Dec. 6, 1960 E. S. SMITH 2,963,232

GRINDER

Filed Nov. 28, 1956 2 Sheets-Sheet 1

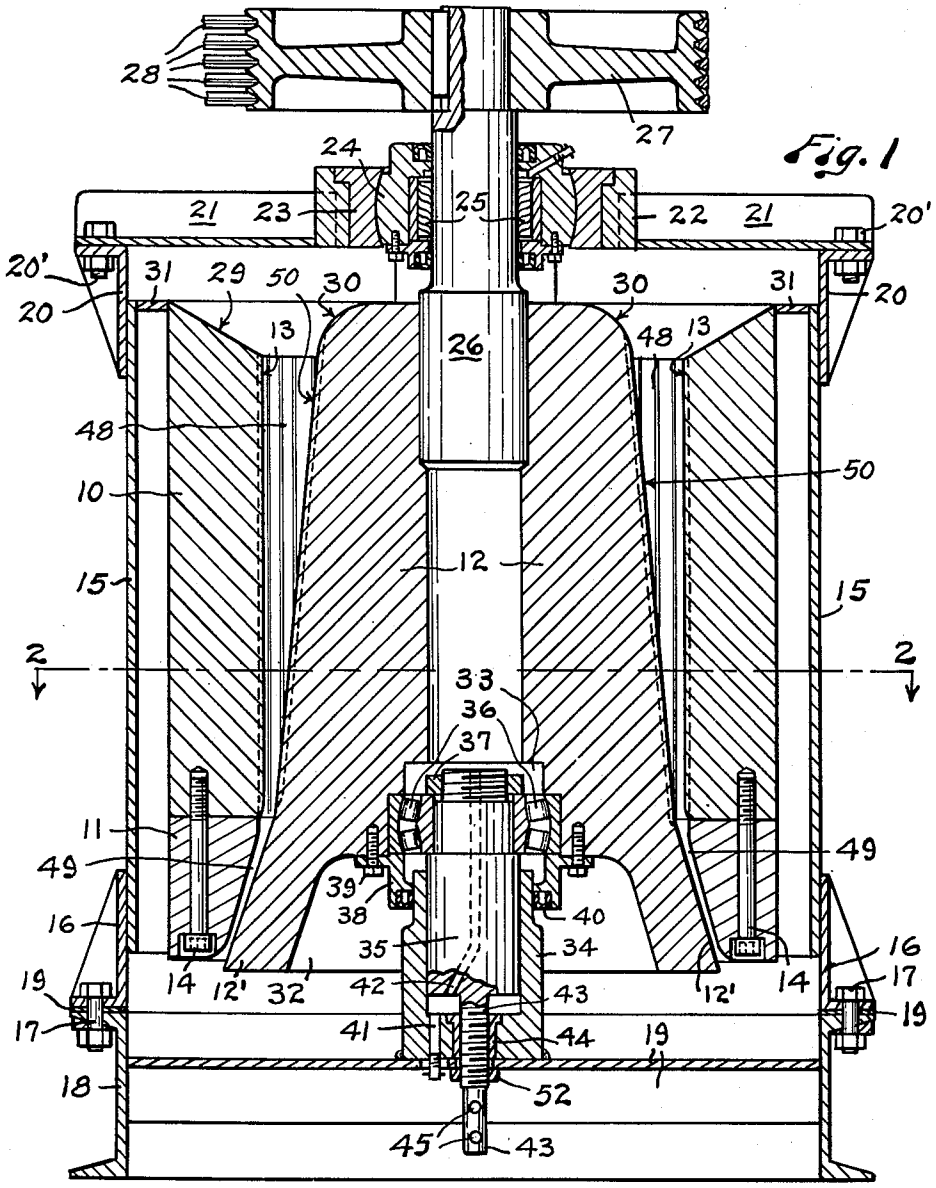


Fig. 1

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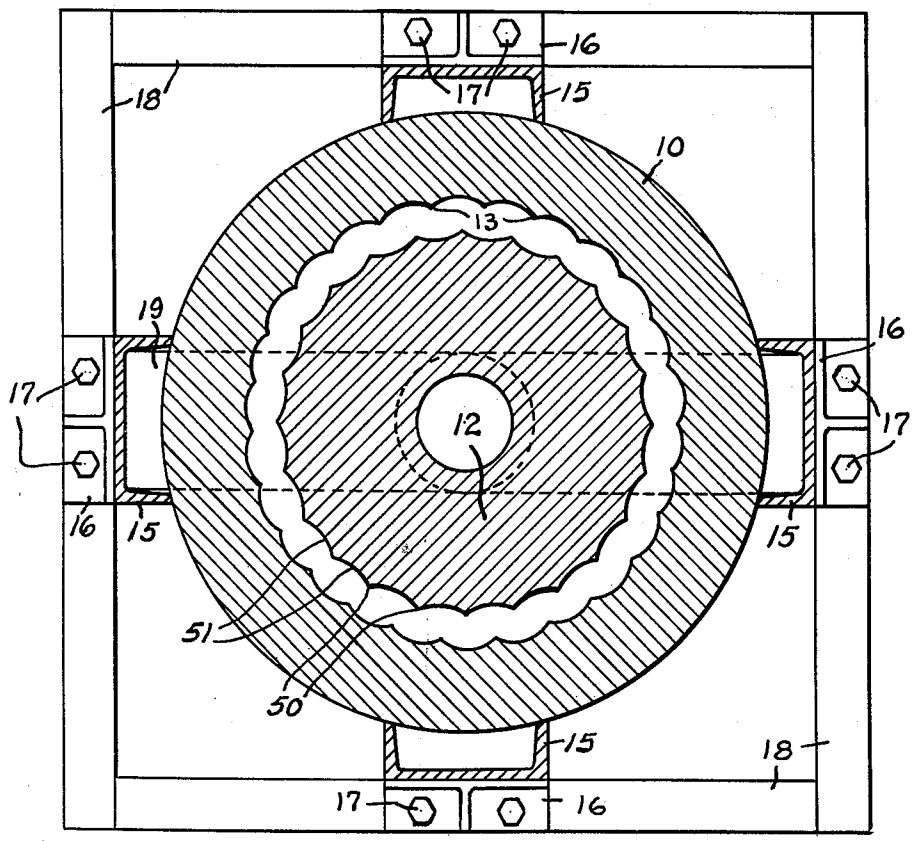


Fig. 2

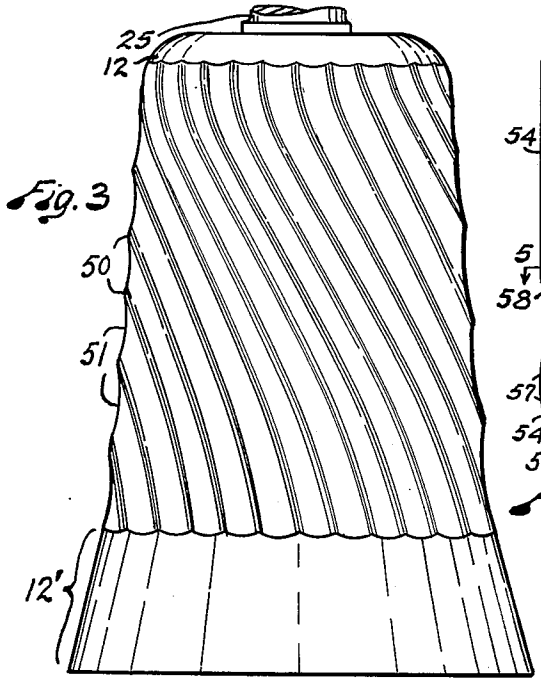


Fig. 3

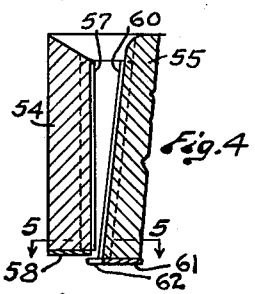


Fig. 4

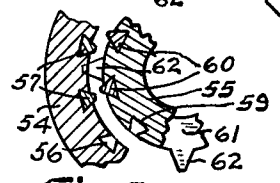


Fig. 5

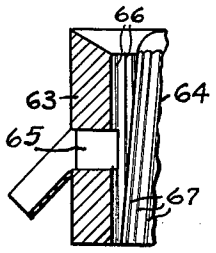


Fig. 6

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GRINDER

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2 Claims. (Cl. 241—259)

This invention relates to a grinder or pulverizer and an object of this invention is to provide a machine of this class which is particularly well adapted for grinding or pulverizing ore but which can be used for grinding other materials.

Another object of this invention is to provide a grinder or pulverizer of strong and sturdy construction which can be made in sizes small enough so that it is portable and is easily transported to locations difficult of access and is available for use in operations where a small capacity machine of nominal cost is needed.

Another object of this invention is to provide a grinder which is highly efficient in operation and can be used in place of more expensive rod mills and ball mills for pulverizing ore.

Another object is to provide a grinder which can be used for grinding garbage which contains tin cans, pieces of metal, glass, bones and like hard objects.

Another object is to provide an efficient grinder by which rock can economically be reduced to an aggregate suitable for use with cement in forming concrete.

Other objects of this invention will be apparent from the following description taken in connection with the accompanying drawings.

Figure 1 is a vertical sectional view of an ore grinding machine constructed in accordance with this invention.

Fig. 2 is a view in cross section of the same taken substantially on broken line 2—2 of Fig. 1.

Fig. 3 is a detached elevation of a grinding cone used in the device shown in Figs. 1 and 2.

Fig. 4 is a fragmentary longitudinal sectional view, on a smaller scale than Figs. 1 and 2 and 3, of a grinding cylinder and cone of modified form used in a machine which is well adapted for grinding garbage containing tin cans and like hard objects.

Fig. 5 is a fragmentary cross sectional view taken substantially on broken line 5—5 of Fig. 4.

Fig. 6 is a fragmentary longitudinal sectional view of a grinder which is particularly well adapted for grinding or reducing rock to a size suitable for use as an aggregate to be mixed with cement used in concrete work, parts being shown in elevation.

Like reference numerals refer to like parts throughout the several views.

The grinder shown in Figs. 1, 2 and 3 comprises two main parts, namely, a tubular housing or grinder shell formed of two parts 10 and 11 and a centrally positioned grinding cone 12 having on its lower end an extension 12' the exterior of which is flared at a greater angle than is the upper portion of the cone. The internal wall of the upper section or part 10 of the housing has corrugations 13 but is otherwise of approximately cylindrical shape. The internal wall of the lower part 11 of the housing or grinder shell is of expanding shape downwardly considered and is preferably smooth. Screws 14 can be used to rigidly secure the two parts 10 and 11 of the housing together, thus leaving the lower part detachable so it can be replaced in the event it becomes

badly worn or to allow substitution of a different part for different grinding purposes or to allow this lower housing part 11 to be removed in grinding coarser products. The walls of all of the grinder parts are of substantial thickness for strength and durability.

The exterior of the upper housing part 10 is welded or otherwise rigidly secured to four equally spaced upright channel bars 15. The lower ends of the channel bars 15 have rigidly attached angle brackets 16 and the angle brackets 16 are secured by bolts 17 to a base frame 18. The base frame 18 is shown to be square in outline and is formed of rigidly connected channel bars. Shims 19, only one of which is shown in Fig. 1, can be used between the angle brackets 16 and the base frame 18 to provide for a limited amount of vertical adjustment of the grinder shell 10, 11 relative to the base frame 18. The base frame 18 is provided with a rigid cross bar 19, which may be a channel bar with its flat side uppermost, from which the grinding cone 12 is adjustably supported.

The upper end portions of the upright channel bars 15 have rigidly attached angle brackets 20 which are secured by bolts 20' to inwardly extending channel shaped bearing supports 21. A bearing supporting ring 22 is rigidly attached to the inner end portions of the bearing supports 21. A split, self-aligning outer bearing housing 23 is disposed within the bearing supporting ring 22 and an inner bearing housing 24 is supported within the outer bearing housing 23. The two bearing housings 23 and 24 are of ball and socket type providing the self-aligning feature. A roller bearing 25 is provided within the inner bearing housing 24. A shaft 26 is rigid with the grinding cone 12 and journaled in the bearing 25. A driving sheave 27, preferably of V-belt type is keyed or otherwise rigidly secured to the upper end portion of the shaft 26 and V-belts 28, from any suitable source of power, are connected with the sheave 27.

The sheave 27 is positioned far enough above the upper end of the grinding shell 10 to allow ample room for the feeding of material into said shell. The channel shaped bearing supports 21 extend inwardly at four equidistantly spaced positions around the grinding shell 10 and ample room for feed of material is provided between these bearing supports 21. The upper end of the grinding shell 10 is concavely beveled from the outside toward the inside providing an inclined upper end surface 29 which facilitates the intake of ore or like material to be ground. Also the upper end of the grinding cone 12 has rounded corner portions 30 which further facilitate intake of material. The brackets 20 elevate the bearing supports 21 a substantial distance above the upper ends of the grinding shell 10 and grinding cone 12 allowing ample clearance for material which is being fed. Preferably seal members 31 are provided at the upper ends of the upright channel bars 15 closing the space between these bars and the grinding shell 12 so that no material which is being fed to the grinder can drop into and through these channel bars.

The extension member 12' on the lower end of the grinding cone 12 has an upwardly extending concentrically positioned recess 32 which terminates in a bearing receiving counterbore 33. The bearing and cone supporting structure at the lower end of the grinding cone 12 comprises a cup member 34 secured to and rigidly supported by the base frame cross bar 19. The cup 34 receives and adjustably supports an upwardly extending bearing post 35. A spherical type self adjusting combined radial and thrust bearing 36 is provided in the counterbore 33 and journals the lower end portion of the grinding cone on the upper end portion of the bearing post 35. A nut 37 on the upper end of the post 35 securely binds the inner race of the bearing 36 to post 35. A fitting 38

secured to the grinding cone 12 by screws 39 traps and holds the outer race of bearing 36 and further holds oil seal means 40 which fits around the upper end portion of cup member 34. Lubricant for bearing 36 is introduced through an opening 41 in the bottom of the cup 34 and passes upwardly through a passageway 42 in the post 35 to the space above the bearing 36, from which it feeds downwardly into said bearing. The post 35 has a downwardly extending threaded stem 43 which is threaded through a bushing 44 in the bottom of the cup member 34. Holes 45 in stem 43 facilitate turning said stem and a lock nut 52 on the stem 43 can be used to lock the same. The shaft 26 moves longitudinally through bearings 25 and oil seal member 38, 40 moves in the same way on cup 34 when the cone 12 is longitudinally adjusted.

The grinding cone is of smaller diameter at the upper end and is of downwardly expanding shape and the upper portion of said cone which is within the cylindrical part 10 of the grinding shell has a taper which can be in the order of six to eight degrees. The lower portion of the grinding cone, that is the extension 12', is disposed within the bell shaped lower part 11 of the grinding shell and has more taper than the upper part of said cone. The incline of the external wall of cone extension 12' is preferably about fifteen degrees and is slightly greater than the incline of the adjacent inner wall of lower housing part 11. The annular downwardly convergent upper grinding chamber 48 is thus a wider primary grinding chamber with corrugated walls for coarser grinding and the lower grinding chamber 49 is a narrower secondary grinding chamber with smooth walls for finer grinding.

The corrugations 13 in shell 10 can be straight and not spiraled and can extend longitudinally of shell part 10. The upper part of the cone 12 is preferably provided externally with pitched or spiraled corrugations comprising alternate vanes 50 and troughs 51. However, the grinder will operate satisfactorily if the corrugations 50, 51 are not spiraled but extend longitudinally of cone 12. The material will feed faster if these corrugations 50, 51 are spiraled and the cone is driven in a direction to cause them to function like screw threads in feeding material downwardly. The corrugations on both the shell and the cone are shown with relatively sharp apex or rib portions but these apex portions can be rounded any amount desired.

In the use of this grinder ore small enough to enter chamber 48 is fed from above and water may be introduced with it for wet grinding. The cone 12 is driven at fairly high speed in a correct direction to feed the ore downwardly. As the ore is crushed and ground it is urged outwardly by centrifugal force and the finer particles getting into the vertical troughs of the corrugated shell part 10 will drop rapidly toward the finer grinding chamber 49. This speeds discharge of the finer particles and increases the capacity of the machine. Coarse grinding takes place in primary grinding chamber 48 and finer grinding in secondary grinding chamber 49. The fineness of grind can be increased by adjusting the cone 12 upwardly and thus narrowing secondary grinding chamber 49. Coarser grinding is attained by adjusting said grinding cone downwardly. The grinding cone can be adjusted either up or down by loosening the nut 52 and turning the shank 43. Also it is possible to adjust the cone 12—12' vertically within the grinding shell 10—11 by inserting or removing shims from between the brackets 16 and base 18.

Figs. 4 and 5 show, by fragmentary longitudinal sectional view, a grinding cylinder 54 and grinding cone 55 which are of modified construction to render them suitable for grinding garbage containing tin cans, metal objects, bone, glass and the like. The cylinder 54 is internally provided with longitudinally extending grooves 56 of dove tail shape within which hardened vanes 57 of triangular cross sectional shape are removably disposed. A bottom plate 58 attached to cylinder 54 serves as a stop member limiting downward movement of vanes 57. The cone 55 is provided with longitudinally extending peripheral grooves 59 of dove tail shape for the reception of hardened vanes or ribs 60 of triangular shape in cross section. A plate 61 is attached to the bottom end of cone 55 and serves as a stop and holding means for vanes 60. Also said plate 61 has radially protruding blades 62 which extend across the material discharge space at the lower ends of the grinding shell 54 and cone 55 and help to prevent ground products from obstructing this space and tending to clog in this part of the machine. The vanes 57 and 60 are removable and can be replaced if they become badly worn and they are highly efficient in grinding the materials above referred to. The cone 55 can be used in the grinding cylinder 10 of Figs. 1 to 3 if the lower cylinder member 11 is removed and only the upper part 10 used.

Fig. 6 shows a cylindrical grinding shell 63 and grinding cone 64 which are of modified construction to adapt them for reducing rock to proper size or mesh for use as an aggregate with cement in concrete work. The grinding shell 63 is similar to the previously described grinding shell 10 except that it has an outlet opening 65 in the wall thereof about midway between the two ends of said shell. In this construction the lower shell part 11 is preferably omitted. Corrugations 66 similar to the previously described corrugations in shell 10 are preferably provided in shell 63. The cone 64 shown in Fig. 6 is similar to previously described cone 12 with part 12' omitted and straight corrugations 67 replacing the spiral corrugations 50—51 of cone part 12.

The devices shown in Figs. 4, 5 and 6 operate similarly to the device shown in Figs. 1, 2 and 3, the operation of which has been described.

The foregoing description and accompanying drawings clearly disclose preferred embodiments of this invention but it will be understood that changes may be made within the scope of the following claims.

I claim:

1. In a grinder, a base frame; an upright tubular grinding shell rigidly supported from said base frame; an upright tubular post guiding member supported from said base frame; a bearing post longitudinally adjustably supported in said upright tubular post guiding member; a downwardly extending stem rigid with said post and threaded through the bottom of said tubular post guiding member, said stem being capable of being turned in vertically adjusting said post; a lock nut on said stem; a driven grinding cone disposed within said grinding shell; lower radial and thrust bearing means rotatively mounting the lower end portion of said grinding cone on said longitudinally adjustable bearing supporting post; an upper radial bearing fixedly supported above said grinding cone; an axial shaft protruding from the upper end of said grinding cone and journaled in said upper radial bearing and adjustably movable longitudinally in said upper radial bearing; and cone driving means connected with said axial shaft.

2. In a grinder, a frame; an upright tubular grinding shell supported by said frame, said shell being continuous from end to end and having a discharge opening for partially ground material extending through the wall thereof intermediate its two ends; longitudinally extending grinding corrugations on the inner wall of said shell; a driven tapered grinding cone rotatively mounted within said shell extending past said discharge opening and providing a downwardly convergent grinding chamber between the outer wall of said cone and the inner wall of said shell, said grinding chamber extending above and below said outlet opening; and longitudinally extending grinding corrugations on the outer wall of said grinding cone.

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