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VIBRATORY DEVICE AND AMPLITUDE ADJUSTMENT MEANS

Filed Jan. 6, 1961

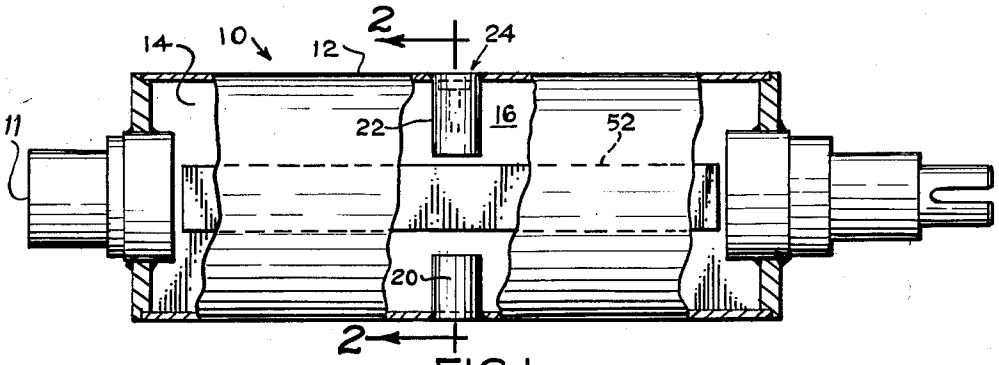


FIG. 1

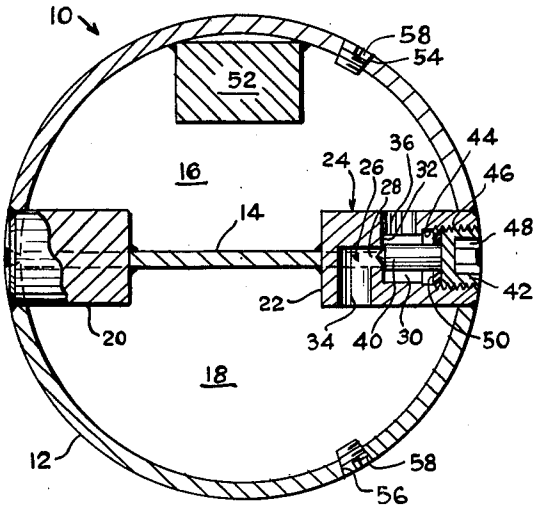


FIG. 2

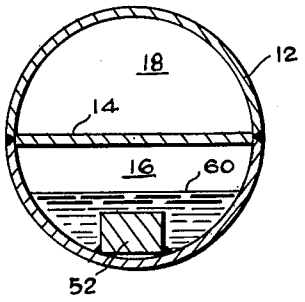


FIG. 3

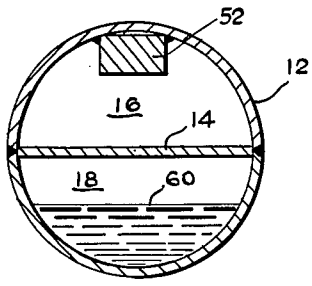


FIG. 4

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VIBRATORY DEVICE AND AMPLITUDE ADJUSTMENT MEANS

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This invention relates to a vibratory means and more particularly to a counterweighted rotatably mounted cylinder and ballast control for modification of the amplitude of vibration during the rotational movement thereof.

The means for ballast control will be described by way of an improvement over the means for ballast regulation described in the copending application Ser. No. 771,095, filed October 31, 1958, and now Patent No. 3,020,683, and entitled "Fluid Ballast Control System for Machine for Precision Finishing of Parts by Controlled Vibration." In the aforementioned application, there is described a fluid ballast means for regulation of the amplitude of vibrations of the machine comprising a rotating hollow cylinder which is provided with an eccentrically loaded mass of fluid within the cylinder. The cylinder is diametrically divided into a pair of hollow chambers, one of which is variably filled with liquid for determining the center of gravity set off from the center of rotation of the cylinder. In the system described it is essential to supply and to remove the hydraulic medium by means of an external member which requires piping and pressure arrangements inherent to such operation.

It is an object of this invention to produce a vibratory device having improved means for adjusting and maintaining eccentricity and it is a related object to provide a device of the type described in which adjustment for eccentricity may be effected without dependence upon external means for the supply or removal of materials.

It is a further object of this invention to provide a ballast control for a vibratory device of the type described in which the amplitude of vibrations can be varied to any desirable degree within a predetermined minimum and maximum.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings, in which—

FIG. 1 is a front elevational view of a vibratory device in the form of a rotatable cylinder embodying the features of this invention;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a schematic sectional elevational view of the vibratory device shown in FIG. 1 with the elements arranged therein for maximum amplitudes of vibration, and

FIG. 4 is a schematic sectional view similar to that of FIG. 3 illustrating the arrangement of elements for a minimum of amplitude of vibration.

Referring now to the drawings, the counterweighted cylinder embodying the features of this invention comprises an elongate hollow cylinder **10** mounted for rotational movement about a central axis **11** and directly or indirectly connected to a machine (not shown) for effecting vibrational movement thereof at amplitudes depending upon the selected adjustment of ballast, as will hereinafter be described.

The cylinder **10** comprises a hollow shell **12** which is subdivided diametrically by a partitioning plate **14** into separated compartments **16** and **18**. In the illustrated modification, the partitioning plate **14** is formed with blocks **20** and **22** in the edge sections thereof and disposed substantially midway between the length of the cylinder with the blocks **20** and **22** being preferably disposed across one from the other to avoid the introduction of excessive eccentricity thereby. The partitioning plate **14** may be of uniform dimension in cross-section corresponding to the cross-section of the blocks **20** and **22** but it is preferred to form the partitioning plate of considerably lesser cross-section so as to minimize the amount of capacity of the cylinder which is taken up thereby. Instead of locating the blocks **20** and **22** in the central portion of the plate, said blocks may be disposed in other portions but with the thought of balancing one block with the other to avoid the build-up of unbalance thereby.

The blocks are formed of larger cross-section to enable the construction to include a valve means **24** therein including a radial passage **26** extending inwardly from the periphery of the cylinder to a point short of the block sectioned of larger dimension with the passage **26** being divided between an inner passage **28** of smaller dimension and an outer passage **30** of larger dimension to define an outwardly facing shoulder **32** therebetween. Communicating with the passage **26** and preferably with the inner portions thereof are a pair of passages **34** and **36** offset one from the other with one passage **34** communicating the central passage **26** of smaller dimension with one compartment **18** while the other passage **36** communicates the central passage **30** of larger dimension with the other compartment **16** whereby said passages are capable of providing communication therethrough between the compartments.

Communication between said compartments through the passages is controlled by a plunger member in the form of a plug **40** which is mounted for radial displacement in the passage **30** of larger dimension into and out of engagement with the shoulder **32** between blocking and unblocking positions respectively to block communication between said passages when in blocking position and to permit communication between said passages and the compartments, when in unblocking position. Various means may be employed for effecting the desired radial displacement of the plug **40** between blocking and unblocking positions. One such means, illustrated in the drawing, comprises a plug **40** having a base portion **42** of larger dimension to fit the opening **44** in the outer portion of the central passage with threads **46** in the periphery of the base member adapted threadably to engage a correspondingly threaded portion provided in the adjacent surface of the block. Thus the block and plug can be displaced into and out of the passage between blocking and unblocking position responsive to turning movement in one direction or the other. To assist in the actuation, the outer edge of the base member **42** may be formed with a recess **48** of polygonal shape in cross-section for receiving the head of a turning tool (not shown) for assistance in turning movement in one direction or the other. A seal **50** is provided to seal off the passages and prevent the escape of material from within the cylinder through the passage.

A metal bar **52** or other dead weight member is fixed, as by welding, to the inner surface of one of the compartments in a position offset from the partitioning plate and preferably midway between the ends thereof for maximum eccentricity during rotational movement of the cylinder. Each compartment is also provided with an opening **54** and **56** fitted with a removal plug dimensioned to be received in sealing relationship within a respective opening for purposes which will hereinafter be described.

In operation, a material capable of free flow is introduced through one or the other of said openings **54** or **56** into one or the other or both of the compartments but the amount of material introduced is adapted to be no more than that necessary to fill one of the compart-

ments. A material of low specific gravity may be employed but for maximum variation in the amplitudes of vibration, it is more desirable to make use of a material having high specific gravity. Thus, if use is to be made of a fluid, use can be made of water, oils, silicone fluids or the like, but it will be preferred to employ mercury or other liquid of high specific gravity for the material introduced into the cylinder. If use is to be made of a solid, it is desirable to make use of a solid subdivided into fairly finely divided form capable of free flow and dimensioned to be considerably smaller than the passages for free flow therethrough. For this purpose, use can be made of glass or metal beads and the like of rounded or cylindrical shape, such as steel shot.

When the free flowing material has been introduced into one or the other or both of the compartments the plugs **58** are replaced to seal the openings.

For minimum amplitude, the material is concentrated in the compartment opposite the compartment having the dead weight **52**, as illustrated in FIG. 4 of the drawings, taking into consideration the differences in the effect of specific gravity on the center of gravity of the weighted elements. For this purpose, the cylinder is positioned with the dead weight uppermost so that free flowing counterbalancing material **60** will flow gravitationally from the upper compartment to the lower compartment when the base **42** is turned in the direction to unseat the valve plug **40** from blocking to unblocking position. It may be necessary to loosen or remove the plug **58** from the upper chamber for purposes of bleeding air into the chamber to replace the liquid material flowing through the passages **36**, **26** and **34** from the upper chamber into the lower chamber for counterbalancing purposes. When the desired amount of material has been transferred from the upper chamber to the lower chamber, the valve can be closed by return to seat the plug and block further communication between the chambers. After the adjustment has been effected, the plug **58** is again tightened to seal the chambers.

When it is desired to vary the center of specific gravity of the cylinder, the opposite procedure is carried out. The cylinder is positioned with the dead weight **52** lowermost. The bleed plug in the upper compartment is opened if necessary and then the valve is adjusted to unblocking position to establish communication between the compartments for flow of material through the passages from the upper compartment to the lower. The center of specific gravity is controlled by the amount of material which is displaced gravitationally from the one compartment to the other. Maximum unbalance for greatest amplitude in vibration is achieved when all of the material is displaced from the upper compartment to the lower compartment already housing the dead weight, as illustrated in FIG. 3. After the amount of material for the desired unbalance has been displaced from the one compartment to the other, the valve is again closed and the plug is returned to sealing position.

It will be apparent from the foregoing that I have

provided a simple and efficient means for the adjustment of the unbalance of a rotating cylinder to set up vibrations of a desirable amplitude upon rotation of the cylinder about its axis. It will be understood that the cylinder can be attached for use with various types of vibratory equipment to impart vibrations which can be adjusted as to degree and amplitude in a simple and efficient manner.

It will also be understood that the vibratory unit embodying the features of this invention may comprise hollow structures of other configurations which are rotatable about a centralized axis such for example as a cube or other hollow cylinder of a polygonal shape in cross-section, such as rectangular, hexagon, octagon, polygon or the like.

It will be further understood that numerous changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. Means for regulating the center of specific gravity of a rotatable cylinder which is utilized to induce vibratory action in a machine affixed thereto comprising the combination of: a hollow cylinder; a partition plate diametrically dividing said cylinder into two hollow compartments; a dead weight mass stationarily affixed in one of said compartments; a movable mass positioned within the cylinder; and means for passage of said movable mass from one compartment to the other.

2. The structure of claim 1 in which the dead weight mass comprises a rigid block affixed to the inner wall of the cylinder in one of the compartments theretof at point of greatest distance from the partition plate.

3. The structure of claim 1 in which the means allowing the passage of said movable mass from one compartment into the other comprises a valve situated within the partition plate and having passages communicating the compartment with the other.

4. The structure of claim 1 in which the movable mass comprises liquid ballast.

5. The structure according to claim 1 in which the movable mass comprises comminuted solid ballast.

6. The structure of claim 4 in which the liquid ballast comprises mercury.

7. The structure of claim 5 in which the comminuted solid ballast comprises steel shot.

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