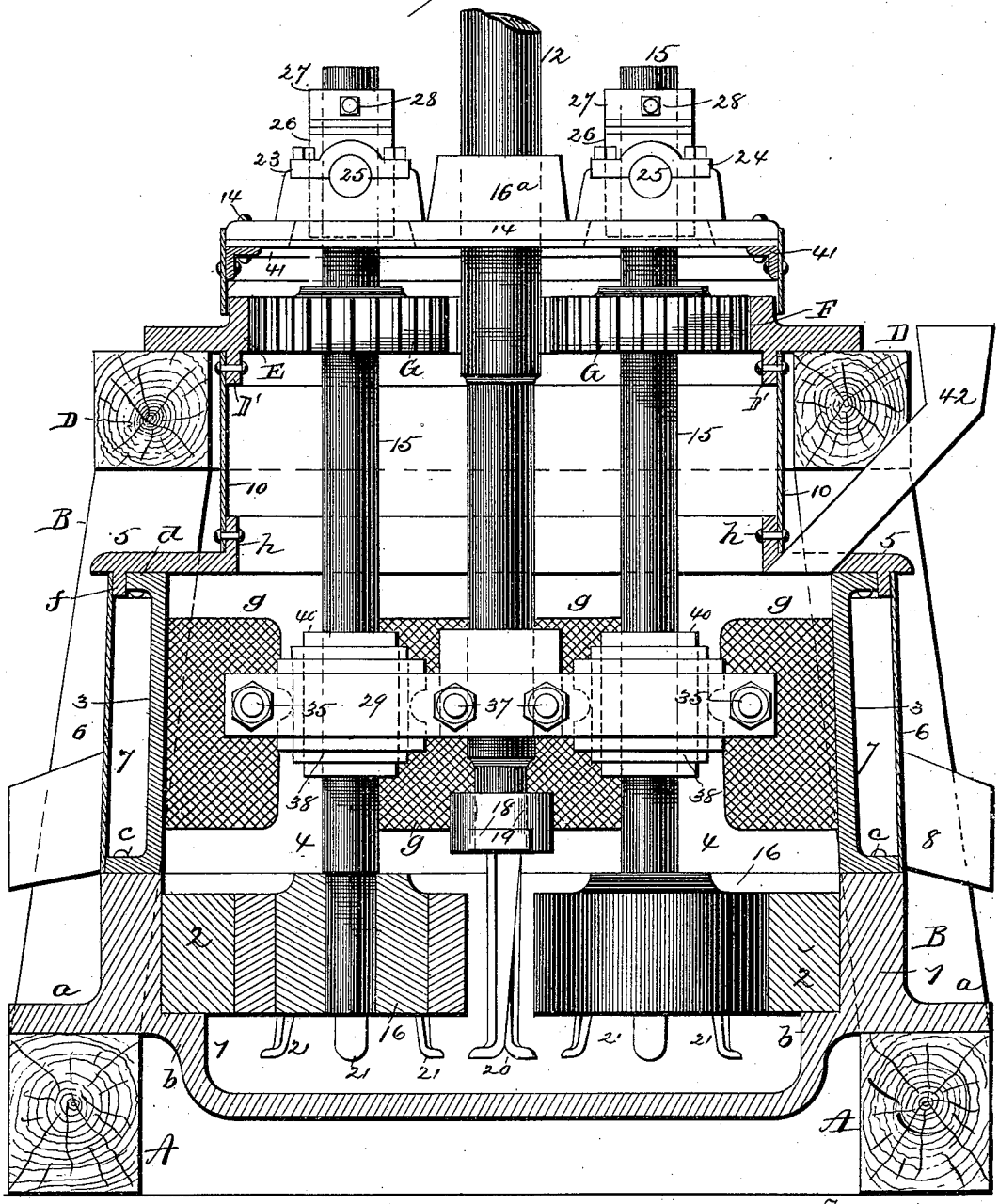
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S. HUGHES.

GRINDING MILL.

No. 438,729. Patented Oct. 21, 1890.

Fig. 1.



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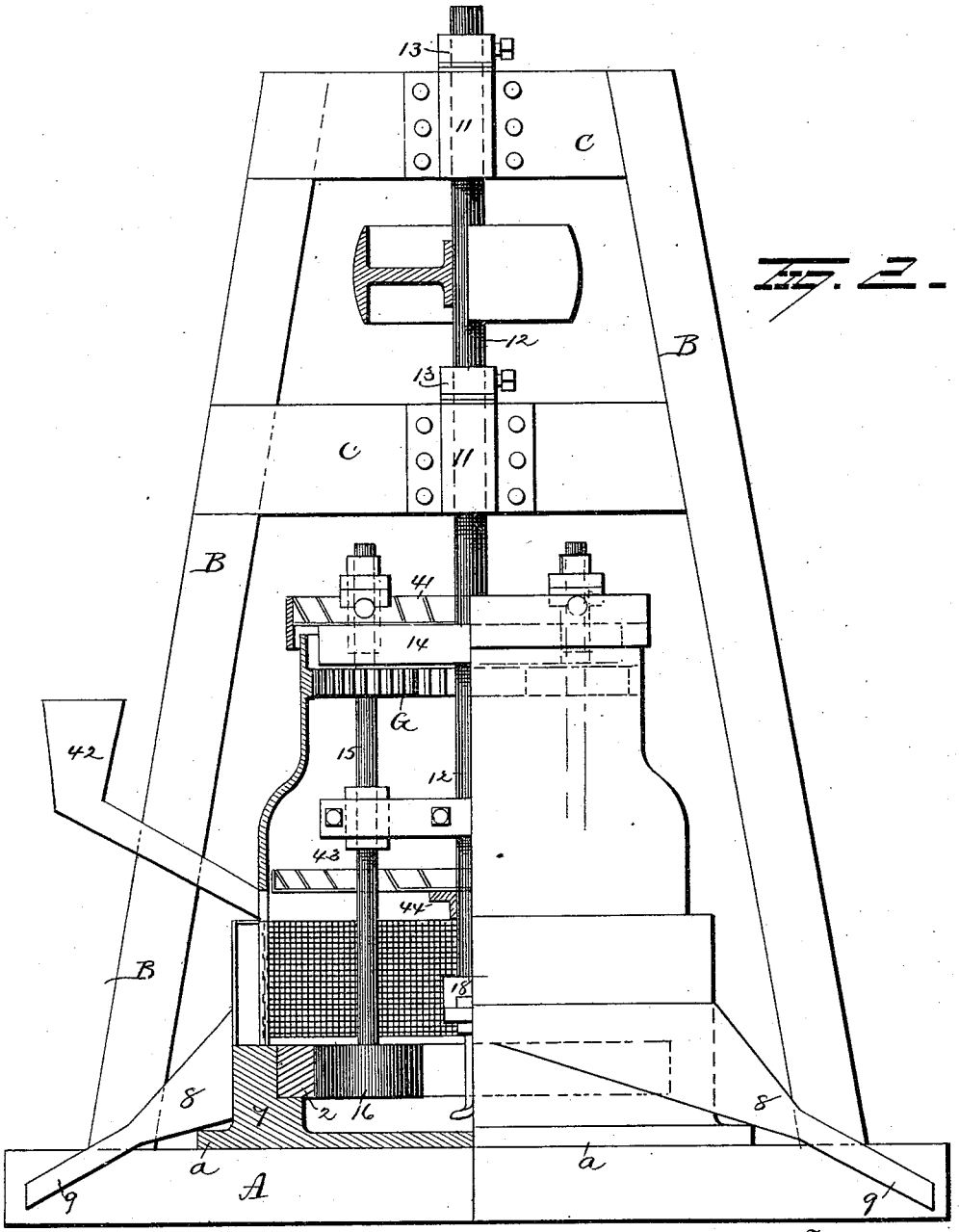


Fig. 2.

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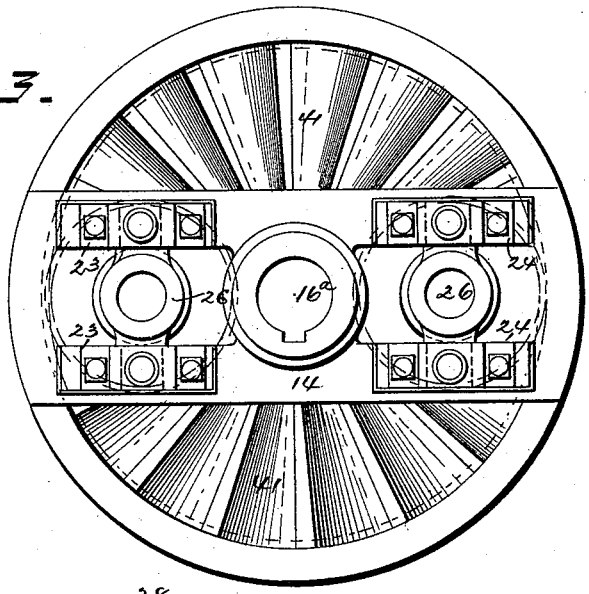
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Fig. 3.



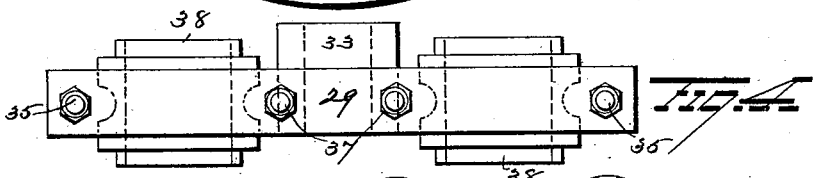
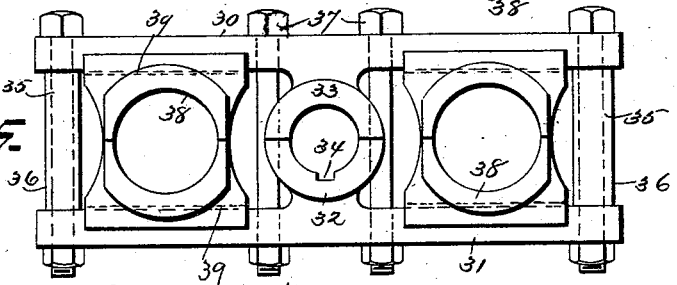


Fig. 4.

Fig. 5.



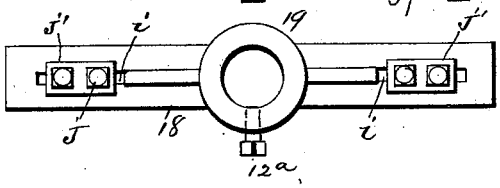


Fig. 6.

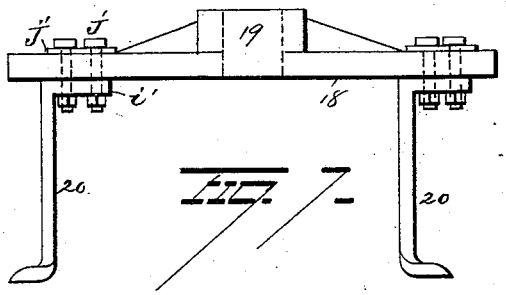


Fig. 7.

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UNITED STATES PATENT OFFICE.

SAMUEL HUGHES, OF CHARLESTON, SOUTH CAROLINA.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 438,729, dated October 21, 1890.

Application filed July 22, 1890. Serial No. 359,530. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL HUGHES, of Charleston, in the county of Charleston and State of South Carolina, have invented certain new and useful Improvements in Grinding-Mills; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in grinding-mills, and is designed more particularly for pulverizing rock, ore, &c., the object being to produce a mill of the class mentioned, the rolls of which shall act by centrifugal force against a circular die and have a positive rotary motion imparted to them.

With this object in view the invention consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a sectional view of my improved mill. Fig. 2 is a view partly in section showing the framework for supporting the mill, the mill being shown constructed and particularly adapted for grinding gritty substances. Fig. 3 is a plan view of the mill with the supporting-frame removed. Fig. 4 is a view in side elevation of the bottom driver. Fig. 5 is a plan view of the same. Fig. 6 is a plan view of the cross-bar carrying the stirrers. Fig. 7 is a side view of the same.

The main frame of the apparatus is composed of base or supporting timbers A, uprights B, connecting-timbers C, and timbers D. Located in the main frame and having a flange *a*, adapted to rest on the base-timbers A, is a receptacle 1, provided interiorly with a shoulder *b*, upon which an annular die 2 is located. Secured upon the receptacle 1 is an annular ring 3, adapted to produce a chamber 4, said annular ring being provided at its top and bottom with flanges *c d*, the flange *c* being secured to the walls of the receptacle 1, and the upper flange *d* having a circular plate 5 bolted thereto, as shown in Fig. 1. The plate 5 is provided in proximity to its periphery with a downwardly-projecting flange *f*, adapted to extend preferably somewhat below the flange *d* of ring 3. Fixed at its upper edge to the flange *f* of the plate 5 and at its lower edge to the flange *c* of ring 3 is a band 6, of sheet metal or other suitable material, thus forming a space or chamber 7, surrounding the band 3, which latter is provided throughout its circumference with a series of openings covered with suitable screening material, whereby a series of screens *g* is produced, through which powdered material may pass into the chamber 7, as presently explained. Two hoppers 8, having inclined bottoms, communicate with the chamber 7 for the reception of powdered material, said material being conveyed from the mill by means of a chute or chutes 9 communicating with said hoppers.

In the drawings I have shown two hoppers and spouts; but it is evident that a greater number may be employed, if desired. The plate 5 is provided interiorly with an upwardly-projecting annular flange *h*, to which a band 10 is secured, and produces the upper portion of the casing of the mill.

While the construction of the casing as above described is convenient, it is evident that said casing may be varied to any desired extent without affecting the scope of my invention.

Located upon the timbers D and having a depending flange D′, which is bolted to the band 10, is an annular gear-band E, provided on its interior face with a series of gear-teeth F, for a purpose that will be explained farther on.

Passing vertically through the cross-bars C of the main frame and journaled in suitable boxes 11 on said cross-bars is a vertical shaft 12, said shaft being provided at points above the cross-bars with adjustable collars 13, adapted to bear on the cross-bars or the journal-boxes secured thereto and maintain said shafts in proper position.

Secured to the shaft 12 at a point in close proximity to the top of the mill is a top driver 14, from which two shafts 15, carrying rolls 16, are suspended, as presently explained. The driver 14 is provided at its center with a perforated boss 16ª, through which the main shaft 12 passes and terminates at its lower end at a point in proximity to the pan or receptacle 1. A cross-bar 18, provided centrally with a perforated boss 19, is placed on

the lower end of the main shaft 12 and adapted to be adjustable thereon, a set-screw 12^a being passed through said boss to engage the shaft whereby to secure said cross-bar in a fixed position. Made in the cross-bar 18 in proximity to its ends are elongated slots *i*, and to the under face of said bar the flanges *i'* of stirrers 20 are located, said stirrers being bent outwardly at their lower ends and terminating in the receptacle at points below the annular die 2. The stirrers 20 are secured in position by means of suitable bolts *j*, which pass through the flanges *i'* of the stirrers and through the elongated slots *i* in the cross-bar, the heads of said bolts being seated upon suitable washers *j'*. Thus it will be seen that the stirrers 20 are adjustably secured to the cross-bar. Curved stirrers 21 are secured to the bottom faces of the roll 16, and projecting downwardly therefrom act in conjunction with the stirrers 20 to keep the material in the pan thoroughly agitated.

The top driver 14 is provided at opposite sides of the perforated boss 16^a with journal-boxes 23 23 24 24 for the reception of the journals or trunnions 25 of sleeve 26. The upper ends of the shafts 15 are passed through the upper driver 14 between the journal-boxes 23 23 24 24, respectively, and through the sleeves 26, said shafts being provided at or near their upper ends with collars 27, which are adjustably secured to said shafts by means of set-screws 28, the lower ends of said collars being adapted to rest upon the upper ends of the oscillating sleeves 26.

Keyed to the shaft 15 at points beneath the driver 14 are gear-wheels G, preferably of smaller size than the rollers 16, said gear-wheels G being adapted to mesh with the gear-band or internal gear E, and thus cause the rollers 16 to be rotated positively when the mill is operated. By this means the rolls, besides simply rolling on the die, will have a slipping action, thereby giving to the mill an additional grinding action.

At a point near the lower ends of the oscillating shafts 15 and in proximity to the grinding-rolls 16 said oscillatory shafts are connected with the main shaft by means of a bottom driver 29. The driver 29 may be conveniently made, as shown in Figs. 4 and 5, in which figures 30 31 represent two side plates, each provided with a semicircular flange 32 33, which together produce a collar adapted to encircle the main shaft 12, the flange 32 being provided with a recess 34 for the reception of a key by means of which to secure the driver to the main shaft. The side plates 30 31 are connected at their ends by means of bolts 35, said plates being maintained at suitable distances apart by means of sleeves 36, located between them and encircling the bolts 35. The plates 30 31 are connected at their center and clamped to the main shaft by means of bolts 37.

In the spaces between the bolts 35 and 37 boxes 38 are located, which boxes may be made in two parts, as shown in Fig. 5, and provided in their opposing faces with recesses 39 for the reception of plates 30 31, and said boxes are permitted to have a sliding movement between said plates. The sliding boxes 38 embrace the oscillatory shafts 15, or, more properly speaking, wearing-collars 40, fitted on said shafts. By this construction the driver 29 may be readily removed when the parts wear, and the worn plates easily and quickly replaced by new ones.

By the employment of the driver 29, located and connected to the shafts, as above described, all strain will be removed from the pivotal bearings of the oscillatory shafts 15, permitting them to vibrate freely, preventing the rolls from lagging or swinging backward when gyrated within and against the circular die 2, and will prevent the rollers from running ahead and drawing the roller-shafts out of their proper positions, which latter might be occasioned when the roller-shafts are rotated positively were this lower driver 29 not provided. It will be readily seen that without the employment of a driver located as the driver 29 is located freedom of action of the rolls cannot be obtained, for the reason that the rolls, being forcibly held against the ring-die, will be retarded to a great extent and a sidewise strain brought to bear upon the pivotal bearings overhead, thus hindering free vibration and to a certain extent chocking the rolls. A fan 41, made preferably of sheet metal, having its vanes projecting upwardly, is secured to and projects from the upper driver 14 and revolves with it. One-half of the fan 41 being on each side of the driver 14, the whole fan forms a top or cover for the mill.

The rock or other material to be ground is introduced into the mill through a suitable spout 42 above the screens, and after being pulverized by the rolls 16 in an obvious manner passes through the screens into the space or chamber 7, and finally discharged over the inclined bottom of the hoppers 8 and through the spouts 9. Any approved means may be employed for feeding material to and conveying it from the mill. During the passage of the material through the mill the fan 41 will operate to blow the dust or pulverized material through the screens into the space 7 and then to the hoppers 8 or other suitable conveyer. The fan 41 being located at the top of the mill, it will prevent the dust or pulverized material from rising to the pivotal bearings and from escaping at the top of the mill.

The mill, as shown in Fig. 2, is particularly adapted for pulverizing gritty material. In this form of the invention the bottom driver is located at a point above the screens instead of in line therewith, as shown in Fig. 1, and just below this driver a disk-fan 43 is located, being secured to a flanged collar 44, secured to the main shaft 12. When the lower fan 43 is employed, the upper fan serves to force air

down into the mill, and at the same time is useful as a cover to the mill, as previously explained, while the lower fan protects the boxes of the lower driver from the gritty material being pulverized.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a grinding-mill, the combination, with a receptacle and a die therein, of a main revoluble shaft, oscillatory roller-shafts connected with the main shaft, gear-wheels on said oscillatory shafts, an annular gear-band with internal gear-teeth against which the gear-wheels operate, and rollers carried by said roller-shafts, substantially as set forth.

2. In a grinding-mill, the combination, with a receptacle and a die therein, of a main revoluble shaft, a driver carried thereby, oscillatory roller-shafts carried by said driver, rollers carried by said oscillatory shafts, a fan carried by the driver, and mechanism for positively revolving said oscillatory shafts, substantially as set forth.

3. In a grinding-mill, the combination, with a receptacle and a die therein, of a main revoluble shaft, an upper driver carried by the main shaft, oscillatory roller-shafts carried by said driver, rolls carried by said oscillatory shafts, a driver connecting the main shaft with the oscillatory roller-shafts at points in proximity to the rollers, gear-wheels on the oscillatory shafts, and an annular gear-band against which said wheels operate, substantially as set forth.

4. In a grinding-mill, the combination, with a receptacle, a die therein, and a casing, of a main revoluble shaft, a driver carried thereby, oscillatory roller-shafts carried by said driver, rollers carried by said roller-shafts, a gear-wheel carried by each roller-shaft, and a gear-band with which said gear-wheels are adapted to mesh, whereby the roller-shafts are rotated positively, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

SAML. HUGHES.

Witnesses:
W. B. S. WHALEY,
W. F. TAYLOR.