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SILENT OR SEMINOISELESS VIBRATOR

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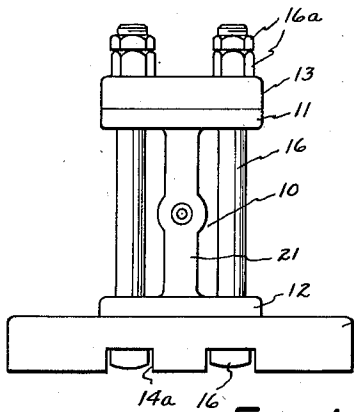


FIG. 1

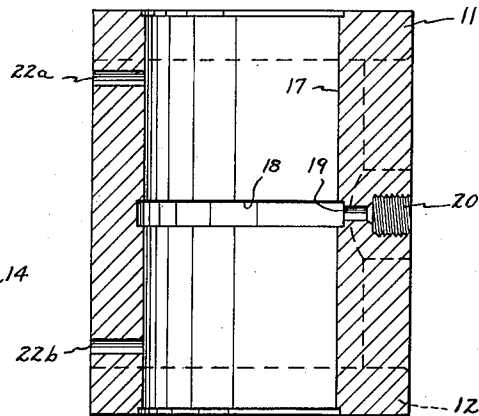


FIG. 2

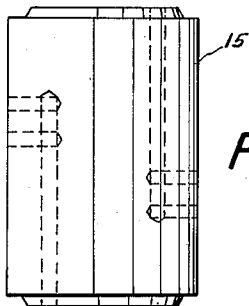


FIG. 3

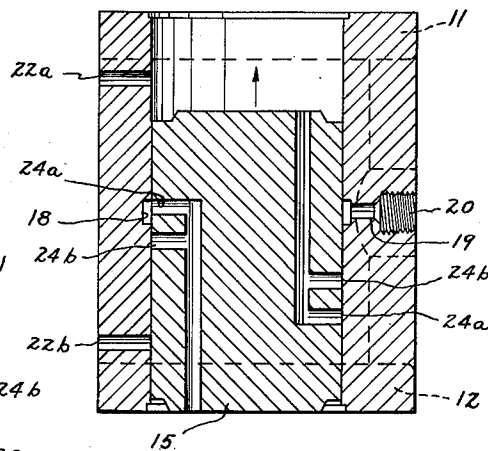


FIG. 4

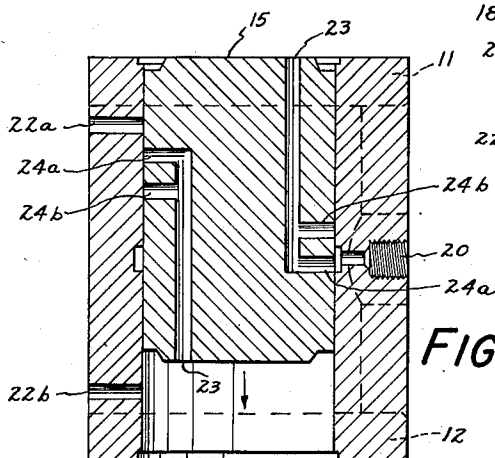


FIG. 5

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SILENT OR SEMINOISELESS VIBRATOR

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4 Claims. (Cl. 121-101)

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This invention relates to vibrators, and more specifically to reciprocating piston type vibrators. At present industrial vibrators of the reciprocating piston type all partake of the disadvantage that they require the impact of a heavy piston on some portion of a cylinder head for their operation. This results in a loud, repetitive, metallic noise which may be very oppressive to the operator as well as those in the vicinity. The noise produced is especially undesirable when the vibrator is used in an enclosed room.

My invention provides for an air cushion at each end of the piston strokes which thereby eliminates the noise as a result of the metallic impact. Heretofore, prior devices have avoided the use of air cushions in this type of vibrator since such a cushion reduced the vibration and resulted in stalling the operation of the device. My invention overcomes this objection by a means which may be more fully understood from reference to the figures and the following detailed description.

Referring to the drawings:

Fig. 1 is an elevational view of the device assembled and secured on a mounting base;

Fig. 2 is a vertical medial cross section of the cylinder with the other parts removed;

Fig. 3 is an elevational view of the piston removed from the cylinder.

Fig. 4 is a cross section on the centerline of the device assembled with the piston at the lower end of its stroke with the heads removed; and

Fig. 5 is a similar view showing the piston at the end of its upward stroke.

Referring more particularly to Fig. 1, my invention consists of a cylinder casting 10 which may be provided with upper and lower flanges 11 and 12, and upper cylinder head 13. A lower cylinder head 14 is provided which may also serve as a mounting base. A piston 15 is slidably disposed within the cylinder. Tie bolts 16 may be used to hold the cylinder heads in proper relation to the cylinder, the bolt heads being disposed in recesses 14a in the lower head and being secured by lock nuts 16a on the portion of the bolts projecting through the upper head.

The cylinder casting as is shown in Fig. 2 is formed with a circular inner cylinder portion 17. An annular groove 18 completely around the cylinder 17 at its mid-section is connected to a source of compressed air through duct 19 leading to the tapped hole 30 disposed in a boss 21 on the side of the cylinder into which a pipe or hose fitting may be screwed. Two air exhaust ports 22a and 22b are provided to exhaust the com-

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pressed air after it has done its work on the piston 15.

The piston 15 is a single piece of heavy material (iron or steel) slidably disposed within the cylinder 17 and into which are drilled certain air passages. These passages more specifically comprise a duplicate system for each end of the piston. Each end is provided with an outlet duct 23 which exhausts into the space between the piston 15 and either of the cylinder heads 13 or 14 to drive the piston away from that end of the cylinder. Two inlet ducts 24a and 24b leading into the duct 23 are spaced axially of the piston.

The operation of the device may be more readily understood by referring to Figs. 4 and 5. Fig. 4 shows the piston at the bottom of the cylinder in its normal starting position. If compressed air is now allowed to enter through a fitting in the tapped hole 20, it will then flow through the duct 19 and the annular groove 18 into the uppermost duct 24a of the two inlet ducts of the system for the lower end of the piston. Since this is connected to the space between the piston and the lower cylinder head 14, through the duct 23, the sudden inflow of compressed air into this space will force the piston upward. During the first part of the upward travel, air in the upper chamber will, for a considerable portion of the travel of the piston, be forced out of the exhaust port 22a. As the piston travels upward the inlet duct 24a will be closed from the annular groove 18. However, the compressed air in the lower chamber will continue to force the piston upward and will open the duct 24b to the groove 18 and a fresh charge of compressed air will enter the lower chamber, forcing the piston upwards even faster. The result being a double impulse on the piston to force it upward.

Somewhat further in its upward travel, the piston 15 will close the exhaust port 22a. At this point the air in the upper chamber will start to be compressed into a smaller and smaller space. The second impulse occurs just prior to the closing of the port 22a. Almost immediately after the exhaust duct 22a is closed, the duct 24b of the upper system of ducts in the piston is opened to the source of compressed air through the groove 18. This admits a charge of compressed air to the upper chamber which acts with the air already in the chamber to start retarding the piston in its travel. The inertia of the piston is, however, sufficient to carry this duct 24a in the system opposite to the groove 18, at which time a second burst of air into the cylinder causes the piston to reverse. At that time the lower ex-

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haust port 22b is uncovered by the piston, relieving the pressure in the lower chamber. As each stroke takes only a short time, it is apparent that the reciprocating of a heavy piston in the cylinder will cause a very severe vibration which is transmitted to the heads. This being a combination of the sudden admission of air, plus the travel of the piston. Since there is no impact of metal on metal, the operation of the device is quiet.

The principal noise from the device is the exhaust of air from the ports 22a and 22b. If this noise should be objectionable, these ports can be provided with a manifold to conduct the exhausting air to some remote point.

It will therefore be noted that at each end of the cylinder there is first the compression of dead air followed by a first admission of live air, then a second admission of live air which increases the speed of the piston on the return stroke. Hence, it will appear that for each end of a stroke air under pressure is admitted in three increments: (1) to cushion, (2) to cushion and start return and (3) to accelerate the return stroke.

Having thus described my invention, I am aware that numerous departures may be made therefrom without departing from the spirit or the scope of my invention.

I claim:

1. A vibration inducing device comprising a cylinder, having means closing said cylinder at each end, said cylinder having exhaust ports near each end and an annular groove at its midsection, duct means opening into said groove for the entry of a compressed fluid thereto; piston means reciprocably disposed in said cylinder forming a chamber at each end thereof, two internal ducts formed within said piston means, each opening at opposite ends of said piston means; two entry means in the side of said piston means for each internal duct cooperating with said annular groove, the first entry arranged to transmit fluid pressure to said chamber at one end of the cylinder to initiate motion of the piston, the second entry arranged to transmit additional fluid pressure to said chamber to accelerate the motion of said piston means and on the return stroke to allow pressure to enter the chamber to prevent impact of said piston means with said cylinder closing means.

2. A pneumatic vibrator including a cylinder having heads on opposite ends thereof, a piston disposed for reciprocatory movement in said cylinder, said cylinder being formed with a centrally disposed inlet port and outlet ports spaced from the ends, said piston having ducts formed therein, each of which comprises an inlet portion and an outlet portion opening through the end of the piston, said ducts opening through opposite ends,

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said inlet ducts for the piston each including openings spaced longitudinally along the piston adapted for successive registry with said inlet port in cylinder.

3. A pneumatic vibrator including a cylinder, heads closing the ends of the cylinders, an annular chamber formed in the inner wall of the cylinder midway between its ends, and a duct for conducting compressed air to said chamber connected therewith, said cylinder being formed with exhaust ducts extending through the wall of the cylinder spaced from the opposite ends and said channel, a piston for said cylinder having a length of at least two thirds the length of the cylinder, said piston being formed with separate ducts opening through opposite ends, each of said ducts having openings through the side of the cylinder comprising a first opening disposed for registry with said channel when one end of the piston is adjacent one end of the cylinder, and a second opening, spaced from said first opening and positioned for registry with the channel when the piston is spaced from the end of the cylinder.

4. The method of operating a pneumatic vibrator having a cylinder with a piston reciprocable therein which comprises supplying a pulse of compressed air to one end of the piston to start it moving in the cylinder, supplying a second pulse of compressed air to the piston after said first pulse to increase the speed of travel of the piston, providing a dead air space for the other end of said piston to absorb the shock and to compress the air toward the end of the stroke and supplying a pulse of compressed air to the said end near the end of the stroke to stop its travel and cause the piston to start on its return stroke and repeating the cycle throughout the operation of the same.

EDWARD S. CANNON.

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