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(54) **Compaction roller vibratory mechanism**

(57) The vibratory mechanism of the drum of compaction roller consists of the outer eccentric weight (10), inner eccentric weight (11), friction clutch (12), and the hydraulic connection of hydromotors (13A and 13B). The mentioned eccentric weights (10 and 11) are pivoted and coaxially mounted against each other on unidentified shafts connected with the mentioned hydromotors (13A and 13B). The sensors (17A and 17B) of the mutual angular displacement of eccentric weights (10 and 11) are situated on both mentioned unidentified shafts. The men-

tioned hydraulic connection of hydromotors (13A and 13B) consists of the brake valves (14A and 14B), vibration circuit piping (18), and by-pass passing (19A and 19B) including the nozzles (15A and 15B) and shut-off valves (16A and 16B) controlled by the control unit (20) together with the mentioned brake valves (14A and 14B). The control unit is adapted to act on the hydraulic connection of the hydromotors to allow a slipping movement of the friction clutch, thereby achieving a mutual displacement of one eccentric weight against the order.

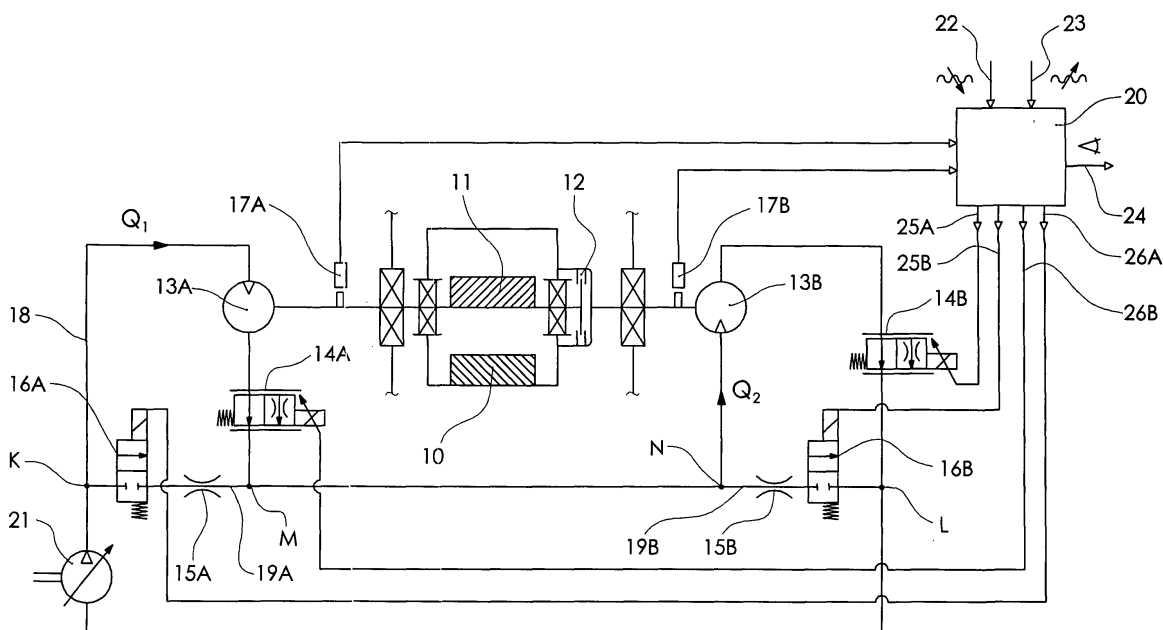


fig.1

Description

Field of Technology

[0001] The invention concerns the arrangement of the vibratory mechanism of compaction roller.

Present Level of Technology

[0002] The current vibratory mechanisms with circular vibration and stepless variation of eccentric moment are for example equipped with co-axial eccentric weights and their required mutual displacement is ensured by means of helix formed in a hollow shaft. The helix is in contact with a finger in an axial and sliding connection with the other eccentric weight. The disadvantage of this described solution of the vibratory mechanism is its considerable exterior length and production complexity. Another substantial disadvantage is a structural weakening of the shaft with helix.

[0003] Another solution of the vibratory mechanism is represented by CZ Patent No. AO 187 542 which is based on the turning of two coaxial eccentrics by means of the limitation of the flow rate of hydraulic liquid of hydromotors connected in parallel. The disadvantage of the described solution is an extreme demand for the precision of control necessary for setting the required value of eccentric moments including the synchronisation of both hydromotors.

[0004] Another known solution is represented by CZ Patent No. 244 465 the principle of which consists in two coaxial eccentrics turning against each other through the axially sliding countershaft with spur gearing with helical teeth. The disadvantage of this known arrangement is the complexity of the gearbox as well as its undesired exterior length.

[0005] Another known solution is represented by DD Patent No. 266 748 A1 which is based on two hydromotors connected in series, when each of them is connected with an eccentric weight. The mentioned eccentric weights are interconnected with a torsion spring with a torsion damper. The mutual turning of eccentric weights is solved by bleeding the hydraulic oil between both mentioned hydromotors by means of a pressure valve with a control nozzle. The disadvantage of the described known solution is the necessity of the permanent dissipation of energy by means of throttling the hydraulic oil when setting the required eccentric moment. Another disadvantage of this arrangement is the possible formation of cavitation on the second hydromotor that is dragged by the first hydromotor through the torsion spring.

[0006] Another known solution is represented by US Patent No. 6 637 280B2 which is based, similarly as above-mentioned solution according to DD Patent No. 266 748A1, on the series connection of hydromotors connected with coaxial eccentric weights pivoted against each other. The mentioned US patent specifies several solutions of the vibratory mechanism. The principle of

one of them is based on the arrangement when one hydromotor is a control hydromotor and the other has a constant capacity. The principle of another solution is the arrangement consisting in the bleeding of hydraulic medium between the hydromotors when one hydromotor has a higher capacity than the other hydromotor. This solution utilises for setting the required eccentric moment a pressure loss on the other hydromotor. The disadvantage of those individual known solutions according to the mentioned US patent is that the dynamic effects of vibrating system and the phase shift between the vector of exciting force and the deflection of vibrating mass in practice result in the undesired dragging of the other eccentric weight and reduction or even absence of the pressure force on the hydromotor. Another known solution is represented by DE Patent Application No. 10 2005 008 807 A1 which is based on the planetary differential gearbox when two sets of coaxial eccentric weights are cinematically connected through the central and planetary elements. Turning the ring gear changes the phase setting of the inner and outer eccentric weight. The disadvantage of this arrangement of the vibratory mechanism is the considerable complexity of the differential gearbox including its weight resulting in a one-sided loading of the vibrating mass of the drum of the vibratory roller.

Principle of the Invention

[0007] The above-mentioned disadvantages will be removed by a new arrangement of the vibratory mechanism of the compaction roller the principle of which is that the inner eccentric weight and the outer eccentric weight are interconnected by means of friction clutch. Further, always one brake valve is connected in series in the direction of the flow of hydraulic liquid behind each individual hydromotor situated on the vibration circuit piping. Further, each hydromotor is equipped with both separate by-pass piping and a separate nozzle and separate shut-off valve. Further, individual by-pass pipes are interconnected with the vibration circuit piping, when the mentioned interconnection is situated before individual hydromotors in the direction of the flow of hydraulic liquid and the interconnection is situated behind individual throttle valves also in the direction of the flow of hydraulic liquid. And further, the control unit operates for one direction of the mutual displacement of the inner eccentric weight against the outer eccentric weight the brake valve at the same time with the shut-off valve and for the opposite direction of the mutual displacement of the inner eccentric weight against the outer eccentric weight the brake valve at the same time with the shut-off valve.

Layout of Illustrations

[0008] The invention shall be further more closely explained with reference to the enclosed drawing, where Fig. 1 shows schematically one of a number of the arrangements of the vibratory mechanism of the drum of

the compaction roller.

Examples of the Implementation of the Invention

[0009] The drum of the compaction roller contains the vibratory mechanism with circular vibration that consists of the inner eccentric weight 11 and the outer eccentric weight 10, when both mentioned eccentric weights are coaxially mounted and at the same pivoted against each other. Between the inner eccentric weight 11 and the outer eccentric weight 10, there is a friction clutch 12 inserted that facilitates in its slipping the mutual displacement of both mentioned eccentric weights. Upon achieving the required displacement of the inner eccentric weight 11 and the outer eccentric weight 10 against each other, the friction clutch 12 thus fixes the achieved value of the displacement.

[0010] The drive of the inner eccentric weight 11 and the outer eccentric weight 10 is ensured by the hydromotors 13A and 13B by means of shafts not identified in the drawing. Both mentioned hydromotors are connected in series in the closed hydraulic piping of the vibration circuit 18 in which also the control pump 21 is connected. The hydraulic liquid flows in the closed piping of the vibration circuit 18 always in one direction, when the hydromotor 13A is connected first in the direction of flow and hydromotor 13B is connected second. The hydromotor 13A is equipped with the separate by-pass piping 19A and the hydromotor 13B is equipped with the separate by-pass piping 19B.

[0011] The mentioned by-pass piping 19A and 19B interconnect the closed piping of the vibration circuit 18 before and behind each individual hydromotor 13A and 13B at the point identified in Fig. 1 by letters K, L, M, and N. The by-pass piping 19A is equipped with the shut-off valve 16A and similarly the by-pass piping 19B is equipped with the shut-off valve 16B. The flow of hydraulic liquid through the by-pass piping 19A is limited by the nozzle 15A and the flow of hydraulic liquid through the by-pass piping 19B is limited by the nozzle 15B. Behind each hydromotor 13A and 13B in the direction of hydraulic liquid flow and before each individual by-pass piping 19A and 19B, there are brake valves 14A and 14B inserted with the proportional characteristics and electric control.

[0012] The mutual displacement of both eccentric weights 11 and 10 against each other is monitored through the position sensors 17A and 17B the signals of which are sent to the control unit 20. The mentioned control unit 20 controls through the outputs 25A, 25B, 26A, and 26B the brake valves 14A and 14B and the shut-off valves 16A and 16B. The setting of the mutual position of the inner eccentric weight 11 and outer eccentric weight 10 is operated by the mentioned control unit 20 and the increase of the vibration amplitude is controlled by means of the input 23 and the decrease of the vibration amplitude is controlled by means of the input 22. The angle output 24 on the control unit 20 gives the informa-

tion about the value of the mutual displacement of the inner eccentric weight 11 against the outer eccentric weight 10.

[0013] The described arrangement of the vibratory mechanism according to the invention enables the mentioned vibratory mechanism to work in several different modes of vibration amplitude, namely the constant vibration amplitude mode, the vibration amplitude increasing mode, and in the vibration amplitude decreasing mode. The text below describes the modes of the setting and control of the vibration amplitude of the vibratory mechanism.

Constant vibration amplitude mode

[0014] In the constant vibration amplitude mode, the inputs, i.e. the input for decreasing the vibration amplitude 22 and the input for increasing the vibration amplitude 23, into the control unit 20 are turned off. Also the outputs, i.e. the brake valve outputs 25A and 26B as well as the shut-off valve outputs 26A and 25B, from the control unit 20 are turned off.

By means of the sensors 17A and 17B situated on the unidentified shafts, the signal is picked-up and afterwards sent to the control unit 20 that will calculate the angle of the mutual displacement of the inner eccentric weight 11 against the outer eccentric weight 10 and the value of the actual displacement of the mentioned angle is shown on the angle output 24. The mutual position of the set angle of the displacement of both eccentric weights 11 and 10 against each other is fixed by the friction clutch 12.

Vibration amplitude increasing mode

[0015] The setting of the vibration amplitude increasing mode is ensured by the signal sent by the compaction roller operator to the control unit 20 by means of the vibration amplitude increasing input 23, activating thus the brake valve output 26B and at the same time also the shut-off valve output 26A. Consequently, the shut-off valve 16A opens the flow of hydraulic liquid to the by-pass piping 19A and to the nozzle 15A. Concurrently with the activity described above, the brake valve 14A begins to throttle proportionately the flow rate Q1 of hydraulic liquid behind the hydromotor 13A in the direction of the mentioned flow Q1.

This results in a pressure loss on the mentioned hydromotor 13A and on the brake valve 14A which will cause a pressure gradient between the points K and M and the hydraulic liquid begins to flow through the by-pass piping 19A and the nozzle 15A.

The flow rate Q1 of hydraulic liquid passing through the hydromotor 13A decreases against the flow rate Q2 of hydraulic liquid passing through the hydromotor 13B and, therefore, the hydromotor 13B begins to drag the hydromotor 13A by means of the friction clutch 12. The gradual increasing of the flow resistance of the brake valve 14A increases the torque on the friction clutch 12 until its spin-

ning and a suitably modulated control signal on the output 26B of the control unit 20 regulates the flow resistance of the proportional brake valve 14A until achieving the required value of the mutual displacement of the inner eccentric weight 11 against the outer eccentric weight 10 expressed in the angle output 24 of the control unit 20.

Vibration amplitude decreasing mode

[0016] The setting of the vibration amplitude decreasing mode is ensured by the signal sent by the compaction roller operator to the control unit 20 by means of the vibration amplitude decreasing input 22, activating thus the brake valve output 25A and at the same time also the shut-off valve output 25B. Consequently, the shut-off valve 16B opens the flow of hydraulic liquid to the by-pass piping 19B and to the nozzle 15B and at the same time the brake valve 14B begins to throttle proportionately the flow rate Q2 behind the hydromotor 13B in direction of the mentioned flow Q2.

The above mentioned activity results in a pressure loss on the mentioned hydromotor 13B and on the brake valve 14B which will cause a pressure gradient between the points N and L and the hydraulic liquid begins to flow through the by-pass piping 19B and the nozzle 15B. The flow rate Q2 of hydraulic liquid passing through the hydromotor 13B decreases against the flow rate Q1 of hydraulic liquid passing through the hydromotor 13A and, therefore, the hydromotor 13A begins to drag the hydromotor 13B by means of the friction clutch 12.

The gradual increasing of the flow resistance of the brake valve 14B increases the torque on the friction clutch 12 until its spinning in the opposite direction of rotation as compared to the vibration amplitude increasing mode described above. A suitably modulated control signal on the output 25A of the control unit 20 regulates the flow resistance of the proportional brake valve 14B until achieving the required value of the mutual displacement of the inner eccentric weight 11 against the outer eccentric weight 10 expressed in the angle output 26 of the control unit 20.

Industrial Utilisation

[0017] The arrangement of the vibratory mechanism of the compaction roller and the manner of its control according to the invention can beneficially be used with all types of the vibratory rollers with the hydrostatic drive of the vibrator of circular vibration, both for single-drum rollers and tandem rollers. With respect to that the displacement of eccentric weights according to the invention uses the hydrostatic drive energy, the described solution and the manner of its control are suitable for all the weight categories of vibratory rollers weighing 7 t and more. The vibratory mechanism according to the invention is simple, inexpensive as for its production, and without a heavy gearbox causing a one-sided loading of the vibrating mass of the vibratory roller.

Claims

1. The vibratory mechanism of the drum of compaction roller consisting of the outer eccentric weight (10), inner eccentric weight (11), friction clutch (12), and the hydraulic connection of hydromotors (13A and 13B), where both mentioned eccentric weights (10 and 11) are pivoted and coaxially mounted against each other on unidentified shafts connected with the mentioned hydromotors (13A and 13B), when the sensors (17A and 17B) of mutual angular displacement are situated on both mentioned unidentified shafts and when the mentioned hydraulic connection of hydromotors (13A and 13B) consists of the brake valves (14A and 14B), vibration circuit piping (18), and by-pass passing (19A and 19B) including the nozzles (15A and 15B) and shut-off valves (16A and 16B) controlled by the control unit (20) together with the mentioned brake valves (14A and 14B), **is characterised in that** the inner eccentric weight (11) and outer eccentric weight (10) are interconnected by means of friction clutch (12).
2. The vibratory mechanism according to paragraph 1 **is characterised in that** always one brake valve (14A and 14B) is connected in series in the direction of the flow of hydraulic liquid following each individual hydromotor (13A and 13B) situated on the vibration circuit piping (18).
3. The vibratory mechanism according to paragraphs 1 to 2 **is characterised in that** each hydromotor (13A and 13B) is equipped with separate by-pass piping (19A and 19B) and a separate nozzle (15A and 15B) and a separate shut-off valve (16A and 16B).
4. The vibratory mechanism according to paragraphs 1 to 3 **is characterised in that** individual by-pass pipes (19A and 19B) are interconnected with the vibration circuit piping (18), when the mentioned interconnection is situated before individual hydromotors (13A and 13B) in the direction of the flow of hydraulic liquid and the interconnection is also situated behind individual brake valves (14A and 14B) also in the direction of the flow of hydraulic liquid.
5. The vibratory mechanism according to paragraphs 1 to 4 **is characterised in that** the control unit (20) operates for one direction of the mutual displacement of the inner eccentric weight (11) against the outer eccentric weight (10) the brake valve (14A) at the same time with the shut-off valve (16A) and for the opposite direction of the mutual displacement of the inner eccentric weight (11) against the outer eccentric weight (10) the brake valve (14B) at the same time with the shut-off valve (16B).

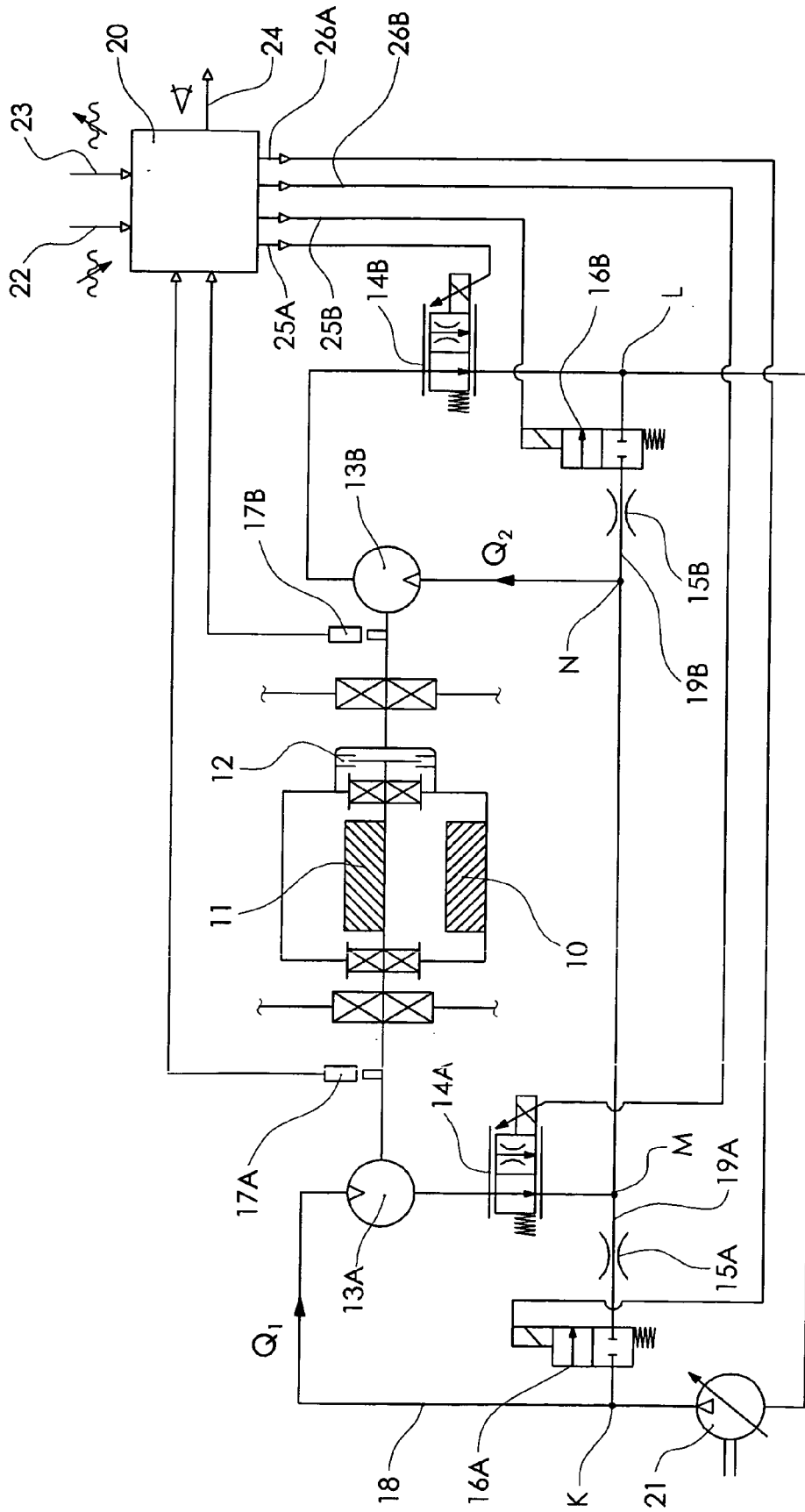


fig.1



EUROPEAN SEARCH REPORT

Application Number
EP 08 46 6018

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2004/120767 A1 (POTTS DEAN R [US] ET AL) 24 June 2004 (2004-06-24) * paragraphs [0011] - [0016]; figures 1,2 *	1-4	INV. B06B1/16 E01C19/28
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B06B E01C
Place of search Munich		Date of completion of the search 6 February 2009	Examiner Trique, Michael
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 08 46 6018

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06-02-2009

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