Feb. 28, 1967 E. I. NILSSON 3,306,523

PRESSURE IMPULSE TRANSMITTER

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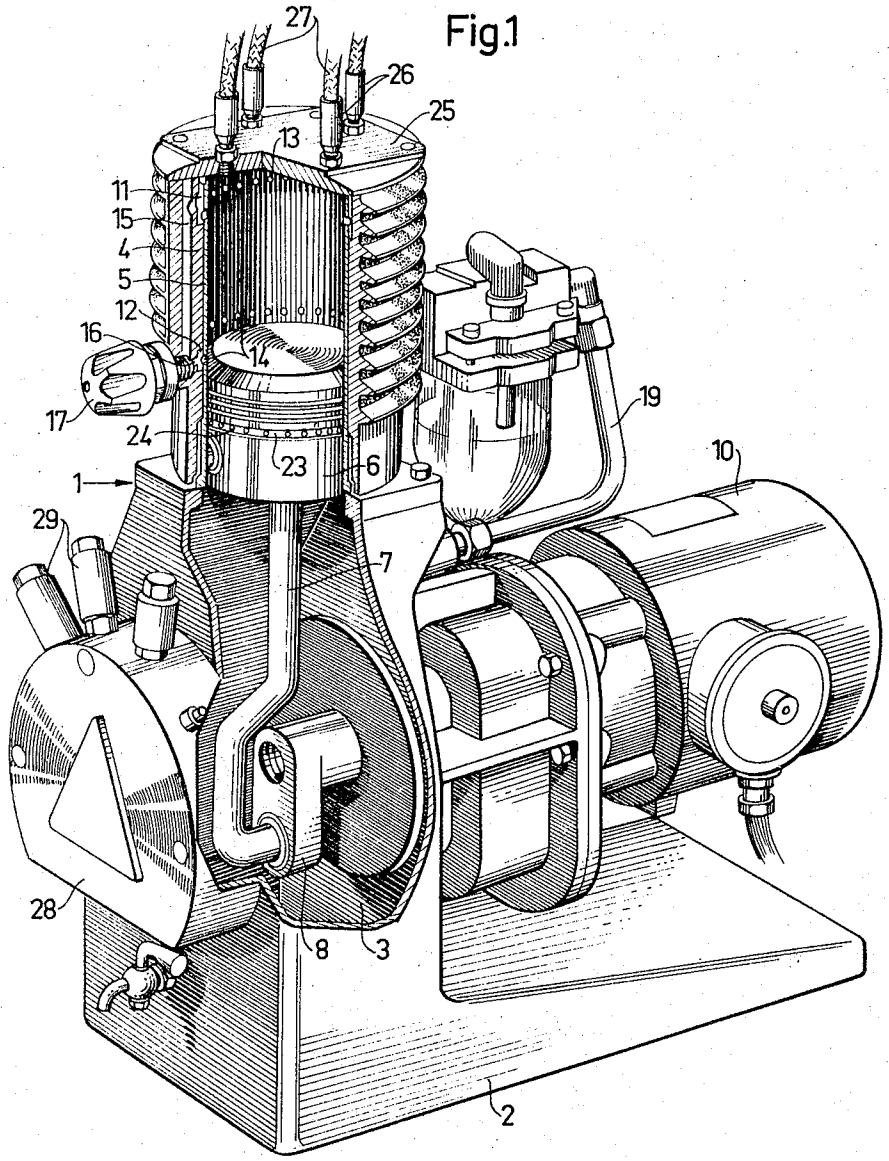
Fig.1



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Filed June 28, 1965 2 Sheets-Sheet 2

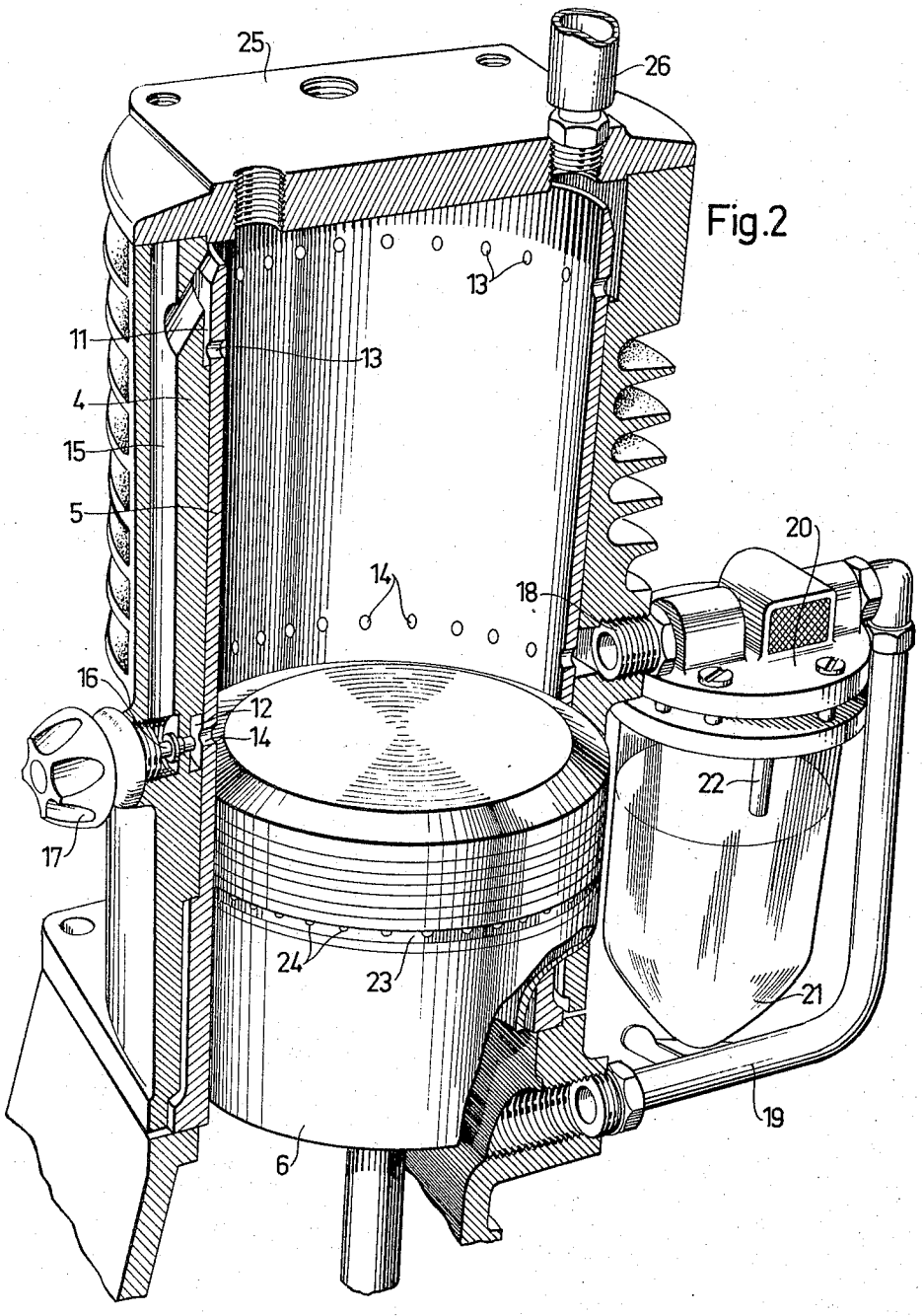

Fig.2

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PRESSURE IMPULSE TRANSMITTER

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The present invention refers to a pressure impulse transmitter which may be used for operating or controlling cyclically operating apparatus of various kinds by means of pressure impulses. Examples of such apparatus are, inter alia, pumps included in printing ink circulation systems for multi-colour printing.

The object of the invention is to provide such a pressure impulse transmitter which will enable a simple control of both the interval between and the amplitude of the pressure impulses so as thereby to make the operation of the pumps adjustable.

The pressure impulse transmitter according to the invention is characterized in the first place by the fact that it consists of a power operated piston compressor, the cylinder space of which communicates with one or more pressure impulses receiving working units, e.g., pumps, through one or more conduits and which is adapted at the end of the compression stroke of the piston to put the cylinder space into communication with the atmosphere so as to cause a sudden pressure reduction in said space and in the working units.

In the following a pressure impulse transmitter according to the invention will be described, by way of example, with reference to the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view of the pressure impulse transmitter, partly in section, and

FIG. 2 is a perspective view at an enlarged scale of part of the pressure impulse transmitter, also partly in section.

The pressure impulse transmitter according to the invention is constructed as a piston compressor and thus comprises a compressor block **1**, which is formed with a base plate **2** and encloses a crankcase **3**, and a cylinder **4**, which is attached to the upper end of the block **1** by means of bolts and which is provided with a cylinder lining **5**, and a piston **6** slidable in the cylinder. This piston is connected through a connecting rod **7** and a crank **8** in the crankcase to a crankshaft **9** which is mounted in bearings outside the crankcase and is there coupled to an electric drive motor **10**.

In the cylinder **4**, on the inside thereof, there are provided two annular grooves **11** and **12** axially spaced from each other a distance which is slightly less than the stroke of the piston, the upper groove **11** being at the upper end of the cylinder. The cylinder lining **5** terminates slightly below the upper end of the cylinder **4**. Therefore, it covers the groove except for the uppermost part of this groove, which thus always freely communicates with the interior of the cylinder. Further, in the cylinder lining **5** there are a row of apertures **13** which communicate with the groove **11**. The cylinder lining completely covers the lower groove **12** in the cylinder, but opposite this groove it has a second row of apertures **14** which put the groove into free communication with the interior of the cylinder. In the cylinder wall there is provided an axial channel **15**, which connects the grooves **11** and **12** with each other. Between the channel **15** and the lower annular groove

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12 disposed nearest the crankcase end of the cylinder a needle valve **16** is provided which is adjustable from the outside of the cylinder **4** by means of a knob **17** for opening and closing the connection between the channel and the groove. The annular groove **12** further communicates by a connecting piece **18** in the cylinder wall and a tube conduit **19** having a certain flow resistance with the crankcase **3**. Between the connecting piece **18** and the tube conduit **19** a lubricating device **20** is inserted which is provided with an oil box **21** and a suction tube **22** immersed into the oil contents therein. The function of the device **20** will be explained below.

The piston **6** has an annular groove **23** therein which communicates freely through a row of apertures **24** with the space within the piston and thereby with the crankcase **3**.

In the cover **25** of the cylinder **4** four connecting pieces **26** are provided for connecting compressed air hoses **27** through which the pressure impulses produced at the movement of the piston are passed to the units controlled or operated thereby, e.g., four pumps each intended for printing ink of a particular colour in a printing ink circulation system.

The operation of the pressure impulse transmitter described above is as follows. It will be assumed that the needle valve **16** is at least partly open, the upper and lower annular grooves **11** and **12** communicating with each other through this valve which affords a flow resistance varying in value in response to the degree of opening. When the piston **6** is in the starting position illustrated in the figures, the cylinder space above the piston **6** communicates through the lower groove **12**, the connecting piece **18** and the tube conduit **19** with the crankcase **3** in which atmospheric pressure always exists. When during the compression stroke of the piston it has moved so far that it will cover the apertures **14**, the cylinder space will be shut off from the atmosphere except for the connection through the tube conduit **19**, and during the continued movement of the piston the air entrapped in the cylinder space will be compressed. At the moment when the annular groove **23** in the piston arrives opposite the lower annular groove **12** in the cylinder wall, the groove **12** is momentarily put into communication with the crankcase **3** direct through the groove **23** and the apertures **24**, but then the compression of the air will again begin. According to the extent of opening of the needle valve **16** a major or minor part of the air may be driven out of the cylinder during the compression stroke through the channel **15**, the needle valve, the groove **12**, the connecting piece **18** and the tube conduit **19**, and the final degree of compression, when the piston **6** reaches its upper limit position, will therefore be dependent on the position of the needle valve. In the upper limit position of the piston the annular groove **23** in the piston will be opposite the apertures **13** in the cylinder lining **5**, and this results in the compression space of the cylinder above the piston being put into direct communication with the atmosphere through the groove **11**, the apertures **13**, the groove **23** and the apertures **24**, so that the pressure in the compression space suddenly decreases to atmospheric pressure. When the piston **6** then returns and again shuts off the outlet through the apertures **13**, a vacuum is formed in the cylinder space. This vacuum is neutralized when the end of the piston passes beyond the apertures **14** and air can flow into the cylinder

space from the crankcase 3 through the tube conduit 19. The air then at the same time draws with it an oil mist from the lubricating device 20 to lubricate the cylinder.

As will be apparent, during the operation of the compressor a pulsating air pressure is obtained in the cylinder space, and the pressure impulses are passed through the hoses 27 further on to the four pumps, not shown, so to control or operate them at an impulse frequency which is equal to the revolutions per minute of the compressor and the motor 10. The control of this frequency may thus take place by speed control of the motor. The impulse amplitude is controlled by controlling the degree of compression by means of the needle valve 16.

In case it is desired to use the pressure impulse transmitter described for controlling or operating a smaller number of working units than four, the compressed air hose or hoses 27 which are left should be connected to suitable substitute means. For this purpose there is attached to the outside of the compressor block 1 a three-chamber housing 28 provided with three connecting pieces 29 which each lead to one of the chambers in this housing and are intended for connecting up to three of the four compressed air hoses 27. The chambers in the house are blindly terminated each by itself and have a volume which is adjusted approximately to correspond to the volume of the air chamber in one of the working units (pumps) or else to afford the same counter-pressure as this air chamber.

What I claim is:

1. A pressure impulse transmitter comprising
a power-operated compressor including a cylinder, a crankcase, and a piston movable in said cylinder;
means for communicating the cylinder with at least one pressure impulses-receiving unit;
means for communicating the cylinder with atmosphere at the end of the compression stroke of said piston and including an annular groove in the wall of said cylinder communicating with the interior of said cylinder and an annular groove in said piston communicating through said piston with the crankcase;
said piston annular groove being located so as to be opposite the cylinder wall annular groove at the end of the compression stroke of the piston and to connect the interior of the cylinder with the crankcase;
flow-resistant means connected between said cylinder wall annular groove and the crankcase; and
adjustable valve means for communicating the interior of the cylinder at the top thereof continuously with the crankcase in series with said flow-resistant means, to control the degree of compression achieved at the compression stroke of the piston.

2. A pressure impulse transmitter comprising
a power-operated compressor including a cylinder, a crankcase, and a piston movable in said cylinder;
means for communicating the cylinder with at least one pressure impulses-receiving unit;
means for communicating the cylinder with atmosphere at the end of the compression stroke of said piston and including an annular groove in the wall of said cylinder communicating with the interior of said cylinder and an annular groove in said piston communicating through said piston with the crankcase;
said piston annular groove being located so as to be opposite the cylinder wall annular groove at the end of the compression stroke of the piston and to connect the interior of the cylinder with the crankcase;
a channel in the cylinder wall freely communicating with the interior of the cylinder;
a second annular groove in the cylinder wall nearer the crankcase end of the cylinder;

a slightly flow-resistant tube conduit communicating said second annular groove with the crankcase; and
a needle valve inserted in the cylinder wall between said channel and said second annular groove for communicating the interior of the cylinder at the top thereof continuously with the crankcase in series with said tube conduit to control the degree of compression achieved at the compression stroke of the piston.

3. A pressure impulse transmitter comprising
a power-operated compressor including a cylinder, a crankcase, and a piston movable in said cylinder;
means for communicating the cylinder with at least one pressure impulses-receiving unit;
means for communicating the cylinder with atmosphere at the end of the compression stroke of said piston and including an annular groove in the wall of said cylinder communicating with the interior of said cylinder and an annular groove in said piston communicating through said piston with the crankcase;
said piston annular groove being located so as to be opposite the cylinder wall annular groove at the end of the compression stroke of the piston and to connect the interior of the cylinder with the crankcase;
a channel in the cylinder wall freely communicating with the interior of the cyinder;
a second annular groove in the cylinder wall nearer the crankcase end of the cylinder;
means permanently communicating said second annular groove with the interior of the cylinder for drawing air into the cylinder;
a slightly flow-resistant tube conduit communicating said second annular groove with the crankcase; and
a needle valve inserted in the cylinder wall between said channel and said second annular groove for communicating the interior of the cylinder at the top thereof continuously with the crankcase in series with said tube conduit to control the degree of compression achieved at the compression stroke of the piston.

4. A pressure impulse transmitter comprising
a power-operated compressor including a cylinder, a crankcase, and a piston movable in said cylinder,
means for communicating the cylinder with at least one pressure impulses-receiving unit;
means for communicating the cylinder with atmosphere at the end of the compression stroke of said piston and including an annular groove in the wall of said cylinder communicating with the interior of said cylinder and an annular groove in said piston communicating through said piston with the crankcase;
said piston annular groove being located so as to be opposite the cylinder wall annular groove at the end of the compression stroke of the piston and to connect the interior of the cylinder with the crankcase;
a channel in the cylinder wall freely communicating with the interior of the cylinder;
a second annular groove in the cylinder wall nearer the crankcase end of the cylinder;
a slightly flow-resistant tube conduit communicating with said second annular groove with the crankcase;
lubricating means connected into said tube conduit to cause lubricating oil to be drawn with the air into the cylinder; and
a needle valve inserted in the cylinder wall between said channel and said second annular groove for communicating the interior of the cylinder at the top thereof continuously with the crankcase in series with said tube conduit to control the degree

of compression achieved at the compression stroke of the piston.

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