Jan. 23, 1923. 1,443,276

S. C. ROBERTS.
GRINDING MILL.
FILED JUNE 18, 1919.

3 SHEETS-SHEET 1

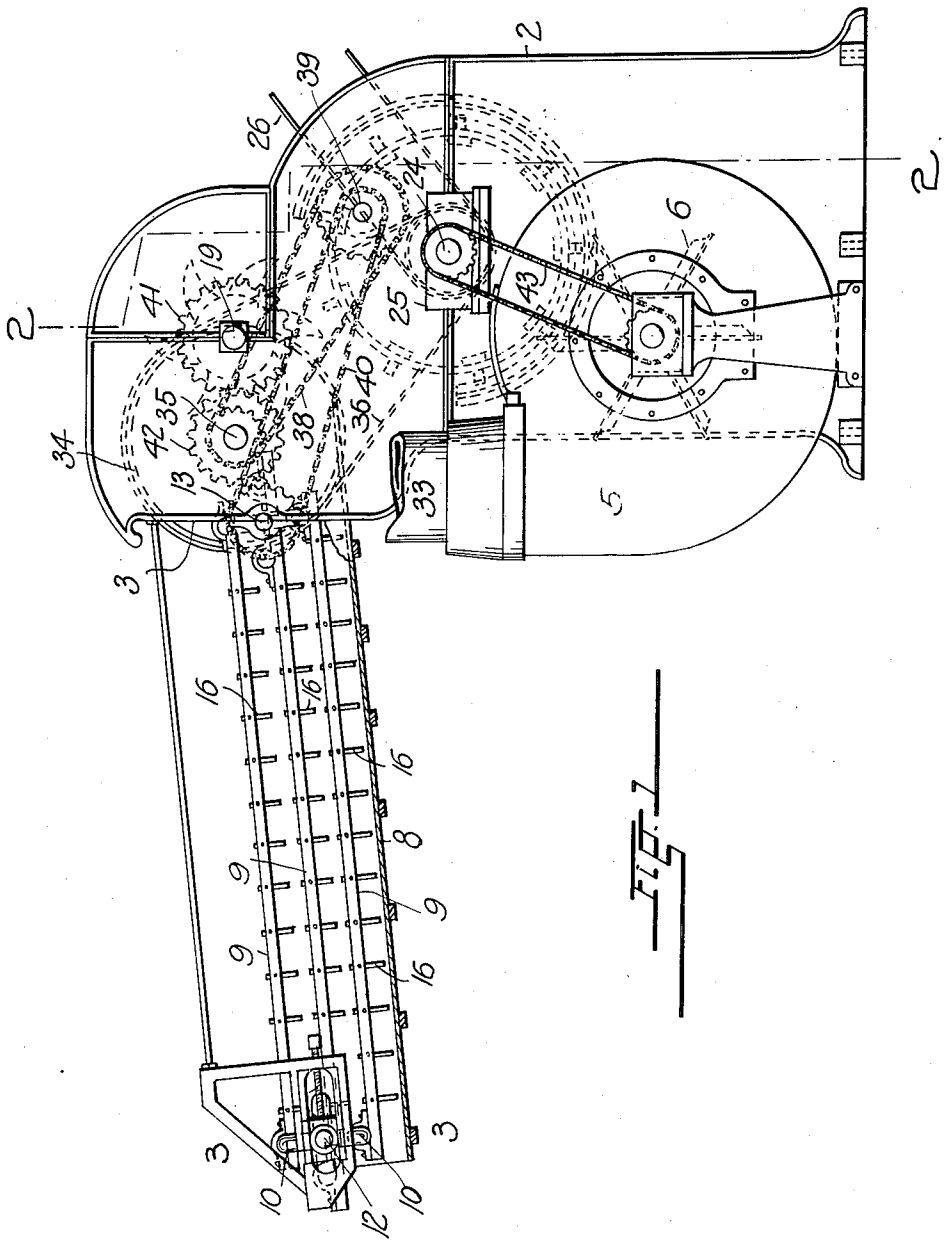


FIG. 1

INVENTOR.
S. C. ROBERTS.

BY

ATTORNEY.

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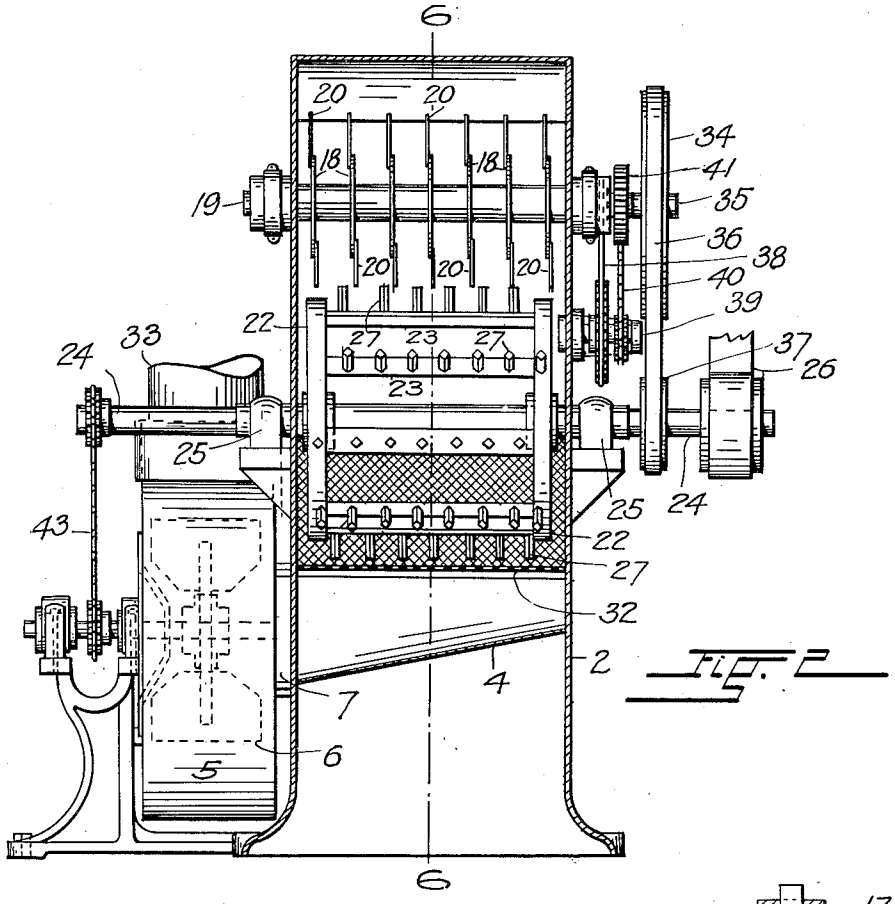


FIG. 2

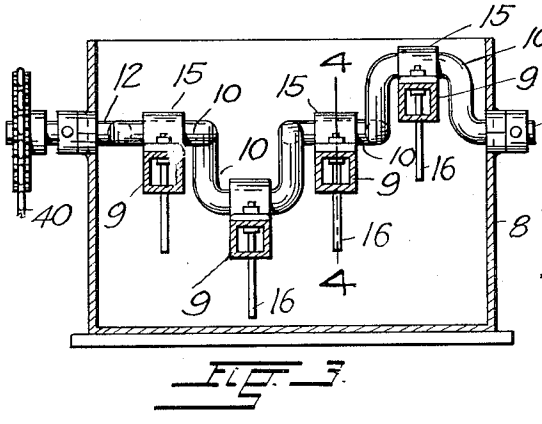


FIG. 3

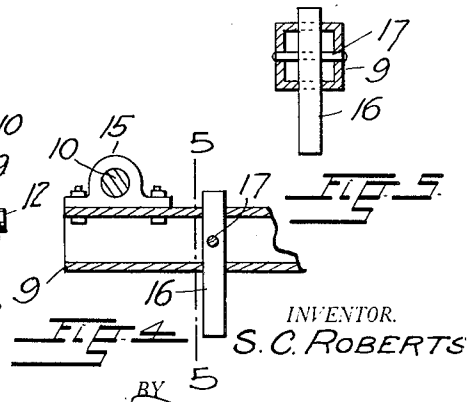


FIG. 4

FIG. 5

INVENTOR.
S. C. ROBERTS
BY
ATTORNEY.

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S. C. ROBERTS.
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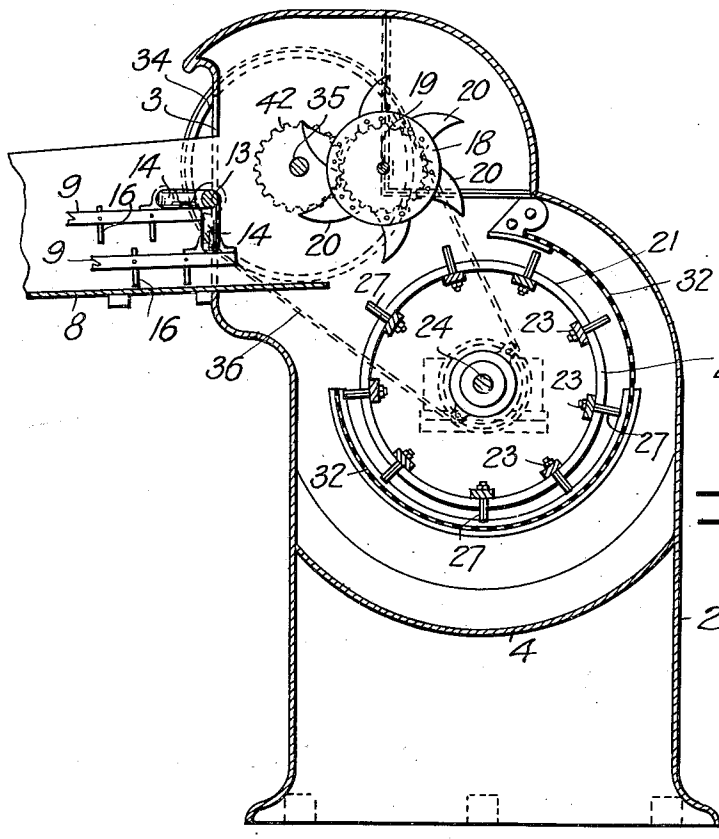


FIG. 6.

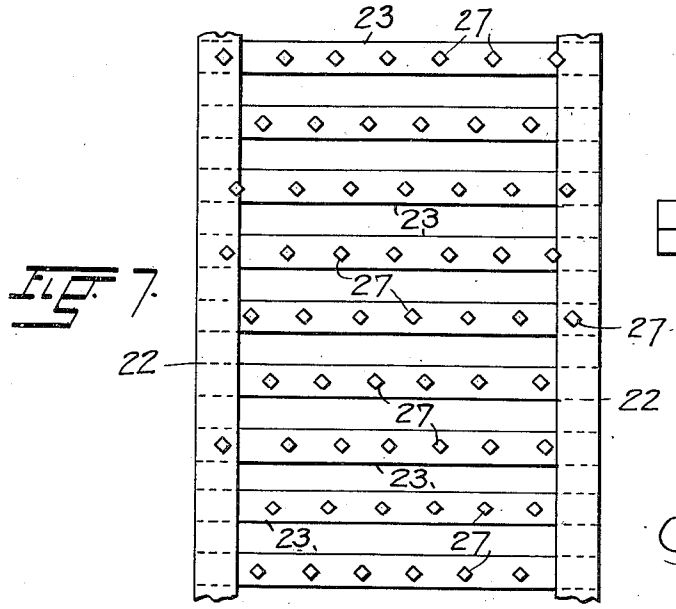


FIG. 7.

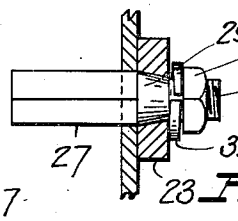


FIG. 8.

INVENTOR.
S. C. ROBERTS.

BY

ATTORNEY.

Patented Jan. 23, 1923. 1,443,276

UNITED STATES PATENT OFFICE.

SHERMAN C. ROBERTS, OF DENVER, COLORADO.

GRINDING MILL.

Application filed June 18, 1919. Serial No. 305,093.

To all whom it may concern:

Be it known that I, SHERMAN C. ROBERTS, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Grinding Mills, of which the following is a specification.

This invention relates to grinding mills of the type principally used for the reduction of grain, alfalfa and other similar products of the soil.

It is the primary object of the present invention to provide in a mill of this character, an association of conveying, cutting and grinding elements of simple, practical and highly efficient construction which are cooperatively arranged to rapidly effect the complete reduction of a material of the nature hereinbefore referred to, to a meal of uniform mesh.

A further object of my invention resides in the provision of a peripherally toothed grinding element the teeth of which are relatively disposed in novel arrangement productive of a maximum efficiency and to prevent clogging at one end of the cylinder by providing a means whereby the matter being ground by the cylinder will be held from movement in one direction, and will be operated on by teeth which are in spiral formation in one direction for a portion of the cylinder and in the opposite direction for other portions of the cylinder, and still another object of the invention is to provide a feeding element which has a separative action upon the material and thereby facilitates the operation of the reduction elements of the mill.

With these and other objects in view, all of which will fully appear in the course of the following description, my improved grinding mill consists of the construction, arrangement and combination of parts shown in their preferred form in the accompanying three sheets of drawings in the various views of which like parts are similarly designated and in which—

Figure 1 is a sectional side elevation of the mill;

Figure 2, a section on the plane indicated by the line 2—2, Figure 1;

Figure 3, an enlarged section on the line 3—3, Figure 1;

Figure 4, a fragmentary further enlarged section taken on the line 4—4, Figure 3;

Figure 5, a section along the line 5—5, Figure 4;

Figure 6, a vertical section through the cutting and grinding elements of the mill taken on the line 6—6, Figure 2;

Figure 7, a fragmentary development of the grinding cylinder of the mill, and

Figure 8, an enlarged elevation of one of the grinding teeth of the same.

Referring more specifically to the drawings, the reference character 2 designates a sectional casing having at its upper end a feed-opening 3 and at its bottom a concave inclined chute 4 which delivers the ground product into the housing 5 of a fan-wheel 6, which adjoins the casing in connection with a discharge-opening 7 in a side thereof.

A trough 8 slanting to the feed opening of the casing provides a support for a conveyor of novel construction which moves the material regularly and in uniform quantities to the reduction elements of the mill and which facilitates in the operation thereof by a preliminary separative action upon the transported matter.

With this end in view the conveyor is composed of a plurality of rake bars 9 which are mounted upon corresponding cranks 10 and 14 of two parallel shafts 12 and 13 supported in bearings at opposite ends of the feed trough.

The cranks on the shafts are set at angles of 90 degrees in order to move the rakes consecutively along the bottom surface of the trough toward the feed opening of the case.

The rake bars which are preferably made of hollow material as shown in Figures 3, 4 and 5 of the drawings, are provided at their ends with boxes 15 for their connection with the cranks of the parallel shafts and they carry series of downwardly projecting equidistantly spaced teeth 16 which are rigidly secured by pins 17.

The material entering the casing through its feed opening is brought in contact with the cutting element of the mill which consists of a series of disks 18 mounted in spaced relation to each other upon a horizontal shaft 19 which is rotatably supported in boxes at opposite sides of the casing.

Each disk of the cutting element carries a series of radially projecting curved and pointed knives 20 which by the rotary movement of the shaft separate and cut the mate-

rial and throw it in a much reduced condition into the grinding space of the mill immediately below the same.

The grinding element of my invention consists of a hollow cylinder 21 made up of two parallel heads 22 connected by equidistantly placed bars 23 which conjointly constitute the circumferential wall of the cylinder.

The heads are secured upon a shaft 24 which is rotatably mounted in boxes 25 on brackets outside the casing and which is driven by connection with a conveniently located motor through the medium of a belt 26.

Each of the bars of the grinding cylinder carries a row of preferably equidistantly spaced teeth 27 of rectangular section which are placed with one of their angles forward with relation to the direction of rotation of the cylinder, to produce a cutting action upon the material in the grinding chamber.

The teeth are provided with screw-threaded stems 28 for their connection with the bars 23 of the skeleton cylinder, there being tapering shanks 29 between ths stems and the body portions of the teeth, which are fitted in correspondingly formed openings in the bars.

The teeth are rigidly secured by nuts 30 screwed upon their threaded stems in engagement with spring washers 31 placed against the inner surface of the bars.

It will be seen that when the forward cutting edges of the teeth become dulled in use, the teeth are readily turned through an angle of 90 degrees to bring another edge thereof in a position to engage the material under treatment, in the rotary movement of the cylinder.

The rows of teeth are irregularly arranged on the bars of the cylinder at different distances from an end of the same as clearly appears in the development shown in Figure 7 of the drawings so that no two teeth are in the same circumferential circle of the cylinder and every point of a line across which the cylinder rotates is traversed by the teeth on the periphery thereof. The irregular arrangement of the longitudinal rows of teeth on the cylinder furthermore provides that the teeth comprised therein are not spirally alined, and thereby eliminates the tendency of moving the material under treatment toward an end of the grinding chamber as would occur in case the rows of teeth were regularly displaced with relation to each other.

The grinding chamber proper is defined by a screen 32 which partially encloses the grinding cylinder at a gradually widening distance from the points of the teeth thereof and in spaced relation to the end walls of the case.

The eccentric screen has an opening in its upper end to admit the material after it has been acted upon by the superposed rotary cutter and its point of nearest approach to the teeth of the grinding element is at the edge of this opening, rearward with respect to the direction of rotation of the same.

It will be seen that by the peculiar arrangement of the teeth on the drum hereinbefore described, every part of the inner surface of the screen is traversed thereby and all the material falling onto the screen through the openings of the skeleton cylinder, is equally subjected to the grinding action of the teeth.

After the material has been ground to the desired fineness, it is drawn by the suction of the rotating fan through the meshes of the screen and along the concave chute 4 into the fan housing 5. The suction produced by the fan wheel and its direct engagement with the reduced material causes the latter to move from the housing through an upwardly extending tangential discharge pipe 33 into a conveniently located receptacle.

The shaft 24 of the grinding cylinder which as hereinbefore explained is directly connected with the motor by which the mill is operated, acts as a medium to drive the other elements of the mill for their synchronous operation.

The conveyor is driven by means of a transmission mechanism which includes a large pulley 34 on a shaft 35 which by a belt 36 is connected with a relatively small driving pulley 37 on the shaft of the grinding cylinder, a sprocket-chain 38 running upon wheels on the shaft 35 of the pulley 34 and a second intermediate shaft 39, and a sprocket-chain 40 passing around wheels on the last-mentioned shaft and the crank-shaft of the conveyor at the feed opening of the casing.

The shaft 35 of the cutting element of the apparatus is driven by connection with the intermediate shaft 35 through the medium of meshing gear-wheels 41 and 42, and the shaft of the fan-wheel 6 is driven from the shaft of the grinding cylinder by means of a sprocket chain 43.

In the operation of my invention, grain, alfalfa or other material to be ground is fed into the conveyor-trough to be acted upon by the rakes which drag it around the forward crank shaft upon which they are mounted and thence move it toward the feed opening in the casing.

The straw in the material is by this movement of the rakes separated and divided and fed, together with the threshed matter which fell directly to the bottom of the trough, uniformly to the cutting and grinding elements of the mill.

The rotating knives cut the material into small particles and force it into the grind-

ing space of the casing where it is ground by the movement of the teeth on the rotating cylinder across the eccentric screen.

The ground product is drawn through the meshes of the screen and moved to and through the discharge conduit of the housing by the suction and impelling action of the rotating fan-wheel.

The conveying element of my improved mill not only serves as a means for feeding the material uniformly into the casing of the cutting and grinding elements, but also acts as a separator, and by dividing the material, lessens the labor of the rotating knives in reducing the same as a preliminary to the grinding action.

The arrangement of the teeth on the rotating grinding cylinder as hereinbefore described, insures a rapid and thorough reduction of the material, to a meal of sufficient fineness to pass through the meshes of the screen, and the positions of the cutting and grinding elements with relation to each other and the fan wheel cause the material to pass rapidly through the mill without the use of conveying means and without a possibility of clogging.

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

In a grinding device for grain, a cylinder comprising a series of longitudinally spaced bars with teeth thereon, said teeth being spaced and arranged on successive bars approximately spiral in the direction of one end of the cylinder for a portion of its circumference and extending in the opposite direction for other portions of its circumference and a concave screen in close relation to said teeth, the latter being adapted to carry the treated material around said concave while alternately moving it to and from its ends.

In testimony whereof I have affixed my signature.

SHERMAN C. ROBERTS.