(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 236 895 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.09.2002 Bulletin 2002/36

(51) Int Cl.[7]: **F04B 17/04**, F01M 1/02, F01M 3/02

(21) Application number: **02004697.5**

(22) Date of filing: **28.02.2002**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **01.03.2001 IT MI010420**

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(54) Electromagnetically operated pump

(57) An electromagnetically operated pump, to feed two-stroke internal-combustion engines with precise and controlled amounts of oil, comprises in a casing (1): a cylinder (2); a piston element (3) with a through pipe (4), axially movable in said cylinder (2); an electromagnetic coil (10) external to the cylinder (2), to control the movements of the piston element (3) against the action of spring means (11); a pumping and metering chamber (7) for the oil to be fed, at one end (9) of the cylinder (2); and valve means (12, 13) housed in said casing (1) close to said end (9), one of said means (12) cooperating with said piston element (3). According to the invention, in said pump the stroke of the piston element (3) is limited, on one side, by the plane surface (8) of the casing (1) onto which abuts the cylinder (2) in correspondence of said chamber (7) and, on the other side, by the inner surface (15) of a cup (16) bearing, with a projecting peripheral edge (17) thereof, onto the end of the cylinder (2) opposite to that of the chamber (7), stout spring means (18) being interposed between said cup (16) and the casing (1) to stop the cylinder (2) therein.

EP 1 236 895 A1

Description

[0001] The present invention concerns an electromagnetically operated pump for the precise and controlled feeding of oil to two-stroke internal-combustion engines.

[0002] There are known to be in technique many types of pumps allowing to feed two-stroke internal-combustion engines with precise and controlled amounts of oil, in strict correlation with the running of the actual engine. Amongst others, use is already being made since quite some time of electrically operated pumps, in which an electromagnetic coil controls the piston of a cylinder in axis therewith, against the action of a spring, so as to empty at each working cycle a pumping chamber thereof in which the oil to be fed is metered.

[0003] The present invention concerns a pump of this type, with the object to improve its characteristics as far as structural simplicity, and metering precision and easiness, all being very important in view of the special use for which said pump is intended.

[0004] To reach this object, the pump according to the invention - comprising in a casing: a cylinder; a piston element with a through pipe, axially movable in said cylinder; an electromagnetic coil external to the cylinder, to control the movements of the piston element against the action of spring means; a pumping and metering chamber for the oil to be fed, at one end of the cylinder; and valve means housed in said casing, close to said end, one of said means cooperating with said piston element - is characterized in that the stroke of the piston element is limited, on one side, by the plane surface of the casing onto which abuts the cylinder in correspondence of said chamber and, on the other side, by the inner surface of a cup bearing, with a projecting peripheral edge thereof, onto the end of the cylinder opposite to that of the chamber, stout spring means being interposed between said cup and the casing to stop the cylinder therein.

[0005] The invention will now be described in further detail, with reference to the accompanying drawing, the only figure of which represents an axial section view of the improved pump according to the invention.

[0006] As clearly shown on the drawing, the pump according to the invention comprises a casing 1, containing a cylinder 2 and a piston element 3, axially movable into the cylinder 2 and crossed by a pipe 4 connected with branches 5 and 6 - for oil inlet and outlet respectively - of the casing 1. At one end of the cylinder 2 there is a chamber 7 for pumping the oil to be fed, delimited by the plane surface 8 of the casing 1, onto which bears the cylinder 2, and by the bottom end 9 of the piston element 3. Externally to the cylinder 2 there is an electromagnetic coil 10 fed with pulse current in strict correlation with the running of the two-stroke engine to be equipped with the pump. When energized, said coil 10 controls the movements of the piston element 3 towards the chamber 7, against the action of a spring 11 which acts in an opposite sense when the coil 10 is de-energized. Two ball valves 12, 13, are provided in the casing 1 close to the oil pumping chamber 7, the first of said valves cooperating with the bottom end 9 of the piston element 3, in correspondence of the outlet of the pipe 4. As better explained hereinafter, when the piston element 3 is moved by the electromagnetic coil 10, the valve 12 is closed while the valve 13 opens; viceversa, the valve 13 closes when the piston element 3 is moved by the spring 11 and while the valve 12 opens.

[0007] According to the invention, an abutment 14 is formed on the piston element 3, close to the end opposite to the bottom end 9, said abutment 14 being apt to cooperate with the inner surface 15 of a cup 16, apt to stop the cylinder 2 into the casing 1. Said cup 16 bears in fact with its projecting peripheral edge 17 onto said cylinder 2 and is pressed against the same by a stout Belleville spring 18 engaging the plane surface 19 of the casing 1. The stroke of the piston element 3 into the cylinder 2 is thereby limited by the cooperation, on one side, between the abutment 14 and the inner surface 15 of the cup 16, and on the other side, between the bottom end 9 of the piston element 3 and the plane surface 8 of the casing 1.

[0008] Said stroke determines the capacity (or volume) of the pumping chamber 7 and the metering of the oil to be fed.

[0009] The figure of the accompanying drawing illustrates the pump according to the invention with the chamber 7 full of oil, the piston element 3 having its bottom end 9 spaced apart from the plane surface 8 of the casing 1 and the abutment 14 in contact with the inner surface 15 of the cup 16. When, in operation, the coil 10 is energized, the piston element 3 moves towards the plane surface 8 compressing the oil into the chamber 7, while the valve 12 closes the pipe 4 into which flows the oil let in through the branch 5. The oil pressure in the chamber 7 opens the valve 13 and the oil is fed through the branch 6 into the engine. Thus, the pumping of the oil is carried out by energizing the electromagnetic coil 10. The piston element 3 stops, with the chamber 7 empty, when the bottom element 9 thereof cooperates with the plane surface 8 of the casing 1. When the coil 10 is de-energized and its action ceases, the spring 11 causes the piston element 3 to return into its initial rest position; the valve 13, no longer subject to pressure, closes while the valve 12 opens, due to the difference between the pressure of the oil let in upstream of the branch 5 and the oil pressure downstream thereof. The oil thus fills again the pumping chamber 7.

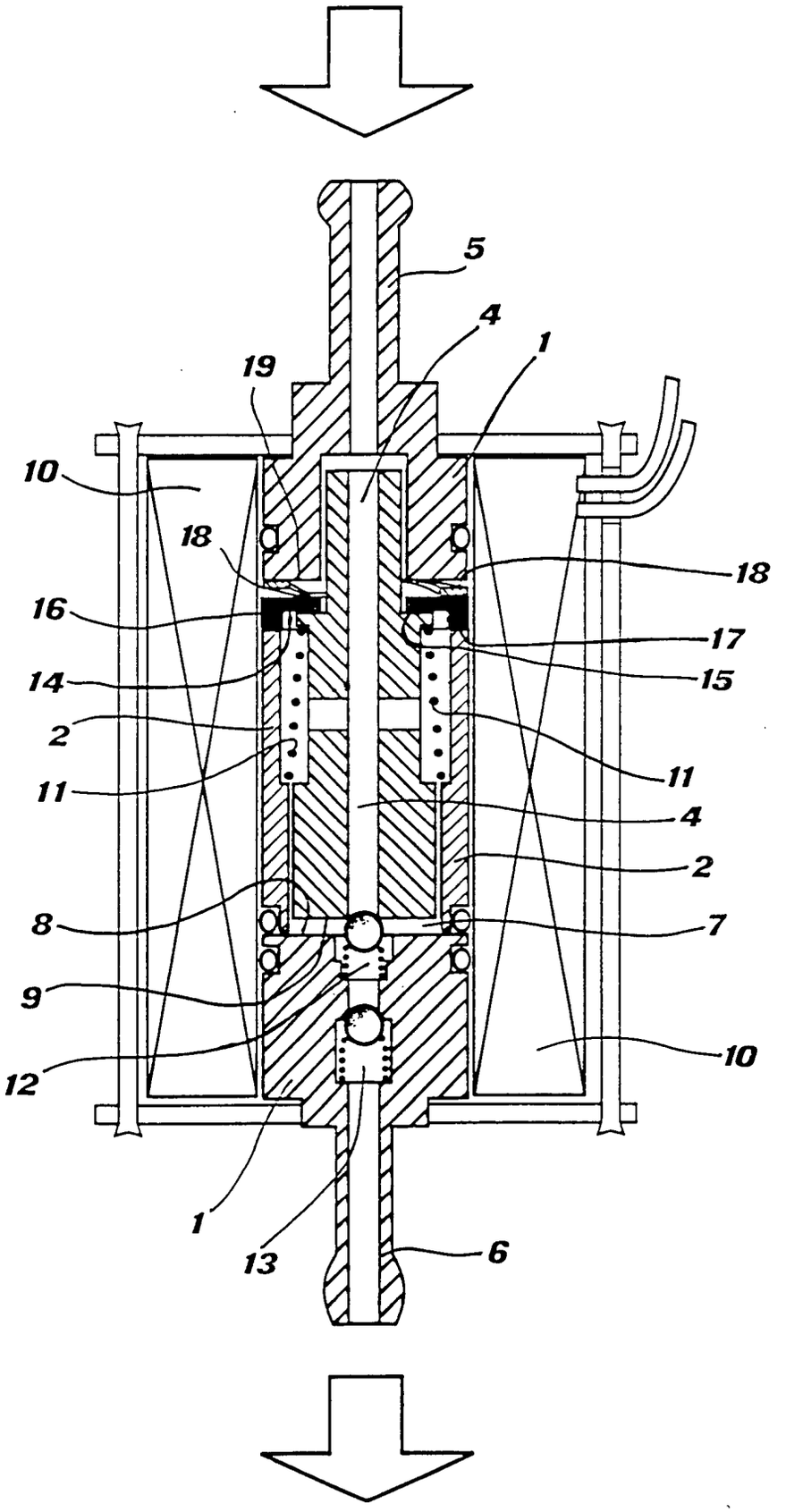
[0010] The pump described heretofore has a very simple structure and its working is very reliable; but, above all, it can be very easily adapted, at extremely reduced costs, to the most different requirements of capacity: the volume of the oil pumping and metering chamber 7 (namely, the amount of oil being fed at each piston stroke C) can in fact be easily adjusted, not only by acting on the axial position of the abutment 14 of the piston element 3, but also by simply replacing the exist-

ing cup 16 with a similar cup in which the projection of its peripheral edge 17 differs from the inner surface 15 thereof, or even by varying with a simple mechanical operation the projection in the cup 16 being used. It can be easily seen that, by keeping unchanged all the other components of the pump and by merely replacing the cup 16, a single pump - with specific characteristics according to the invention - can feed even considerably different oil capacities per piston stroke, and be thus immediately adapted to many different requirements and applications. The same can be done, with a simple mechanical operation, by reducing to different extents the starting projection of the edge 17 in respect of the inner surface 15 of a cup 16 of given dimensions. Moreover, the simple mechanical working of the cup allows to obtain - in case of special requirements, but, if wishing, also in mass production - extremely precise meterings of the oil volumes being pumped at each piston stroke. Finally, as already said, the structure of the pump according to the invention allows to obtain all this at extremely reduced costs and without having to carry out particularly elaborate mechanical operations.

[0011] It is anyhow understood that further embodiments of the pump can be provided, other than that described heretofore, without thereby departing from the protection scope of the present invention.

Claims

1. Electromagnetically operated pump to feed two-stroke internal-combustion engines with precise and controlled amounts of oil - of the type comprising, in a casing (1): a cylinder (2); a piston element (3) with a through pipe (4), axially movable in said cylinder (2); an electromagnetic coil (10) external to the cylinder (2), to control the movements of the piston element (3) against the action of spring means (11); a pumping and metering chamber (7) for the oil to be fed, at one end (9) of the cylinder (2); and valve means (12, 13) housed in said casing (1) close to said end (9), one of said means (12) cooperating with said piston element (3) - is **characterized in that** the stroke of the piston element (3) is limited, on one side, by the plane surface (8) of the casing (1) onto which abuts the cylinder (2) in correspondence of said chamber (7) and, on the other side, by the inner surface (15) of a cup (16) bearing, with a projecting peripheral edge (17) thereof, onto the end of the cylinder (2) opposite to that of the chamber (7), stout spring means (18) being interposed between said cup (16) and the casing (1) to stop the cylinder (2) therein.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EUROPEAN SEARCH REPORT

Application Number
EP 02 00 4697

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.7)
A	US 5 492 449 A (KLEIN JOACHIM ET AL) 20 February 1996 (1996-02-20) * the whole document *	1	F04B17/04 F01M1/02 F01M3/02
A	US 4 306 842 A (MASAKA MITUSUKE) 22 December 1981 (1981-12-22) * the whole document *	1	
A	EP 0 953 764 A (MAGNETI MARELLI SPA) 3 November 1999 (1999-11-03) * the whole document *	1	
A	EP 0 288 216 A (EATON SA MONACO) 26 October 1988 (1988-10-26) * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F04B
F01M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 May 2002	Mouton, J

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 00 4697

This annex lists the patent family membersrelating 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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29-05-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5492449 A	20-02-1996	DE 4130166 C1	11-03-1993
		AT 135798 T	15-04-1996
		AU 659489 B2	18-05-1995
		AU 2495192 A	05-04-1993
		DE 59205780 D1	25-04-1996
		DK 603233 T3	05-08-1996
		WO 9305293 A1	18-03-1993
		EP 0603233 A1	29-06-1994
		ES 2084378 T3	01-05-1996
		JP 6510583 T	24-11-1994
US 4306842 A	22-12-1981	JP 1099926 C	18-06-1982
		JP 55005455 A	16-01-1980
		JP 56042755 B	07-10-1981
		US 4299544 A	10-11-1981
EP 0953764 A	03-11-1999	IT B0980263 A1	27-10-1999
		EP 0953764 A1	03-11-1999
EP 0288216 A	26-10-1988	DE 3870017 D1	21-05-1992
		EP 0288216 A1	26-10-1988
		ES 2030856 T3	16-11-1992

EPO FORM P0459

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