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PISTON AND CYLINDER SYSTEMS

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Fig. 1

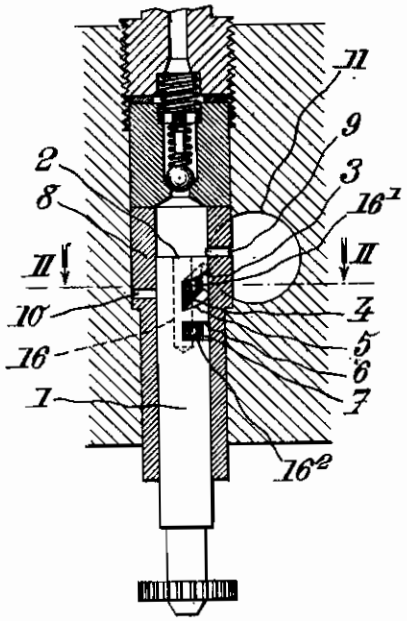


Fig. 3

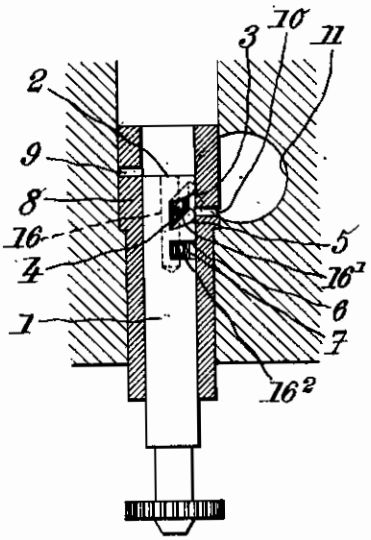


Fig. 2

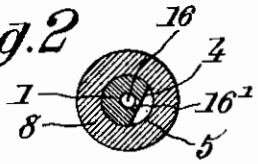


Fig. 6

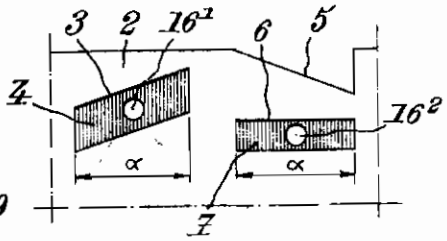


Fig. 4

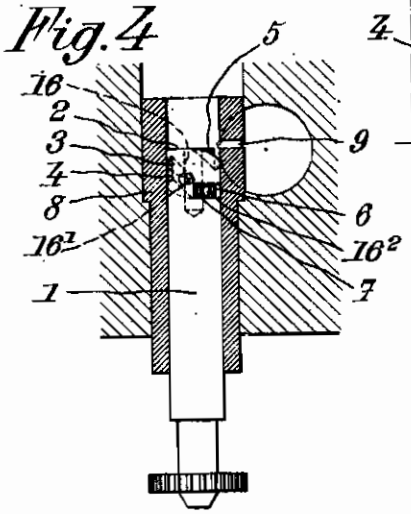
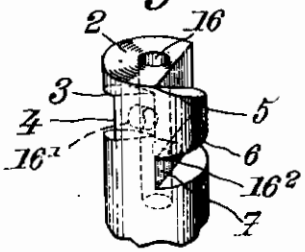


Fig. 5



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ALIEN PROPERTY CUSTODIAN

PISTON AND CYLINDER SYSTEMS

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The present invention relates to piston and cylinder systems of the kind in which the distributing means are provided in the form of edges and orifices carried in a suitable manner by the active surfaces of the piston and the cylinder. The invention is more especially, although not exclusively, concerned, among these systems, with pumps, and, in particular, fuel injection pumps and the like.

The object of the present invention is to provide a system of the type above mentioned which is better adapted to meet the requirements of practice than those used for the same purpose up to the present time.

According to a feature of the present invention, in a system of the kind above referred to, the distributing means are divided into at least two sets capable each of separately ensuring the working of the system, under similar or different conditions, the shifting from one to the other being obtained by a relative displacement, for instance a rotation of 180° about their common axis, of the piston and cylinder with respect to each other.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatic axial sectional view of a piston and cylinder system for a pump, made according to a first embodiment of the present invention;

Fig. 2 is a diagrammatic transverse section corresponding to Fig. 1;

Fig. 3 is a view, similar to Fig. 1, showing this system in a different relative position of the elements thereof;

Fig. 4 is an axial sectional view of a system of the same kind made according to another embodiment of the invention;

Fig. 5 is a transverse sectional view corresponding to Fig. 4;

Fig. 6 shows the developement of the edges of the active surfaces of the piston of Figs. 4 and 5.

In the following detailed description, it will be supposed that the invention is applied to the construction of an injection pump, of the mono-cylindric or poly-cylindric type, to be used for the feed of an internal combustion engine. This pump will further be supposed to be of the kind in which the distributing means include edges or inclined surfaces, especially on the piston, variation of the pump output being obtained by a relative rotation of the piston and cylinder with respect to each other so as to modify the time at which the orifice or orifices coacting with these edges or inclined surfaces are opened and closed.

In particular, it should be reminded that, in existing pumps of this kind, the variation of the output of the pump can be obtained in three different ways, to wit: by advancing the beginning of the injection, or on the contrary by postponing the end thereof, or again by simultaneously varying the beginning and the end.

Now, it is known that some motors are preferably controlled by variations of the first kind, others by variations of the second kind, and others by variations of the third kind. It is therefore necessary to provide different interchangeable pistons corresponding respectively to these solutions.

An important object of the present invention is to obviate this drawback, and to this effect, according to a feature of the invention, the distributing means of the pump are divided into two or more distinct sets capable each of separately ensuring the distribution according to the respective types of variation of the output above mentioned. Shifting from one operation to the other is obtained by a relative displacement, for instance a rotation of given amplitude about their common axis, of the cylinder and piston.

In order to carry out this method of working, many specific embodiments may be provided by persons skilled in the art, especially according as one or several orifices are used, according to the particularly arrangement that is chosen for the distributing edges or inclined surfaces, and according to the value of the amplitude of rotation of the piston and cylinder with respect to each other, this amplitude being preferably chosen equal to 180° when two different conditions of operation are to be obtained, as it will be hereinafter supposed.

According to the embodiment of Figs. 1 to 3, I make use of two sets of distribution edges, superposed along the same generatrix of the piston, to wit:

a. a first set constituted, on the one hand by the edge 2 of the piston end face which, in this example, it at right angles to the piston axis, and, on the other hand by an oblique edge 3 of a notch 4 provided laterally in the periphery of the piston;

b. a second set constituted, on the one hand by an oblique edge 5, which in this case is parallel

to edge 3 and corresponds to the same notch, and, on the other hand, by an edge 6 at right angles to the piston axis and corresponding to a second notch 7, itself perpendicular to the piston axis.

Pistons 4 and 7 are, in the known manner connected with the piston end corresponding to the face of the piston which compresses the fluid, the connecting passage being formed either in the lateral wall of the piston or on the inside thereof, as shown by the drawing (Figs. 1 and 3, conduits 16, 16^1, 16^2).

In cooperation with such a piston, I make use of a cylinder 8 provided with two orifices 9 and 10 located on diametrally opposed generatrices, these orifices being spaced apart in the axial direction of the piston and cylinder, in such manner that it is possible to bring either one of them (9, located at the upper part of the cylinder) into coaction with the first set of edges 2 and 3, or the other (10, located at the lower part of the cylinder) with the second set of edges 5 and 6.

The pump further includes:

On the one hand a control device, for instance of the cam type, for imparting rectilinear reciprocating displacements to the piston, and

On the other hand, means for producing relative rotations of the cylinder and piston with respect to each other about their common axis, so as to permit of varying the output of the pump by modification of the relative positions of the inclined edges with respect to orifices 9 and 10.

Such a system can operate in two different ways, respectively illustrated by Figs. 1 and 3.

It will be seen that, in one of these ways of working, corresponding to Fig. 1, the beginning of the injection remains invariable since it takes place when edge 2 comes to close orifice 9, that is to say always at the same time whatever be the angular position of the piston with respect to the cylinder. As the end of the injection takes place when oblique edge 3 uncovers said orifice, that is to say at a time variable in accordance with said angular position, the variation of output of the pump is obtained by varying the time at which the end of the injection takes place.

On the contrary, with the other way of working the pump, the beginning of the injection is variable, while the end is fixed.

In order to ensure the relative rotation of 180° which permits of passing from one working position to the other, I act either on the piston or on the cylinder.

For this purpose, I will merely, in some cases, act directly and manually upon the parts in question. For instance if it is desired to modify the working position of the cylinder, I remove said cylinder as it is customary to do when a part of the pump is to be examined or changed, after which said cylinder is refitted in an angular position at 180° from the preceding angular position.

But it may be advantageous, in some cases, to provide means for controlling from a distance the working position of the parts in question, which permits, in particular, simultaneously to act on the pistons or cylinders of several pump units.

These means may have their elements at least partly in common with elements of the means for varying the output of the pump.

They might further be used for adjusting the injection timing. Supposing for instance that said means act on the cylinder, by turning the latter through an angle of 180°, they might be made in such manner as to permit of effecting an initial adjustment of each of the two working positions, this adjustment producing a modification of the injection timing.

Finally, it goes without saying that suitable feed conduits are provided for supplying fuel to that of orifices 9 and 10 which is chosen.

In Figs. 1 to 3, which correspond to an embodiment in which the shifting from one of the ways of operation to the other is obtained by a rotation of 180° of the cylinder, the feed is ensured through a single conduit 11, of suitable section for enabling it to coact as well with one as with the other of said orifices, but separately.

If the shifting from one operation to the other is obtained by a rotation of the piston, I may have recourse to two conduits located at the level of the two orifices. I might also, in both cases, have recourse to a conduit surrounding the cylinder.

Instead of making use of two orifices as shown by Figs. 1 to 2, I may provide a single one, for instance by placing the two sets of inclined edges in suitable angular relation to each other, as shown by Figs. 4 to 6.

According to this embodiment, and supposing, for the sake of explanation, that the piston is divided into two portions by an axial plane, I provide, on one side of this plane, edges 2 and 3 analogous to those above described with reference to Figs. 1 to 3, with a notch 4 analogous to that disclosed by said Figs. On the other side of said axial plane, I provide, on the one hand, an upper oblique edge 5 symmetrical to edge 3 with reference to said plane, and which may be constituted by a bevelled edge of the piston end, and, on the other hand, a lower edge 6, with a notch 7, said last mentioned edge and notch being perpendicular to the axis of the piston.

It will be readily understood that these two sets of edges can coact, one or the other, with the same orifice 9, thus producing two different ways of working as above explained.

The switching from one to the other can take place, in this case also, either by acting on the piston (as shown by the drawing, orifice 9 being in this disclosure fed through a lateral conduit 11) or by acting on the cylinder.

Fig. 6 shows, for the sake of clarity, the development of the distributing edges. These edges may, as in the case of Figs. 1 to 3, extend over angles α of the same order of magnitude as usually employed (say 130°), since, in each of the two working positions, there is a marging of nearly 180° available for adjustment.

Anyway, whatever be the particular embodiment that is chosen, I obtain a system the operation of which results sufficiently clearly from the preceding description for making it unnecessary to enter into further explanations. This system has, over similar systems, many advantages, among which the following may be cited:

It permits of adapting the pumps to engines of different types; and

It necessitates no modification of existing pumps, with the exception of the piston, which is different.

The invention further permits of prolonging the life of the piston. As it is known, the piston wears particularly on that of its surfaces which coacts with the corresponding feed orifice. Therefore, if the wear becomes too great, it is possible, by turning the piston through an angle of 180°, to obtain its operation along zones which are not worn. Accordingly, the present invention applies to the case in which the piston is provided with two sets of distribution edges adapted

to coact separately either with the same orifice or with two distinct orifices so as to produce two ways of working, even when these two ways are similar or even identical.

On the other hand, it should be well understood that, when it is desired to obtain, by means of at least two different sets of distribution edges, different ways of working, these ways of working may differentiate from each other, or from one another, in any manner whatever. In other words, instead of having two sets of inclined surfaces or edges which are inversely disposed with respect to each other (an oblique edge in one set corresponding to a perpendicular edge in the other set), these sets may be of any shape and disposition as necessary. For instance, at least one of them may have two oblique edges, either of the same inclination or of different inclinations and even of opposed inclinations.

It is thus possible, with a single type of piston, to adapt a given pump to two wholly different applications.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

PAUL DESCOURTIS.