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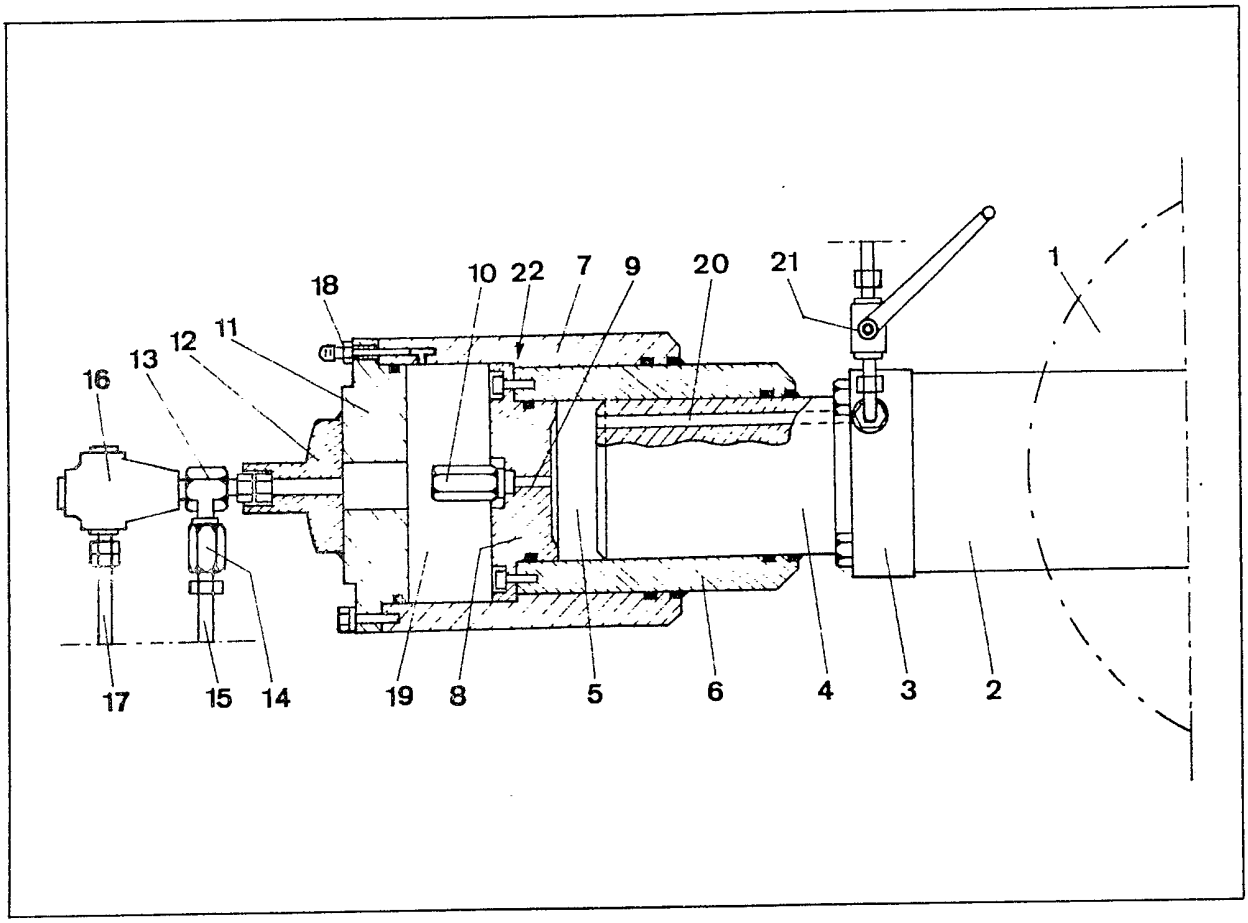
(71) Applicants
Maschinenfabrik Klaus-Gerd Hoes GmbH and Co. KG,
Ammerlander Str 93,
2906 Wardenburg,
Germany
(72) Inventors
Hans Ruge,
Gerold Wobken
(74) Agents
Marks and Clerk,
57—60 Lincoln's Inn Fields, London WC2A 3LS

(54) Improvements in or relating to tensioning devices for endless chains

(57) A tensioning device, for instance for endless chains of a tracklaying vehicle, comprises a working cylinder 7 which is connected to a pressure-regulated hydraulic source and whose cylinder chamber 19, which guides a tensioning piston 6 pressing against the guide wheel 1, is provided with an outlet comprising a pressure relief valve 16 and an inlet, connected to the hydraulic source, with an incorporated non-return valve 14. The tensioning device can also be used in the case of other chains, for example, chain cutters of trench cutting machines, as well as conveyor belts etc.



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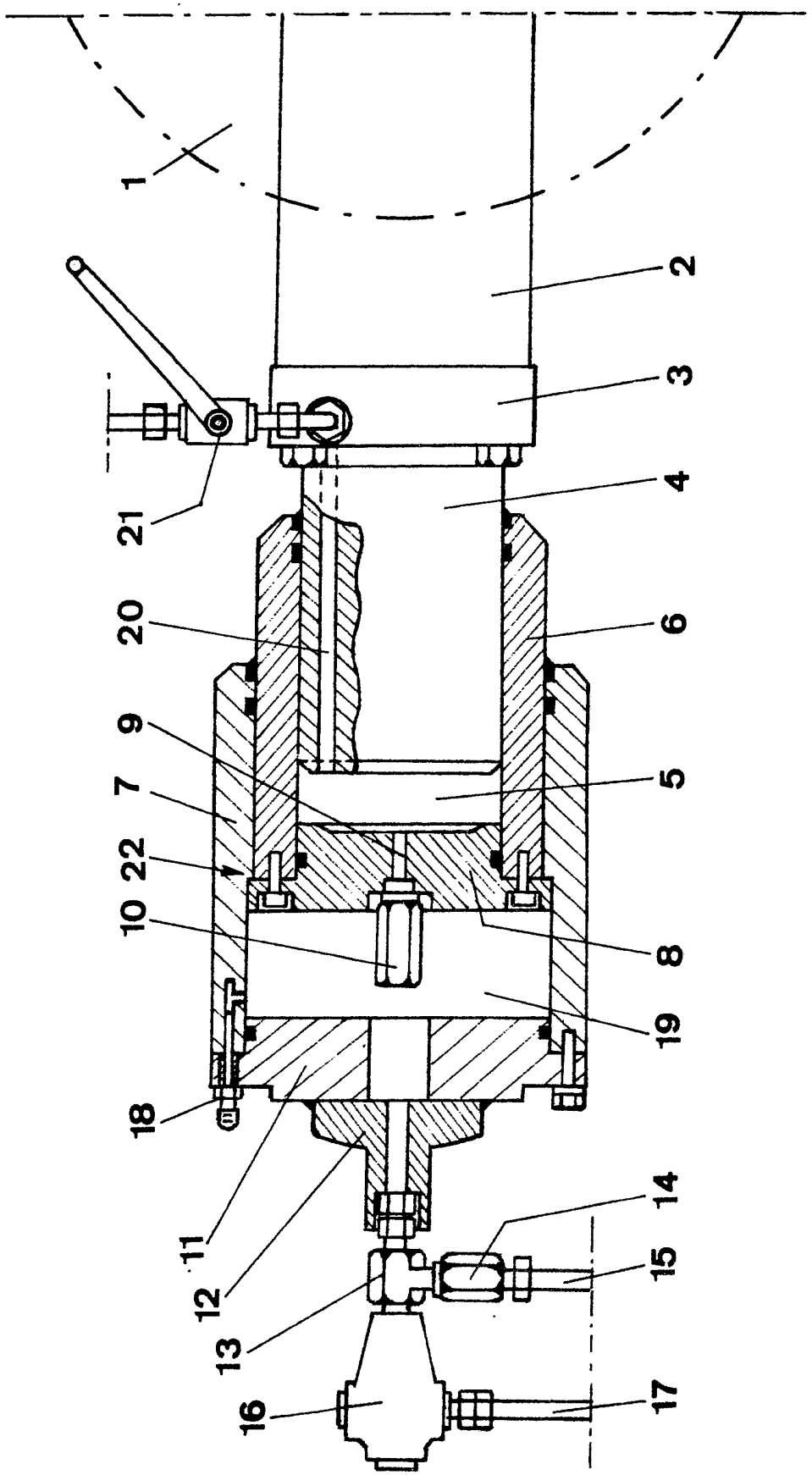
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SPECIFICATION

Improvements in or relating to tensioning devices for endless chains

The invention relates to a tensioning device for acting on a guide element of a rotating chain or the like. Such a tensioning device may be used to act on the guide wheel of a tracklaying vehicle, for an endless chain. Such a tensioning device may also be used, for instance, with chain cutters of trench, cutting machines or with conveyor belts.

Endless chains should always be sufficiently taut so as not to run off. They should however run over a guide wheel and over a drive wheel as freely and loosely as possible, so that automatic cleaning can take place. If this automatic cleaning does not take place in the case of chains which are constantly tensioned, dirt accumulates, especially in the tooth spaces of the drive wheel, as a result of which the chain is forced to run into the teeth.

Furthermore, one of the wheels, usually the guide wheel, must be able to yield in order to prevent breaks occurring if, for example, a stone enters between the drive wheel and the chain. However, it should on no account yield when, for example, the tractive force of the upper chain run has to be taken up by the guide wheel during steering or reverse travel. On the other hand, the spring forces should not be so great, even in the case of complete spring excursion, that axles or wheel mountings are damaged. No great impacts should occur during backspring.

The requirements of a tensioning device are therefore as follows: firstly, it should be automatically adjustable as far as possible; secondly, the constantly active tensional force should be as small as possible; thirdly, the holding force should be sufficiently great to take up the normal chain pull; fourthly, the spring action should not, as far as possible, be greater than the holding force, even during complete spring excursion; fifthly, the backspring should not occur abruptly; and sixthly, the forces should be adjustable, according to the type and size of the machines.

Known chain tensioners operate with metal or gas or plastics springs, which can be adjusted as required by grease or oil cocking cylinders. The springs are internally pre-tensioned to 23 tonnes, for example, such that the initial tension does not constantly act on the chain, but only becomes effective when the spring action begins. A spring excursion of, for example, 50 mm results in a tractive force in the chain of, for example, approximately 50 tonnes, which have a negative effect on the gearing and drive wheel mountings of the track-laying vehicle and may damage the latter. These high spring tensions also cause the chain to practically "crash" into the drive wheel again after jumping over a tooth.

The initial tension in conventional chain tensioners with springs may be too low owing to spring fatigue, so that the chain begins to jump even when there is a slight increase in tension, as occurs, for example, when the tracklaying vehicle is steered.

Improvements to these embodiments are also known in which the metal or pneumatic springs act on hydraulic media and, instead of the direct, pre-tensioned tension springs, act indirectly via these media by being actuated by fluid which is displaced by the insertion of a spring plunger. With respect to single springs, this solution has the advantage that, owing to the fact that a pressure relief valve, which is adjusted to the holding force, is mounted in the overflow duct, an additional resistance is produced which increases during the spring action only by the spring force which, in this case, is correspondingly relatively slight. Consequently in this solution the increase in spring force during spring action is not so great and the recoil action is not so violent. However this solution has not provided successful with respect to the obtained improvement on account of the complicated design and various tensioning devices have to be used, depending on the size of the machines.

According to the invention there is provided a tensioning device for acting on a guide element of an endless chain, comprising a working cylinder which is connected to a pressure-regulated hydraulic source and whose cylinder chamber, which guides a tensioning piston for pressing against the guide wheel, is provided with an outlet comprising a pressure relief valve and an inlet, connected to the hydraulic source, with an incorporated non-return valve.

By means of such a device, an endless chain may be held so as to cope with all operating conditions, in which the tensional force is therefore as low as possible, tension regulation is automatic, the holding force is sufficiently great and adjustable, the force until the end of the path of spring action is not greater than the holding force and the restoring force is sufficient but not too violent.

With respect to the hitherto known tensioning devices with springs, a preferred tensioning device has the advantage that the piston power, which is dependent on the controllable or adjustable pressure of the hydraulic source, produces the required tensional force and that the holding force, which is adjusted upon the spring action of the guide wheel, can be predetermined by the pressure relief valve and does not increase until the end of the path of spring action. If the hydraulic source forces the working medium, e.g. hydraulic oil, into the cylinder chamber at a constant pressure of, for example, 50 bar, this results in the tensional force and, at the same time, the restoring force. The piston supporting the guide wheel could only enter the cylinder chamber when these forces are exceeded, but is prevented from doing so by the non-return valve, so that the pressure which is building up in the cylinder chamber rises above the 50 bar supplied by the hydraulic source until the adjusted pressure relief valve opens.

This pressure is usually higher than that required to produce the tensional force. With

respect to springs with progressive, steeply rising characteristic curves, the preferred tensioning device has the advantage that a constant characteristic curve is obtained during spring action whose height is a function of the adjustment of the pressure relief valve and that an essentially lower characteristic curve, also constant, is obtained during the recoil action whose height is a function of the adjusted pressure of the hydraulic source.

Moder tracklaying vehicles for different operations, for example draining ploughs, excavators, road finishers etc. are provided with hydraulic motors as drive elements, so that a hydraulic source is already provided in vehicles of this type. For example, pumps which produce a constant pressure of approximately 50 bar, are used for the steering clutches of drive shafts, so that there is no need to install an additional pump in modern tracklaying vehicles. In other vehicles it is usually also possible to use pumps which are already provided, for example for control circuits of conveying hydraulic technology.

It is however also possible to install separate geared pumps with a pressure-retaining valve or a pressure-controlled piston pump.

The tensioning piston, which can be extended as a function of the pressure of the hydraulic source and which pre-tensions the chain with a predetermined tensional force, also replaces tension regulation of the chain, which was previously necessary in conventional spring chain tensioners, by a so-called "grease tensioner". The pre-tension, which is adjusted as a function of the pressure of the hydraulic source, is sufficiently small not to overtension the chain. The non-return valve enables the tensioning piston to be held in its extended position.

In a preferred embodiment of the tensioning device, the tensioning piston is guided in a holding cylinder which is formed as a holding piston guided in the working cylinder.

In this embodiment the piston crown of the holding piston may be provided with a through-opening in which a second non-return valve is mounted.

This preferred embodiment has the further advantage that, when the piston system is compressed, the restoring force resulting from the constant pressure of the hydraulic source acts upon the holding piston, which has a greater piston area than the tensioning piston acting on the guide wheel. The restoring force is therefore greater and suffices to re-tension the chain sufficiently quickly. This restoring force is, however, smaller with respect to conventional spring tensioners, so that a violent impact, resulting in damage, is avoided when the chain jumps over.

Such a tensioning device can be inexpensively produced and needs no maintenance, as the tension of the chain is automatically regulated.

In order to remove the chains for repair work or the like a spherical faucet can be provided by means of which the pressure of the working medium maintained by the non-return valves in the cylinder chambers can be released.

It is of course also possible, without departing from the scope of the invention, to use the tensioning device in, for example, chain cutters of trench cutting machines, conveyor belts or the like.

The invention will be further described, by way of example, with reference to the accompanying drawing, which is a schematic sectional view of a chain tensioner constituting a preferred embodiment of the invention.

The reference number 1 indicates an outlined guide wheel, which is used at the end of a tracklaying vehicle to turn round an endless chain (not shown). The guide wheel is supported *via* a schematically indicated guide wheel support 2 on the piston head 3 of a tensioning piston 4, which is guided in a holding cylinder 5. The holding cylinder is externally formed as a holding piston 6, which is displaceable in a working cylinder 7. The piston crown 8 of the holding piston 6 is provided with a through-opening 9 to the holding cylinder 5, in which opening a non-return valve 10 is mounted. The cylinder head 11 of the working cylinder is provided with an opening 12 which serves as an inlet and an outlet and to which is connected a pipeline which is connected to a T-fitting 13 and which, with the interposition of a non-return valve 14, continues *via* a pipeline 15 to a pressure-controlled hydraulic pump which delivers a working medium, for example hydraulic oil, at an adjustable, constant pressure. The T-fitting 13 is also connected to an adjustable pressure relief valve 16, from which a return pipe 17 extends to the supply container which contains the working medium and which also supplies the pump (not shown).

The reference number 18 designates a vent for the cylinder chamber 19 of the working cylinder 7.

The tensioning piston 4 is provided with an axial bore 20, the exit of which is at at the piston head 3 and which leads to a spherical faucet 21.

The device operates as follows.

A pressure-regulated pump, which is not shown, delivers hydraulic oil through the opening 12 to the cylinder chamber 19 of the working cylinder *via* the pipeline 15 and the non-return valve 14, the holding piston 6 extending as far as a stop 22 formed by a recessed step. The pressure medium, which is conveyed further, then flows through the non-return valve 10 and the opening 9 into the holding cylinder 5, as a result of which the tensioning piston 4 is extended and presses with the piston head 3 against the guide wheel support 2 bearing the guide wheel 1 until the endless chain, which is not shown and runs over the guide wheel 1, is tensioned.

The necessary tensional pressure is dependent on the piston area of the tensioning piston 4 and the regulated pressure of the working medium which is supplied *via* the pipeline 15 and the non-return valve 14.

As the pressure is maintained constant, it is not necessary to regulate the tension of the endless

chain. The latter is constantly held at a preselected tension.

As soon as the tension of the endless chain increases, as a result, for example, of a stone in the drive wheel, the guide wheel 1 must be able to undergo a spring action. The non-return valve 10 is initially impeded as a result of the tensioning piston 4 springing into the holding cylinder 5. The force exerted by the guide wheel does not therefore press the tensioning piston 4, but rather the holding cylinder 6 back into the working cylinder, in whose cylinder chamber 19 a pressure builds up and closes the non-return valve 14. If the pressure building up in the cylinder chamber 19, resulting from the force exerted by the increasing tension in the endless chain on the guide wheel, reaches a level which exceeds the value set in the adjustable pressure relief valve 16, oil is forced out of the cylinder chamber 19 *via* the pressure relief valve 16 and the return pipe 17 connected thereto, so that the holding piston 6, and therefore also the guide wheel 1, is pushed in.

If the increased tension in the endless chain is again reduced, as a result, for example, of the stone falling out or the endless chain jumping over a tooth in the drive wheel, which is not shown, of the vehicle, the pressure in the cylinder chamber 19 decreases, the pressure relief valve closes, the non-return valve 14 opens again and working medium is forced into the cylinder chamber 19 by the pump, as a result of which the holding piston is again extended and pressed against the guide wheel until the original operating condition is re-established.

CLAIMS

1. A tensioning device for acting on a guide element of an endless chain, comprising a working cylinder which is connected to a pressure-regulated hydraulic source and whose cylinder chamber, which guides a tensioning piston for pressing against the guide wheel, is provided with an outlet comprising a pressure relief valve and an inlet, connected to the hydraulic source, with an incorporated non-return valve.

2. A tensioning device as claimed in claim 1, in which the tensioning piston is guided in a holding cylinder which is formed as a holding piston guided in the working cylinder.

3. A tensioning device as claimed in claim 2, in which the piston crown of the holding piston is provided with a through-opening in which a second non-return valve is mounted.

4. A tensioning device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

5. An endless tracked vehicle including a tensioning device as claimed in any one of the preceding claims.

6. A tracklaying vehicle comprising an endless tracked vehicle as claimed in claim 5.

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