separated from the two seals on the jacket surface of the piston, with a possible separate choke in the leakage duct or at the cylinder wall in accordance with the invention very secure and stable control is achieved of piston and piston rod in the cylinder through guide bands and seals co-acting on the jacket surface of the piston. Through the leakage seal at the piston wall being omitted there is accordingly space for several seals that have the task of sealing between cylinder wall and cylinder and also giving the piston more secure guidance in the cylinder so that so-called 'box effects' at movement of the piston in the cylinder is eliminated. This has been achieved through the additional seal of stable type having been arranged between leakage duct and guide band. The two seals on either side of the leakage duct orifice on the jacket surface of the piston are of type so-called compact seals or low friction seals. Through adjusting the spring resistance of the check valve in the master-slave-coupled hydraulic cylinders, a leakage flux can flow past the guide band that is arranged furthest out on the piston, and into the orifice for hydraulic fluid on the piston rod side so that all hydraulic cylinders that are coupled together can reach their end positions after the first piston in the coupling has reached its end position. The arrangement of the leakage flux duct also has the advantage that the magnitude of the leakage flux can be controlled by the size of the duct. This decreases wear on the main seal since the cutting jet of oil at the leakage groove can be restricted. With better control of the piston wear on the main seals is also decreased through the free play between piston and cylinder being more exact when the piston is not influenced to deviate. The device according to the invention can

also be manufactured in a repeatable process with better tolerances and at a lower cost. The integrity of the check valve is not critical, since it only seals the beginning of the "minus" movement (commonly only up to 10 mm) and does not affect the function of the cylinder during the remainder of the stroke length.

Drawings summary

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

Fig. 1 shows a partial longitudinal section view of a first embodiment of a device according to the invention.

Fig. 2 shows a partial longitudinal section view of a second embodiment through a hydraulic cylinder with a device according to the invention.

Fig. 3 shows a partial longitudinal section view of a third embodiment through a hydraulic cylinder with a device according to the invention.

Fig. 4 shows a partial longitudinal section view of a fourth embodiment through a hydraulic cylinder with a device according to the invention.

Detailed description of preferred embodiments

Fig. 1 shows a first embodiment of a device according to the invention at a hydraulic cylinder 100 at an agricultural implement, for example a harrow or a cultivator of a type shown in SE-A-530 030. The hydraulic cylinder 100 has a piston 101 and fastened at the piston a piston rod 102. The piston 101 is moveable along a cylinder 103 and a cylinder end part 104 is fastened, preferably screwed fast, at the end 105 of the cylinder 103. At the end 105 of the cylinder is a portion 107 with a port 107a for hydraulic oil, preferably fixed welded at 106. The piston 101 comprises a ring-shaped, outer part 108, which at 110 is welded fast at an elongation 111 of the piston rod 102. The piston 101 is accordingly comprised of the ring-shaped part 108 and the elongation 111 of the piston rod 102. A sealing ring 112 is adapted to prevent internal leakage that can arise through the weld 110. A ring-shaped wiper seal 113 is arranged in a recess in the end 114 of the cylinder end part 104 facing away from the piston 101, which seal 113 is intended for wiping against the piston rod 102. A ring-shaped guide band 115 for the piston rod 102 is arranged in a ring-shaped recess at the circular surface 116 of the cylinder end part 104 facing the piston 101 and lies in contact with the piston rod 102. Between the wiper seal 113 and the ring-shaped guide band 115 an additional seal 117 is arranged in a ring-shaped recess in the cylinder end part 104.

A first ring-shaped seal 118 is arranged in a recess at the end 119 of the piston 101 facing the piston rod side and is intended to function as a piston ring against the cylinder wall 120. A ring-shaped guide band 121 for the piston 101 is arranged in a ring-shaped recess in the ring-shaped part 108 of the piston 101 at the piston surface 122 facing away from the piston rod and lies in contact with the inner wall 120 of the cylinder 103. A second ring-shaped seal 123 is arranged in a ring-shaped recess in the cylinder between the first seal 118 and the guide band 121 . The diameter of the piston 101 is slightly less than the internal diameter of the cylinder 103 so that a gap 124 is formed between these. The guide band 121 and the seals 118 and 123 form guide and seal between the piston 101 and the cylinder 103.

At least one bypassing leakage duct 125 is fashioned in the piston from the piston jacket surface 126 between the first and the second seal 118 and 123 respectively and runs past the guide band 121 for the piston 101 and discharges at the surface 122 facing away from the piston rod. A check valve 127 of known type with a spring-loaded ball or similar and possibly a choke 128 is arranged in the leakage duct 125.

The port 107a for hydraulic oil is connected to a connecting orifice 129 through the wall of the cylinder 103 so that when the piston 101 is disposed in the position shown in Fig. 1 hydraulic oil can be brought to flow through the leakage duct 125 via the check valve 127 into the gap 124 between the jacket surface 126 of the piston 101 and the inner wall 120 of the cylinder 103 and from there on through the orifice 129 into the port 107. The orifice 129 extends on the piston rod side, when piston has almost reached its end position, to a ring-shaped recess 130 on the piston rod side of the piston 101, whereby initial movement of the piston in the direction of its piston side is facilitated. From the port 107 a not shown conduit leads to the piston side of the next hydraulic cylinder or back to the tractor. The orifice 129 can be designed so that the leakage duct 125, when the piston has almost reached its end position, discharges directly into this.

The function of the hydraulic cylinder with respect to the leakage flux past the check valve 127 and the interaction with the seals 118 and 123 will be explained in more detail here. When the piston 101 is to move to the left from the position shown in Fig. 1, hydraulic oil flows in through the port 107a and presses against the surface 130 on the piston rod side 119 of the piston 101. The seal 123 and the check valve 127 prevent flow towards the piston side ofthe piston 101. After the piston 101 has moved a few millimetres in the cylinder 103 the flux is prevented by the seal 118 instead. This means that the check valve 127 is no longer

subjected to oil pressure from the piston rod side of the piston 101 but that during the continued stroke of the piston 101 to the left shown in Fig. 1 the seal 118 tightens against the piston side of the piston 101. When instead the piston moves to the right in Fig. 1 and approaches the end position where the piston 101 comes to abut against the cylinder end surface 116 the seal 118 slides over the orifice 129 in the cylinder wall so that the gap 124 beside the mouth of the leakage duct 125 connects to the opening 129. A leakage flux of hydraulic oil can then due to the hydraulic pressure on the piston side of the piston 101 pass by the check valve 127 and through the port 107a to the piston side of the piston of the next cylinder so as to achieve an optimal master-slave action, where all hydraulic cylinders in the system reach their end positions. It should be pointed out here that this description of the piston's movement at the beginning and end of the stroke in the vicinity of the piston rod end of the cylinder is similar with regard to the other below-described embodiments of the device according to the invention at a hydraulic cylinder.

Placing the guide band 121 for the piston 101 at the end of the piston facing the piston side of the hydraulic cylinder causes both the guide bands 121 and 115 to come as far from each other as possible, especially in the position where the piston has reached its end position against the end surface 116 of the cylinder. Through this it is ensured that the piston 101 and piston rod 102 run more securely and the risk of seizing of the piston 101 and the piston rod 102 is decreased.

Fig. 2 shows a second embodiment of a device according to the invention at a hydraulic cylinder 200 at an agricultural implement, for example a harrow or a cultivator of a type that is shown in SE 530 030. The hydraulic cylinder 200 has a piston 201 and fastened at the piston a piston rod 202. The piston 201 is moveable along a cylinder 203 and a cylinder end part 204 is fastened, preferably screwed fast, at the end 205 of the cylinder 203. At the cylinder end 205 a portion 207 with a port 207a for hydraulic oil is preferably welded fast at 206. The piston 201 comprises a ring-shaped, outer part 208, which at 210 is welded fast at an elongation 211 of the piston rod 202. The piston 201 is accordingly comprised of the ring-shaped part 208 and the elongation 211 of the piston rod 202. A sealing ring 212 is adapted to prevent internal leakage that can arise through the weld 210.

A ring-shaped wiper seal 213 is arranged in a recess in the end 214 of the cylinder end part 204 facing away from the piston 201, which seal 213 is intended for wiping against the piston rod 202. A ring-shaped guide band 215 for the piston rod 202 is arranged in a ring-shaped recess at the circular surface 216 of the cylinder end part 204 facing the piston 201

and lies in contact with the piston rod 202. Between the wiper seal 213 and the ring-shaped guide band 215 an additional seal 217 is arranged in a ring-shaped recess in the cylinder end part 204.

A first ring-shaped seal 218 is arranged in a recess at the end 219 of the piston 201 facing the piston rod side and is intended to function as a piston ring against the cylinder wall 220. A ring-shaped guide band 221 for the piston 201 is arranged in a ring-shaped recess in the ring-shaped part 208 of the piston 201 at the piston surface 222 facing away from the piston rod and lies in contact with the inner wall 220 of the cylinder 203. A second ring-shaped seal 223 is arranged in a ring-shaped recess in the cylinder between the first seal 218 and the guide band 221. The diameter of the piston 201 is slightly less than the internal diameter of the cylinder 203 so that a gap 224 is formed between these. The guide band 221 and the seals 218 and 223 form guide and seal between the piston 201 and the cylinder 203.

At least one bypassing leakage duct 225 is fashioned in the piston from the piston jacket surface 226 between the first and the second seal 218 and 223 respectively and runs past the guide band 221 for the piston 201 and discharges at the surface 222 facing away from the piston rod. A check valve 227 of known type with a spring-loaded ball or similar and possibly a choke 228 is arranged in the leakage duct 225.

The port 207a for hydraulic oil is via a widened space 207b connected to two connecting orifices 229a and 229b through the wall of the cylinder 203 so that when the piston 201 is disposed in the position shown in Fig. 2 hydraulic oil can be brought to flow through the leakage duct 225 via the check valve 227 into the gap 224 between the jacket surface 226 of the piston 201 and the inner wall 220 of the cylinder 203 and from there on through the orifice 229a, through the orifice 229b and into the port 207a. The orifice 229b is on the piston rod side, when piston has almost reached its end position, connected to a ring-shaped recess 230 on the piston rod side of the piston 201, whereby initial movement of the piston in the direction of its piston side is facilitated. From the port 207a a not shown conduit leads to the piston side of the next hydraulic cylinder or back to the tractor. The orifice 229a can be designed so that the leakage duct 225, when the piston has almost reached its end position, discharges directly into this.

Placing the guide band 221 for the piston 201 at the end of the piston facing the piston side of the hydraulic cylinder causes both the guide bands 221 and 215 to come as far from each other as possible, especially in the position where the piston has reached its end position

against the end surface 216 of the cylinder. Through this it is ensured that the piston 201 and piston rod 202 run more securely and the risk of seizing of the piston 201 and the piston rod 202 is decreased.

Fig. 3 shows a third embodiment of a device according to the invention at a hydraulic cylinder 300 at an agricultural implement, for example a harrow or a cultivator of a type that is shown in SE 530 030. The hydraulic cylinder 300 has a piston 301 and fastened at the piston a piston rod 302. The piston 301 is moveable along a cylinder 303 and a cylinder end part 304 is fastened, preferably screwed fast, at the end 305 of the cylinder 303. At the cylinder end 305 a portion 307 with a port 307a for hydraulic oil is preferably welded fast at 306. The piston 301 comprises a ring-shaped, outer part 308, which at 310 is welded fast at an elongation 311 of the piston rod 302. The piston 301 is accordingly comprised of the ring-shaped part 308 and the elongation 311 of the piston rod 302. A sealing ring 312 is adapted to prevent internal leakage that can arise through the weld 310.

A ring-shaped wiper seal 313 is arranged in a recess in the end 314 of the cylinder end part 304 facing away from the piston 301, which seal 313 is intended for wiping against the piston rod 302. A ring-shaped guide band 315 for the piston rod 302 is arranged in a ring-shaped recess at the circular surface 316 of the cylinder end part 304 facing the piston 301 and lies in contact with the piston rod 302. Between the wiper seal 313 and the ring-shaped guide band 315 an additional seal 317 is arranged in a ring-shaped recess in the cylinder end part 304.

A first ring-shaped seal 318 is arranged in a recess at the end 319 of the piston 301 facing the piston rod side and is intended to function as a piston ring against the cylinder wall 320. A ring-shaped guide band 321 for the piston 301 is arranged in a ring-shaped recess in the ring-shaped part 308 of the piston 301 at the piston surface 322 facing away from the piston rod and lies in contact with the inner wall 320 of the cylinder 303. A second ring-shaped seal 323 is arranged in a ring-shaped recess in the cylinder between the first seal 318 and the guide band 321. The diameter of the piston 301 is slightly less than the internal diameter of the cylinder 303 so that a gap 324 is formed between these. The guide band 321 and the seals 318 and 323 form guide and seal between the piston 301 and the cylinder 303.

At least one bypassing leakage duct 325 is fashioned within the ring-shaped part of the piston and also within the elongation 311 of the piston rod 302 from the piston jacket surface 326 between the first and the second seal 318 and 323, respectively, and runs past the guide band

321 for the piston 301 and discharges at the surface 322a of the piston's centre part and the elongation 311. A check valve 327 of known type with a spring-loaded ball or similar and possibly a choke 328 is arranged in the leakage duct 325.

The port 307a for hydraulic oil is connected to a connecting orifice 329 through the wall of the cylinder 303 so that when the piston 301 is disposed in the position shown in Fig. 3 hydraulic oil can be brought to flow through the leakage duct 325 via the check valve 327 into the gap 324 between the jacket surface 326 of the piston 301 and the inner wall 320 of the cylinder 303 and from there on through the orifice 329 into the port 307. The orifice 329 extends on the piston rod side, when piston has almost reached its end position, to a ring-shaped recess 330 on the piston rod side of the piston 301, whereby initial movement of the piston in the direction of its piston side is facilitated. From the port 307 a not shown conduit leads to the piston side of the next hydraulic cylinder or back to the tractor. The orifice 329 can be designed so that the leakage duct 325, when the piston has almost reached its end position, discharges directly into this.

In addition to the seal 312 between the piston elongation 311 and the ring-shaped part 308 of the piston an additional sealing ring 330 is arranged at the other side of the leakage duct 325 to prevent leakage from the transition of the leakage duct 325 from the elongation 311 to the ring-shaped part 308 of the piston 301. This transition is so designed that a ring-shaped groove 331 is fashioned in the inner surface of the ring-shaped part 311. This provides greater tolerances at assembly of the ring-shaped part 308 of the piston, i.e. the reciprocal angle between these parts at assembly is omitted and in addition the adjustment in the longitudinal direction is easily executable in such a way that distances of the leakage duct 325 and the ring-shaped groove 331 to the shoulder 332 on the piston rod 302 at the transition to its elongation are adjusted and mainly equal.

Placing the guide band 321 for the piston 301 at the end of the piston facing the piston side of the hydraulic cylinder causes both the guide bands 321 and 315 to come as far from each other as possible, especially in the position where the piston has reached its end position against the end surface 316 of the cylinder. Through this it is ensured that the piston 301 and piston rod 302 run more securely and the risk of seizing of the piston 301 and the piston rod 302 is decreased.

Fig. 4 shows a fourth embodiment of a device according to the invention at a hydraulic cylinder 400 at an agricultural implement, for example a harrow or a cultivator of a type that

is shown in SE 530 030. The hydraulic cylinder 400 has a piston 401 and fastened at the piston a piston rod 402. The piston 401 is moveable along a cylinder 403 and a cylinder end part 404 is fastened, preferably screwed fast, at the end 405 of the cylinder 403. At the cylinder end 405 a portion 407 with a port 407a for hydraulic oil is preferably welded fast at 406. The piston 401 comprises a ring-shaped, outer part 408, which at 410 is welded fast at an elongation 411 of the piston rod 402. The piston 401 is accordingly comprised of the ring-shaped part 408 and the elongation 411 of the piston rod 402. A sealing ring 412 is adapted to prevent internal leakage that can arise through the weld 410.

A ring-shaped wiper seal 413 is arranged in a recess in the end 414 of the cylinder end part 404 facing away from the piston 401, which seal 413 is intended for wiping against the piston rod 402. A ring-shaped guide band 415 for the piston rod 402 is arranged in a ring-shaped recess at the circular surface 416 of the cylinder end part 404 facing the piston 401 and lies in contact with the piston rod 402. Between the wiper seal 413 and the ring-shaped guide band 415 an additional seal 417 is arranged in a ring-shaped recess in the cylinder end part 404.

A first ring-shaped seal 418 is arranged in a recess at the end 419 of the piston 401 facing the piston rod side and is intended to function as a piston ring against the cylinder wall 420. A ring-shaped guide band 421 for the piston 401 is arranged in a ring-shaped recess in the ring-shaped part 408 of the piston 401 at the piston surface 422 facing away from the piston rod and lies in contact with the inner wall 420 of the cylinder 403. A second ring-shaped seal 423 is arranged in a ring-shaped recess in the cylinder between the first seal 418 and the guide band 421. The diameter of the piston 401 is slightly less than the internal diameter of the cylinder 403 so that a gap 424 is formed between these. The guide band 421 and the seals 418 and 423 form guide and seal between the piston 401 and the cylinder 403.

At least one bypassing leakage duct 425 is fashioned in the piston from the piston jacket surface 426 between the first and the second seal 418 and 423 respectively and runs past the guide band 421 for the piston 401 and discharges at the surface 422 facing away from the piston rod. An adjustable check valve 427 of known type with a spring-loaded ball or similar is arranged in the portion 407 and is connected to a connecting orifice 429a in the wall of the cylinder 403. A choke 428 is possibly arranged in the leakage duct 425.

The port 407a for hydraulic oil is connected to the orifice 429a through the wall of the cylinder 403 via a space 407b so that when the piston 401 is disposed in the position shown

in Fig. 4 hydraulic oil can be brought to flow through the leakage duct 425 into the gap 424 between the jacket surface 426 of the piston 401 and the inner wall 420 of the cylinder 403 and from there on through the orifice 429a into the port 407a via the check valve 427 in the space 407b in the portion 407. An orifice 429b from the space 407b is fashioned in the wall of the cylinder 403 and discharges, when the piston has almost reached its end position, into a ring-shaped recess 430 on the piston rod side of the piston 401, whereby initial movement of the piston in the direction of its piston side is facilitated. From the port 407a a not shown conduit leads to the piston side of the next hydraulic cylinder or back to the tractor. The orifice 429a can be designed so that the leakage duct 425, when the piston has almost reached its end position, discharges directly into this.

Placing the guide band 421 for the piston 401 at the end of the piston facing the piston side of the hydraulic cylinder causes both the guide bands 421 and 415 to come as far from each other as possible, especially in the position where the piston has reached its end position against the end surface 416 of the cylinder. Through this it is ensured that the piston 401 and piston rod 402 run more securely and the risk of seizing of the piston 401 and the piston rod 402 is decreased.

Both seals 118, 218, 318, 418 and 123, 223 323, 423 are of the type compact seals or low friction seals or similar, which have the characteristic that they satisfactorily seal the gap between piston and cylinder and also that they are durable and not so compliant that they are caused to be worn through the piston stroke and the forces that the hydraulic oil subjects them to in the gap. A typical such seal can be manufactured as a ring with essentially rectangular cross-section, where the radially viewed outer layer is of a more resistant material, such as hard plastic, while the radially viewed inner layer is of a material with predetermined sealing compliance, such as rubber. The seals are preferably inserted in respective ring slots in the piston with a predetermined pre-tension in order to achieve the best sealing capability and durability.

With the four embodiments the orifice 129, 229a, 329 and 429a, which is in connection with the associated leakage duct 125, 225, 325 and 425 respectively when the piston 101, 201, 301 and 401 respectively has reached or almost reached its end position on the piston rod side of the hydraulic cylinder, is so designed either with or without depression on the piston side that its axial elongation allows an early connection with the leakage duct so as to thereby hasten the pistons in the master-slave system to quickly reach their end positions in the stroke.

The leakage flux in the above-described embodiments can be adjusted to a suitable level by means of the chokes 128, 228, 328, 428.

The hydraulic cylinders according to Figs. 1 - 4 are constructed so that they can be used in such master-slave-coupling systems as are described in SE-A-530 030 and SE-A-441 117. A leakage flux, such as described above, through the ducts 125, 225, 325 and 425 has been achieved between the hydraulic cylinders. According to that which is shown and described in SE-A-530 030 a hydraulic conduit, which is coupled to the hydraulic system of a tractor, leads to the piston side of a first hydraulic cylinder and from the piston rod side of this via a conduit to the piston side of the next hydraulic cylinder and in the same way through the requisite number of hydraulic cylinders in the master-slave-coupling in the agricultural machine. Finally a conduit from the piston side of the last hydraulic cylinder leads back to the hydraulic system of the tractor.

Although the above-described embodiments only shows one leakage duct 125, 225, 325 or 425 past the respective guide band 121, 221, 321 or 421 on the piston it is possible within the framework of the attached claims to fashion two or more ducts along the circumference of the piston. This can be advantageous in order to ensure operation if one duct is clogged by dirt or other particles. An important aspect of the invention is that the check valve is separated from the seal, which is achieved through the leakage duct discharging on the piston jacket surface at a predetermined distance from each one of the two seals 118, 218, 318, 418 and 123, 223, 323, 423.

The invention can naturally be applied on different types of agricultural machines.

Although four embodiments of the invention have been described above the device according to the invention can be modified through combination of characteristics of these embodiments within the framework of the attached claims.

CLAIMS

1. Device at a hydraulic cylinder (100, 200, 300, 400) for controlling a hydraulic master-slave system comprising a cylinder (103, 203, 303, 403), a piston (101, 201, 301, 401), a piston rod (102, 202, 302, 402) fastened at the piston, guide bands (121, 221, 321, 421 and 115, 215, 315, 415) arranged along the piston jacket surface (126, 226, 326, 426) and along the piston rod with the aim of controlling the piston and the piston rod in the hydraulic cylinder and two seals (118, 218, 318, 418; 123, 223, 323, 423) arranged along the piston jacket surface, wherein a leakage duct (125, 225, 325, 425) is fashioned through the piston and extends from a place on the piston jacket surface and discharges at a place in contact with the piston side of the cylinder, **characterised** in that a check valve (127, 227, 327, 427) is arranged in direct connection with said leakage duct (125, 225, 325, 425) and that the leakage duct extends from said place on the piston jacket surface (126, 226, 326, 426) between and at a predetermined distance from said two seals (118, 218, 318, 418; 123, 223, 323, 423), which are of similar type and are disposed on the cylinder's piston rod side of said guide band, whereby said check valve is adapted, at a predetermined pressure, to leak through said leakage duct from the piston side of the hydraulic cylinder (100, 200, 300, 400) to the piston rod side of the hydraulic cylinder, when the piston (101, 201, 301, 401) has reached or almost reached its end position on the piston rod side of the hydraulic cylinder.

2. Device according to Claim 1, **characterised** in that said two similar seals (118, 218, 318, 418; 123, 223, 323, 423) are comprised of such seals as have at least two layers, where the outer layer in the radial direction has less compliance, such as hard plastic, and the inner layer has greater compliance, such as rubber.

3. Device according to Claim 1 or 2, **characterised** in that the diameter of the piston (101, 201, 301, 401) is slightly less than the internal diameter of the cylinder (103, 203, 303, 403) so that a gap (124, 224, 324, 424) is formed between these, wherein the leakage duct (125, 225, 325, 425) discharges into said gap.

4. Device according to Claim 1 or 2, **characterised** in that the check valve (127, 227, 327) is arranged in the leakage duct (125, 225, 325).

5. Device according to Claim 1 or 2, **characterised** in that the check valve (427) is arranged in a connecting orifice (429a) in the wall of said cylinder (403) and that said leakage duct (425) is arranged to connect to said orifice when the piston (401) has reached or almost reached its end position on the piston rod side of the hydraulic cylinder (400).

6. Device according to Claim 1 or 2, **characterised** in that said piston guide band (121, 221, 321, 421) has an interruption along its circumferential direction so as to allow leakage past same and that the leakage duct (125, 225, 325, 425) discharges at a place between the piston guide band and the nearest (123, 223, 323, 423) of said two seals.

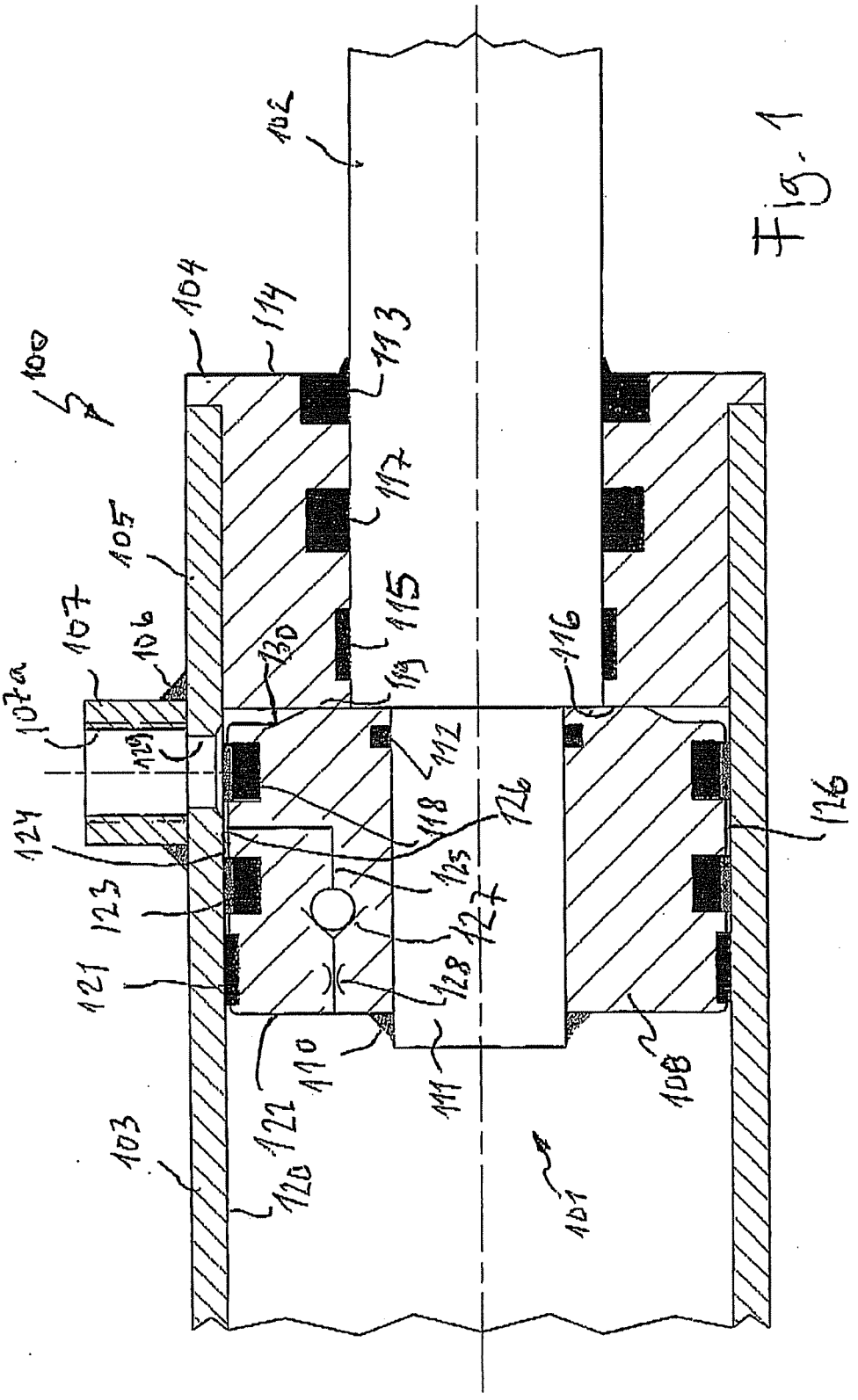
7. Device according to any one of Claims 1 - 6, **characterised** in that the leakage duct (125, 225, 425) extends through a ring-shaped part (108, 208, 408) of the piston, which part is mounted on an elongation (111, 211, 411) of the piston rod (102, 202, 402).

8. Device according to any one of Claims 1 - 6, **characterised** in that the leakage duct (325) extends through a ring-shaped part (308) of the piston, which part is mounted on an elongation (311) of the piston rod (302), and also through said elongation of the piston rod.

9. Device according to any one of Claims 1 - 8, **characterised** in that the leakage duct (125, 225, 325, 425), when the piston (101, 201, 301, 401) has reached or almost reached its end position on the piston rod side of the hydraulic cylinder, discharges into an orifice (129, 229a, 329, 429a) through the wall of the cylinder (103, 203, 303, 403).

10. Device according to any one of Claims 1 - 9, **characterised** in that through-running orifices (129, 229b, 329, 429b) in the wall of the cylinder (103, 203, 303, 403) are connected to a port (107a, 207a, 307a, 407a) connected to the piston rod side of the hydraulic cylinder (100, 200, 300, 400) and also to a ring-shaped recess (130, 230, 330, 430) on the piston rod side of the piston (101, 201, 301, 401), whereby initial movement of the piston in the direction of its piston side is facilitated.

11. Device according any one of Claims 1 - 10, **characterised** in that a choke (128, 228, 328, 428) is arranged in the leakage duct (125, 225, 325, 425).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102
104
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106
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107a
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130
101
103

Fig. 1

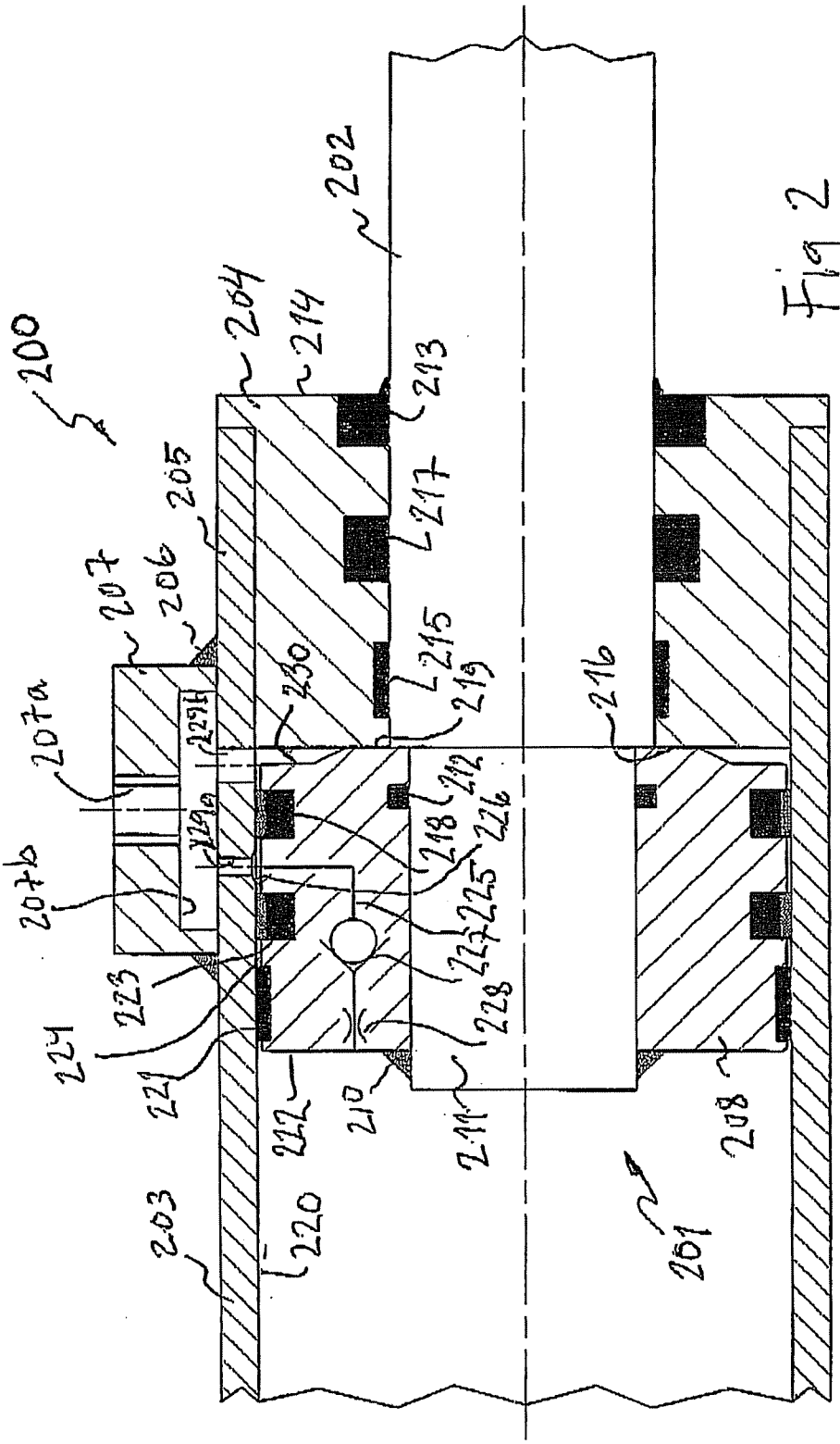
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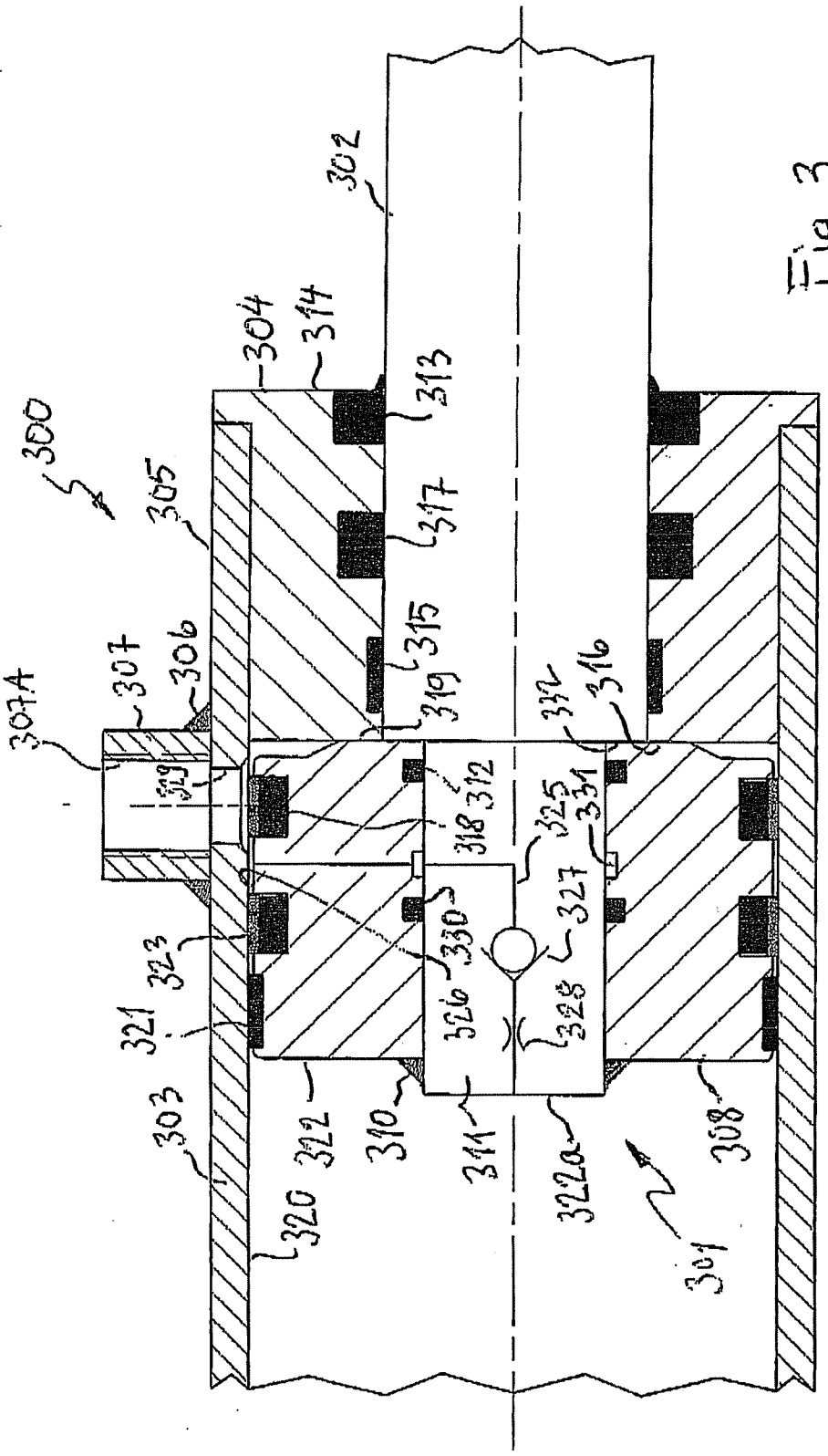
Fig 2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307A
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322a
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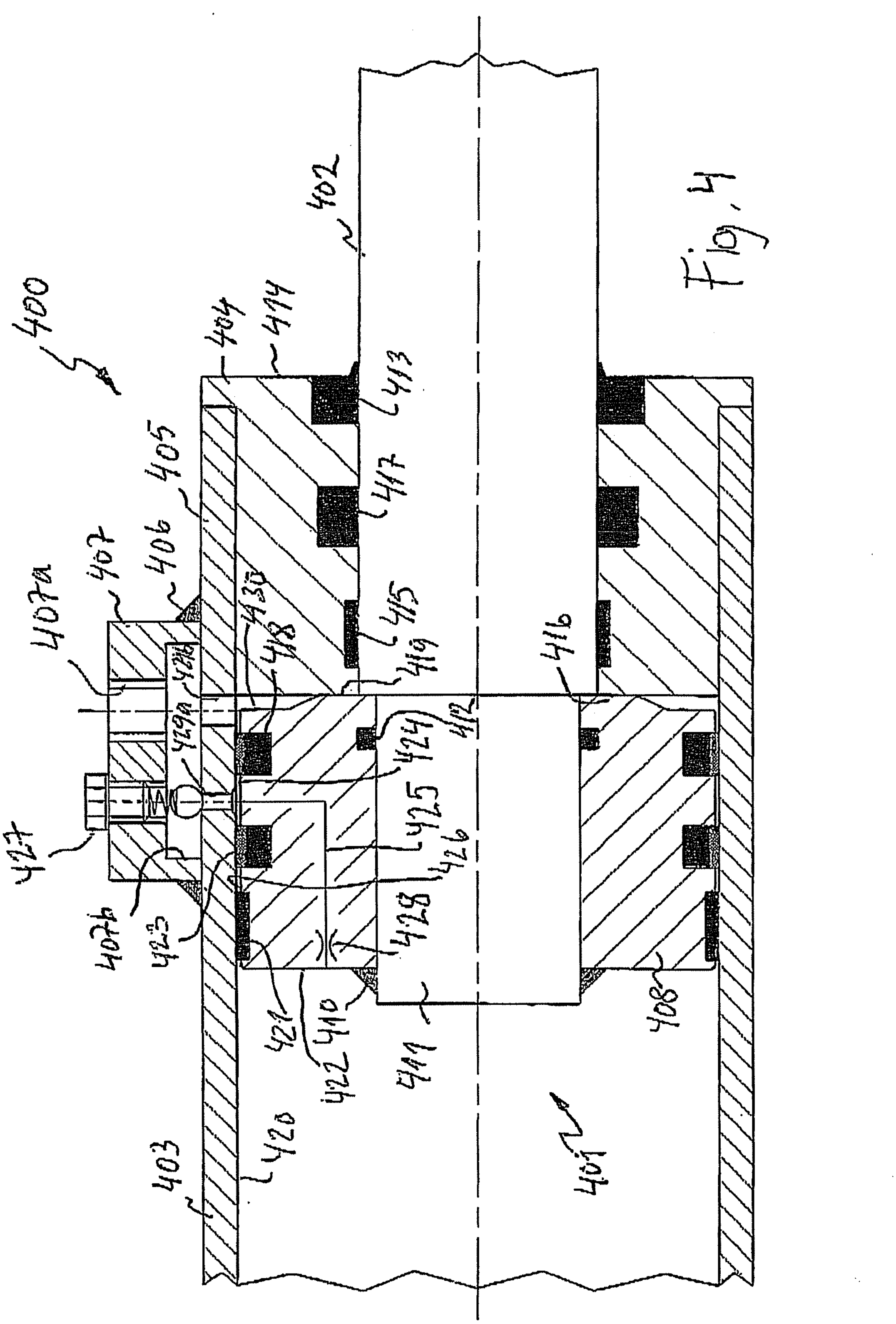
332

Fig. 3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407a
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429b
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407b
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Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2009/051402

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2008002256 A1 (VADERSTAD- VERKEN AKTIEBOLAG), 3 January 2008 (03.01.2008), figures 1,2, claims 1-8	1-11
A	SE 441117 B (C. STARK), 9 Sept 1985 (09.09.1985), figures 1-6, abstract	1-11
A	US 6186043 B1 (R.E. CALLIES), 13 February 2001 (13.02.2001), figures 1-6, claims 1,2,11	1-11

D Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to lie of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 March 2010	17-03-2010
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Lena Nilsson / MRo Telephone No. + 46 8 782 25 00

International application No.
PCT/SE2009/051402

International patent classification (IPC)

F15B 15/14 (2006.01)
F16J 15/18 (2006.01)

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Cited literature, if any, will be enclosed in paper form.

Box No. IV Text of the abstract (Continuation of item 5 of the first sheet)

The invention refers to a device at a hydraulic cylinder (100, 200, 300, 400) comprising a cylinder (103, 203, 303, 403), a piston (101, 201, 301, 401), a piston rod (102, 202, 302, 402), control bands (121, 221, 321, 421 and 115, 215, 315, 415) arranged along the casing surface of the piston (126, 226, 326, 426) and along the piston rod and two sealings (118, 218, 318, 418; 123, 223, 323, 423) arranged along the casing surface of the piston, whereby a stray flux channel (125, 225, 325, 425) is provided through the piston extending from a point on the casing surface of the piston leading to a point being in contact with the piston side of the cylinder. A check valve (127, 227, 327, 427) is arranged in direct connection with said stray flux channel (125, 225, 325, 425) which extends from said point on the casing surface of the piston (126, 226, 326, 426) between and at a predetermined distance from said sealings (118, 218, 318, 418; 123, 223, 323, 423) being of the similar kind and located on the piston rod side of said control band.

WO	2008002256	A1	03/01/2008	EP	2032860	A	11/03/2009
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				SE	0601427	A	30/12/2007
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