The invention relates to a valve drive for gas exchange valves of an internal combustion engine, wherein each rocker arm has a first end act on at least one gas exchange valve and with a second end is connected in an articulated manner to a push rod (4) each, wherein each push rod (4) is brought into operational connection with an adjusting device for influencing the valve timing, wherein the adjusting device for influencing the valve timing comprises an adjustable valve lever (7) for each push rod (4), which on the one side interacts with an eccentric shaft (5) and on the other side with a roller (8) running on a cam (9) of a camshaft (10), wherein for influencing the valve timing the eccentric shaft (5) is rotatable and because of this a contact region of the roller (8) of the respective valve lever (7) on the respective cam (9) of the camshaft (10) is variable, and wherein the adjusting device for influencing the valve timing is formed in such a manner that the eccentric shaft (5) for influencing the valve timing is rotatable because of torques acting on said eccentric shaft (5) during the operation.
Keksintö koskee venttilikäytöä polttomoottorikoneen kaasunvaihtoventtiilejä varten, jossa venttilikäytössä on keinuvut, jolloin kukin keinuvipu vaikuttaa ensimmäisellä pääällä kaasunvaihtoventtiilin ja toinen pää on kulloinkin kytketty nivoolaidysti työntötankoon (4). Jolloin kukin työntötanko (4) on tuotu vaikutusyhteysen säädlöitteeseen kanssa venttilinohjausaihoihin vaikuttamiseksi, jolloin säädlöitteessä venttilinohjausaihoihin vaikutamiseksi on säädettävä keinuvipu kullokin työntötangolle (4), joka yhtyllä toimii yhdessä epäkeskoakselin (5) ja toisaalta nokka-akselin (10) nokalla (5) kulkevan rullan (8) kanssa, jolloin venttilinohjausaihoihin vaikutamiseksi epäkeskoakselin (5) on kiertyvä ja siten kulloisenkin keinuvipun (7) rullan (6) kosketusalue nokka-akselin (10) kulloeellakin nokalla (9) on muutettavissa, ja jolloin säädlöitte venttilinohjausaihoihin vaikutamiseksi on muodostettu siten, että epäkeskoakselin (5) venttilinohjausaihoihin vaikutamiseksi on kierretavissa tähän käytössä vaikuttavien väintömomenttien perusteella.
Valve drive for gas exchange valves on an internal combustion engine

The invention relates to a valve drive for gas exchange valves of an internal combustion engine according to the preamble of Claim 1.

Fig. 1 shows a detail from the valve drive 1 for gas exchange valves of an internal combustion engine known from DE 10 2004 057 438 A1 together with a cylinder head 2 of the internal combustion engine, which is preferentially embodied as a diesel engine. The valve drive 1 according to Fig. 1 comprises rocker arms 3, wherein each rocker arm 3 with a first end acts on at least one gas exchange valve which is not shown and with a second end is connected in an articulated manner with a push rod 4 each. Fig. 1 merely shows a rocker arm 3 and a push rod 4 of the valve drive 1. Each push rod 4 of the valve drive is brought into operational connection with an adjusting device for influencing the valve timing of the gas exchange valves, wherein the adjusting device for influencing the valve timing comprises an adjustable valve lever 7 for each push rod 4. Each of the valve levers 7 is coupled to an eccentric shaft 5, namely via an eccentric 6 coupled between the eccentric shaft 5 and the respective valve lever 7. Each of the valve levers 7 does not only act together with the eccentric shaft 5, but furthermore with a cam 9 which is positioned on a camshaft 10, namely via a roller 8 running on the respective cam 9. To influence the valve timing, the eccentric shaft 5 is rotatable in the sense of the double arrow 11 (see Fig. 2), wherein through the rotation of the eccentric shaft 5 a contact region of the roller 8 of the respective valve lever 7 on the respective cam 9 of the camshaft 10 changes in the sense of the double arrow 12 (see also Fig. 2). This causes a change of the valve timing of the gas exchange valves of the internal combustion engine.

In order to rotate the eccentric shaft with valve drives known from the prior art for influencing the valve timing of the gas exchange valves, a separate drive system is
required with valve drives known from the prior art. This can be for example a separate electric or a separate hydraulic drive system. By way of such a separate drive system, a torque is applied to the eccentric shaft in the case of valve drives known from the prior art, in order to influence the valve timing of the gas exchange valves in this way.

Starting out from this, the present invention is based on the object of creating a new type of valve drive for gas exchange valves of an internal combustion engine which has a simpler construction.

This object is solved through a valve drive according to Claim 1. According to the invention, the adjusting device for influencing the valve timing is designed in such a manner that the eccentric shaft for influencing the valve timing is rotatable because of torques acting on said eccentric shaft during the operation.

With the present invention it is proposed for the first time not to provide an additional drive unit for rotating the eccentric shaft in a valve drive for gas exchange valves. It is rather proposed to rotate the eccentric shaft based on torques acting on said eccentric shaft during the operation.

Thus, during the operation, an operationally-induced torque on the eccentric shaft which is caused through the upward and downward movement of the rollers of the valve levers relative to the cams of the camshaft. According to the invention, this operationally-induced torque is utilised in order to rotate the eccentric shaft for influencing the valve timing. Because of this it is possible to omit a separate drive system for rotating the eccentric shaft. Because of this, the construction of the valve drive according to the invention is simplified relative to the valve drives known from the prior art.
According to an advantageous further development of the invention, the adjusting device for influencing the valve timing is designed as a hydraulic non-self-locking adjusting device, which when the latter permits a rotation of the eccentric shaft in a defined direction of rotation, blocks a rotation of the eccentric shaft in an opposite direction of rotation, so that the eccentric shaft can be rotated step-by-step or ratchet-like in the defined direction.

Because of this it is possible to specifically utilise the operationally-induced and alternately acting torque, which is brought about through the upward and downward movement of the valve lever on the cam of the camshaft for rotating the eccentric shaft for influencing the valve timing. To this end, the rotation of the eccentric shaft is exclusively permitted in a defined direction of rotation, whereas the rotation of the eccentric shaft in the opposite direction of rotation is blocked. Because of this, a step-by-step rotation of the eccentric shaft in the desired direction of rotation is permitted for influencing the valve timing of the gas exchange valves.

Accordingly, the rotation of the eccentric shaft for influencing the valve timing of the gas exchange valves is composed of a multiplicity of small individual rotations, wherein an opposite rotation in each case is prevented. Such a step-by-step rotation of the eccentric shaft corresponds to a ratchet-like rotation of the latter in the defined direction of rotation.

Preferentially, the adjusting device comprises a switching means, with the help of which the defined direction of rotation, in which the eccentric shaft can rotate, can be changed. By way of the switching means, the direction of rotation in which the eccentric shaft for influencing the valve timing of the gas exchange valves can rotate, can be defined and changed. It is likewise possible via the switching means to completely prevent a rotation of the eccentric shaft.
According to an advantageous further development of the invention, the adjusting device comprises a plurality of hydraulic chambers interacting with the eccentric shaft, wherein for releasing the rotation of the eccentric shaft in a first direction of rotation and for blocking the rotation of the eccentric shaft in an opposite second direction of rotation, hydraulic oil can flow out of a first hydraulic chamber and hydraulic oil can flow into a second hydraulic chamber, and wherein for releasing the rotation of the eccentric shaft in the second direction of rotation and for blocking the rotation of the eccentric shaft in the opposite first direction of rotation, hydraulic oil can flow out of a second hydraulic chamber and hydraulic oil can flow into a first hydraulic chamber. Preferentially, both hydraulic chambers are assigned at least one non-return valve, which prevents a return flow of the hydraulic oil from the hydraulic chamber, in which for the rotation of the eccentric shaft in the desired direction of rotation hydraulic oil is to flow, and which for the hydraulic chamber from which hydraulic oil is to drain, is bridged via a bypass line. The above embodiment of the adjusting device with the hydraulic chambers, non-return valves and bypass lines allows a simple design implementation of the valve drive according to the invention.

Preferred further developments of the invention are obtained from the subclaims and the following description. Exemplary embodiments of the invention are explained in more detail by means of the drawing without being restricted to this. Here it shows:

Fig. 1: a detail of a valve drive for gas exchange valves of an internal combustion engine known from the prior art;

Fig. 2: a detail of the valve drive of Fig. 1;

Fig. 3: a schematic diagram of details of a valve drive according to the invention;

Fig. 4: a schematic diagram of details of an alternative valve drive according to the invention;
Fig. 5: a schematic diagram of details of a further alternative valve drive according to the invention;

Fig. 6: a schematic diagram of details of a further alternative valve drive according to the invention; and

Fig. 7: a schematic diagram of design embodiment of a valve drive according to the invention.

The present invention relates to a valve drive for gas exchange valves of an internal combustion engine whose principal construction is shown in Fig. 1 and 2.

Thus, the valve drive 1 comprises rocker arms 3, wherein each rocker arm 3 with a first end acts on at least one gas exchange valve and with a second end is connected in an articulated manner to a push rod 4 each. Each push rod 4 is brought into operational connection with an adjusting device for influencing the valve timing of the respective gas exchange valve. The adjusting device for influencing the valve timing comprises and adjustable valve lever 7 for each push rod 4, which on the one side acts together with an eccentric shaft 5 via an eccentric 6 and on the other side with a roller 8 running on a cam 9 of a camshaft 10. For influencing the valve timing, the eccentric shaft 5 is rotatable, as a result of which a contact region of the roller 8 of the respective valve lever 7 on the respective cam 9 of the camshaft 10 can be changed in order to change the valve timing of the gas exchange valves in this way.

According to the invention, the adjusting device for influencing the valve timing of the gas exchange valves is designed in such a manner that the eccentric shaft 5 for influencing the valve timing is rotatable because of torques packing on the eccentric shaft 5 during the operation. Accordingly, the valve drive according to the invention does not require a separate drive unit for rotating the eccentric shaft 5 for influencing the valve timing of the gas exchange valves, the valve drive according to the invention rather utilises operationally-induced torques, which act on the eccentric shaft 5 due to the upward and downward movement of the rollers 8 of the valve levers 7.
The rolling of the rollers 8 of the camshaft 10 brings about a horizontal force component in the direction of the eccentrics 6 interacting with the eccentric shaft 5, wherein this horizontal force component in the direction of the eccentric 6 because of the distance of the centre points of the eccentrics 6 to the centre point of the eccentric shaft 5 brings about a torque on the eccentric shaft 5. This operationally-induced torque is reciprocal, i.e. acts alternately in different directions and according to the invention is realised for rotating the eccentric shaft 5 and thus for influencing the valve timing of the gas exchange valves.

Owing to the fact that a multiplicity of valve levers 7 roll on corresponding cams 9 of the camshaft 10 which are operationally connected to the eccentric shaft 5, a multiplicity of torque impulses on the eccentric shaft 5 are obtained per revolution of the camshaft 10. As already explained, these torque impulses are reciprocal, i.e. they act alternately in different directions.

The adjusting device for influencing the valve timing is preferentially designed as hydraulic non-self-locking adjusting device which, when the latter permits a rotation of the eccentric shaft 5 in a defined direction of rotation, blocks a rotation of the eccentric shaft 5 in the opposite direction of rotation, so that only those torque impulses are utilised for rotating the eccentric shaft 5, which bring about a rotation of the eccentric shaft 5 in the same defined direction of rotation at any time.

This causes a step-by-step rotation of the eccentric shaft 5 in the defined rotation of direction. By contrast, the rotation of the eccentric shaft 5 is not possible in the opposite direction of rotation, as a result of which a ratchet-like rotating of the eccentric shaft 5 in the defined direction of rotation is obtained.
In order to make possible a rotation of the eccentric shaft in different directions of rotation and thus change the valve timing of the gas exchange valves in different operational directions, the adjusting device comprises a switching means, with the help of which the defined direction of rotation, in which the eccentric shaft 5 can be rotated, can be changed. Preferentially, this switching means permits the rotation of the eccentric shaft in a first defined direction of rotation in a first switching position, wherein the rotation of the eccentric shaft in the second direction of rotation which is opposite with respect to the first defined direction of rotation is then blocked. In a second switching position of the switching means, the latter permits the rotation of the eccentric shaft in the second direction of rotation, wherein the rotation of the eccentric shaft of the first direction of rotation is then blocked. In a third switching position it is provided to block both directions of rotation of the eccentric shaft 5.

Fig. 3 shows a first variant of a possible implementation of the valve drive 1 according to the invention, wherein according to Fig. 3 the adjusting device for influencing the valve timing comprises a plurality of hydraulic chambers interacting with the eccentric shaft 5, namely a first hydraulic chamber 13 and a second hydraulic chamber 14. The two hydraulic chambers 13, 14 are each formed by a hydraulic cylinder 15, 16 in the variant of Fig. 3, wherein in the exemplary embodiment of Fig. 3 both hydraulic cylinders 15, 16 are coupled on the one hand among themselves via their piston rods 17 and on the other hand to the eccentric shaft 5 via a connecting rod 18 acting on the piston rods 17.

To release the rotation of the eccentric shaft 5 in a first direction of rotation, for example the direction of rotation visualised in Fig. 3 by the arrow 19 and for blocking the rotation of the eccentric shaft 5 in a second direction of rotation opposite thereto, hydraulic oil can flow out of a first hydraulic chamber, in Fig. 3 out of the hydraulic chamber 14 and hydraulic oil can flow into a second hydraulic chamber, in Fig. 3 into the hydraulic chamber 13. For this purpose, the two hydraulic chambers 13 and 14 are connected to storage tanks 20 and 21 for hydraulic oil.
By contrast, when a rotation of the eccentric shaft 5 is to take place in the second direction of rotation, i.e. in Fig. 3 opposite to the first direction of rotation 19, hydraulic oil can flow out of the second hydraulic chamber, i.e. in Fig. 3 out of the hydraulic chamber 13 and hydraulic oil can flow into the first hydraulic chamber, i.e. in Fig. 3 into the hydraulic chamber 14.

In order to prevent that hydraulic oil flows out of that hydraulic chamber 13 and 14 into which hydraulic oil is to flow for rotating the eccentric shaft 5 in the desired direction of rotation back into the respective storage tank 20 and 21, a non-return valve 24 and 25 each are connected in lines 22 and 23, via which the hydraulic chambers 13 and 14 are coupled to the respective storage tank 20 and 21 and via which hydraulic oil is to be delivered into the respective hydraulic chamber 13 and 14.

These lines 22, 23, in which the non-return valves 24, 25 are connected, are dependent on the switching position of switching means 26, 27 for that hydraulic chamber 13, 14, out of which hydraulic oil is to flow for rotating the eccentric shaft 5, is bridged via a bypass line 28, 29.

Thus, in Fig. 3, the bypass line 28, which interacts with the hydraulic chamber 13 and which is switched parallel to the line 22, is interrupted via the relevant switching means 26, so that in Fig. 3 hydraulic oil can flow into the hydraulic chamber 13 starting out from the storage tank 20, but no hydraulic oil can flow back into the storage tank 20 from the hydraulic chamber 13. The bypass line 29, which interacts with the other hydraulic chamber 14, by contrast, is opened via the relevant switching means 27, so that hydraulic oil can flow out of the hydraulic chamber 14 into the storage tank 21. Thus, the rotation of the eccentric shaft 5 in the direction of the arrow 19 of Fig. 3 is permitted and the opposite rotation is blocked. By changing the switching position of the switching means 26, 27, the
permitted direction of rotation of the eccentric shaft 5 is reversible and the rotation of the latter completely blockable.

Accordingly, with the above configuration of the valve drive it is possible because of the reciprocal torque impulses acting on the eccentric shaft 5 during the operation to make possible dependent on the switching position of the switching means 26 and 27 the rotation of the eccentric shaft 5 in a defined direction of rotation, namely step-by-step or ratchet-like in a plurality of stages. The direction of rotation opposite with respect thereto however is blocked in each case.

Accordingly, for rotating the eccentric shaft 19 in a defined direction of rotation and accordingly to influence the valve timing of the gas exchange valves, a hydraulic chamber of a hydraulic cylinder in the variant of Fig. 3, in which both hydraulic chambers 13 and 14 are provided by separate hydraulic cylinders 15 and 16, is opened such that hydraulic oil can flow out of the latter, whereas hydraulic oil can flow into the hydraulic chamber of the other hydraulic cylinder. Depending on the switching position of the switching means 26 and 27, a step-by-step or gradual rotation of the eccentric shaft 5 in a defined direction of rotation is thereby possible, whereas the rotation movement of the eccentric shaft 5 in the opposite direction of rotation is blocked. Accordingly, by switching over the switching means 26 and 27 a direction of rotation reversal for the eccentric shaft 5 is possible.

An alternative implementation of the valve drive according to the invention is shown by Fig. 4, wherein in Fig. 4 both hydraulic chambers 13 and 14 are provided by a common hydraulic cylinder 30. The hydraulic cylinder 30, which in Fig. 4 provides both hydraulic chambers 13 and 14, is connected on the one side fixed to the housing and on the other side is coupled to the eccentric shaft 5 via the piston rod 17 and the connecting rod 18. The representation of the storage tanks for hydraulic oil, of the non-return valves and bypass lines has been omitted in Fig. 4 for the sake of clarity.
Further alternative configuration possibilities for the valve drive according to the invention are schematically shown by Fig. 5 and 6, wherein the hydraulic chambers 13 and 14 in turn for the sake of clarity are shown in Fig. 5 and 6 without the storage tanks for hydraulic oil, without the non-return valves and without the bypass lines.

In the variant of Fig. 5, the hydraulic chambers 13 and 14 are provided by a rotary vane piston, which comprises a stator 31 and a rotor 32, wherein the rotor 32 of the rotary vane piston schematically shown in Fig. 5 is arranged coaxially with respect to the eccentric shaft 5 and connected or coupled to the eccentric shaft 5.

In the variant of Fig. 6, the hydraulic chambers 13 and 14 in turn are provided by a common hydraulic cylinder 33, wherein between both hydraulic chambers 13 and 14 a thrust piston 34 extends. Thus, the thrust piston 34 is coupled to a toothing 36 of the eccentric shaft 5 via a toothing 35 in order to convert a linear displacement of the push rod 34 into a rotation of the eccentric shaft 5 for influencing the valve timing of the gas exchange valves.

As already explained, the hydraulic chambers 13 and 14 of the variants of Fig. 4 to 6 can be coupled in a manner similar to the variant of Fig. 3 via lines 22, 23 to non-return valves 24, 25 and via bypass lines 28, 29 to switching means 26, 27 to storage tanks 20, 21 for hydraulic oil. In contrast with the exemplary embodiment of Fig. 3, in which for each hydraulic chamber 13 and 14 a separate oil storage tank 20, 21 and a separate non-return valve 24, 25 are present, it is also possible for both hydraulic chambers to utilise a common oil supply and a common non-return valve. Such a variant is discussed in the following making reference to Fig. 7.
Thus, Fig. 7 in turn shows a variant of the invention, in which the two hydraulic chambers 13 and 14 are provided by separate hydraulic cylinders 15 and 16, the piston rods 17 of which are coupled to the eccentric shaft 5 via a coupling rod 18. With respect to these details, the variant of the Fig. 7 corresponds to the variant of Fig. 3.

In contrast with the variant of Fig. 3, however, both hydraulic chambers 13, 14 and thus both hydraulic cylinders 15, 16 are assigned a common non-return valve 37 in the variant of Fig. 7, which is connected in a line 38, via which the hydraulic chambers 13 and 14 starting out from an engine lubricating oil system can be filled with hydraulic oil. Viewed in flow direction of the hydraulic oil downstream of the non-return valve 37, this line 38 splits into two part lines 38a and 38b, which are opened or blocked like bypass lines 40 and 41, depending on the switching position of a common switching means 39.

The common switching means 39 in Fig. 7 is a valve rod, which can be linearly displaced by a valve control solenoid 42, wherein in the switching position of Fig. 7 with respect to the hydraulic chamber 13, the part line 38a is opened and the bypass line 40 is blocked, whereas with respect to the hydraulic chamber 14, the part line 38b is blocked and the bypass line 41 is opened, so that in the switching position in Fig. 7 hydraulic oil can flow into the hydraulic chamber 13 and out of the hydraulic chamber 14.

Through corresponding linear displacement of the valve rod 39, it is possible, for reversing the direction of rotation for the eccentric shaft 5, with respect to the hydraulic chamber 13, to block the part line 38a and open the bypass line 40 and with respect to the hydraulic chamber 14, open the part line 38b and block the bypass line 41.

Accordingly, depending on the switching position of the valve rod 39, the eccentric shaft 5 can be displaced in different directions of rotations in order to thereby
influence the valve timing of the gas exchange valves, wherein the rotation of the eccentric shaft 5 in both possible directions of rotation is limited by stops 43.

To improve the dynamics of movement of the eccentric shaft 5 during the rotation of the latter, the bypass lines 40 and 41 are assigned drainage orifices 44 in Fig. 7, via which hydraulic oil can flow out of the respective hydraulic chambers 13, 14. Likewise, to improve the dynamics of movement of the eccentric shaft 5 in the region of the stops 43, damping via end position dampers which are not shown can take place.
List of reference numbers

1  Valve drive
2  Cylinder head
5  3  Rocker arm
4  Push rod
5  Eccentric shaft
6  Eccentric
7  Valve lever
10 8  Roller
9  Cam
10 Camshaft
11 Rotation of the eccentric shaft
12 Displacement of the roller
15 13 Hydraulic chamber
14 Hydraulic chamber
15 Hydraulic cylinder
16 Hydraulic cylinder
17 Piston rods
20 18 Connecting rod
19 Rotation of the eccentric shaft
20 Storage tank
21 Storage tank
22 Line
25 23 Line
24 Non-return valve
25 Non-return valve
26 Switching means
27 Switching means
30 28 Bypass line
29 Bypass line
30 Hydraulic cylinder
31 Stator
32  Rotor
33  Hydraulic cylinder
34  Push rod
35  Tooothing
5  36  Tooothing
37  Non-return valve
38  Line
38a  Part line
38b  Part line
10  39  Valve rod
40  Bypass line
41  Bypass line
42  Valve control solenoid
43  Stop
15  44  Drainage orifice
1. A valve drive for gas exchange valves of an internal combustion engine having rocker arms (3), wherein each rocker arm (3) with a first end acts on at least one gas exchange valve and with a second end is connected in an articulated manner to a push rod (4) each, wherein each push rod (4) is brought into operational connection with an adjusting device for influencing the valve timing, wherein the adjusting device for influencing the valve timing comprises an adjustable valve lever (7) for each push rod (4), which on the one side interacts with an eccentric shaft (5) and on the other side with a roller (8) running on a cam (9) of a camshaft (10), and wherein for influencing the valve timing the eccentric shaft (5) is rotatable and because of this a contact region of the roller (8) of the respective valve lever (7) on the respective cam (9) of the camshaft (10) can be changed, characterized in that the adjusting device for influencing the valve timing is designed in such a manner that the eccentric shaft (5) for influencing the valve timing can be rotated because of torques acting on said eccentric shaft (5) during the operation.

2. The valve drive according to Claim 1, characterized in that the adjusting device for influencing the valve timing is designed as a hydraulic, non-self-locking adjusting device, which when it permits a rotation of the eccentric shaft (5) in a defined direction of rotation, blocks a rotation of the eccentric shaft (5) in an opposite direction of rotation, so that the eccentric shaft (5) can be rotated in the defined direction in a step-by-step or ratchet-like manner.

3. The valve drive according to Claim 2, characterized in that the adjusting device comprises at least one switching means (26, 27, 39), with the help of which the direction of rotation in which the eccentric shaft (5) can rotate, can be changed.
4. The valve drive according to Claim 2 or 3, characterized in that the adjusting device comprises a plurality of hydraulic chambers interacting with the eccentric shaft (5), wherein for releasing the rotation of the eccentric shaft (5) in a first direction of rotation and for blocking the rotation of the eccentric shaft (5) in an opposite second direction of rotation hydraulic oil can flow out of a first hydraulic chamber (14) and hydraulic oil can flow into a second hydraulic chamber (13), and wherein for releasing the rotation of the eccentric shaft (5) in the second direction of rotation and for blocking the rotation of the eccentric shaft (5) in the opposite first direction of rotation, hydraulic oil can flow out of a second hydraulic chamber (13) and hydraulic oil can flow into a first hydraulic chamber (14).

5. The valve drive according to Claim 4, characterized in that both hydraulic chambers (13, 14) are assigned at least one non-return valve (24, 25, 37), which prevents a return flow of the hydraulic oil out of the hydraulic chamber (13, 14), into which hydraulic oil is to flow, and which for the hydraulic chamber (13, 14), out of which hydraulic oil is to flow, is bridged via a bypass line (28, 29, 40, 41).

6. The valve drive according to Claim 4 or 5, characterized in that both hydraulic chambers (13, 14) are formed by a common hydraulic cylinder (13), which on the one side is connected fixed to the housing and which on the other side is coupled to the eccentric shaft (5).

7. The valve drive according to Claim 4 or 5, characterized in that the two hydraulic chambers (13, 14) are formed by a rotary vane piston, whose rotor (32) is coaxially coupled to the eccentric shaft (5).
8. The valve drive according to Claim 4 or 5, characterized in that both hydraulic chambers (13, 14) are formed by a common hydraulic cylinder (33), which comprises a thrust piston (34) positioned between these, which is coupled to a toothing (36) of the eccentric shaft (5) via a toothing (35).

9. The valve drive according to Claim 4 or 5, characterized in that the first hydraulic chamber (14) is formed by a first hydraulic cylinder (16) and the second hydraulic chamber (13) by a second hydraulic cylinder (15), which on the one side are coupled to each other and on the other side to the eccentric shaft (5).

10. The valve drive according to any one of the Claims 4 to 9, characterized in that both hydraulic chambers (13, 14) are assigned a common non-return valve (37) or an individual non-return valve (24, 25) each, which is or are connected into a line (38, 22, 23), via which the hydraulic chambers (13, 14) starting out from an engine lubricating oil system can be filled with hydraulic oil.

11. The valve drive according to any one of the Claims 4 to 10, characterized in that bypass line (28, 29, 40, 41), which can be diverted from the hydraulic chambers (13, 14), drain orifices (44) are assigned.

12. The valve drive according to any one of the Claims 1 to 11, characterized in that the rotation of the eccentric shaft (5) is limited via stops (43).

13. The valve drive according to Claim 12, characterized in that the rotation of the eccentric shaft (5) in the region of the stops (43) is dampened by end position dampers.
Patenttivaatimukset

1. Venttiilikäyttö poltomoottorikoneen kaasunvaihtoverttiilejä var-ten, jossa venttiilikäytössä on keinuvivut (3), jolloin kuvun keinuvipu (3) vaikut-taa ensimmäisellä päällä kaasunvaihtoverttiiliin ja toinen pää on kulloinkin kyt-ketty nivelöidysti työntötankoon (4), jolloin kuvun työntötanko (4) on tuotu vaiku-tusyhteyteen säätolaitteen kanssa venttiilinohjausaikoihin vaikuttamiseksi, jol-lon säätolaitteessa venttiilinohjausaikoihin vaikuttamiseksi on säädetävä kei-nuvipu kullekin työntötangolle (4), joka yhtäältä toimii yhdessä epäkeskoakselin (5) ja toisaalta noppa-akselin (10) nokalla (9) kulkevan rullan (8) kanssa, ja jolloin venttiilinohjausaikoihin vaikuttamiseksi epäkeskoakseli (5) on kiertyvä ja siten kulloisenkin keinuvivun (7) rullan (8) kosketusalue noppa-akselin (10) kulloisellakin nokalla (9) on muutettavissa, t u n n e t t u siitä, että säätolaitte venttiilinohjausaikoihin vaikuttamiseksi on muodostettu siten, että epäkeskoakseli (5) venttiilinohjausaikoihin vaikuttamiseksi on kierrettävissä tähän käytössä vaikuttavien vääntömomenttien perusteella.

2. Patenttivaatimuksen 1 mukainen venttiilikäyttö, t u n n e t t u siit-tä, että säätolaitte venttiilinohjausaikoihin vaikuttamiseksi on muodostettu hyd-rauliseksi, ei-itserejottavaksi säätolaitteeksi, joka sitten, kun tämä sallii epä-keskoakselin (5) kiertymisen määrätysä kiertosuunnassa, estää epäkeskoaksel-selin (5) kiertymisen vastakkaiseen kiertosuuntaan, niin että epäkeskoakseli (5) on kierrettävissä määrätysä suunnassa askelmaisesti tai räikkämäisesti.

3. Patenttivaatimuksen 2 mukainen venttiilikäyttö, t u n n e t t u siit-tä, että säätolaitte käsittää vähintään yhden kytkinvälineen (26, 27, 39), jonka avulla kiertosuunta, jossa epäkeskoakseli (5) voi kiertyä, on muutettavissa.

4. Patenttivaatimuksen 2 tai 3 mukainen venttiilikäyttö, t u n n e t t u siit-tä, että säätolaitteessa on useampia epäkeskoakselin (5) kanssa yhdessä vaikuttavia hydraulikkaammiota, jolloin epäkeskoakselin (5) kiertymisen va-pauuttamiseksi ensimmäiseen kiertosuuntaan ja epäkeskoakselin (5) kiertymi-sen estämiseksi vastakkaiseen kiertosuuntaan ensimmäisestä hydraulikkaammiosta (14) voi virrata hydraulikkaöljyä ulos ja toiseen hydraulikkaammi-oon (13) voi virrata hydraulikkaöljyä sisään, ja jolloin epäkeskoakselin (5) kier-tymisen vaapauuttamiseksi toiseen kiertosuuntaan ja epäkeskoakselin (5) kierty-misen estämiseksi vastakkaiseen kiertosuuntaan toisesta hydraulikkaammi-oista (13) voi virrata hydraulikkaöljyä ulos ja ensimmäiseen hydraulikkaam-
5. Patenttivaatimuksen 4 mukainen venttiilikäyttö, **tunnettu siitä**, että molemmat hydraulikakammiot (13, 14) on järjestetty vähintään yksi takaiskuventtiili (24, 25, 26), joka estää hydraulikkaöljyn takaisinvirtaamisen hydraulikakammioista (13, 14), jonka sisään hydraulikkaöljyn tulee virrata, ja joka on ohitettu ohitusjohtolla (28, 29, 40, 41) hydraulikakammioita (13, 14) varten, josta hydraulikkaöljyn tulee virrata ulos.

6. Patenttivaatimuksen 4 tai 5 mukainen venttiilikäyttö, **tunnettu siitä**, että molemmat hydraulikakammiot (13, 14) on muodostettu yhteisestä hydraulikkasylyinteristä (30), joka on toisaalta kotelonsa suhteen kiinteästi asennettu ja toisaalta kytkeyty epäkeskoakselin (5).

7. Patenttivaatimuksen 4 tai 5 mukainen venttiilikäyttö, **tunnettu siitä**, että molemmat hydraulikakammiot (13, 14) on muodostettu siipikierto- männästä, jonka roottori on kytkeyty koaksialisesti epäkeskoakselin (5) kanssa.

8. Patenttivaatimuksen 4 tai 5 mukainen venttiilikäyttö, **tunnettu siitä**, että molemmat hydraulikakammiot (13, 14) on muodostettu yhteisestä hydraulikkasylyinteristä (33), joka käsitteää näiden väliti sijoitetun iskumännän (34), joka on kytkeyty hammastuksen ((35) välyksellä epäkeskoakselin (5) hammastuksen (36).

9. Patenttivaatimuksen 4 tai 5 mukainen venttiilikäyttö, **tunnettu siitä**, että ensimmäinen hydraulikakammio (14) on muodostettu ensimmäisestä hydraulikkasylyinteristä (16) ja toinen hydraulikakammio (13) on muodostettu toisesta hydraulikkasylyinteristä (15), jotka on toisaalta kytkeyty keskenään ja toisaalta epäkeskoakselin (5).

10. Jonkin patenttivaatimuksen 4 - 9 mukainen venttiilikäyttö, **tunnettu siitä**, että molemmilla hydraulikakammioiden (13, 14) on järjestetty yhteen takaiskuventtiili (37) tai kuloinkin oma takaiskuventtiili (24, 25), joka täyttää, että ohitettu ohitusjohtoon (38, 22, 23), jonka kautta hydraulikkakammioita (13, 14) voidaan tyhjentää, on järjestetty poistokuristin (44).

11. Jonkin patenttivaatimuksen 4 - 10 mukainen venttiilikäyttö, **tunnettu siitä**, että ohitusjohtoon, (28, 29, 40, 41), jonka kautta hydraulikkakammiota (13, 14) voidaan tyhjentää, on järjestetty poistokuristin (44).

12. Jonkin patenttivaatimuksen 1 - 11 mukainen venttiilikäyttö, **tunnettu siitä**, että epäkeskoakselin (5) kiertyminen on rajoitettu vasteilla (43).
13. Patenttivaatimuksen 12 mukainen venttiilikäyttö, tunnettu siitä, että epäkeskoakselin (5) kiertyminen on vaimennettu vasteiden (43) alueella päätasentovaimentimilla.
Fig. 7