Jan. 17, 1933. R. PAUL 1,894,701

COMPRESSOR

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Fig. 1

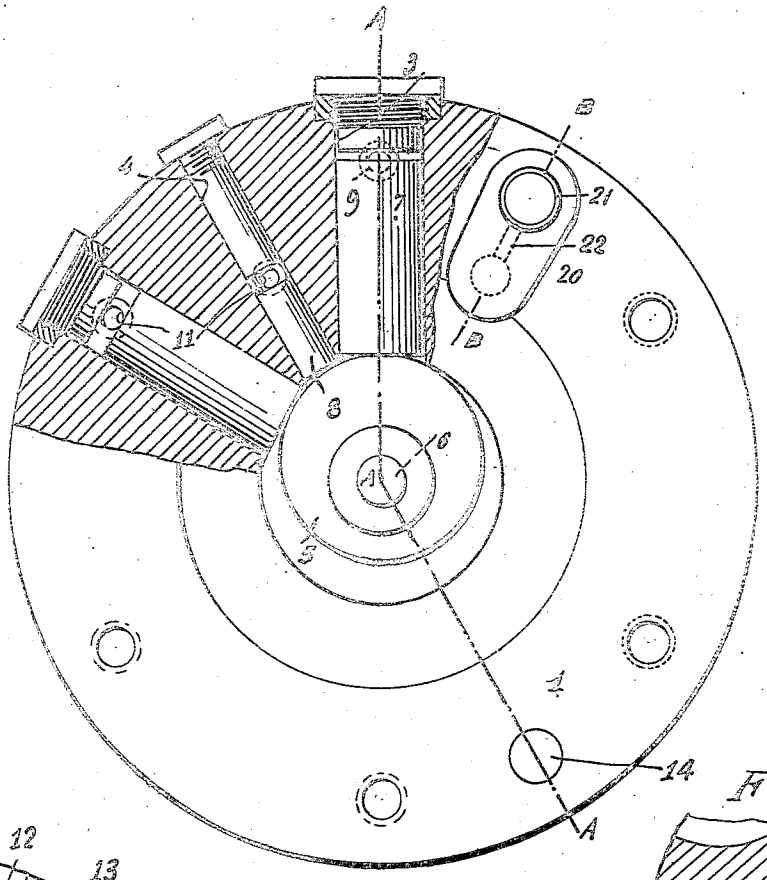


Fig. 1a

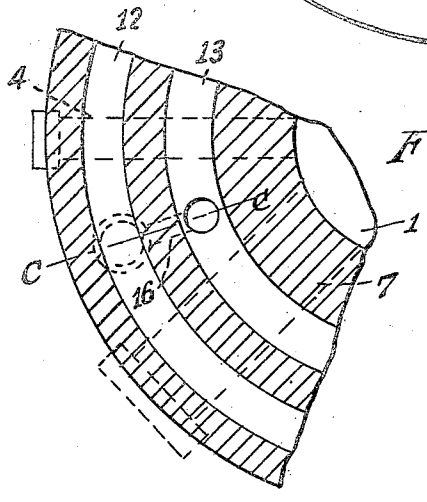
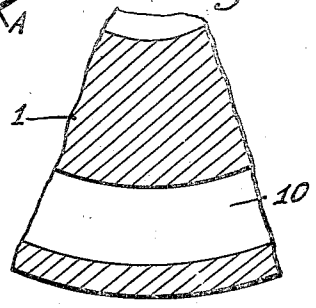


Fig. 1b



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Fig. 2

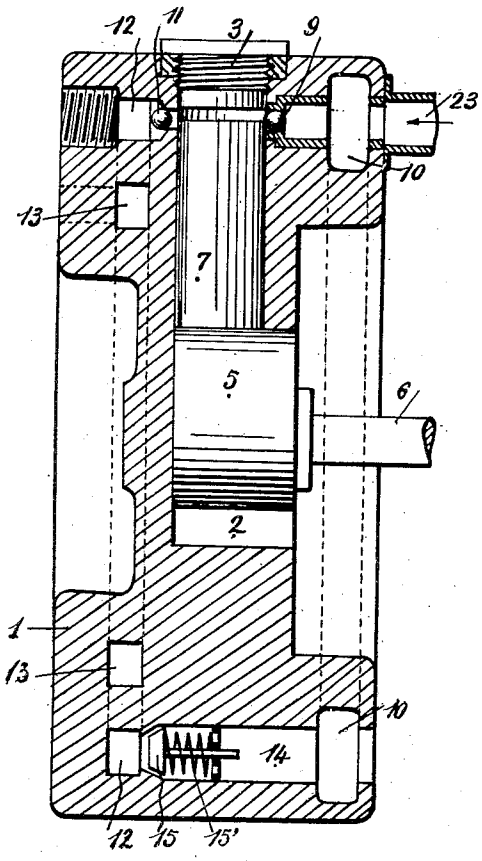


Fig. 3

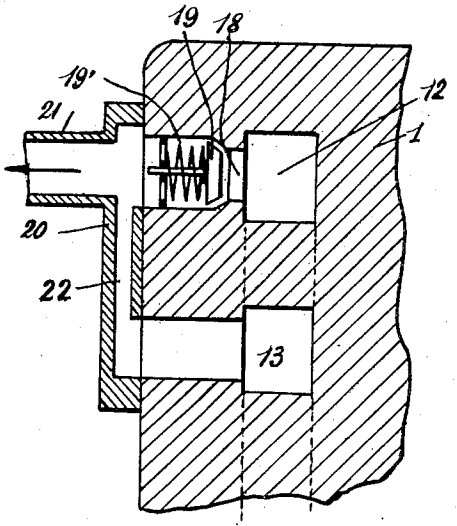
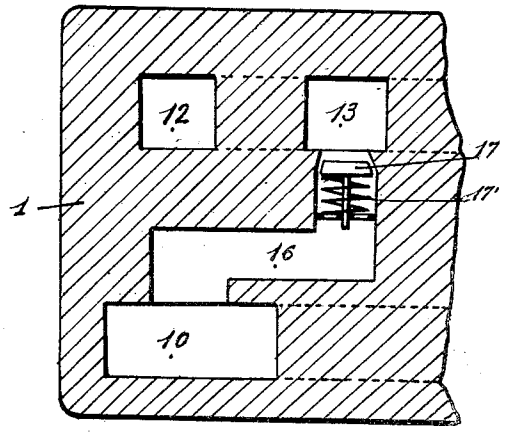


Fig. 4



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Patented Jan. 17, 1933

1,894,701

UNITED STATES PATENT OFFICE

RENÉ PAUL, OF COLOMBES, FRANCE

COMPRESSOR

Application filed January 8, 1930, Serial No. 419,225, and in France January 23, 1929.

The subject of the present invention is improvements in compressors of the type in which one disc or a number of discs coupled together have drilled in them a certain number of radial passages forming compressor cylinders in which move pistons actuated by the movement of an eccentric so as to draw in and deliver a compressible fluid.

The compressor in accordance with the invention is essentially characterized in that it is adapted for variable output at constant speed by automatic regulation dependent on the pressure. For this purpose the compressor comprises a single suction chamber as usual and two or more delivery chambers each corresponding to a particular predetermined relief pressure. These delivery chambers are fed with fluid by sets of pistons, the diameters of which are alike for one chamber but may be different as between one chamber and another. Return or by-pass passages controlled by automatic regulators are provided between each of the delivery chambers and the suction chamber to discharge the various delivery chambers in succession as the pressure increases and reaches the value assigned to each delivery chamber.

All the delivery chambers may be connected to an outlet manifold, preferably by pipes or passages of different diameters adapted for a smaller quantity of fluid as the pressure increases. Finally, regulators or retaining valves are provided between the delivery chambers and the manifold so as to isolate the said chambers in succession when, on attainment of the pressure assigned to any chamber the corresponding by-pass comes into operation.

The accompanying drawings show by way of example one embodiment of a compressor in accordance with the invention, in which two delivery chambers are provided.

Figure 1 shows the compressor in elevation with parts in section. Figure 2 is a section through A—A of Figure 1, and Figures 3 and 4 are sections through the lines B—B and C—C, respectively, of Figures 1 and 1a.

The compressor comprises a block or disc 1 having a central opening 2 and two sets of radial passages, 3, 4 of different diameters. In the opening 2 there is placed an eccentric 5 moved by an external source of power by means of the shaft 6. This eccentric actuates pistons 7 of large diameter moving in the cylinders 3 and pistons 8 of small diameter moving in the cylinders 4.

The large cylinders 3 are in communication on the one hand by valves 9 with an annular suction chamber 10 and on the other hand by valves 11 with a delivery chamber 12, called the low pressure receiver. The small cylinders 4 communicate in a similar way with the same suction chamber 10 and with a separate delivery chamber 13 called the high pressure receiver.

In addition, the passage or by-pass 14 (Figure 2) connects the low pressure receiver 12 to the suction chamber 10, and is opened and closed by a valve 15 normally held on its seating by a spring 15′, while another by-pass 16 (Figure 4) controlled by a similar valve 17 with spring 17′ connects the high pressure receiver 13 to the suction chamber 10. Finally, Figure 3 shows how the compressed fluid is taken to the consuming device (press or the like). A passage 18 provided with a retaining valve 19 controlled by a spring 19′, makes communication by means of the manifold 20 with the outlet pipe 21, and forms the outlet of the receiver 12. The manifold also comprises a passage 22 of small diameter connecting the outlet pipe 21 with the high pressure receiver 13.

The operation of the arrangement is substantially as follows: The fluid is introduced into the compressor by an inlet pipe 23, communicating with the suction chamber 10. The eccentric 5 actuates the different sets of pistons (7 and 8) which draw in and discharge the fluid, the pistons 7 into the receiver 12 and the pistons 8 into the receiver 13.

The spring of the valve 19 is set for a difference of pressure a. If b is the pressure in the outlet manifold up to which the larger pistons 7 are to operate, the spring of the valve 15 is set to $a+b$ and at any pressure up to this value the valve 15 remains closed and the receiver 12 discharges only into the manifold 20 through the passages 18 and 21. The pistons 8 also add their quota and

the quantity of fluid delivered is that corresponding to the displacement of both sets of pistons.

The spring of the valve 17 is set for a pressure *c* higher than *b* and at any pressure between *b* and *c* in the manifold 20 the valve 15 opens and by-passes through 14 the fluid from the pistons 7 before the pressure can rise sufficiently in the receiver 12 to raise the valve 19 against the force of spring 19' and the back pressure from the manifold 20, tending to hold the valve seated. The quantity of fluid delivered at this higher pressure is thus that corresponding to the displacement of pistons 8 only.

Finally, if the pressure in the manifold 20 rises above *c* the valve 17 opens and by-passes through 16 the pressure developed in receiver 12 by the pistons 8, so that no fluid is passed to the manifold 20, until the pressure again falls below *c*.

In the embodiment shown on the drawings there are two sets each comprising six pistons, but any number of sets for different pressures may be used and each set may comprise different numbers of pistons. Further, the block or disc 1 may contain some or only one of such sets and further sets may be arranged in separate blocks with a common drive.

What I claim is:—

1. In an automatic variable output compressor, the combination of a block formed with a plurality of sets of radial cylinders, the cylinders of the different sets having different cross-sectional area, pistons positioned in said cylinders for reciprocation therein, an eccentric for reciprocating said pistons in said cylinders, a plurality of receivers, means for conducting fluid from each set of cylinders to one of said receivers, an outlet adapted to communicate with said receivers and means for limiting the fluid pressure discharged from each of said receivers into said outlet.

2. In an automatic variable output compressor, the combination of a plurality of sets of cylinders and pistons having different total displacement volume per set, means for producing relative reciprocating movements between said pistons and cylinders, a plurality of receivers, each receiver communicating with one of said sets of cylinders, a main outlet communicating with said receivers to receive the fluid pressure discharged therefrom and means for limiting to predetermined pressures the discharge from said receivers to said outlet.

3. In an automatic variable output compressor, the combination of a plurality of sets of cylinders and pistons having different total displacement volume per set, means for producing relative reciprocating movements between said pistons and cylinders, a plurality of receivers, each receiver communicating with one of said sets of cylinders, a main outlet communicating with said receivers to receive the fluid pressure discharged therefrom and valve means for limiting to a predetermined pressure the discharge of fluid from one of said receivers into said outlet.

4. In an automatic variable output compressor, the combination of a plurality of sets of cylinders and pistons having different total displacement volume per set, means for producing relative reciprocating movements between said pistons and cylinders, a plurality of receivers, each receiver communicating with one of said sets of cylinders, a main outlet communicating with said receivers to receive the fluid pressure discharged therefrom, valve means for limiting to a predetermined pressure the discharge of fluid from one of said receivers into said outlet, and by-pass valve mechanism associated with said receivers to limit the pressure therein.

5. In a variable output compressor, a cylinder block, a plurality of sets of radial cylinders and pistons therein, each set being of different total displacement volume than any other set, means for reciprocating said pistons in said cylinders, a separate receiver for each set of cylinders, by-pass devices for one of said cylinders for limiting the maximum pressure therein and an outlet for said receivers.

6. In a variable output compressor, a cylinder block, a plurality of sets of radial cylinders and pistons therein, each set being of different total displacement volume than any other set, means for reciprocating said pistons in said cylinders, a separate receiver for each set of cylinders, by-pass devices for one of said cylinders for limiting the maximum pressure therein, a main outlet for receiving the discharge from said receivers and restricted passages for producing communication between said receivers and said main outlet.

7. In an automatic variable output fluid pump, a plurality of sets of cooperative cylinders and pistons having different total displacement volume per set, means for reciprocating said pistons in said cylinders, inlet means for said cylinders, discharge means for said cylinders including fluid receivers and a discharge outlet leading therefrom, one-way valves placed between one of said receivers and said discharge outlet and spring pressed one way valves constructed to cause said receivers to communicate with said inlet means.

8. In an automatic variable output fluid pump, a plurality of sets of cooperative cylinders and pistons having different total displacement volume per set, means for reciprocating said pistons in said cylinders, inlet means for said cylinders, discharge means for said cylinders including fluid receivers and a discharge outlet leading therefrom, one-way

valves placed between one of said receivers and said discharge outlet and spring pressed one-way valves constructed to cause said receivers to communicate with said inlet means, said last named valves opening automatically when the pressure in said receivers reaches predetermined maximum degrees, said maximum degrees being different for the different receivers.

9. In an automatic variable output fluid pump, a pressure producing device of substantial total displacement, a second pressure producing device of less total displacement volume, discharge means for said devices, including a main discharge outlet, and means for limiting the passage of fluid from said first named device to said outlet to a predetermined pressure at said outlet.

10. In an automatic variable output fluid pump, a pressure producing device of substantial total displacement, a second pressure producing device of less total displacement volume, discharge means for said devices including a main discharge outlet, and means for limiting the passage of fluid from said first named device to said outlet to a predetermined pressure at said outlet and a pressure limiting device associated with said first named pressure producing devices for limiting the pressure available for discharge into said outlet.

In testimony whereof I have signed this specification.

RENÉ PAUL.