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(54) **Fuel injection pump control linkage.**

(57) A fuel injection pump 10 is described having a control spindle 12 and an operating lever 14 for rotating the control spindle 12. The operating lever 14 is a two armed lever having a connector 14d, 14e on each of its two arms 14a, 14b for enabling a control linkage to be connected to the operating lever 14.

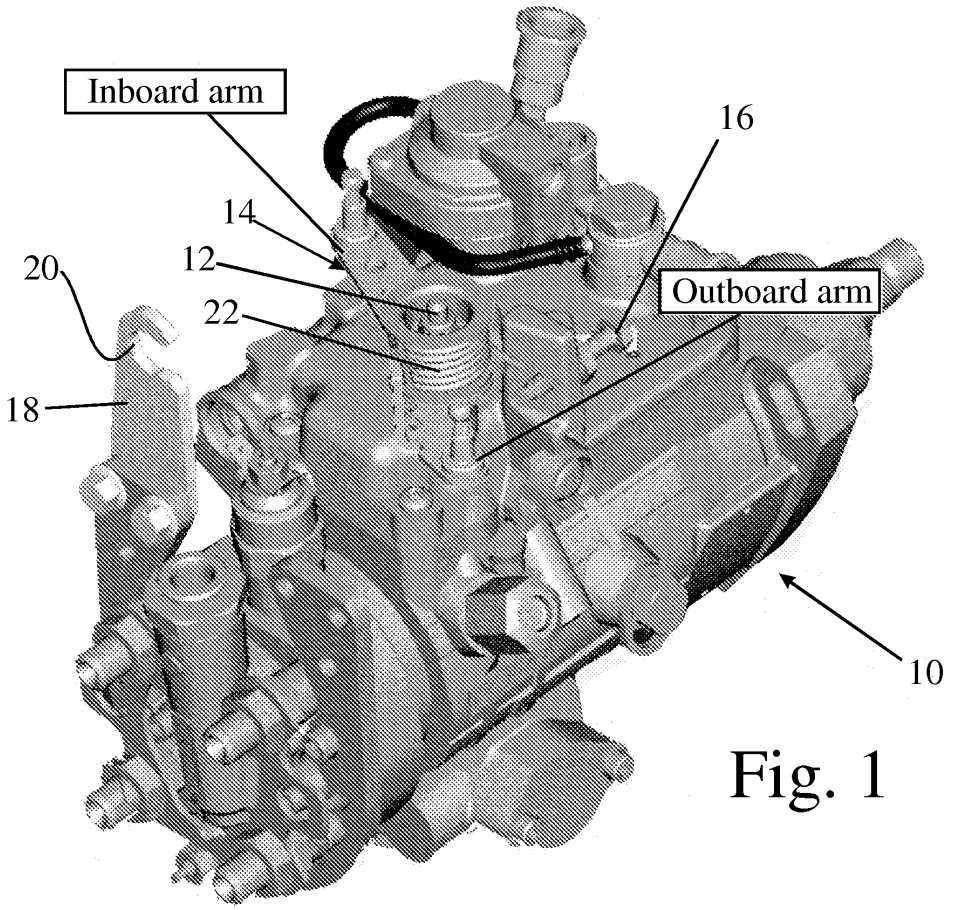

Fig. 1

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Description

[0001] The present invention relates to a fuel injection pump and is particularly concerned with the design of an operating lever used to control the fuel injection pump.

[0002] Fuel injection pumps of a diesel engine, as used in agricultural vehicles and construction machines, are controlled by rotating a spindle. An operating lever mounted on the control spindle is connected to a mechanical control linkage, such as a Bowden cable, to enable the pump to be controlled remotely by the operator of the vehicle or construction machine.

[0003] When the injection pump is installed in a tractor, the control linkage enters the engine compartment from the rear and requires an inboard configuration of the operating lever, that is to say the operating lever should point towards the side of the pump that is mounted on the engine. On the other hand, when the injection pump is installed in a construction machine, the control linkage comes into the engine compartment from the front and the operating lever needs to point towards the outboard side of the pump.

[0004] If a pump is manufactured with different variants (inboard and outboard configurations of the operating lever), the documentation and workshop manuals are complicated by the need to allow for both variants and it becomes necessary for the vehicle manufacturer to stock and store two separate items with different part numbers.

[0005] An alternative solution would be to provide a reversible operating lever but this requires additional work to be carried out at the assembly stage to reverse the orientation of the operating lever when necessary.

[0006] The invention therefore seeks to provide a fuel injection pump that will accept a control linkage entering the engine compartment from either end without the need for adaptation during assembly.

[0007] According to the present invention, there is provided a fuel injection pump having a control spindle and an operating lever for rotating the control spindle, wherein the operating lever is a two armed lever having a connector on each of its two arms for enabling a control linkage to be connected to the operating lever.

[0008] The control linkage is preferably a Bowden cable having an inner cable connected to one of the arms of the throttle lever and an outer sheath.

[0009] When using a Bowden cable, it is necessary to provide a stop for the outer sheath of the cable. The outer sheath stop will often incorporate an adjustment screw to take up free play in the cable.

[0010] In the preferred embodiment of the invention, a single fixed abutment is provided on the body of the fuel injection pump to limit movement of the end of the outer sheath of the Bowden cable when the inner cable is connected to one of the two arms of the operating lever. A second stop for the outer sheath, may be releasably secured to the fuel injection pump when the inner cable of the Bowden cable is to be connected to the other arm of the operating lever.

[0011] The invention will now be described further, by way of example, with reference to the accompanying drawing, in which :

Figure 1 is a perspective view of a fuel injection pump of the invention, and

Figure 2 is a perspective view of the operating lever of the fuel injection pump shown in Figure 1.

[0012] Figure 1 shows a known form of fuel injection pump which is generally designated 10. The internal workings of the fuel injection pump 10 are immaterial for the purposes of the present invention and they will not therefore be described. The fuel injection pump receives diesel fuel under low pressure and compresses it for injection into the cylinders of the engine. The quantity of fuel injected during each operating cycle of the engine is adjustable by rotating a spindle 12 which is connected to an operating lever 14. The power generated by a diesel engine is determined by the injected quantity of fuel and the lever 14 therefore performs a function analogous to that of an intake throttle in a spark ignition engine.

[0013] In use, the fuel injection pump is bolted onto the side of an engine, and the side of the pump shown in the drawing is the outboard side that is to say the side facing away from the engine.

[0014] Conventionally, the lever 14 has a single arm which may be oriented to point either towards the outboard side of the pump or towards the inboard side. If the lever is to be operated by a Bowden cable that reaches the pump from the right-hand side of the drawing, as viewed, then the arm of the operating lever would point towards the outboard side of the pump. The outer sheath of the cable is engaged by an adjustable stop 16 while the inner cable passes through the adjustable stop 16 and is connected to a nipple on the operating lever 14. A lever oriented in this manner would however be unsuitable in the case where the cable approaches the fuel injection pump from the left, as viewed. For such a situation, an inboard pointing lever is required.

[0015] Hitherto, it has been proposed either to make the fuel injection pump with two different variants or to provide an operating lever that is reversible. Both these solutions present problems as has already been mentioned above.

[0016] In the present invention, the operating lever 14 is formed with two arms which in Figure 1 are labelled as an inboard arm and outboard arm, respectively. The operating lever is shown on its own more clearly in Figure 2 in which the inboard arm is designated 14a and outboard arm 14b. A non-circular hole 14c engages the spindle 12 and nipples 14d and 14e are provided on both arms of the operating lever, each capable of connection to the inner cable of a Bowden cable.

[0017] If the Bowden cable enters the engine compartment from the right-hand side, as viewed in figure 1, then the stop 16 is used as an adjustable abutment for the outer sheath of the cable. It would be possible to form a

second such stop permanently on the body of the injection pump but in the illustrated embodiment a bracket 18 is bolted onto the body of the fuel injection pump to receive within a slot 20 and adjustable stop for the outer sheath of the cable.

[0018] A spring 22 acts on an upturned flange 14f of the operating lever to bias the spindle 12 into the idling position while a downturned flange 14g serves as a stop to limit the range of movement of the operating lever 14.

[0019] By virtue of its double ended configuration, the operating lever 14 of the invention allows the same pump to be used without modification regardless of the positioning of the engine within the vehicle and thereby avoids the need to stock separate items or to have to modify the pump during the course of its installation.

[0020] Although it is most common to use a Bowden cable as the control linkage connected to one of the arms of the operating lever 14, it will be appreciated by the person skilled in the art that it is alternatively possible to use rigid control rods for the same purpose.

Claims

1. A fuel injection pump (10) having a control spindle (12) and an operating lever (14) for rotating the control spindle (12), and
   characterized in that the operating lever (14) is a two armed lever having a connector (14d, 14e) on each of its two arms (14a, 14b) for enabling a control linkage to be connected to the operating lever (14).

2. A fuel injection pump as claimed in claim 1, wherein the control linkage is a Bowden cable having an inner cable connected to one of the arms (14a, 14b) of the throttle lever (14) and an outer sheath.

3. A fuel injection pump as claimed in claim 2, wherein at least one stop (16) is provided on the body of the fuel injection pump (10) to limit movement of the end of the outer sheath of a Bowden cable of which the inner cable is connected to one of the two arms (14a, 14b) of the operating lever (14).

4. A fuel injection pump as claimed in claim 3, wherein a single stop (16) is provided on the body of the fuel injection pump (10) for use when a Bowden cable is attached to a first arm (14b) of the operating lever (14) and a second stop (18) is releasably secured to the fuel injection pump (10) for use when a Bowden cable is attached to the second arm (14a) of the operating lever (14).

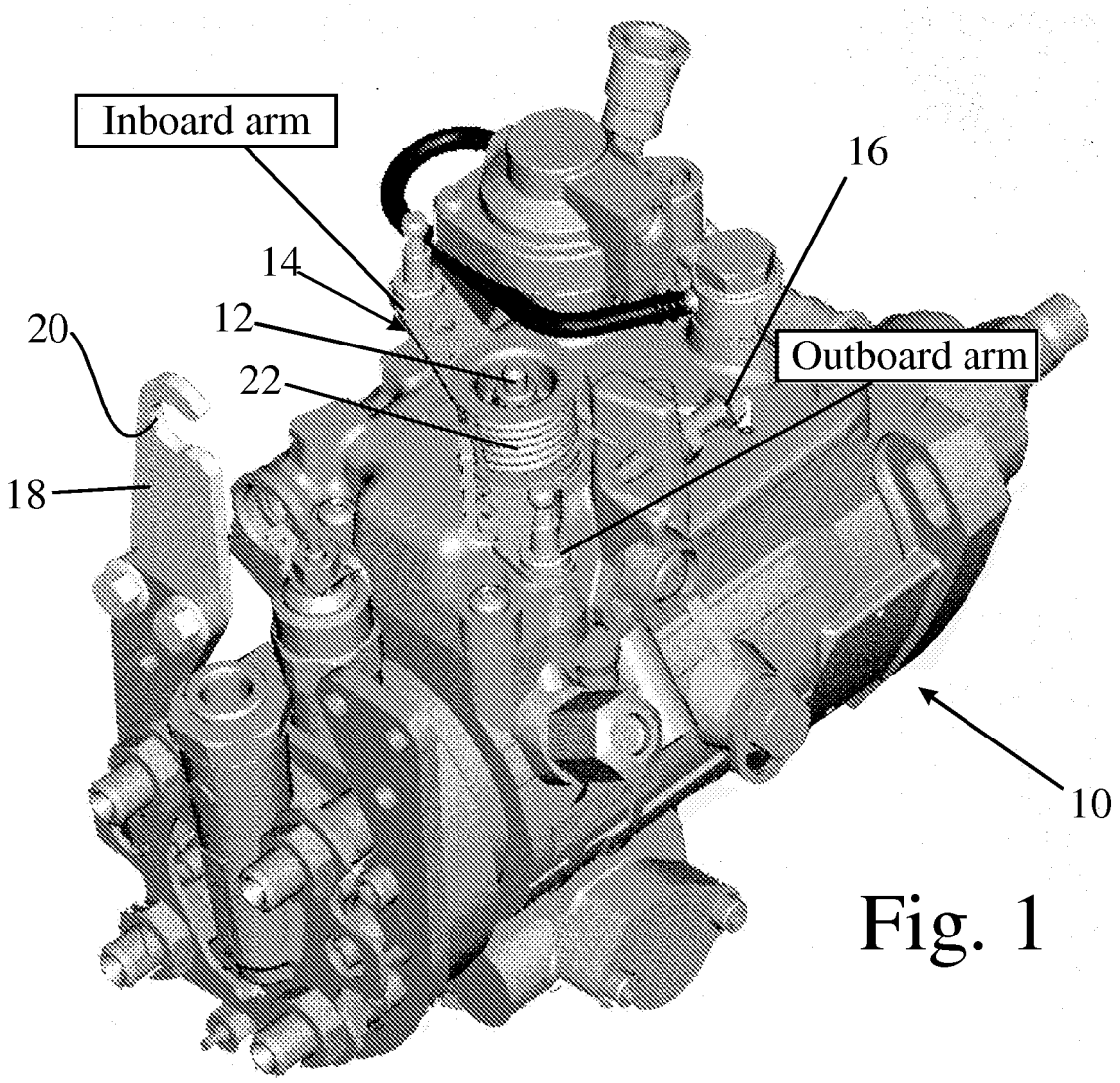
Inboard arm
16
14
12
20
22
Outboard arm
18
10

Fig. 1

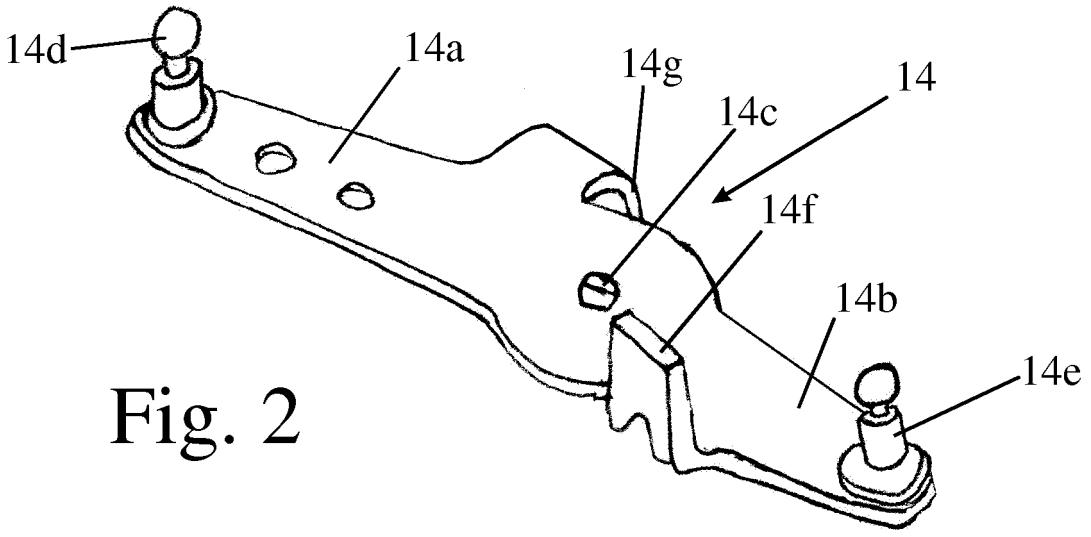
14d
14a
14g
14
14c
14f
14b
14e

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 06 12 1455

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 34 02 934 A1 (MOTOREN TURBINEN UNION [DE]) 8 August 1985 (1985-08-08) * the whole document *	1	INV. F02D1/10
A	US 3 695 244 A (VAUILLE ANDRE) 3 October 1972 (1972-10-03) * column 1, lines 29-50; figure 5 *	1	
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TECHNICAL FIELDS SEARCHED (IPC)

F02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 January 2007	Vedoato, Luca

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 12 1455

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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09-01-2007

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82