

(19)



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(11)

EP 0 704 578 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

03.04.1996 Bulletin 1996/14

(51) Int Cl.⁶: **E02F 9/22**

(21) Application number: **95630080.0**

(22) Date of filing: **11.07.1995**

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **30.09.1994 KR 9425151**

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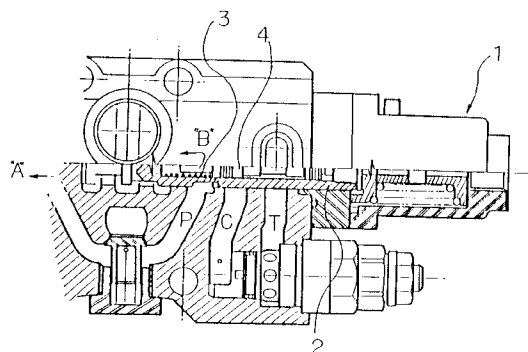
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(54) **Device for bucket fluid regeneration of hydraulic system of construction vehicle**

(57) A device for bucket fluid regeneration of a hydraulic system for a construction vehicle is disclosed. The device has means for feeding, during a bucket-in motion, a portion of the return fluid of a bucket cylinder back to supply fluid for the bucket cylinder. The bucket fluid regeneration is carried out within a regeneration possible range of an operational range of the bucket, which regeneration possible range is defined

between a given bucket-out position of the center of gravity of the bucket to a position where the center of gravity of the bucket is placed on a vertical line.

FIG 2



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates in general to devices for pressurized fluid regeneration of a hydraulic system in construction vehicles such as power excavators and, more particularly, to a device for bucket fluid regeneration of the hydraulic system for smoothing bucket operation and for preventing possible cavitation of the bucket cylinder due to a shortage of bucket fluid.

Description of the prior Art

"Regeneration" is also known as "positive feedback" or "regenerative feedback" and means a feedback in which a portion of the output fluid or the return fluid of the actuator of a hydraulic system is fed back to the input fluid or the supply fluid of the actuator to increase the total supply fluid to prevent possible cavitation of the actuator due to a shortage of fluid, and to achieve smooth operation of the actuator. For example, a portion of the high pressured return fluid out of the boom cylinder of a power excavator, which was obtained by weight of the boom, is fed back to the supply fluid for the boom cylinder during the boom lowering motion so as to be reused in the following boom raising motion.

However, it has been noted that such a fluid regeneration should be accompanied by a precondition in which the actuator to be regenerated in its pressurized fluid may be operated by weight of its corresponding working unit, such as a boom or an arm, other than the supplied fluid. In this regard, it has been noted that the regeneration of the pressurized fluid used in, a power excavator, for example can be exclusively effected in the case of the boom lowering motion and arm-in motion of the excavator. In particular, the regeneration of the pressurized fluid for the boom cylinder is a fixed regeneration, while the regeneration of the pressurized fluid for the arm cylinder is a variable regeneration as the turning operational range of the arm cylinder has both a regeneration possible range and a regeneration impossible range in accordance with arm positions.

SUMMARY OF THE INVENTION

In accordance with this applicant's study of pressurized fluid regeneration, it has been noted that there is a regeneration possible range in the turning operational range of a bucket of, for example, a power excavator and the regeneration can be also applied to pressurized fluid for a bucket cylinder of the excavator.

It is, therefore, an object of the present invention to provide a fluid regeneration device which is applied to a bucket fluid line of a hydraulic system and allows smooth bucket operation, and prevents possible cavitation of the

bucket cylinder due to a shortage of fluid.

In order to accomplish the above object, the present invention provides a device for bucket fluid regeneration for the hydraulic system of a construction vehicle having a bucket comprising: means for feeding, during a bucket-in motion, a portion of return fluid of a bucket cylinder back to supply fluid for the bucket cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a view showing the regeneration possible range and the regeneration impossible range of a turning operational range of a bucket;

Fig. 2 is a partially sectioned view of a bucket fluid directional control valve with a regeneration device in accordance with the invention; and

Fig. 3 is a partially enlarged sectional view of the control valve of Fig. 2, showing the regeneration device of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a view showing the regeneration possible range (I) and the regeneration impossible range (II) of a turning operational range of a bucket. As shown in the drawing, the turning operational range of the bucket B in a buck-in motion includes the regeneration possible range (I) where the high pressured return fluid is generated in bucket cylinder A due to the movement of bucket B caused by weight of the bucket B. In the above regeneration possible range (I), a portion of the return fluid under high pressure is fed back to the supply fluid of the bucket cylinder A so as to achieve the regeneration of the pressurized fluid for bucket cylinder A.

In the turning operation of bucket B in the buck-in motion for its pivot holder P, the regeneration possible range (I) is defined between a given bucket-out position (X) of the center (W) of gravity of bucket B to a position where the center (W) of gravity is placed on a vertical line (L). As bucket B in the bucket-in motion can be turned due to its own weight within the above regeneration possible range (I), high pressured return fluid is generated in bucket cylinder A. When the above high pressured return fluid is partially fed back to the supply fluid of bucket cylinder A, desired regeneration of the pressurized fluid the bucket cylinder A can be achieved.

Figs. 2 and 3 show a bucket fluid directional control valve with the regeneration device of this invention. As shown in the drawings, the directional control valve 1 is provided with a regeneration spool 4 which is set in a main spool 2 and elastically biased by a preset spring force of a pressure setting spring 3. The regeneration

spool 4 linearly moves in the main spool 2 in accordance with hydraulic pressure of a return line of bucket cylinder A and such a movement of the spool 4 controls the fluid flowing direction in the valve 1, thus achieving the desired regeneration of the pressurized fluid for bucket cylinder A. That is, when the main spool 2 moves in direction A of Fig. 2, an actuator port C of the valve 1 communicates with a conduit 11 of the main spool 2 so that the hydraulic pressure in the actuator port C biases the regeneration spool 4 in the direction B. Therefore, the return fluid out of the actuator port C is partially applied to a tank port T of the valve 1 through a conduit 12 and in turn returned to a return tank (not shown), while the other fluid out of the port C is applied to a pump port P of the valve 1 through a conduit 13 and in turn fed back in phase with the supply fluid for bucket cylinder A.

As described above, the present invention provides a regeneration device, which device is applied to a bucket fluid line of a hydraulic system and achieves regeneration of pressurized fluid for a bucket cylinder and allows smooth bucket operation, and prevents possible cavitation of the bucket cylinder due to a shortage of fluid.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. A device for bucket fluid regeneration of a hydraulic system of a construction vehicle having a bucket comprising:
means for feeding, during a bucket-in motion, a portion of the return fluid of a bucket cylinder back to supply fluid for the bucket cylinder.
2. The device according to claim 1, wherein the bucket fluid regeneration of the device is carried out within a regeneration possible range of an operational range of the bucket.
3. The device according to claim 2, wherein said regeneration possible range is defined between a given bucket-out position of the center of gravity of the bucket to a position where the center of gravity of the bucket is placed on a vertical line.

FIG 1

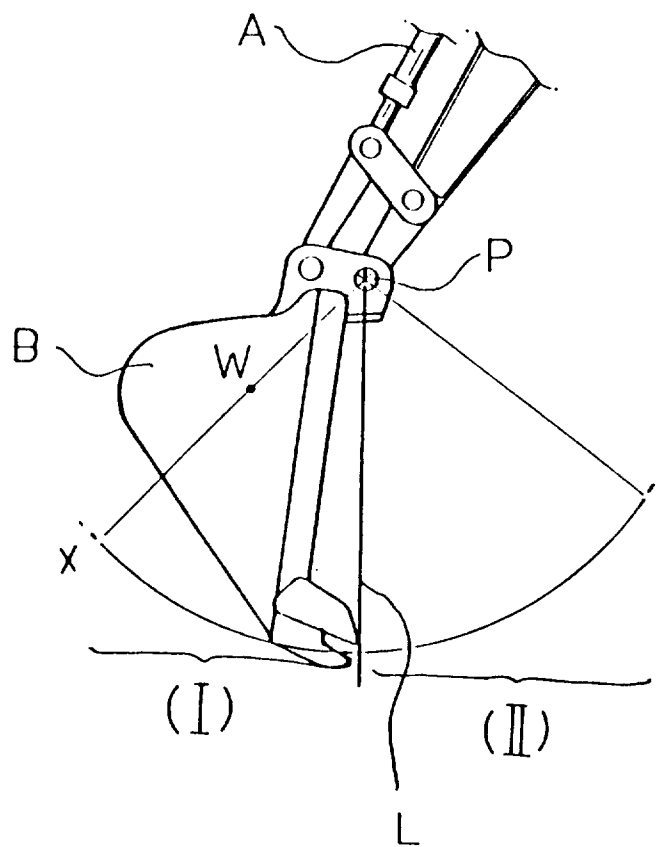


FIG 2

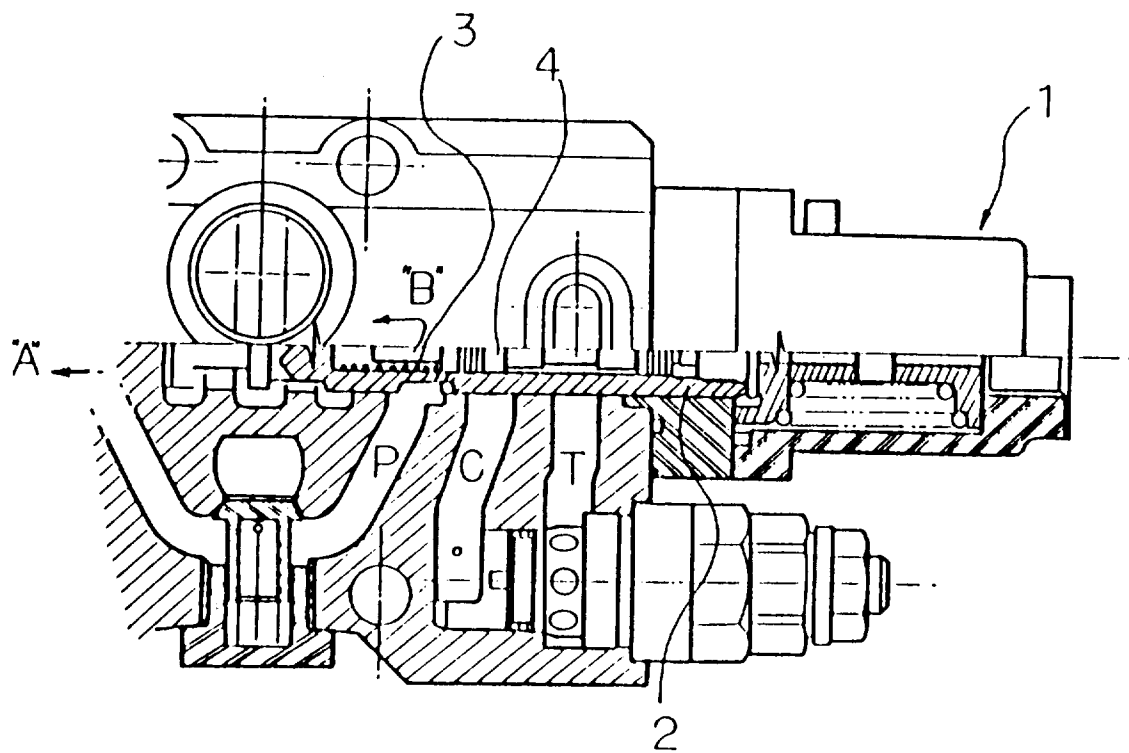
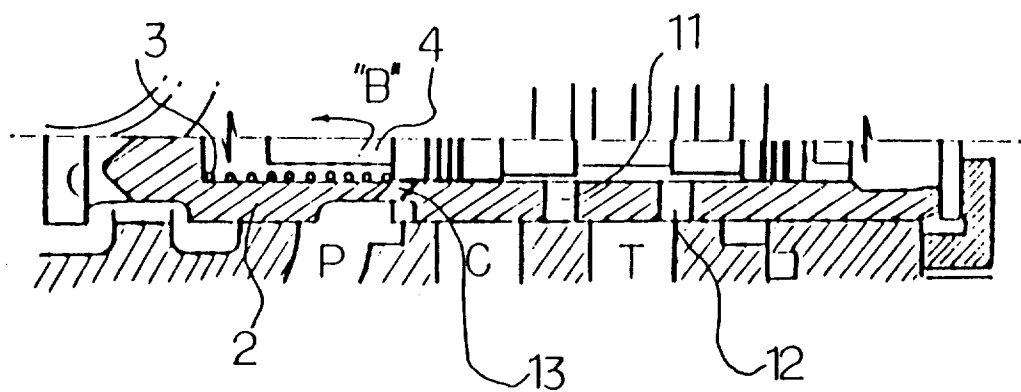


FIG 3





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EUROPEAN SEARCH REPORT

Application Number
EP 95 63 0080

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-4 913 616 (DUNN) * column 3, line 4 - column 6, line 29; figures * -----	1-3	E02F9/22
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E02F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23 January 1996	Examiner Ernst, R
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p> <p>& : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (P04C01)