May 28, 1963 D. W. PEASE 3,091,435

ROTARY-OSCILLATORY DEVICE FOR MIXING, TUMBLING, COMMINUTING, AND THE LIKE

Filed Jan. 30, 1961

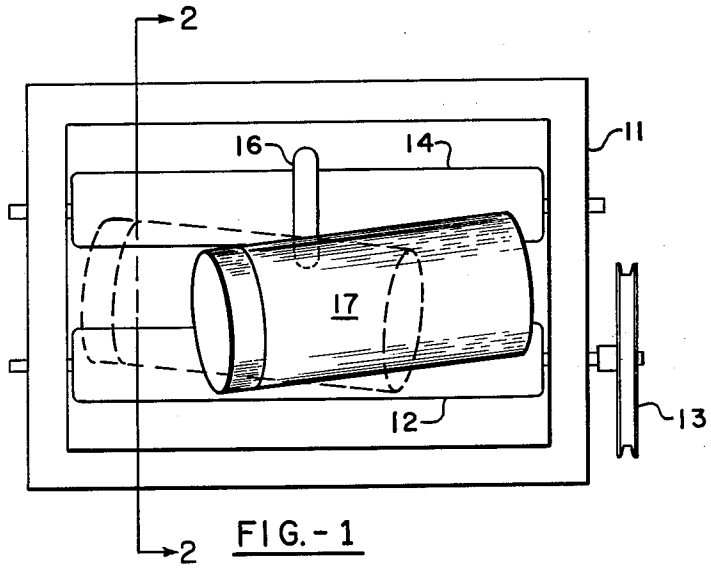


FIG.-1

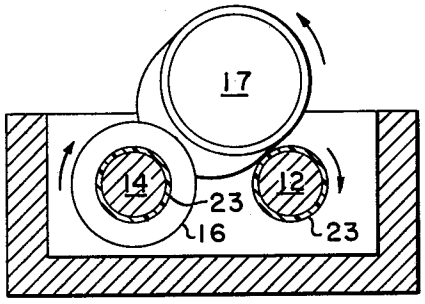


FIG.-2

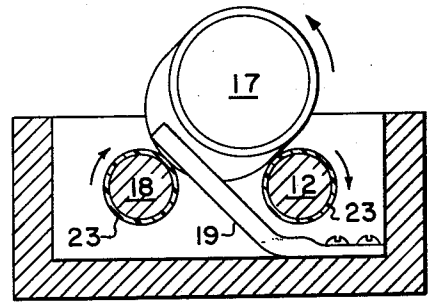


FIG.-3

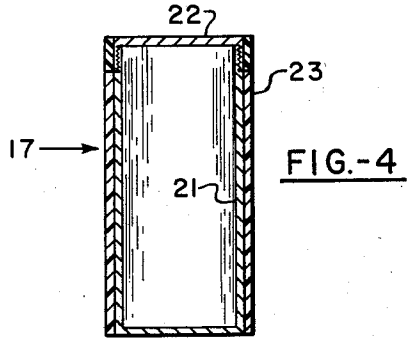


FIG.-4

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United States Patent Office 3,091,435 Patented May 28, 1963

3,091,435

ROTARY-OSCILLATORY DEVICE FOR MIXING, TUMBLING, COMMINUTING, AND THE LIKE

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Filed Jan. 30, 1961, Ser. No. 85,782
3 Claims. (Cl. 259—72)

This invention relates in general to the class of machines having a barrel rotatable on its longitudinal axis, the barrel being adapted to contain materials to be mixed, tumble-polished, or ground as in a ball mill. More particularly, the present invention relates to such a device having provision for oscillating or librating the longitudinal axis of the barrel during rotation.

A common type of ball mill is that in which a cylindrical container or barrel rests longitudinally on a pair of spaced-apart parallel rollers, of which one is driven and the other is an idler. When the driven roller is rotated at a suitable speed, the barrel turns at such a rate that grinding balls contained therein travel part way around with the barrel and drop upon the material to be comminuted. Although this system is satisfactory for grinding a single substance, it does not provide a good mixing action for grinding simultaneously a plurality of substances which may be loaded into the barrel without previous blending. Neither is it suitable for use as a mixer and blender of powdered materials which are already ground to the desired fineness, owing to the fact that the materials tumble only across the diameter of the barrel, and there is very little transfer of material from end to end.

The present invention overcomes these difficulties and is suitable for use as a blender of a plurality of materials, for use as a ball mill in which it is desired to grind and mix a plurality of materials simultaneously, or for rotating and oscillating cans or drums of paint or other liquids to produce a thorough stirring action. Although for convenience the device of this invention is called a barrel rotator or tumbling device, it is to be understood that its uses include grinding, mixing, blending, tumbling, and similar processes.

It is an object of the present invention to provide an improved barrel rotating device.

It is a further object to provide a device having a barrel rotatable about a librating axis.

Another object of the invention is to provide a barrel rotating device in which the contents of the barrel pitch from end to end thereof during tumbling.

The foregoing objects and advantages and others ancillary thereto will be readily understood on reading the following specification in connection with the accompanying drawings, in which

FIGURE 1 is a plan view of one embodiment of the improved barrel rotating device;

FIGURE 2 is a cross-sectional elevation of the device, taken on line 2—2 of FIGURE 1;

FIGURE 3 is a view similar to FIGURE 2 of another embodiment of the device; and

FIGURE 4 is a centerline longitudinal cross-section of the rotatable barrel.

Referring more particularly to FIGURE 1, there is shown a cradle **11** in which a pair of parallel rollers are journaled in horizontal position and in a single horizontal plane. The cradle may be a simple open-topped box, as shown, a skeleton framework, or any other arrangement suitable for journaling a pair of rollers horizontally in parallel relation. The driven roller **12** of the pair is provided with a pulley **13** or other suitable means for connection thereto of any convenient source of rotary motive power (not shown). An idler roller **14** is positioned parallel to the driven roller and spaced apart therefrom. Approximately midway of its length the idler roller is provided with a short section **16** of increased diameter, preferably having its external surface rounded. A generally cylindrical barrel element **17** rests on the two rollers, one end of the barrel touching the main surface of both rollers and the other end resting on the main surface of the driven roller and on the larger diameter **16** of the idler.

The barrel is thus cocked so that its longitudinal axis is angularly disposed to the axes of both rollers, and when the driven roller is rotated in the direction shown by the arrows in FIGURES 2 and 3, the barrel will not only be rotated by the driven roller, but will also advance longitudinally in the direction of whichever end of the barrel is higher, thus climbing over the enlarged section of the idler. When the barrel has thus advanced sufficiently past its longitudinal center that its unsupported end will overbalance the weight of the material contained therein, which tends to gather at the lower end, the previously free end will topple downward, rocking the barrel across the enlarged roller section, and become the supported end resting on the main surface of both rollers, as shown in dotted lines in FIGURE 1.

Meanwhile, the material in the barrel has been tumbling in a rotational manner, and when the barrel topples and the free end strikes the rollers, the material is thrown toward the other end of the barrel, where it again begins rotational tumbling. The barrel will now begin advancing in the other direction and repeat the cycle, while rotating constantly in the same direction. The entire operation is entirely automatic and needs no attention, and the device will operate over a wide range of speeds. It is necessary, however, that the driven roller be rotated in such a direction that its top is turning away from the idler, as otherwise the longitudinal advance and the toppling action will not take place.

FIGURE 3 shows another embodiment having an idler roller **18** without an enlarged section. Instead, a cylindrical rod **19** of suitable size is positioned transversely to the axis of the idler roller and crossing that portion of the idler roller surface on which the barrel would otherwise ride; however, the rod is not allowed to contact the roller surface, so that the idler is free to turn. The rod may be bolted by one end to the cradle, as shown, or otherwise fastened by any convenient means. For instance, the rod may be curved in hoop fashion over the idler roller and have both ends secured. The essential element is that the device be provided with a raised means interrupting the surface of the idler roller in such a manner that the barrel cannot lie parallel thereto and that the barrel will be raised out of contact with said surface at the point of interruption.

FIGURE 4 shows a longitudinal cross-section of the barrel **17**. It may be of simple canister type having a hollow body portion **21** with a closure **22**, such as the screw cap shown or a clamped lid, or it may be any other convenient type of cylindrical barrel element adapted to contain the material it is desired to mix or grind. The material of the barrel may be metal or ceramic, or other material suited to a particular use. For instance, standard commercial drums such as contain paint or other liquid products may be used in the combination of this invention. If desired, the barrel and its cover may be sheathed with sleeves **23** of shock-absorbing material such as rubber or plastic, which lessens the noise during operation and prevents possible chipping or denting of the barrel; the rollers may be similarly sheathed, as shown. Such sheathing, if used on the barrel, need not cover the entire peripheral surface, but may be simply a band at each end of the barrel where impact will occur. However, it should be understood

that the device will operate without sheathing on either the barrel or the rollers.

The cradle may be made of any material having sufficient strength and rigidity; wood and metal have both been found suitable. The rollers are preferably of metal, but wood or plastic rollers may be used in devices where the load is not too heavy. The device may be made of any desired dimensions; it has been found convenient to have the rollers of equal diameter, except for the enlarged portion of the idler roller, and to have the barrel diameter about twice the diameter of the driven roller, with the axes of the rollers parallel and spaced about two roller diameters apart. The diameter of the enlarged portion of the idler roller, or the height of such other interruption as may be used, may be chosen in accordance with the angle it is desired that the axis of the barrel shall make with the axis of the rollers and the vigor of the pitch it is desired to give the barrel as it rocks across the interruption. The device may be ganged longitudinally if desired. That is, two rollers of extended length may be used, with a plurality of interruptions at intervals along the idler roller, so that a plurality of barrels may operate thereon.

Although this invention has been described above in a specific embodiment by way of example, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the scope of the invention. It is intended to cover all such modifications by the appended claims.

What is claimed is:

1. A rotary-oscillatory tumbling device, comprising in combination a cradle, an idler roller supported by said cradle and having a horizontal longitudinal axis, a driven roller of the same diameter as said idler roller and supported by said cradle and having a longitudinal axis parallel with said idler roller axis, said rollers being in the same horizontal plane and having their axes spaced apart approximately two roller diameters, said driven roller being adapted to be driven with its top surface turning in a direction away from said idler roller, a generally cylindrical barrel element having a diameter approximately twice that of said driven roller and having a longitudinal axis and adapted to be rotated by said driven roller, said barrel being supported at one end by both said rollers, and means raising the remainder of said barrel and preventing it from contacting the surface of said idler roller and maintaining said barrel axis always angularly disposed to said roller axes in such a manner that when said driven roller is rotated with its top surface turning away from said idler roller said barrel is rotated about its angularly disposed axis and is translated alternately back and forth in the generally axial direction with its ends alternately contacting said idler roller.

2. The combination recited in claim 1, wherein said raising means is a portion of said idler roller of enlarged diameter.

3. The combination recited in claim 1, wherein said raising means is a rodlike element mounted on said cradle and extending between the surface of said idler roller and said barrel.

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