J. HERCHE.

GRINDING MACHINE.

APPLICATION FILED JAN. 25, 1917.

1,355,093.

Patented Oct. 5, 1920.

3 SHEETS—SHEET 1.

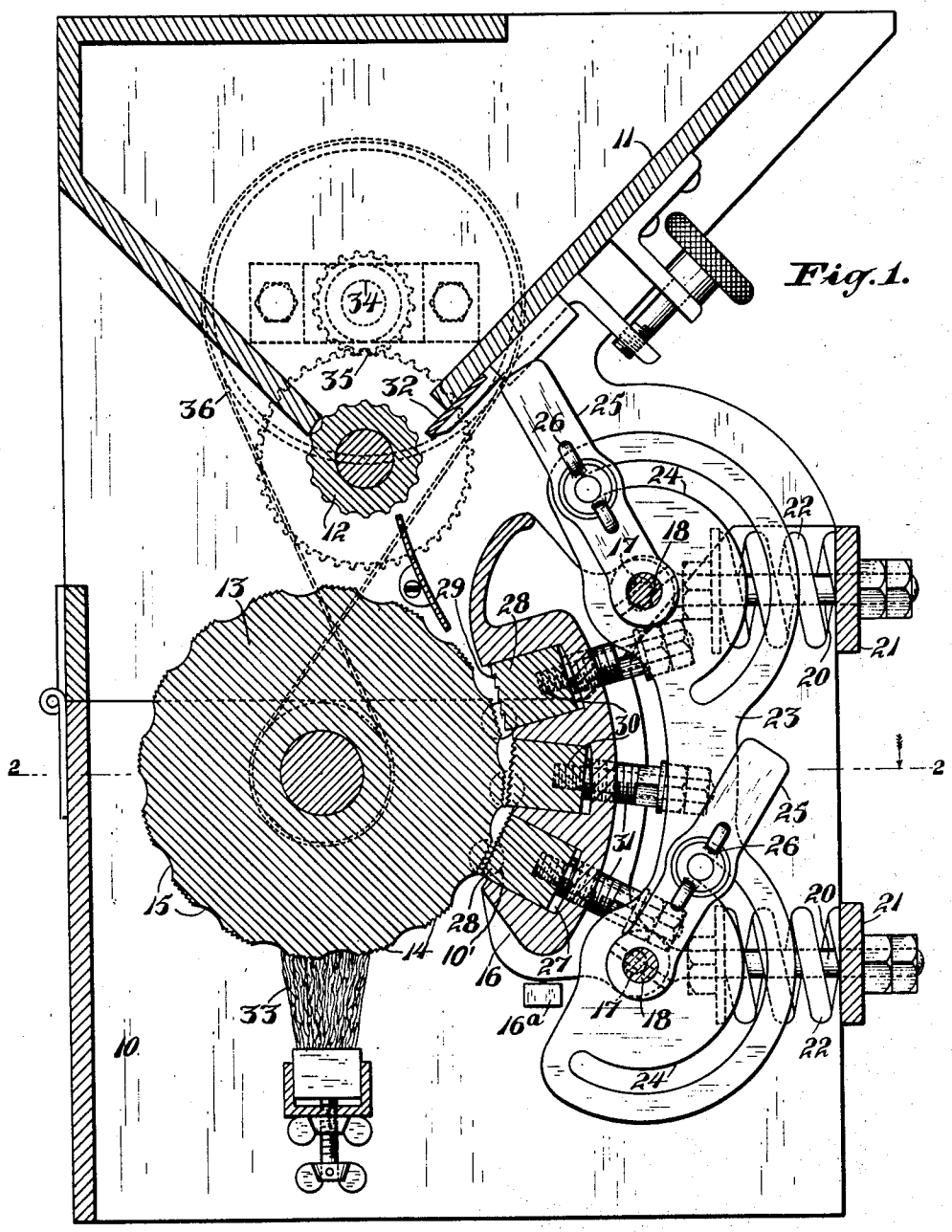


Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

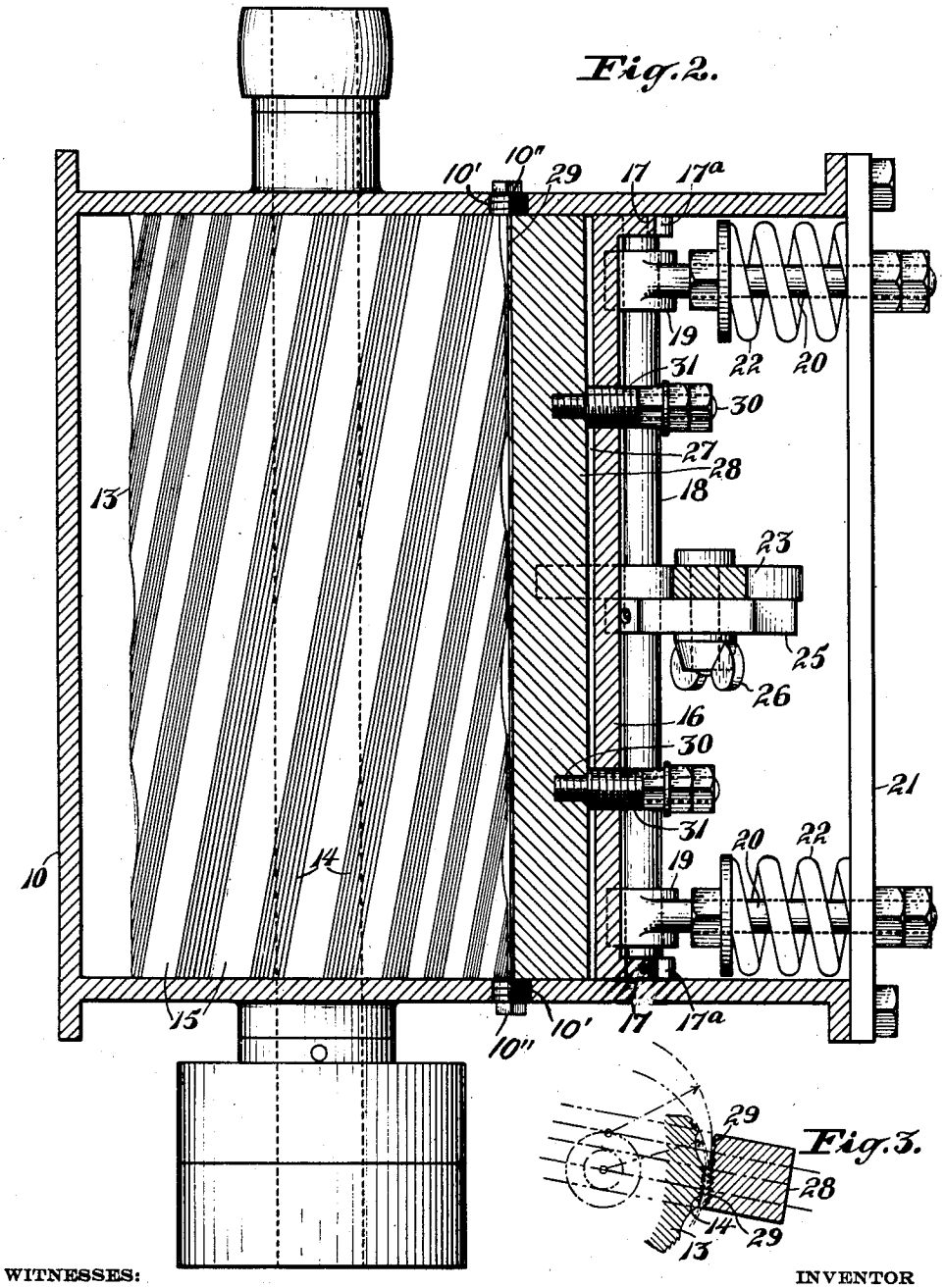


Fig. 3.

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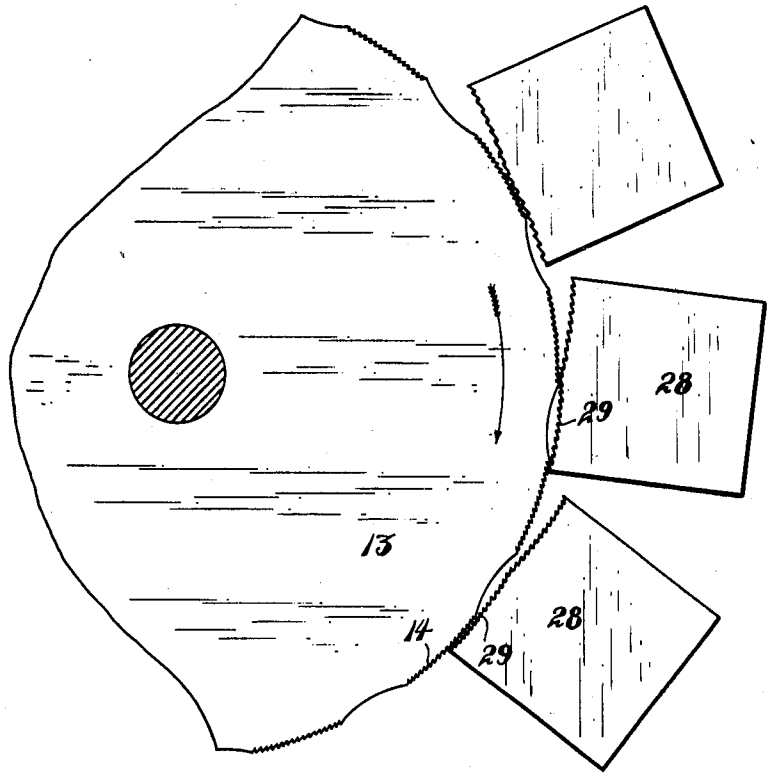
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3 SHEETS—SHEET 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

JAMES HERCHE, OF OAKLAND, CALIFORNIA.

GRINDING-MACHINE.

1,355,093. Specification of Letters Patent. Patented Oct. 5, 1920.

Application filed January 25, 1917. Serial No. 144,354.

To all whom it may concern:

Be it known that I, JAMES HERCHE, a citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented new and useful Improvements in Grinding-Machines, of which the following is a specification.

In grinding grain, spices, chemicals, paint, rock and other substances on rolls, the usual mode employed is what is known as the "gradual reduction process," in which the grinding is performed by a successive number of reductions, commencing with a coarsely corrugated pair of rolls for the first operation, as in flour milling, followed by a number of pairs of rolls with corrugations of gradually increased fineness, for each successive stage; and for very finely reduced material, such as flour, these several reductions on corrugated rolls are followed by a number of reductions on successive pairs of smooth rolls.

In the gradual reduction process, as practised in flour-mills, the number of pairs of rolls employed varies from four pairs (two pairs corrugated and two pairs smooth) in the so-called short system, to twelve pairs of rolls (one-half corrugated and one-half smooth) in the so-called long system.

The object of my invention is to eliminate the number of separate grinding machines to a minimum, while retaining the principle of gradual reduction, by performing a number of said reductions on one machine.

The principle embodied in my invention is a combination of furrow grinding, one being the runner and the other the stationary or bedstone, and the grinding by rolls either corrugated or smooth.

In this invention the machine comprises a metallic roll, the surface of which consists of alternate grinding faces and furrows, both running helically with respect to the axis of said roll. The roll for preliminary grinding has its grinding faces, as well as its furrows, corrugated, said corrugations running helically and parallel with said furrows and grinding faces; for fine grinding both the furrows and grinding faces remain smooth. The corrugations are preferably in the form of serrations and the furrows are made arcuate, so that the roll may be reversed end for end to change the direction of the teeth, whereby sharp or dull grinding may be carried on.

In conjunction with the roll there is a metallic concave section adjacent to one side of the roll. This contains on its concave side a number of separate grinding bars, each having two adjoining grinding faces. The grinding faces are so arranged on the bars that only one is in grinding relation with the periphery of said roll; the other face being so spaced as to act as a furrow. The bar is reversible so that the face forming the furrow becomes the grinding face and vice versa. The uppermost of these grinding blocks is corrugated coarsely, the next lower one somewhat finer, and so on downward, for preliminary grinding; while for fine grinding both faces remain smooth. The bars are disposed parallel to the axis of the roll and can be adjusted separately toward and from the roll, and suitable means are provided for adjusting the position of the concave section as a whole. The corrugations on both faces of each bar are in the form of serrations inclined in the same direction, and, therefore, when the bar is reversed the grinding edges of the teeth are changed from dull to sharp or vice versa.

One form which my invention may assume is exemplified in the following description and illustrated in the accompanying drawings, in which—

Figure 1 shows a vertical, central, sectional view of a device embodying my invention.

Fig. 2 shows a sectional view, taken on the line 2—2 of Fig. 1.

Fig. 3 shows a detail, sectional view of the grinding roll and coöperating bars.

Fig. 4 shows an enlarged sectional view of the grinding roll and coöperating bars.

Referring in detail to the form of my invention illustrated herewith, a main frame 10 is shown which includes a hopper 11, a feed roller 12, at the bottom of the hopper, and a grinding roll 13, the latter journaled below the feed roller within the frame. The grinding roll has helical grinding faces 14 on its periphery with intermediate arcuate furrows 15. A concave holder 16 is carried adjacent to the grinding roll, being movably supported on lugs 16ª fixed to the ends of the frame 2. Eccentric pintles 17 formed on the ends of a pair of horizontally extending shafts 18 are journaled in bearings 17ª on the holder. The shafts are supported in eyes 19, formed on the ends of bolts 20, extending through side bars 21 of the frame and pressed toward the grinding roll by

means of springs 22, so that a yielding movement toward and from the roll is allowed the shafts and concave holder.

Upon the intermediate portion of the shafts is fixed a plate 23 with slots 24, near each end, made concentric with the adjacent shaft 18 and forming a quadrant. Also upon each shaft, adjacent to the plate 23, is a lever 25 for turning the shaft and having a thumb-screw 26 extending through the adjacent slot 24 for fixing the position of the lever. Thus by turning the levers the shafts are rotated in their bearings 19 to rock the concave holder by means of the eccentric pintle 17, whereby to move said holder toward and from the roll.

Carried in longitudinally extending sockets 27, one above the other, on the concave holder is a series of grinding bars 28, each with double concave grinding faces 29 provided with serrations or corrugations. The transverse axis of each of the sockets 27 is not radial with respect to the roll 13, the arrangement being such that when the bar 28 is in place the lower grinding face thereof coincides with an arc struck from the center of the roll, while the center, of which the upper grinding face forms an arc, falls above the axis of the roll 13. Thus only one grinding face of each of the bars is in active grinding relation with the roll; the other being spaced some distance therefrom and forming a furrow. This is best shown in Fig. 3.

The bars are held in place by stud-bolts 30, screw-threaded into the bar and extending through an adjustable sleeve 31 carried by the holder, whereby the bars may be moved separately in and out within their sockets. The bars are reversible endwise to dispose the faces formerly out of active relation with the grinding faces of the roll into coöperative relation with said roll and the faces formerly in active grinding relation with the roll into inactive relation.

The serrations or teeth on the grinding bars, preferably, are extended parallel with the longitudinal axis of the bar and all are inclined in the same direction on both faces of each bar. Thus when the reversal of the bar occurs a change from dull to sharp grinding takes place or vice versa. In the usual operation of the machine the teeth on the upper bar are made coarse, while the teeth on the lower ones are made gradually finer. However for some classes of grinding, as peas, the upper bar is set farther from the roll than the lower ones.

The grinding roll is so mounted as to be reversed end for end, whereby to change the direction of the serrations or teeth. When positioned as shown in Fig. 1, the sharp edges of the teeth will do the grinding, while if reversed end for end the dull surfaces of the teeth will serve to do the grinding. The fact that the furrows 15 of the roll are made arcuate allows the roll to be reversed in this manner without interfering with the function of the furrows. The reversibility of the roll and bars permits a wide variety of grinding actions to take place in a single machine as the teeth can be made to grind sharp to sharp, sharp to dull, or dull to dull.

The helical arrangement of the grinding faces and furrows on the row affords a smooth grinding action, inasmuch as there is continuous coöperation with the grinding faces of the bars. The arrangement of the active grinding faces on the bars on an arc struck from the center of the roll provides an increased grinding surface, and the double concave or arcuate faces on these bars struck from different centers permit the upper faces of the bars to be spaced some distance from the roll, whereby to provide a furrow which allows cooling of the ground material. The helical furrows on the row have a different function from that of the furrows in ordinary stone grinding in that they serve to draw the material past the grinding bars, without which the grain would not pass between the grinding faces. The reversibility of the bars distributes the wear upon the grinding faces in addition to permitting a change in the character of grind from sharp to dull. Extra bars of varying degrees of fineness from coarse to smooth may be carried on hand and readily substituted for different conditions of grinding. In the opposite end walls of casing 10 are provided sight openings 10′ in line with the active faces of the grinding bars 28 for inspection of said grinding faces and also to facilitate adjustment or setting of the bars. Normally, these sight openings are closed by screw plugs 10′.

Other, though not essential, parts of the mechanism include an adjustable feed gate 32 for the hopper coöperating with the feed roller 12 and an adjustable brush 33 coöperating with the grinding roll to remove dust and grit therefrom and scour the grinding surface. Any suitable operating mechanism may be used for the grinding roll and feed roller, the one here shown comprising a drive shaft 34 with a gear connection 35 to the feed roller and a belt and pulley connection 36 to the grinding roll.

Various changes in the construction and arrangement of the several parts herein shown and described may be employed without departing from the spirit of my invention as disclosed in the appended claims.

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

1. A gradual reduction grinding machine comprising a single roll with alternate grinding faces; said faces being further arranged so that the upper edges of each bar

will be spaced to form downwardly extending gullets between the periphery of the roll and the bar and intermediate furrows running helically, and a series of separate grinding bars arranged at one side of the roll in a normal fixed relation to each other and one above the other, each bar having a grinding face to coöperate with the roll, the faces on said bars being corrugated or roughened and the texture of the faces being of gradually increased fineness from top to bottom, said faces being further arranged so that their upper edges will be spaced from the roll to form downwardly extending gullets between the periphery of the roll and the bars.

2. A gradual reduction grinding machine comprising a single roll with alternate grinding faces and intermediate furrows running helically, and a series of separate grinding bars arranged at one side of the roll in a normal fixed relation to each other and one above the other, each bar having a grinding face to coöperate with the roll, the distance between the bars and roll being gradually lessened from top to bottom and the grinding faces of each bar separately positioned so that the distances from the circumference of the roll will be gradually decreased from top to bottom.

3. In a gradual reduction grinding machine, the combination of a grinding roll with alternate grinding faces and intermediate furrows running helically and over the entire length of which grain is fed, the grinding faces being corrugated longitudinally, and a series of separate grinding bars relatively fixed in relation to each other to coöperate with said roll, the corrugations on said roll being in the form of serrations and the furrows made arcuate so that the roll may be reversed end for end to change the cutting edge of the serrations from sharp to dull or vice versa, said furrows forming pockets to draw the material past the grinding bars.

4. In a gradual reduction grinding machine, the combination of a grinding roll and a series of grinding bars to coöperate therewith, said bars being parallel with the roll and arranged one above the other, and each formed with two longitudinally extending and transversely concaved surfaces, one of which coacts with the roll to form a grinding surface and the other being spaced therefrom and forming a gullet, the bar being reversible endwise so that the face previously acting as the gullet becomes a grinding surface and vice versa.

5. In a gradual reduction grinding machine, the combination of a grinding roll and a series of grinding bars to coöperate therewith, said bars being parallel with the roll and arranged one above the other, and each formed with two longitudinally extending and transversely concaved surfaces, one of which coacts with the roll to form a grinding surface and the other being spaced therefrom and forming a gullet, the bar being reversible endwise so that the surface previously acting as the gullet becomes a grinding surface and vice versa, and serrations on said surfaces all directed the same way so that the reversal of the bar changes the cutting edge of the serrations from dull to sharp and vice versa.

6. The combination in a grinding machine, of a grinding roll with alternate grinding faces and intermediate furrows running helically, a concaved section adjacent to the roll, and a series of grinding bars adjustably secured to said section and superimposed one above the other, said bars being formed with a pair of relatively eccentric concaved abrading surfaces, one of which is adapted to coincide with the circumference of the roll.

7. In a mill, a grinding roller, a holder for supporting an arcuate grinding face opposite the periphery of the roller, means for adjusting the upper part of the holder toward and from the roller, and other means operable independently of the first means for adjusting the lower part of the holder toward and from the roller, each of said means including a cam shaft arranged to move the holder, means for holding the cam shaft at set adjustments, and means yieldably holding the shaft and holder against movement away from the roller.

8. In a gradual reduction grinding mill, a grinding roll having alternate faces and intermediate furrows helically arranged, a concave section adjacent to the roll, a series of grinding bars carried thereby, one above the other, and coöperating with the roll, and a plurality of means for adjusting said section toward and from the roll and in a desired relation to the circumference of the roll, said furrows forming pockets to draw the material past the grinding bars.

9. In a gradual reduction grinding mill, a roller having grinding faces extending longitudinally thereof and arranged helically, arcuate furrows between said faces, means for delivering grain to the roller and simultaneously distributing it throughout the length thereof, straight grinding bars positioned adjacent to the circumference of said roller in a normal fixed relation to each other and between which the grain passes, the upper face of said bars being formed to provide gullets whereby the grain will be alternately transferred from one grinding face of the roller to a grinding face of one of the bars and alternately thrown and fed from the furrows of said roller and bars.

10. A grinding bar for reduction mills having a pair of relatively eccentric con-

caved grinding faces whereby when the bar is set with the lower edge of its lower face coincident with the circumference of a grinding roller the upper face will form a V-shaped furrow groove leading thereto.

11. In a gradual reduction grinding mill, an abrading grinding roller and a series of grinding bars disposed parallel to each other and arranged with their grinding faces concentric with the roller, said bars having surfaces extending upwardly and outwardly from the grinding roll extending throughout their lengths and as a continuation of said grinding faces whereby downwardly tapering gullets are formed between the upper portions of the bars and the periphery of the roller.

12. In a grinding mill, a series of grinding bars, a frame, a concaved section, means for separately mounting said bars upon said section, means for individually adjusting the bars in relation to the section and to each other, means for adjusting the concaved section with its bars in relation to the circumference of a grinding roll and means whereby said concaved section may be yieldingly supported in its adjusted position.

13. In a gradual reduction grinding mill, a roller having grinding faces extending the length of its outer periphery, arcuate furrows formed between said faces, and fixed grinding bars disposed along the side of said roller and superimposed in relation to each other, each of said bars having a grinding face and a double arcuate face extending upwardly and outwardly from the roller and defining a furrow above the grinding face, said bars so disposed as to present alternate furrows and grinding faces to the periphery of the roller.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JAMES HERCHE.

Witnesses:
JOHN H. HERRING,
W. W. HEALEY.