April 17, 1962 M. A. I. FONTAINE 3,030,079

VIBRATOR

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FIG. 1

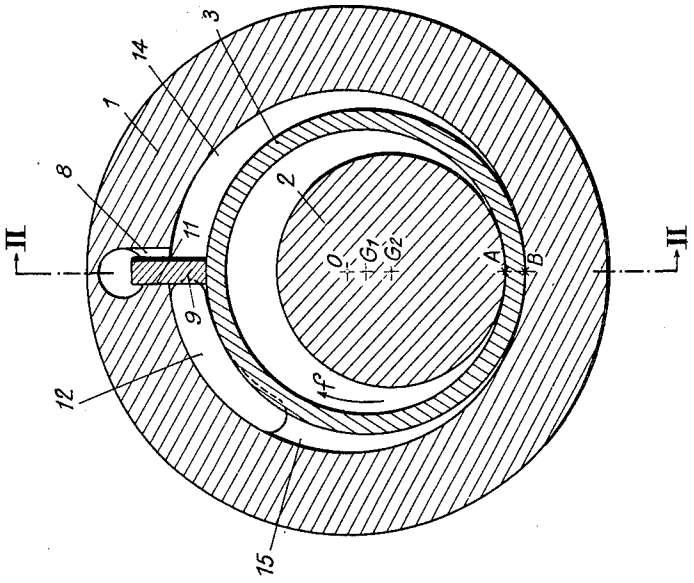
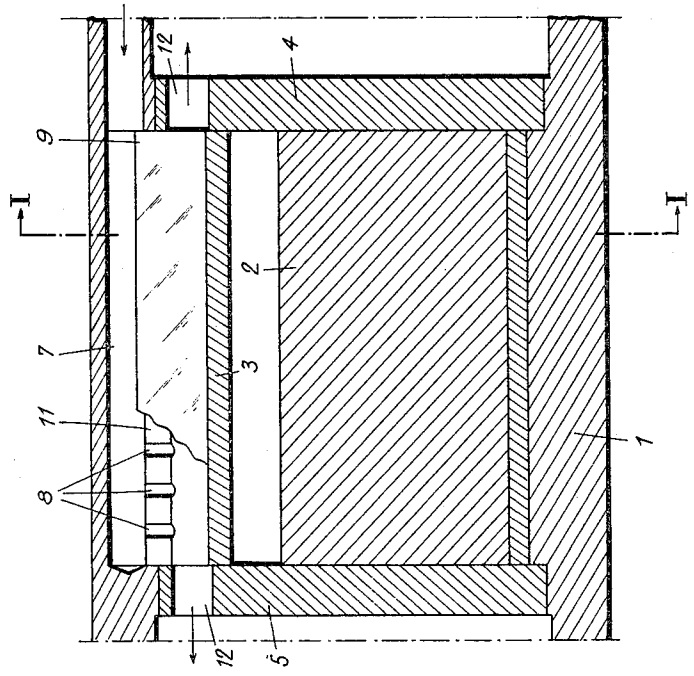


FIG. 2



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FIG. 3

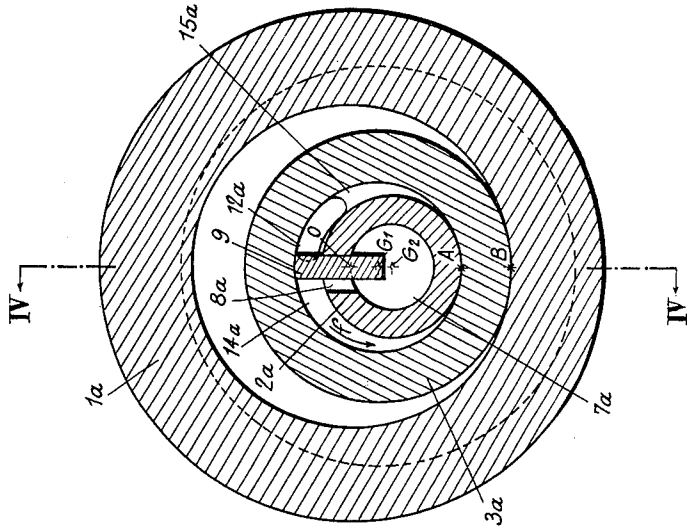
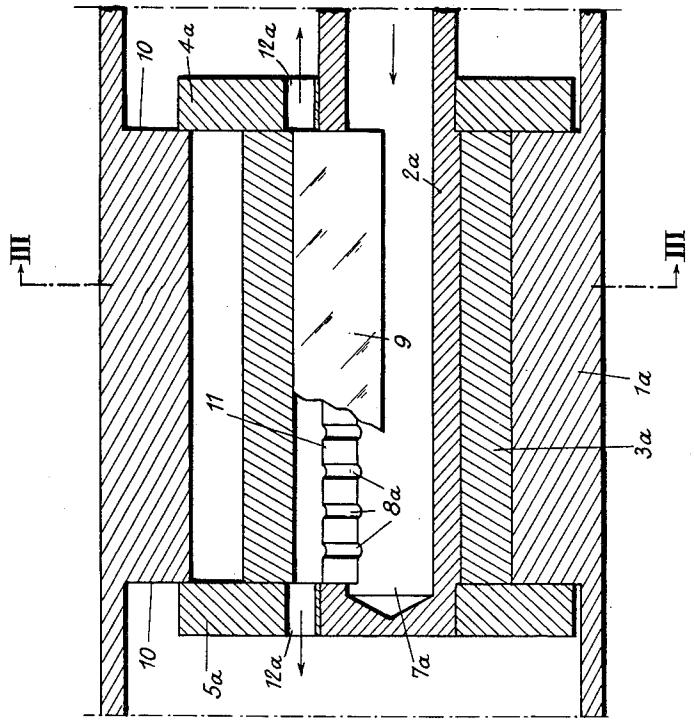


FIG. 4



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FIG. 5

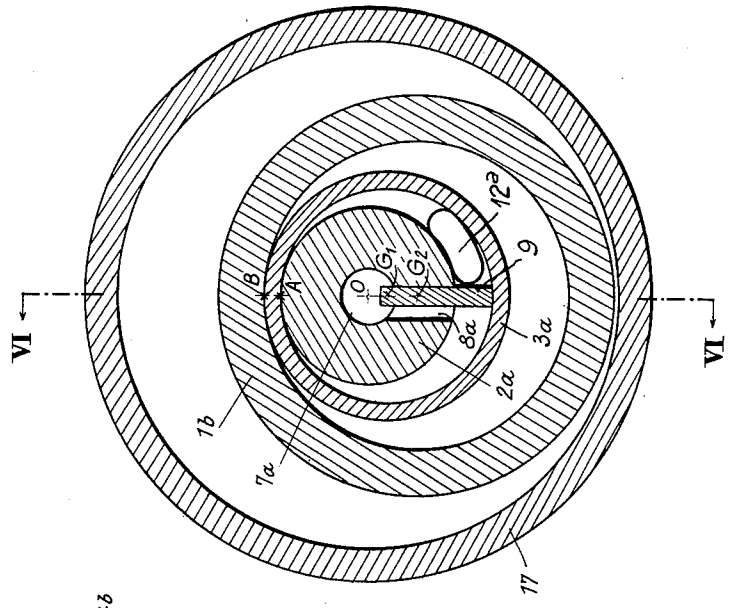
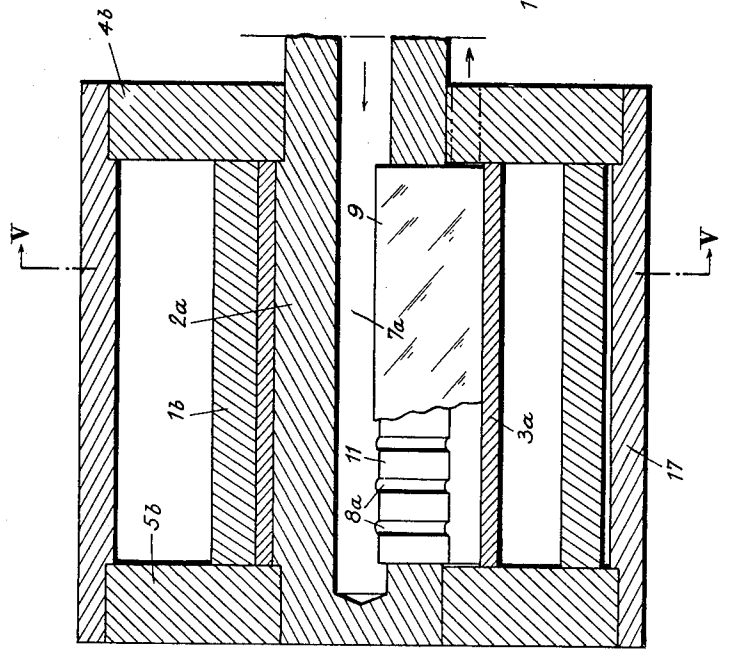


FIG. 6



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VIBRATOR

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6 Claims. (Cl. 259—1)

The invention concerns vibrators of the type which can be actuated by the static pressure of a pressurized fluid, and comprising an outer hollow cylinder in which an inner cylinder with smaller diameter can revolve eccentrically, each cylinder having guide end faces arranged perpendicularly to its axis, so that the guide faces of each cylinder slide in contact with the guide faces of the other cylinder, and a radially movable blade in a slot machined in one of the cylinders so as to define inside the arrangement two chambers, one of which communicates with an inlet aperture for the pressurized fluid and the other with an outlet aperture, whilst the blade can recede or efface itself completely into the cylinder in which it is seated.

Under otherwise identical conditions, the efficiency of these arrangements increases with the relative eccentricity of the two cylinders. It must, however, be noted that the volume of the working chambers of the pressurized fluid increases as a function of this increase in the eccentricity, so that the consumption of the fluid medium is also increased, and this obviously presents a disadvantage.

The present invention provides an apparatus of the aforementioned type, which can be given as large an eccentricity as desired, whilst maintaining the operating chambers for the fluid under pressure at a very small capacity, so that the consumption is correspondingly reduced.

According to a feature of the present invention, a vibrator actuated by a pressure fluid comprises an outer hollow cylinder, an eccentrically disposed inner cylinder, a blade slidably mounted in the wall of one of the cylinders and an eccentrically disposed intermediate cylinder within the outer cylinder and enclosing the inner cylinder and in contact with one end of the blade to form two chambers between the intermediate cylinder and one of the other cylinders, one of which chambers communicates with an outlet aperture, such that on application of pressure fluid to other of said chambers the intermediate cylinder and one of the cylinders roll around a periphery of the other cylinder.

According to another feature of the present invention a vibrator for actuation by the static pressure of a pressurized fluid, comprises an outer hollow cylinder in which an inner cylinder with smaller diameter can revolve eccentrically, each cylinder having guide end faces arranged perpendicularly to its axis, so that the guide faces of each cylinder slide in contact with the guide faces of the other cylinder, a radially movable blade in a slot machined in one of the cylinders and able to recede into the cylinder in which it is seated and located between the inner and outer cylinders, an intermediate hollow cylinder, which encloses the inner cylinder and can roll eccentrically within the outer cylinder, said blade resting with one edge against the cylindrical surface of the intermediate cylinder, so as to define two chambers between the intermediate cylinder and one of the inner and outer cylinders, one of which chambers communicates with an inlet aperture for the pressurized fluid and the other with an outlet aperture.

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It must be stressed that, although there is relative movement between the cylinders it may, according to the working conditions, be assumed that either the inner or the outer cylinder is stationary.

Whatever the case, in order to produce a high degree of eccentricity, that is, a high degree of efficiency of the apparatus, it is necessary for these two diameters to differ by a large amount. However, by suitable selection of the dimensions of the intermediate cylinder, the working chambers may be given as small a volume as desired, without necessitating the slightest modification or reduction of the eccentricity of the two main cylinders, i.e., the inner and outer cylinders.

The inlet of the pressurized fluid may be effected through the wall of one of the two former cylinders, and the blade may be mounted in that cylinder, whilst the outlet may be effected through at least one of the ends of the space defined by said first cylinder and the intermediate cylinder.

In the case where the outer cylinder is mobile, this cylinder may be protected by a cylindrical shell, the inner diameter of which is sufficient to ensure that the movement of the outer cylinder is not restricted, said outer shell being connected to the inner cylinder by means of two sidepieces or flanges which constitute the aforementioned guide end faces.

The invention will be further described, by way of example, with reference to the accompanying drawings which illustrate three embodiments of the invention, and in which:

FIG. 1 is a cross-section along the line I—I in FIG. 2, of a compressed fluid vibrator according to this invention, in which an inner cylinder revolves within an outer cylinder;

2. A vibrator for actuation by pressure fluid compris-
FIG. 1;

FIG. 3 is a cross-section along the line III—III in FIG. 4 of another embodiment of the vibrator, in which an inner cylinder also revolves within an outer cylinder, the pressurized fluid being admitted through the inner cylinder and not through the outer cylinder;

FIG. 4 is a longitudinal section along the line IV—IV in FIG. 3;

FIG. 5 is a cross-section along the line V—V in FIG. 6, of yet another embodiment in which the outer cylinder revolves about the inner cylinder, and the fluid is admitted through the inner cylinder;

FIG. 6 is a longitudinal section along the line VI—VI in FIG. 5.

Reference O indicates the axis of the stationary cylinder, G1 the axis of the intermediate cylinder, and G2 the axis of the other cylinder.

The pressurized fluid operated vibrator shown in the FIGURES 1 and 2 consists essentially of an outer hollow cylinder 1, and a solid inner cylinder 2 located inside an intermediate cylinder 3. These are so arranged that the inner cylinder 2 and the intermediate cylinder 3 revolve together along the inner wall of the outer cylinder 1.

The inner cylinder 2 and the intermediate cylinder 3 have the same length and their end faces act as guides which abut against the inner faces of adbutments 4 and 5 respectively, forming part of the outer cylinder 1. This latter is longer than the two cylinders it embraces. On the drawing, only the active part of this outer cylinder has been drawn.

The pressurized fluid, which can be compressed air, is admitted through a duct 7 which extends longitudinally within the thickness of the wall of the outer cylinder 1 and enters the inner space or bore of the cylinder through a number of radial holes 8.

A blade 9 may slide radially in a slot 11 which connects the duct 7 with the bore of the outer cylinder 1. The dimensions of the assembly are such that the blade can rest with its outer edge against the outer cylindrical surface of the intermediate cylinder 3, and that it can completely recede into the thickness of the wall of the outer cylinder 1, when the intermediate cylinder 3, which rolls along the inner wall of the outer cylinder, arrives at the position of this blade.

The outlet of the pressurized fluid is effected through apertures 12, having the shape of beans, and machined into the abutments 4 and 5 at opposite ends of the blade 9, near the inner cylindrical wall of the outer cylinder 1. The outlets are adjacent to the blade 9 on the side opposite to the holes 8.

During operation, the pressurized fluid, admitted through the duct 7, passes through the holes 8 and fills a working chamber 14, defined by the inner surface of the outer cylinder 1, the outer surface of the intermediate cylinder 3, and one surface of the distributing blade or vane 9. This chamber tends to increase its volume under the effect of the pressure of the fluid causing the intermediate cylinder to be driven in the direction of the arrow *f*, and to roll along the inner wall of the outer cylinder 1, carrying with it the solid inner cylinder 2. The fluid contained in a second chamber 15 escapes through the openings 12.

It is believed that during the rotational movement of the inner cylinders, the point of contact A between the inner cylinder and the intermediate cylinder, the point of contact B between the intermediate cylinder and the outer cylinder, and the centre O of this outer cylinder are located substantially on a straight line.

An important result of such a construction is that it is possible to produce an eccentricity, shown by the distance OG2, which is as large as possible, between the inner and the outer cylinders. A maximum efficiency of the arrangement is obtained for the generation of vibration, whilst the chambers 14 and 15, which receive the pressurized fluid, may be kept at as small a volume as desired. In order to produce this effect, it is sufficient to design the intermediate cylinder 3 so that its outer diameter is as near as desired to the inner diameter of the outer cylinder 1.

In the embodiment of FIGURES 3 and 4, there is again shown an outer cylinder 1*a*, an inner cylinder 2*a* and an intermediate cylinder 3*a*, but the pressurized fluid, which can be compressed air, instead of being admitted through the outer cylinder, is here admitted through the inner cylinder, namely through an axial duct 7*a* in this cylinder and radial holes 8*a*. The outlet is effected through apertures 12*a*, machined into end flanges 4*a* and 5*a*, respectively, which form part of the inner cylinder 2*a*. These flanges 4*a* and 5*a* are in contact with a shoulder 10 of the outer cylinder 1*a*.

This arrangement operates in a similar manner as that of FIGURES 1 and 2. The pressurized fluid is admitted into the axial duct 7*a* of the inner cylinder 2*a*, and passes into the working chamber 14*a* through the holes 8*a*. This causes the centre of the inner cylinder to revolve in the direction of the arrow *f*, thus actuating the intermediate cylinder 3*a* in the same direction of revolution within the outer cylinder 1*a*. The pressurized fluid contained in the chamber 15*a* escapes through the apertures 12*a*.

It is also possible here to obtain a large amount of eccentricity between the inner cylinder 2*a* and the outer cylinder 1*a*, whilst keeping the volume of the working chambers for the fluid at a minimum, by providing the intermediate cylinder 3*a* with an inner diameter which is near the outer diameter of the inner cylinder 2*a*.

The embodiment shown in FIGURES 5 and 6 is a modification of the design of FIGURES 3 and 4. The pressurized fluid, which can be compressed air, is admitted through the inner cylinder 2*a*, but with the difference that outer cylinder 1*b*, instead of being stationary, rolls along the cylinder 2*a* by means of the intermediate cylinder 3*a*.

In this embodiment the diameters of the flanges 4*b* and 5*b* are larger than that of the outer cylinder 1*b*, and they support a cylindrical shell 17 which protects the whole assembly.

The circulation of the fluid is the same as in the embodiment of FIGURES 3 and 4 and from this there follows the same possibilities relating to a large degree of eccentricity of the cylinders combined with a small volume of the working chambers.

While a particular embodiment of this invention has been illustrated and described herein, it is intended that this invention be not limited to such disclosure, and changes and modifications can be made and incorporated within the scope of the claims.

I claim:

1. A vibrator for actuation by pressure fluid comprising an outer hollow cylinder, an eccentrically disposed inner cylinder, a blade slidably mounted in the wall of one of said cylinders and an eccentrically disposed intermediate cylinder within the outer cylinder and enclosing the inner cylinder and in contact with one end of the blade to form two chambers between the intermediate cylinder and one of the other cylinders, one of which chambers communicates with an inlet aperture for the fluid under pressure and the other with an outlet aperture.

2. A vibrator for actuation by pressure fluid comprising an outer hollow cylinder, an eccentrically disposed inner cylinder, one of said inner or outer cylinders being stationary, a blade slidably mounted in the wall of one said cylinders and an eccentrically disposed intermediate cylinder within the outer cylinder and enclosing the inner cylinder and in contact with one end of the blade to form two chambers between the intermediate cylinder and one of the other cylinders, one of which chambers communicates with an inlet aperture for the fluid under pressure and the other with an outlet aperture.

3. A vibrator for actuation by pressure fluid comprising an outer hollow cylinder, an eccentrically disposed inner cylinder, a blade slidably mounted in the wall of one of said cylinders and an eccentrically disposed intermediate cylinder within the outer cylinder and enclosing the inner cylinder and in contact with one end of the blade to form two chambers between the intermediate cylinder and one of the other cylinders, one of which chambers communicates with an inlet aperture for the fluid under pressure and the other with an outlet aperture, each cylinder being provided at its ends with guiding side faces perpendicular to its axis, the guiding side faces of one cylinder sliding in contact with the guiding side faces of another cylinder.

4. A vibrator as claimed in claim 3, in which the inlet aperture is pierced in the wall of the outer or inner cylinder in which the blade is mounted, and the outlet aperture is pierced through the guiding side face of said cylinder.

5. A vibrator as claimed in claim 1, in which the outer cylinder is mobile and protected by a cylindrical shell or envelope, the inner diameter of the shell being sufficient to allow free movement of said outer cylinder, the shell being connected to the inner cylinder by guide end faces.

6. A vibrator for actuation by the static pressure of a pressurized fluid, comprising an outer hollow cylinder in which an inner cylinder with smaller diameter can revolve eccentrically, each cylinder having guide end faces arranged perpendicularly to its axis, so that the guide faces of each cylinder slide in contact with the guide faces of the other cylinder, a radially movable blade in a slot machined in one of the cylinders and able to recede into

the cylinder in which it is seated and located between the inner and outer cylinders, and an intermediate hollow cylinder, which encloses the inner cylinder and can roll eccentrically within the outer cylinder, said blade resting with one edge against the cylindrical surface of the intermediate cylinder so as to define two chambers between the intermediate cylinder and one of the inner and outer cylinders, one of which chambers communicates with an

inlet aperture for the pressurized fluid and the other with an outlet aperture.

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