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

(11) Publication number: **0 062 933**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **82200280.4**

(51) Int. Cl.³: **F 01 B 25/02**

(22) Date of filing: **05.03.82**

(30) Priority: **10.04.81 IT 2105881**

(43) Date of publication of application:
20.10.82 Bulletin 82/42

(84) Designated Contracting States:
AT BE CH DE FR GB LI NL SE

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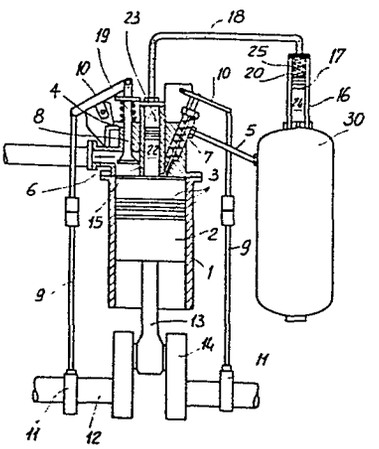
(54) Pressurized air motor provided with an inlet chamber of variable volume.

(57) The pressurized air motor comprises an inlet chamber formed in the cylinder head and having a variable volume depending on the supplied air pressure, means for varying the inlet chamber volume depending on the pressurized air source pressure, a needle inlet valve (7) communicating to the base portion of the inlet chamber (22) for supplying pressurized air thereto and a discharging valve (8) for discharging the expanded air.

The variable volume inlet chamber (22) consists of a small cylinder (15) therein a plunger (19) slides provided with sealing means, and oppositely located to the motor piston (2) which tightly slides in an expansion chamber. The plunger (19) is operated by a further plunger (17) sliding in a small cylinder (16) applied to the pressurized air source (30), thereby at the maximum supply pressure the plunger (19) is displaced to the minimum volume position.

Fig. 1



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The present invention generally relates to the pressurized aeriform substance piston motors, and,more specifically to a motor of the mentioned type which has been improved from the operative point of view.

The known pressurized air piston motors comprise at least a cylinder-piston assembly of two stroke operation and provided withpressurized air inlet and outlet valves.The piston is coupled to the crankshaft by means of a conventional connecting rod-crank mechanism.As these motors are operated by bottle pressurized air,it is necessary to provide the bottles with pressure reducing means in order to bring the supply pressure to the desired value.

A motor of the above type is also known comprising at least to blade air motors coupled to the driveshart,said air motors acting as cascade coupled pressure reducing means effective to simultaneously provide kinetic energy.The volume included between the cylinder head and the piston upper dead point is greater than that of the two blade air motors,and the volumes of the three motors are rated in such a way as to provide three consecutive pressure

reductions.More specifically, the volumes of the three motors are designed in such a way as to provide a volumetric air passage for each revolution of the crankshart, said passage being equal for all of the three motors.

While these motors operate in a satisfactory way, , on the other hand, present the drawback that they operate at predetermined pressures and that it is necessary to periodically adjust the pressurized air supply pressure, as the latter changes in the bottle, which tends to decrease depending on the consumed pressurized air.

Accordingly, the task of the present invention is to eliminate the thereinabove mentioned drawbacks, by providing such a piston motor effective to use either pressurized air or steam and to operate as far as the pressurized fluid source is completely exhausted, without the necessity of carrying out periodic adjustings of the motor supply pressure.

According to one aspect of the present invention this task is achieved by a piston motor characterized in that it comprises an inlet chamber located in the cylinder head and having a variable volume, means for varying said volume depending on the pressurized

air source pressure, an inlet needle valve communicating to said inlet chamber base portion for supplying pressurized air thereto, and a discharging valve for discharging the expanded air.

Advantageously the variable volume inlet chamber consists of a small cylinder therein a plunger tightly slides which is oppositely located with respect to the motor piston, the latter being movable in a tight way in an expansion chamber, said plunger separating the small cylinder into two opposite chambers, one thereof forms said inlet chamber.

Preferably the means for varying the inlet chamber volume consist of mechanical means, operated by the same system pressure.

As a variation, said means may be of hydraulic or pneumatic type, in which case the small cylinder chamber opposite to the inlet chamber forms the driving chamber for the plunger movable in said small cylinder, in order to vary the volume of said chamber in an inversely proportional relationship with respect to the supply pressure.

In this manner, with a high motor supply pressure, a minimum volume of the inlet chamber is obtained

which increases as the supply pressure decreases, thereby said chamber acts as a calibrating means for the volumetric flow rate to the motor cylinder.

The present invention will be described in a more detailed way thereinafter, with reference to the accompanying drawing the sole figure thereof schematically illustrates, by partially cross-section and plan views, the pressurized air motor according to the invention.

As it is shown in fig.1, the pressurized air motor comprises a cylinder 1 therein a piston 2 is able of sliding, said piston being provided with piston rings 3 and defining an expansion chamber in said cylinder.

More specifically the cylinder 1 has a head 4 provided with a discharging outlet 6 therein the discharging valve 8 is located, the inlet of the air being controlled by a needle valve 7. The discharging and needle valves, 8 and 7 respectively, are operated, through tappets 9 and rocking levers 10, by cam members 11, coupled to the driveshaft 12. Thus the cylinder-piston assembly has a two stroke type of operation. The piston 2 is coupled to the driveshaft 12 by means of the connecting rod 13 and crank 14,

by the gooseneck of said driveshart 12.

The needle valve 7 is coupled, through a pipe 5, to a tank, acting as a pressure equalizer for the piston 2, wich latter operates by impulses, or it is directly coupled to a pressurized air bottle 30, as it is shown in the drawing.

In the motor head 4 there is provided an inlet chamber , in the form of a small cylinder, therein a plunger 19 slides, dividing said small cylinder into two chambers, that is the inlet chamber 22 and an opposite chamber 23. The plunger 19 is provided with a resilient plunger ring, for a tight engagement in said inlet chamber defining small cylinder 15.

The needle valve 7 is operated by the tappet 9 through the rocking lever 10. The nozzle of said needle valve is so located as to communicate to the base portion of the inlet chamber 22, in the space between the piston 2 and plunger 19.

The pressurized air bottle 30 (or the pressure equalizing tank) is also provided with a small cylinder 16 therein a plunger 17 slides, the latter being also provided with a sealing plunger ring and

being normally held at the lower position thereof by means of a biassing spring 20, calibrated in a proportional way to the pressure in the bottle 30.

Also in this case the plunger 17 separates the small cylinder 16 into two chambers 24 and 25, said chamber 24 communicating with said pressurized air bottle 30.

The two plungers 19 and 17 in the small cylinders 15 and respectively 16 are positively coupled to one another, thereby as the plunger 17 is at the upper position thereof, in which it is held by the pressure in the bottle 30, the plunger 19 is in the lower position thereof, the inlet chamber volume being thus minimum.

The upper chamber 25 of the small cylinder 16 is coupled to the upper chamber 23 of the small cylinder 15 which is applied in the head 4 by means of a duct 18, the two mentioned chambers and said duct 18 being filled with oil thereby the rising of the plunger 17 causes a corresponding lowering of the plunger 19.

Supposed that a pressure of 200 atms is present in the bottle 30, then that same pressure will be also present in the chamber 24 of the small

cylinder 16 applied to the bottle 30,and it will push the plunger 17 upwardly,against the biassing of the spring 20 which latter will be calibrated for the value of 200 atms.

Accordingly the oil contained in the upper chamber 25 of the small cylinder 16 will cause the plunger 19 of the small cylinder 15 to be displaced to the lower position thereof,in such a way as to define a minimum volume inlet chamber.

At this time the needle valve 7 will be opened,which will communicate said 200 atm pressure to this minimum volume,thereby causing the motor piston 2 to lower.As the piston 2 is rised again, the discharging valve8will be opened and the air expanded during the active stroke of the piston will be discharged to the outside.

As the pressure in the bottle 30 decreases due to the pressurized air consume,the plunger 17 of said small cylinder 16 will be lowered with a consequent raising of the plunger 19 in the small cylinder 15,thereby the volume of the inlet chamber 22 will increase depending on the movement of the plunger 17.Thus,as the needle valve 7 is opened,a greater air volume,at a smaller pressure,will pass

to the inlet chamber, which will act again on the piston 2 in such a way as to cause the latter to lower again, the cycle being repeated as far as the pressurized air in the bottle has been completely consumed.

Thus, by the thereinabove illustrated system, it is possible to omit the pressure reducing assembly which is conventionally provided on the bottle, since the pressure reducing operation is carried out by the system itself: in this way the motor can be operated directly by the bottle pressurized air, at the desired pressure.

Another important aspect of the present invention consists of the fact that the motor is supplied with pressurized substances, in particular steam, which affords the possibility of obtaining from the steam mechanical or electric power.

Moreover the heat remaining in the motor may be used for heating spaces or supplying steam heated apparatus or systems. Thus, owing to its particular construction, the instant motor is effective to recover thermal power and operate with aeriform substances at a pressure from 5 to 200 atms.

Obviously the positive displacement of the two

plungers 19 and 17 can be also obtained in any ways known to those skilled in the art.

While the present invention has been disclosed and illustrated with reference to a single embodiment thereof, it should be noted that it is susceptible to all modifications and variations falling within the scope of the inventive idea.

C L A I M S

1- An aeriform substance operated piston motor, characterized in that it comprises an inlet chamber (22) formed in the cylinder head (4) and having a variable volume, means for varying said volume depending on the pressurized air source pressure, a needle inlet valve (7) communicating to said inlet chamber (22) base portion for supplying pressurized air thereto, and a discharging valve (8) for discharging the expanded air.

2- A motor according to claim 1, characterized in that the variable volume inlet chamber (22) consists of a small cylinder (15) therein a plunger (19) tightly slides, said plunger (19) being oppositely located with respect to said motor piston (2), the latter tightly sliding in an expansion chamber, said plunger (19) dividing said small cylinder (15) into two opposite chambers (22,23), one thereof (22) is said inlet chamber.

3- A motor according to claim 1, characterized in that the means for varying the volume of the inlet chamber (22) consist of mechanical means operated by the system pressure.

4- A motor according to claim 3, characterized in that said means are either hydraulic or pneumatic means, in which case the chamber (23) of said small cylinder opposite to the inlet chamber (22) forms the driving chamber for the plunger (19) movable in said small cylinder, in such a way as to vary the inlet chamber volume in an inversely proportional relationship with respect to the supply pressure.

5- A motor, according to the preceding claims, characterized in that said inlet chamber (22) is effective to calibrate the pressurized aeriform substance volumetric flow rate as said needle valve (7) is opened with said motor piston (2) at the upper dead point thereof.

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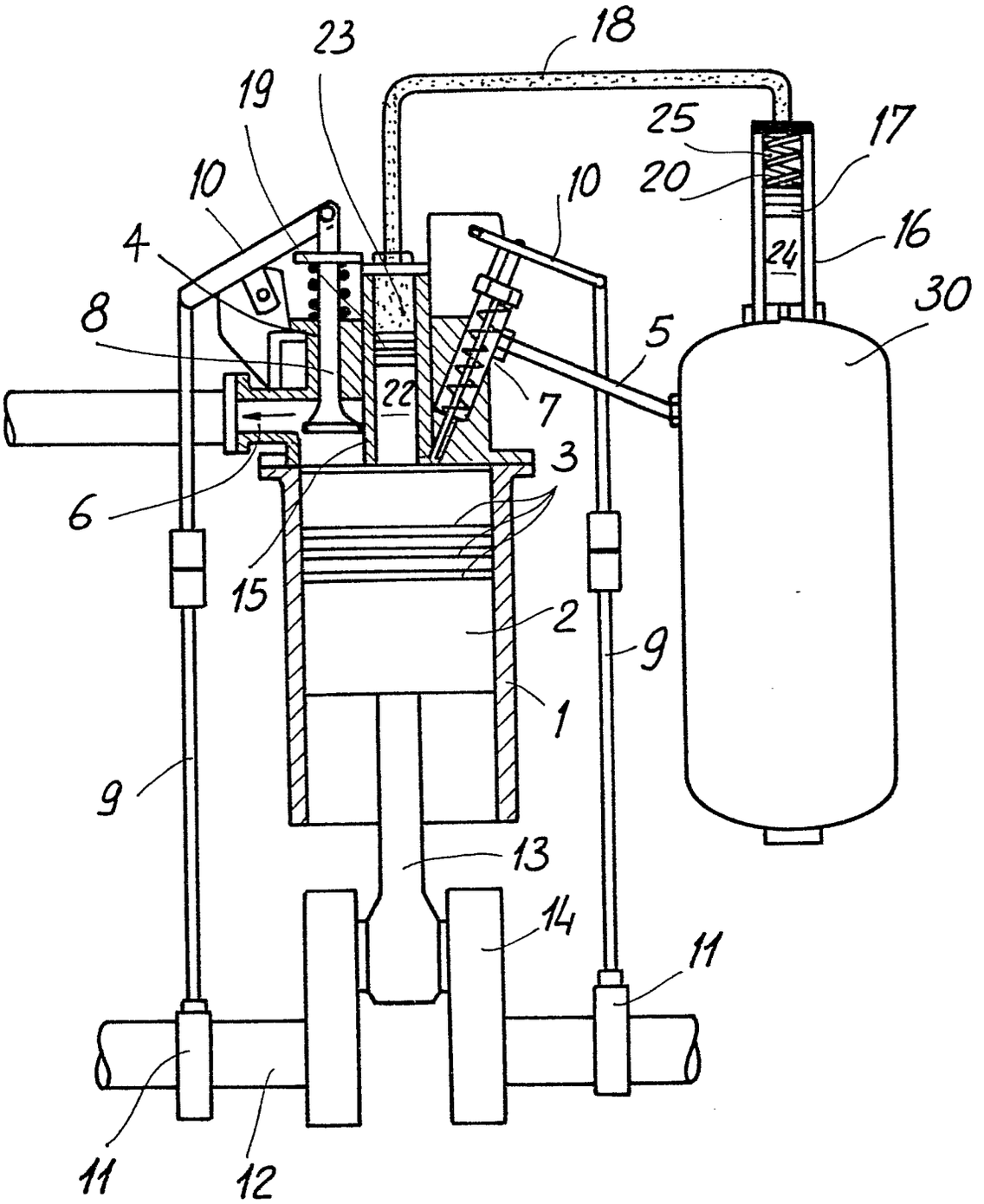
Fig. 1



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EUROPEAN SEARCH REPORT

0062933

Application number

EP 82 20 0280

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. ³)
A	US-A-1 812 572 (TALBOT) *Page 1, line 51 to page 2, line 63*	1,2,3	F 01 B 25/02
A	FR-A- 433 692 (BUGATTI) *The whole document*	1	
A	DE-C- 582 620 (KARL ZUR NIEDEN) *Page 3, lines 21-29*	1,4	
A	FR-A- 345 741 (PIFRE) *Page 1, line 63 to page 2, line 62*	1,4	
A	DE-C- 430 449 (WURMBACH)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	GB-A- 263 894 (BENTLEY)		F 01 B F 02 B
A	US-A-3 978 672 (STENGER)		
A	GB-A- 3 966 (STRANAHAN) (AD. 1910)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30-06-1982	BAATH C.

CATEGORY OF CITED DOCUMENTS

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