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(54) **Piston speed modulation for a concrete pump**

Veränderung der Kolbengeschwindigkeit in einer Betonpumpe

Variation de la vitesse de course des pistons d'une pompe à béton

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US-A- 5 106 272 US-A- 5 332 366**

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Description

[0001] The present invention concerns a concrete pump comprising means to modulate the speed of the piston stroke into the pumping cylinders, said means being electronically controlled according to the maximum concrete capacity allowed by the pump.

[0002] The object of the invention is to improve the characteristic of the concrete capacity fed into the concrete transport and delivery duct, at the different working speeds of the pumping unit.

[0003] There are known to be concrete pumps which comprise a pumping unit, fed from a hopper, and a transport and delivery duct to distribute the concrete on the working site. Generally, the pumping unit consists of a pair of concrete pumping cylinders, alternatively operated by a pair of hydraulic cylinders, and of a special rocking valve (S-valve) which connects the concrete transport and delivery duct to one of the two pumping cylinders, while the other cylinder draws concrete from the hopper. The rocking S-valve is alternatively moved by a second pair of hydraulic cylinders. By combining the movement of the S-valve with the movement of the pumping cylinders, the concrete flow is generated through the transport and delivery duct. Said concrete flow is apt to move through the duct in the two directions; the concrete is actually pumped when the flow is directed from the pumping unit towards the outlet end of the duct, so as to be delivered, while it is drawn when the flow is directed in the opposite sense. The two types of operations are obtained by suitably combining the movement of the pumping cylinders with the position of the S-valve.

[0004] From US-A-5 332 366, US-A-5 106 272 it is further known that the speed of the pistons of the concrete-pumping cylinders may be varied and controlled during the cylinder stroke, so as to control the concrete flow rate.

[0005] This type of known pumps leads to cracks in the material drawn from the hopper, in the filling step of the pumping cylinders, thus involving discontinuities in the capacity of the concrete subsequently pumped into the transport and delivery duct.

[0006] The present invention proposes to overcome this drawback - highly unpleasant, for obvious reasons - by providing to modulate the speed at which the pistons of the pumping cylinders move into said cylinders by way of electronic control means.

[0007] More precisely, the present invention concerns a concrete pump - of the type comprising a pair of pumping cylinders alternatively operating under the control of a backflow hydraulic pump, to draw concrete from a hopper and feed it by way of a rocking valve (S-valve) into the transport and delivery duct, and wherein said cylinders are provided with stops to control the starting movement of the S-valve - characterized in that the speed of the piston stroke of said cylinders is modulated by being increased in the initial length of said stroke, and in that electronic means are provided to control said speed according to the maximum concrete capacity allowed by the pump.

[0008] In this pump, said electronic means preferably comprise a microprocessor unit, which receives the signals issued by said stops, detects and reckons the number of pumping cycles per minute, reckons the pump operating time with maximum capacity, and controls the movement of the S-valve and the reversal of the backflow hydraulic pump.

[0009] The invention is now described in further detail, with reference to the accompanying drawings, which illustrate a preferred embodiment thereof and in which:

Fig. 1 is a general diagram of a concrete pump comprising the means according to the invention; and

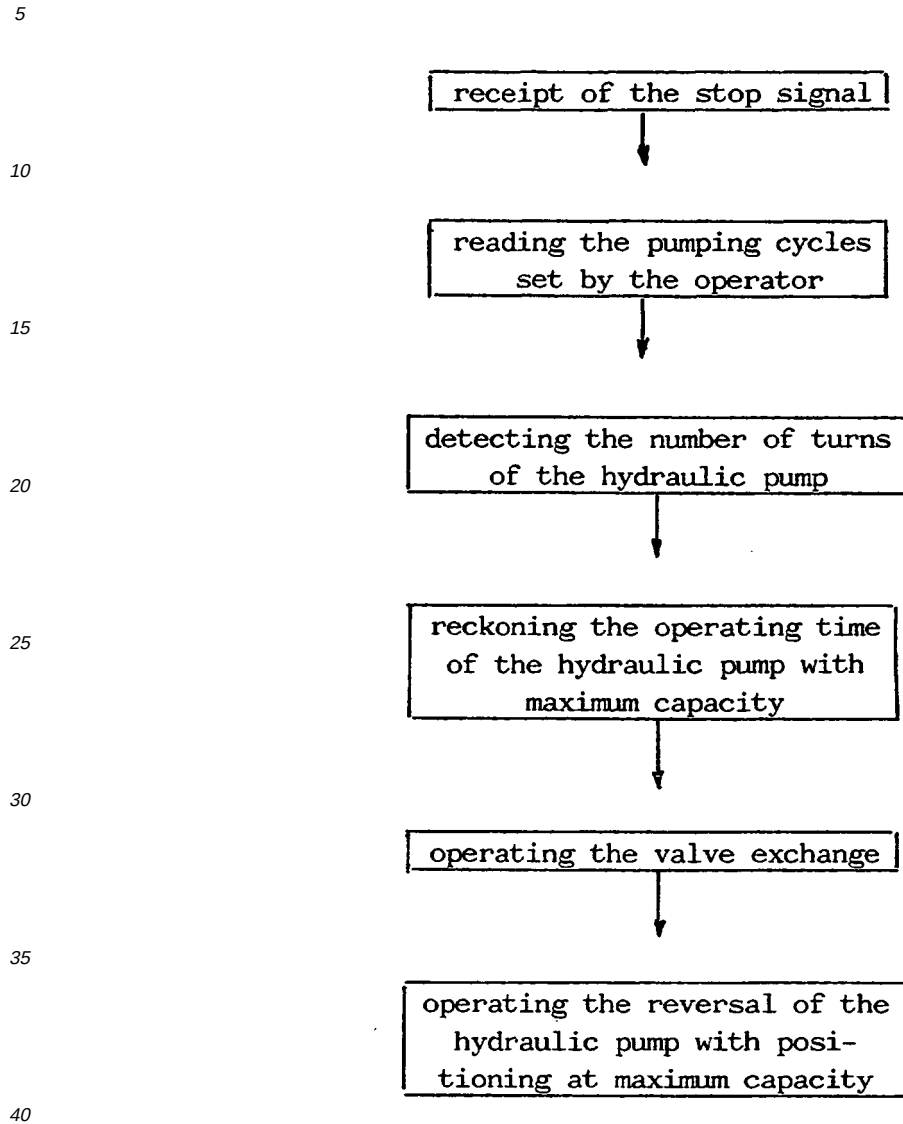
Fig. 2 diagrammatically illustrates how the means according to the invention are applied onto a pump as shown in fig. 1.

[0010] As shown on the drawings, a concrete pumping plant essentially comprises a pumping unit 1 fed from a hopper 2, and a transport and delivery duct (not shown) to distribute the concrete on the working site. The pumping unit 1 consists of a pair of concrete pumping cylinders 3 alternatively operated by a pair of hydraulic cylinders 4 controlled in the two directions by a backflow hydraulic pump 5 operated by a prime mover 6, and of a rocking S-valve 7 which connects the concrete transport and delivery duct to one of the two pumping cylinders 3, while the other cylinder draws concrete from the hopper 2. The S-valve 7 is alternatively moved by a second pair of hydraulic cylinders 8, fed by a hydraulic circuit with accumulator 9 and controlled by a set of solenoid valves 10. By combining the movement of the S-valve 7 with the movement of the pumping cylinders 3, a concrete flow is generated (the concrete being either pumped, or drawn) and moves, in a practically continuous but irregular manner, through the concrete transport and delivery duct.

[0011] According to the invention, the backflow hydraulic pump 5 - which controls the hydraulic cylinders 4 - and the S-valve 7 are operated by a microprocessor unit 11, into which are set the working cycles by a panel 12 and which receives signals issued by stops 13 of the pumping cylinders 3, and by a sensor 14 detecting the number of cycles of the pump 5. The microprocessor unit 11 controls the speed of the piston strokes of the pumping cylinders 3 according to the maximum concrete capacity allowed by the pump 5, increasing said speed in the initial length of the stroke, so as to promptly remove the cracks produced in the concrete drawn from the hopper 2, when filling said cylinders 3, to the full advantage of a homogeneous and continuous concrete delivery from the respective duct.

[0012] This allows to obtain curves to modulate the speed of the piston strokes, apt to improve the pumping performances according to the operating conditions and to the concrete characteristics, particularly its consistency.

[0013] The concrete pumping plant is controlled by the microprocessor unit 11 according to the following flow diagram:



which perfectly synthesizes the sequence of the operating steps.

[0014] It is anyhow understood that the invention is not limited to the embodiment described heretofore, but other practical embodiments may fall within the protection scope thereof.

Claims

1. Concrete pump (1), of the type comprising a pair of pumping cylinders (3) alternately operating under the control of a backflow hydraulic pump (5) to draw concrete from a hopper (2) and feed it, by way of a rocking S-valve (7), into the transport and delivery duct, wherein said cylinders (3) are provided with stops (13) to control the starting movement of the S-valve, (7), and wherein the speed of the pistons of said cylinders (3) is not constant along their stroke; **characterised in that** said speed is modulated by being increased in the initial length of each piston stroke and **in that** electronic means are provided to control said speed according to the maximum concrete capacity allowed by the pump (1).
2. Concrete pump as in claim 1), wherein said electronic means comprise a microprocessor unit (11), which receives the signals issued by said stops (13), reads the pumping cycles set by the operator, detects and reckons the number

of pumping cycles per minute, reckons the pump operating time with maximum capacity, and controls the movement of the S-valve and the reversal of the backflow hydraulic pump.

5 Patentansprüche

1. Betonpumpe (1) der Bauart, die ein Paar von Pumpzylindern (3) umfaßt, die unter der Steuerung einer hydraulischen Rückfluß-Pumpe (5) abwechselnd arbeiten, um Beton von einer Zuführung (2) abzuziehen und ihn im Wege eines Kippventils (S-Ventils) (7) in die Transport- und Abgabelleitung einzuleiten, wobei die genannten Zylinder (3) mit Anschlägen (13) versehen sind, um die Startbewegung des S-Ventils (7) zu steuern, und wobei die Geschwindigkeit der Kolben der genannten Zylinder (13) entlang ihres Hubs nicht konstant ist, **dadurch gekennzeichnet, daß** die genannte Geschwindigkeit moduliert wird, **dadurch** daß sie in dem anfänglichen Längenabschnitt eines jeden Kolbenhubs vergrößert wird, und daß elektronische Mittel vorgesehen sind, um die genannte Geschwindigkeit entsprechend der maximalen Förderleistung von Beton, die die Pumpe (1) zuläßt, zu steuern.
2. Betonpumpe nach Anspruch 1, **dadurch gekennzeichnet, daß** die genannten elektronischen Mittel eine Mikroprozessoreinheit (11) umfassen, die die Signale erhält, die von den genannten Anschlägen (13) abgegeben werden, die Pumpzyklen einliest, die durch die Bedienungsperson vorgegeben werden, die Anzahl von Pumpzyklen je Minute erfaßt und abschätzt, die Betriebszeit der Pumpe mit maximaler Förderleistung abschätzt, und die Bewegung des S-Ventils und die Umsteuerung der hydraulischen Rückfluß-Pumpe steuert.

Revendications

1. Pompe à béton (1), du type comprenant une paire de cylindres (3) de pompage fonctionnant en alternance sous la commande d'une pompe hydraulique anti-refoulement (5) dans le but d'extraire du béton d'une trémie (2) et de l'amener, au moyen d'une vanne S basculante (7), dans le conduit de transport et de délivrance, dans laquelle lesdits cylindres (3) sont pourvus de butées (13) servant à commander le mouvement de démarrage de la vanne S (7), et dans laquelle la vitesse des pistons desdits cylindres (3) n'est pas constante le long de leur course ; **caractérisé en ce que** ladite vitesse est modulée en étant accélérée dans la longueur initiale de chaque course de piston, et **en ce que** des moyens électroniques sont prévus pour commander ladite vitesse en fonction de la capacité maximale de béton admissible par la pompe (1).
2. Pompe à béton selon la revendication 1, dans laquelle lesdits moyens électroniques comprennent un module (11) de microprocesseur qui reçoit les signaux délivrés par lesdites butées (13), lit les cycles de pompage fixés par l'opérateur, détecte et compte le nombre de cycles de pompage par minute, comptabilise le temps de fonctionnement de pompe avec une capacité maximale, et commande le mouvement de la vanne S et l'inversion de la pompe hydraulique anti-refoulement.

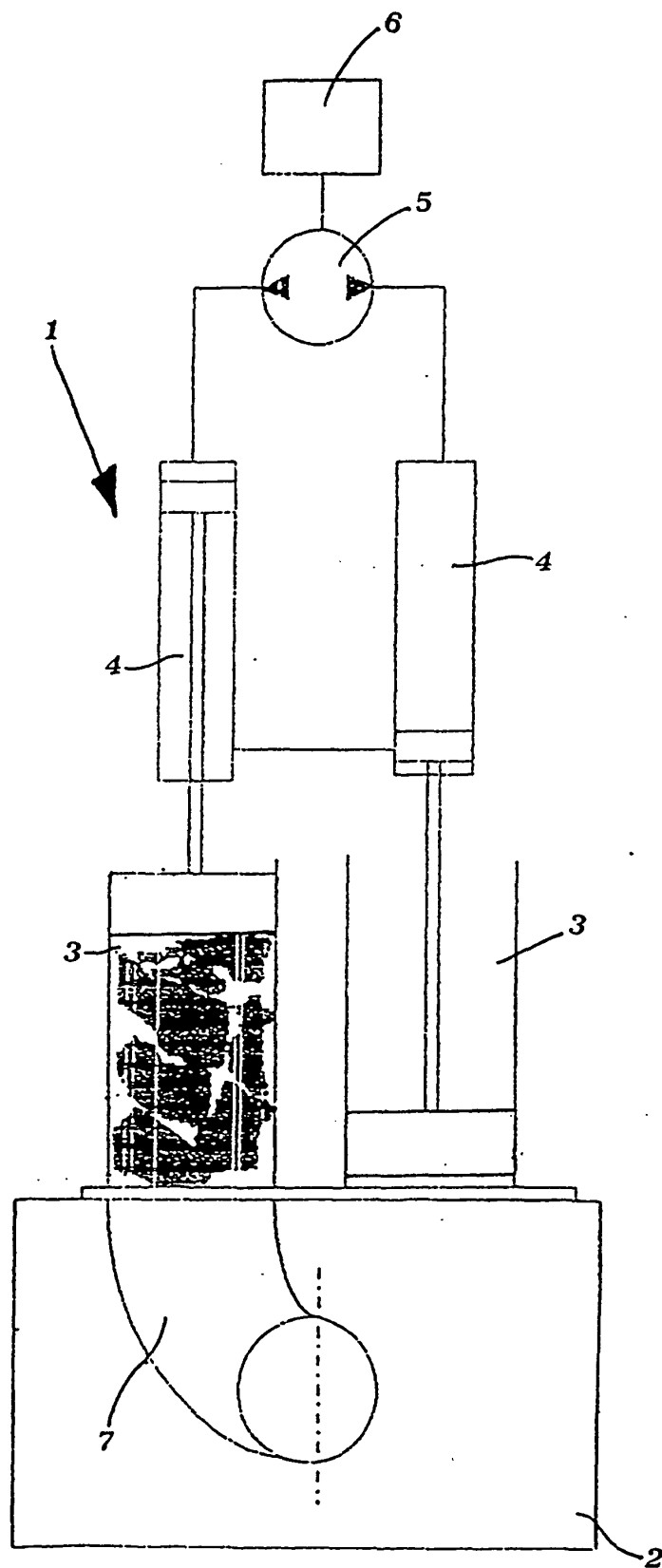


FIG.1

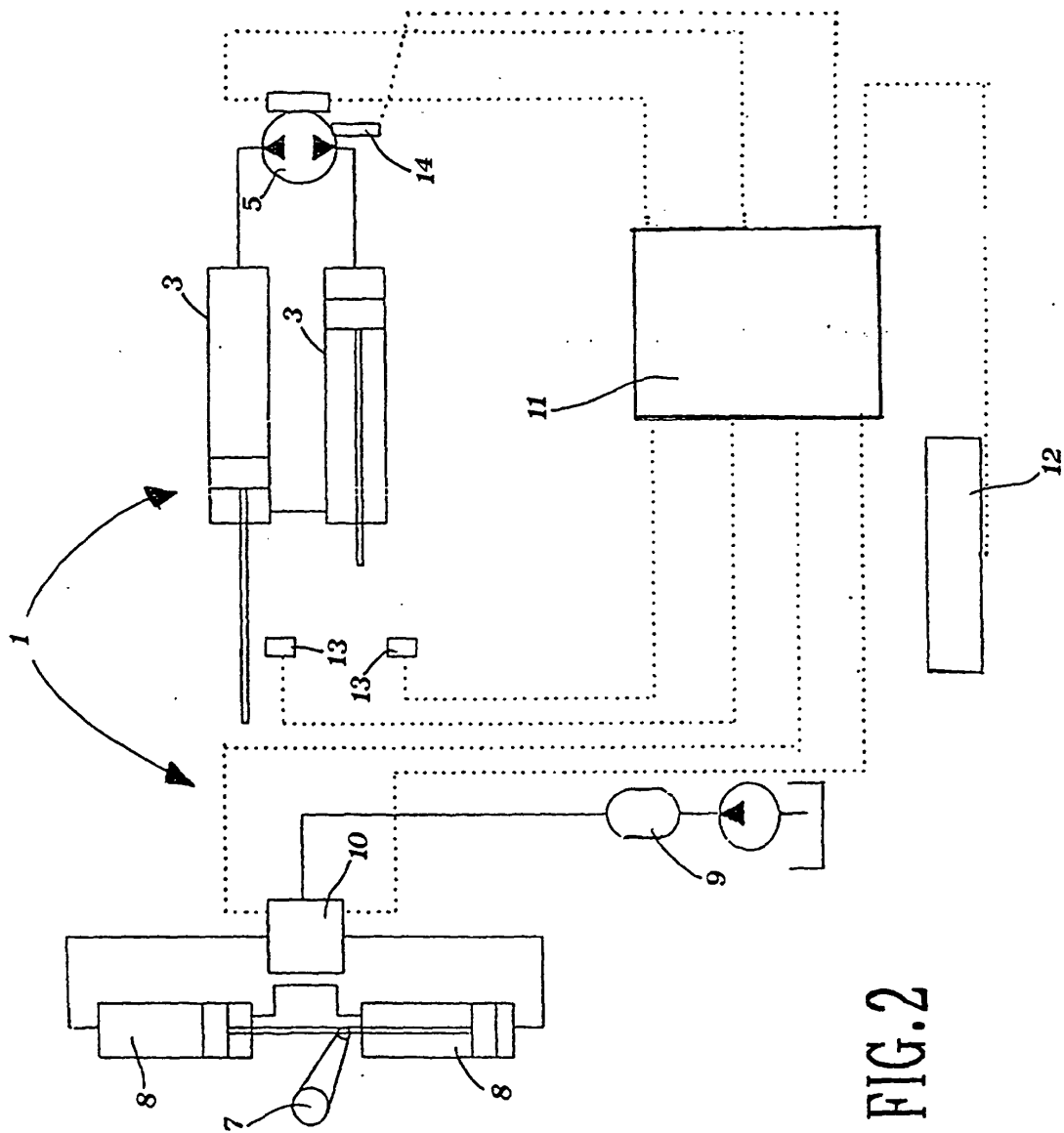


FIG.2