April 15, 1930. F. L. BUCHANAN 1,754,414

PENDULUM ROLL MILL

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Fig. 1.

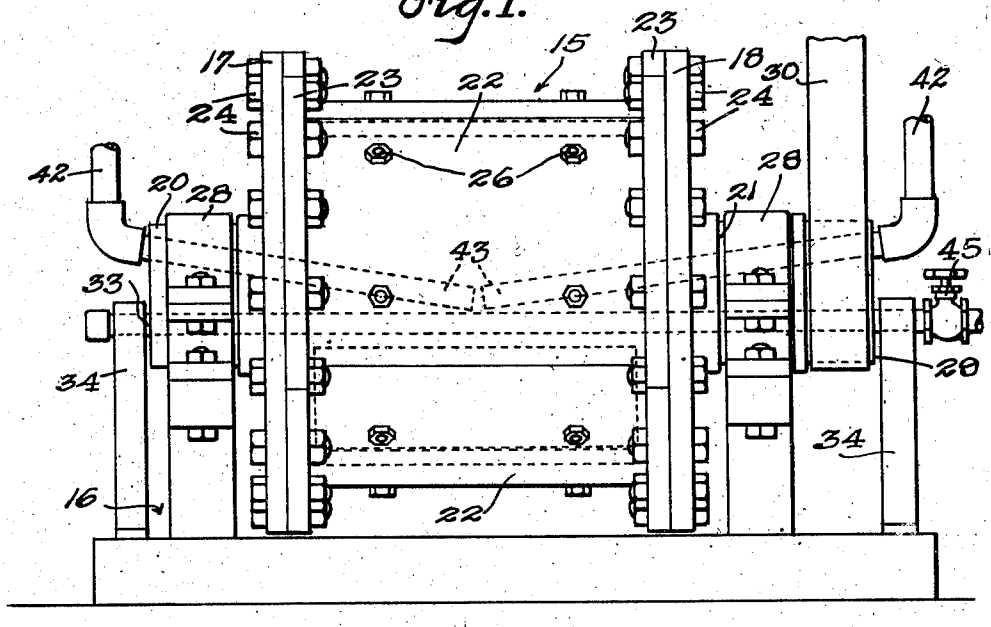
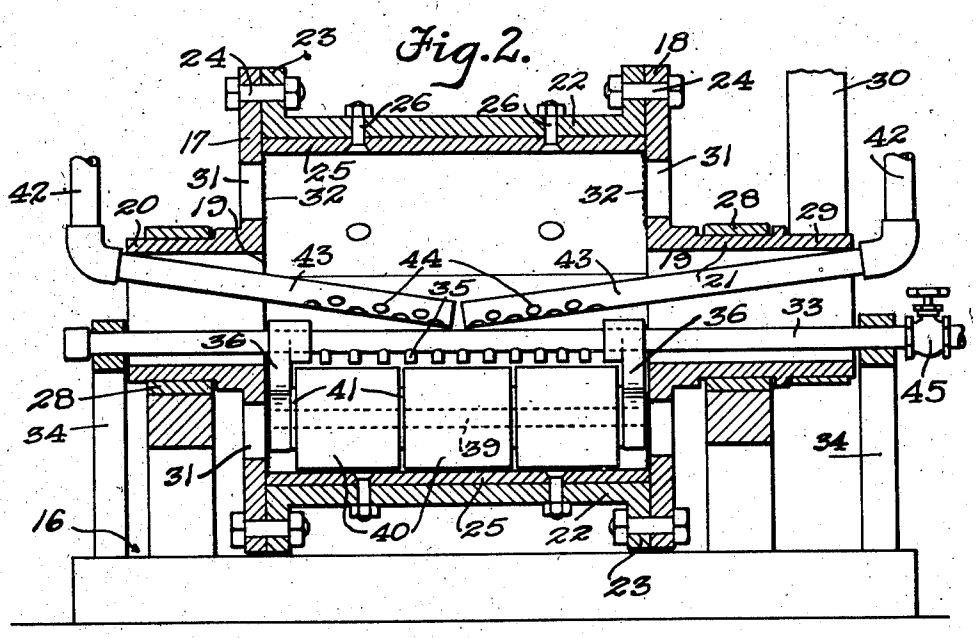


Fig. 2.



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Fig.3.

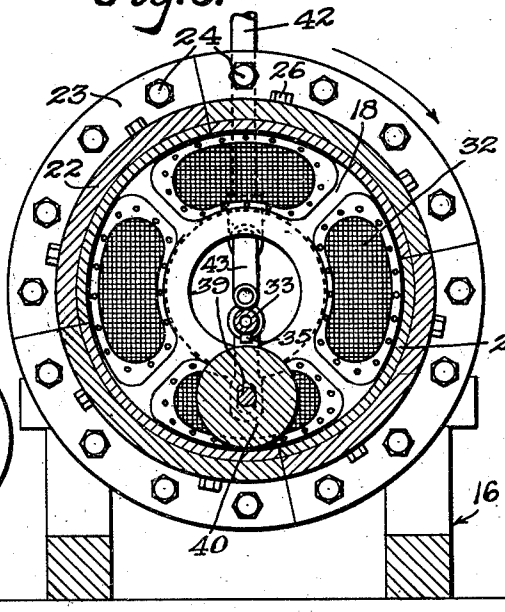


Fig.5.

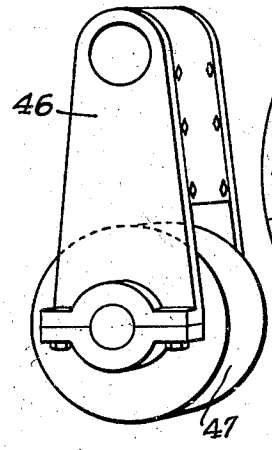


Fig.4.

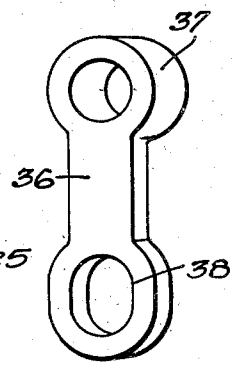


Fig.8.

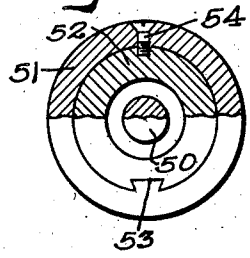
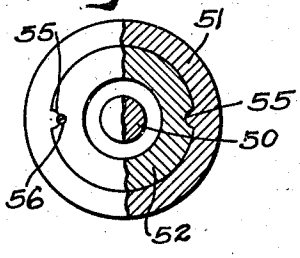


Fig.9.



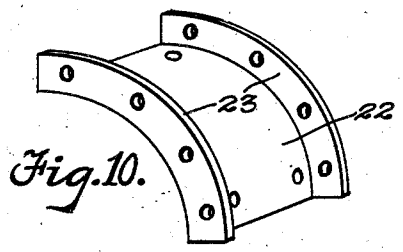


Fig.10.

Fig.11.

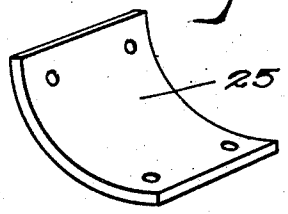
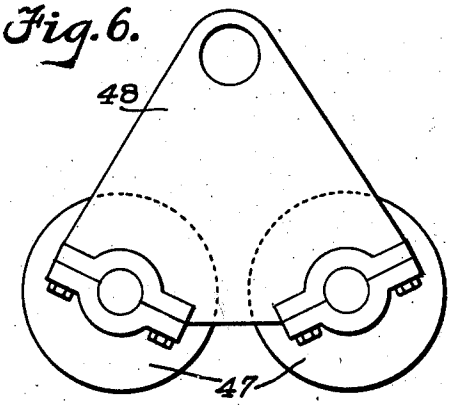


Fig.6.



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Fig. 12.

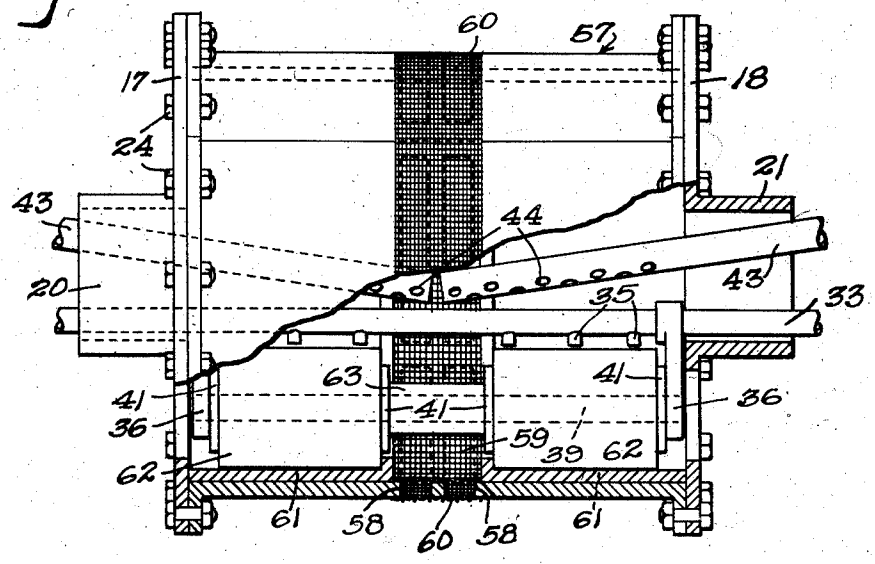


Fig. 13.

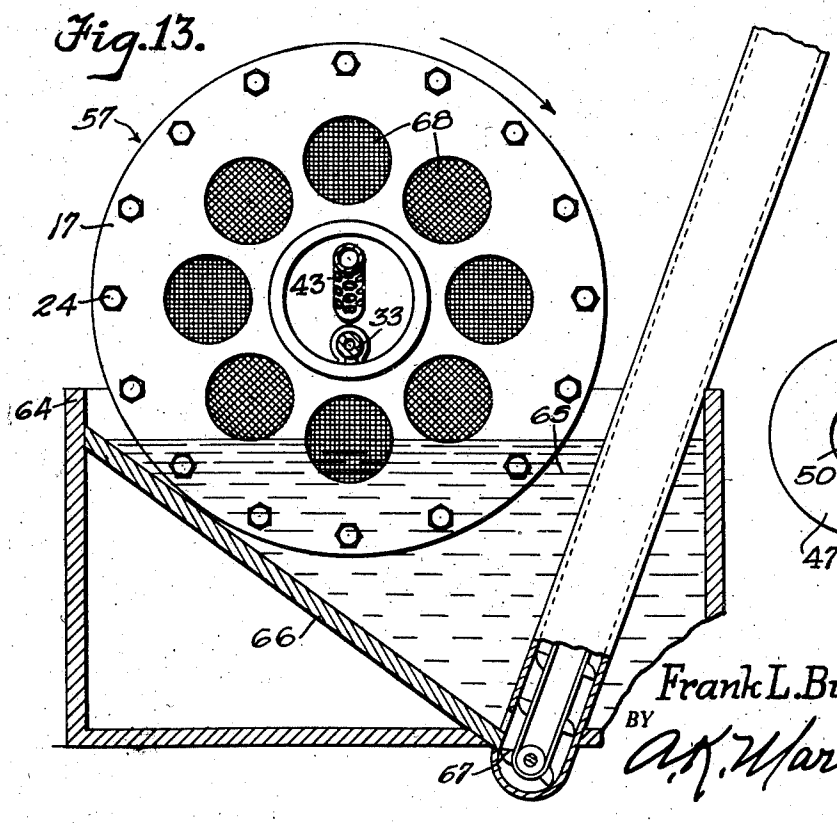
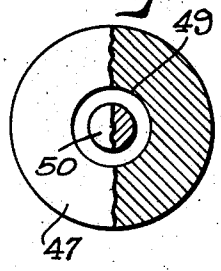


Fig. 7.



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UNITED STATES PATENT OFFICE

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PENDULUM ROLL MILL

Application filed September 24, 1928. Serial No. 307,828.

My invention relates to mills for grinding ores, cement, grains, spices and the like, and more particularly to a pendulum roll mill adapted for grinding these various materials.

The primary object of my invention is to provide an all-purpose mill which will grind to any degree of fineness and may be operated by a relatively small amount of power.

A further object is to provide a highly efficient roll mill in which dry grinding or wet grinding may be done with equal facility and success.

A further object is to provide a roll mill, of the character described, which is simple in construction, which is made in sections so that it readily may be transported to mountainous regions and which has relatively few wearing parts adapted to be renewed when they become worn or to be replaced by similar parts designed for different kinds of work.

Other objects and advantages will appear hereinafter and while I show herewith and will describe a preferred form of construction, I desire it to be understood that I do not limit my invention to such preferred form but that various changes and adaptations may be made therein without departing from the spirit of my invention as hereinafter claimed.

Referring to the drawings which accompany this specification and form a part thereof,

Fig. 1, is a side view of my pendulum roll mill.

Fig. 2, is a vertical sectional view of the mill shown in Fig. 1, the section being taken longitudinally in a plane approximately through the axis thereof.

Fig. 3, is a transverse sectional view of the mill shown in Fig. 1, taken through the middle part thereof.

Fig. 4, is an enlarged view in perspective of one form of hanger used in my pendulum mill.

Fig. 5, is a similar view of another form of hanger for use in my mill with a unit type of roller as shown therewith.

Fig. 6, is an end view of a hanger similar to that shown in Fig. 5, but modified to hold two parallel rollers.

Figs. 7, 8 and 9 are end views, partly in elevation and partly in section, of slightly different types of rollers adapted for use with the hangers shown in Figs. 5 and 6.

Fig. 10, is a view in perspective of one of the outer sections of the drum portion of my mill.

Fig. 11, is a similar view of one of the inner or liner sections of the drum.

Fig. 12, is a side view, partly in elevation and partly in section, of a slightly modified drum and the rollers used therewith.

Fig. 13, is an end view of the drum shown in Fig. 12, mounted in a water tank, the tank being shown in section.

Considered more in detail the drawings will be seen to show my pendulum roll mill as comprising a horizontally disposed drum 15 held in a suitable supporting frame 16 so that it may be revolved about its axis, the grinding being done by devices within the drum as presently will appear. The drum is made up of two end plates or discs 17 and 18, having relatively large central openings 19, which are equipped with outwardly extending annular flanges 20 and 21, respectively, and two or more arcuate plates 22 fitting together between discs 17 and 18 so as to form the peripheral walls of the drum, said arcuate plates being equipped with end flanges 23 whereby they are secured to said end discs by bolts 24 extending therethrough, as shown in Fig. 2. Liner plates 25, conforming to the inner face of outer plates 22, are removably attached thereto by bolts 26 whose heads 27 are countersunk in plates 25 flush with the grinding face thereof. Annular flanges 20 and 21 are made long enough to form tubular trunnions which turn in suitable bearings 28 attached to the supporting frame, and flange 21 is extended beyond the bearing, as at 29, to serve as a pulley around which the driving belt 30 is run. Apertures 31 equipped with screens 32 of suitable mesh for the work in hand are provided in end discs 17 and 18.

A thick-walled water pipe 33 is placed so as to extend through the drum parallel to and

somewhat below its axis, said pipe being rigidly supported by two-legged standards 34 secured to the framework adjacent trunnion 20 at one end and adjacent pulley 29 at the other. A series of nipples or nozzles 35 are fixed in the under side of pipe 33, within the drum, and two hangers 36, as shown in Fig. 4, are mounted on said pipe 33 adjacent the ends of the drum, said hangers having a bearing 37, on their upper ends, adapted to fit pipe 33 rather loosely and an elongated aperture 38 in their lower ends adapted to receive the ends of a shaft 39 whose length is somewhat less than the internal length of the drum. One or more rollers 40, adapted to turn on shaft 39, are mounted thereon with washers 41 at their ends, and between them when there are more than one, as shown in Fig. 2.

Relatively large vertical feed pipes 42 are placed adjacent each end of drum 15, said feed pipes terminating in perforated extensions 43 which are brought obliquely through tubular trunnions 20 and 21 into the drum, with their inner ends meeting at the center of the latter. The perforations 44 in extensions 43 are made large enough to permit the passage through them of such granular material as is to be ground.

When my mill is used for the wet grinding of ores, such as certain metallic sulphides and oxides, the ore, in suitably granulated form, is fed through feed pipes 42 at a uniform rate while drum 15 is revolved by belt 30 and water, regulated by a valve 45 in the pipe line, is permitted to flow through nipples 35 over the rollers 40. As is evident, the grinding takes place between liner plates 25 which are made of chilled steel or manganese steel and rollers 40 which are surfaced with similar material, the rollers being made of suitable weight to provide the necessary grinding effect. As the grinding proceeds such part of the material as has been reduced to the proper degree of fineness is carried out with the water which flows through screens 32. When used for dry grinding my mill is operated in the same way except that the water is completely shut off.

The modified form of hanger 46, shown in Fig. 5, is best adapted for use with a single relatively long roller 47 and the modified form 48 shown in Fig. 6 is designed for two such long rollers working in parallel relation to each other. It is evident that similar hangers modified further to hold three or four such parallel rollers, instead of two, readily may be provided.

A certain amount of vertical play of rollers 40 is provided by the elongated aperture 38 in the lower end of hanger 36 which allows the ends of shaft 39, on which said rollers are mounted, such vertical play. With rollers 47 a similar vertical play is provided by making the axial bore 49 therein of somewhat larger diameter than that of the shaft 50 on which it runs, as shown in Fig. 7.

The rollers shown in Figs. 8 and 9 are similar to roller 47 except that each is made of an outer shell 51 fitting over an inner shell 52. The outer and inner shells are held in fixed relation to each other by a longitudinal tongue and groove joint 53 and a radial screw 54, as shown in Fig. 8, or by a pair of diametrically opposite tongue and groove joints 55, with locking 56 in the ends thereof, as shown in Fig. 9.

The modified drum 57 shown in Figs. 12 and 13 is similar to that shown in Figs. 1, 2 and 3, except that apertures 58 are made in the middle of the drum sections 22 and these are covered by a coarser screen 59 on the inner side and a finer screen 60 on the outer side of the drum. Furthermore, the liner plates 61 are modified to provide clearance for apertures 58 and two rollers 62 are used with a spacing sleeve 63 on the shaft 39 between them.

As shown in Fig. 13, the drum may be mounted on a tank 64, for wet grinding, so that its lower side will run in water 65 contained therein, the tank being provided with an inclined bottom 66 and an elevator 67, the former to direct the flow of ground material, which is carried out of the drum through the side apertures 58 and through screened end apertures 68, also provided therein, downwardly, into the latter.

My pendulum mill requires relatively little power to drive it and will do the work of any of the various mills now in use with exceptional speed and efficiency.

Having thus illustrated and described my invention, I claim:

1. A roll mill comprising a revolvable drum having tubular trunnions on the ends thereof a fixed bar extending longitudinally through said drum and projecting from said trunnions; rollers suspended from said fixed bar so as to make contact with the interior of said drum as it revolves; feed pipes extending through said trunnions into said drum, and means attached to one of said trunnions for revolving said drum.

2. A roll mill comprising a horizontally disposed drum; tubular trunnions on the ends of said drum, coaxial therewith; a water pipe extending through said drum and trunnions, parallel to the axis thereof, said water pipe being supported just outside of said trunnions; hangers mounted on said water pipe; rollers held in contact with the concave interior surface of said drum by said hangers; feed pipes extending through said trunnions into said drum; means attached to one of said trunnions for revolving said drum and valve means connected to said pipe for controlling the flow of water therethrough.

3. A roll mill for grinding ores, grains and the like comprising a horizontally disposed

drum made in sectional parts which readily may be disassembled; detachable liner plates attached to the concave interior face of said drum to provide a grinding surface therein; tubular trunnions formed on the ends of said drum so as to form co-axial openings therein; screens fixed in the ends of said drum to serve as strainers; a fixed water pipe extending through said drum and said trunnions, parallel to the axis thereof, said water pipe being connected to a pipe line through a valve adapted to control the flow of water therethrough; a series of nozzles fixed in the under side of said water pipe within said drum; hangers mounted on said water pipe within said drum; rollers supported by said hangers so as to make contact with the grinding surface of said drum below said water pipe; feed pipes fixed adjacent the ends of said drum so as to extend inwardly through said trunnions toward the middle thereof, and means attached to one of said trunnions for revolving said drum.

4. In a roll mill for general grinding a horizontally disposed drum having end discs and sectional peripheral walls which readily may be disassembled, said end discs having central openings provided with tubular trunnions and a series of apertures equipped with screens which serve as strainers; detachable liner plates attached to the concave face of said peripheral wall sections to provide a grinding surface within said drum; a fixed water pipe extending through said drum and trunnions parallel to the axis thereof, said water pipe being provided with a series of nozzles in the under side thereof, within said drum, and with a valve adapted to control the flow of water therethrough; rollers suspended from said pipe so as to make contact thereunder with the grinding surface of said drum; means for feeding the material to be ground into the drum and means attached to one of said trunnions for revolving said drum about its axis.

FRANK L. BUCHANAN.