E. B. COX.

APPARATUS FOR TREATING GRAIN.

APPLICATION FILED OCT. 5, 1911.

1,024,832.

Patented Apr. 30, 1912.

3 SHEETS—SHEET 1.

Fig. 1.

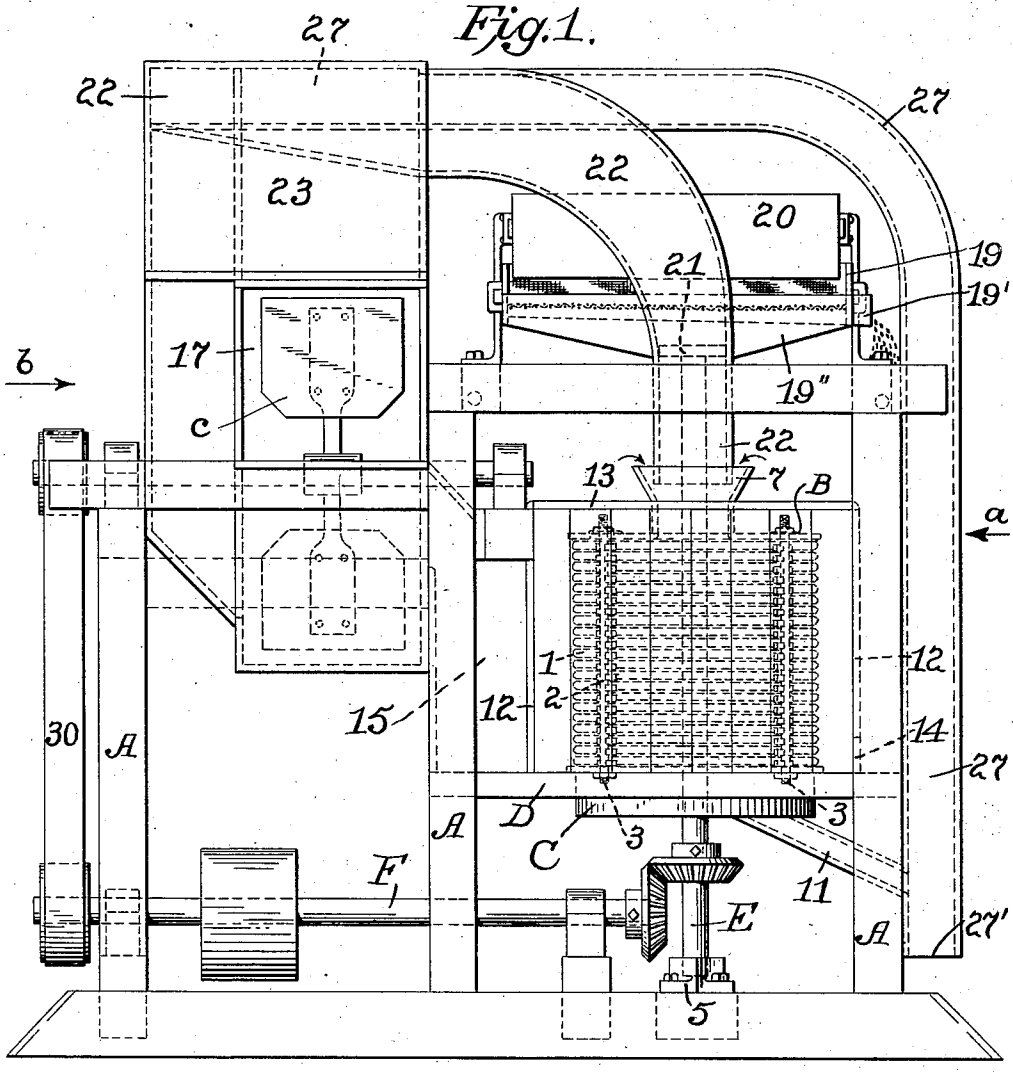


Fig. 5.

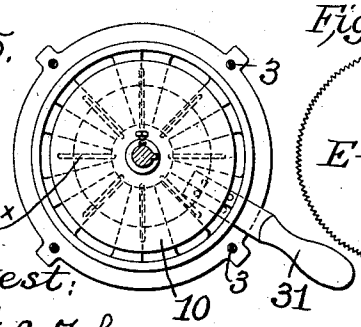


Fig. 6.

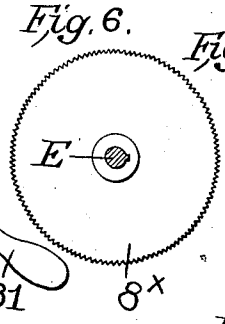
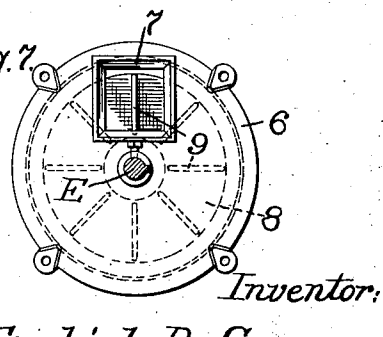


Fig. 7.



Attest:

Edwd. L. Tolson.

Inventor:

Ezekiel B. Cox,

by Spear, Middleton, Donaldson & Spear

Atty's.

E. B. COX.

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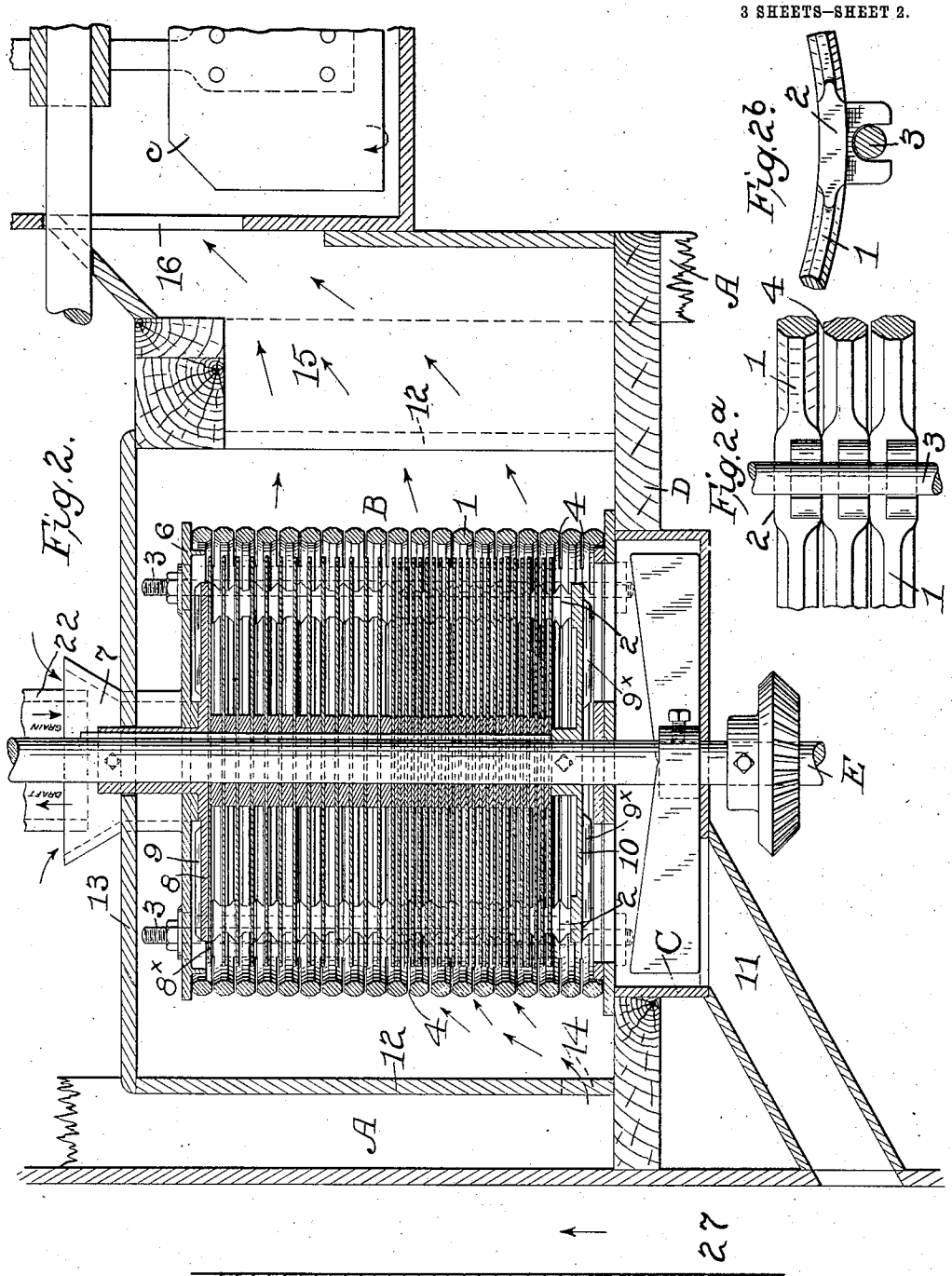
3 SHEETS—SHEET 2.



Attest:

Edwd. L. Tolson,

Benton McStaff

Inventor:

Ezekiel B. Cox,

by Spear, Middleton, Donaldson & Spear

Atty's.

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3 SHEETS—SHEET 3.

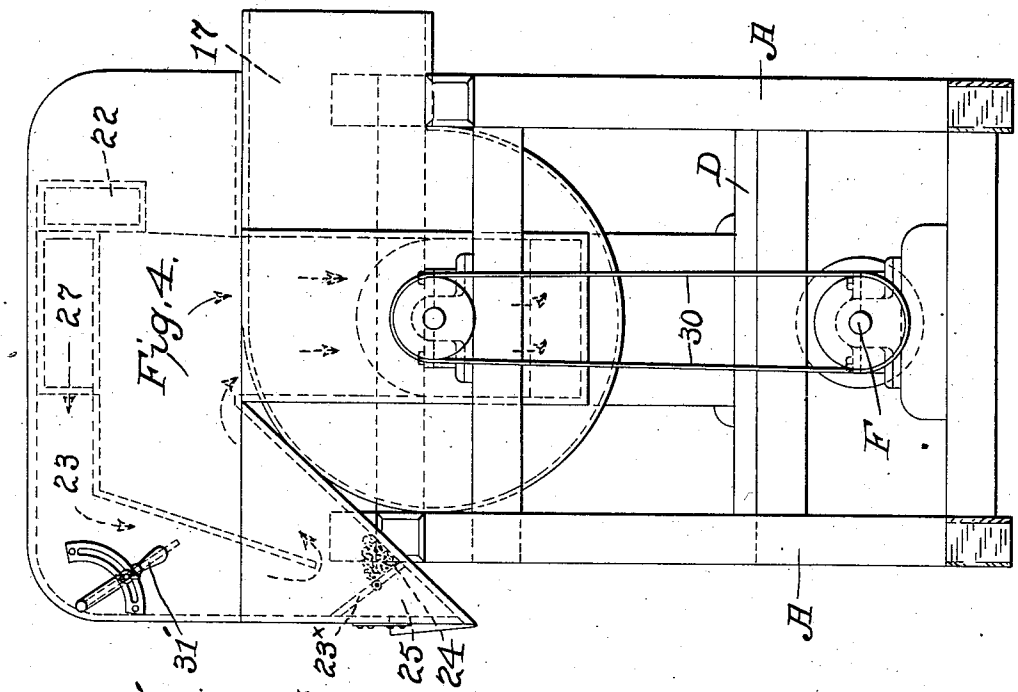

Fig. 4.

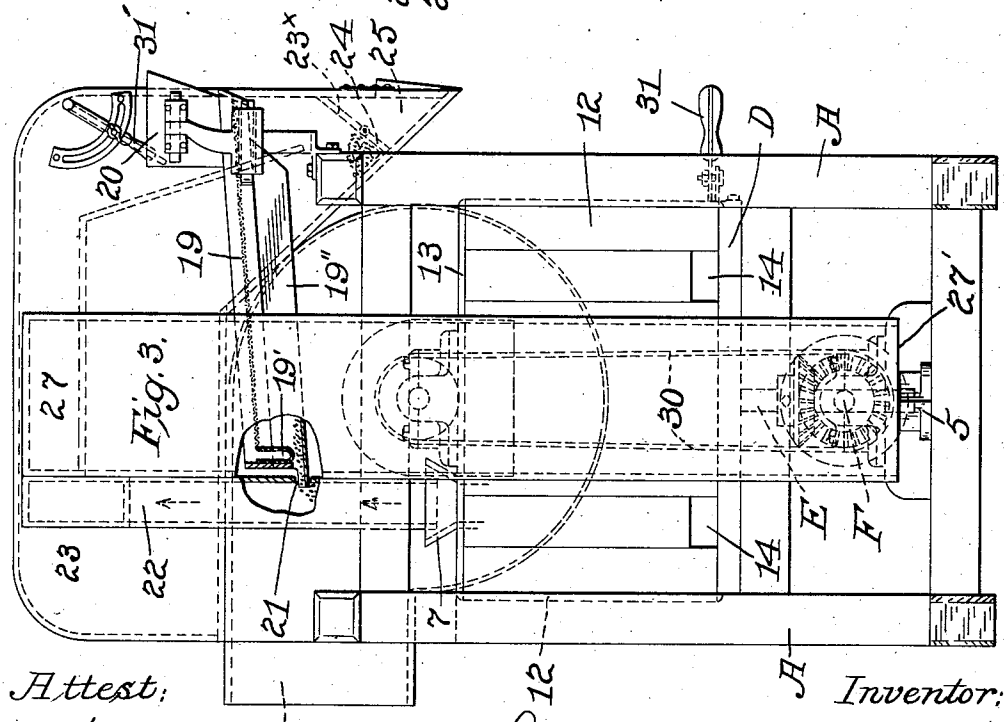

Fig. 3.

Attest:

Edwd. R. Tolson.

Benton McStahl

Inventor:

Ezekiel B. Cox,

by Spear, Middleton, Donaldson & Spear

Atty's.

UNITED STATES PATENT OFFICE.

EZEKIEL B. COX, OF NEWTOWN, PENNSYLVANIA, ASSIGNOR TO E. B. COX MANUFACTURING CO., OF HOPEWELL, NEW JERSEY.

APPARATUS FOR TREATING GRAIN.

1,024,832. Specification of Letters Patent. Patented Apr. 30, 1912.

Application filed October 5, 1911. Serial No. 653,074.

To all whom it may concern:

Be it known that I, EZEKIEL B. COX, citizen of the United States, residing at Newtown, Pennsylvania, have invented certain new and useful Improvements in Apparatus for Treating Grain, of which the following is a specification.

My invention relates to the cleaning of wheat or other grains or seeds, for the purpose of removing therefrom dust and other foreign injurious matters.

In the cleaning of grains, such as wheat, for example, it is desirable to remove not only all materials foreign to the grains, but, in case of substances such as smut balls, garlic and the like, to remove them at an early stage of the cleaning process, so that the grains shall not be contaminated by continued attrition or mixture of the contaminating substances.

My said invention includes in part some elements of the apparatus for which Letters Patent of the United States were granted me on the 7th day of June 1910, numbered 961068. But it includes further, with improvements on said machine, a new method of operation.

An important feature therefore, of my invention consists in a prolonged abrading action in the mill itself, upon the mass of grain mixed with the impurities, not sufficient to abrade or crush the grain, and throughout this prolonged action, drawing off the impurities as fast as they are sufficiently reduced or detached.

Further, my invention comprises, in connection with the separating mechanisms, a series of separate and distinct exhausts, the first applied as the grain with its impurities falls from the hopper, and before it reaches the abrading mill, whereby the dust, dirt and other smaller and lighter matters, not requiring comminution, are drawn off, and not permitted to enter the mill; a second exhaust applied during the passage of the material through the mill; and a third, an exhaust applied as the grain leaves the mill.

My invention consists also in the new mechanism, hereinafter described and illustrated in the accompanying drawings, in which:—

Figure 1 is a front elevation of a machine embodying my invention; Fig. 2 is an enlarged vertical section of a portion of the machine showing the grain cylinder, with its casing and a portion of the fan associated therewith, but viewed from the rear of Fig. 1. Fig. 2^a is an enlarged detail of a fragment of the cylinder rings; Fig. 2^b is a plan view of the same; Fig. 3 is a side elevation of Fig. 1 viewed from the right in the direction of arrow *a;* Fig. 4 is a similar view looking toward the left of Fig. 1 in the direction of arrow *b;* Fig. 5 is a detail plan view of the bottom disk of the cylinder, and top and bottom damper plates associated together; Fig. 6 is a plan of one of the serrated disks, and interposed collar thereon, and Fig. 7 is a detail plan of the top plate of the cylinder, showing the receiving hopper for the grain, and the top disk which rotates directly thereunder for distributing the grain.

The posts supporting my apparatus are indicated at A, carrying suitable cross beams as indicated in various views. The pulverizing or abrading mechanism which herein I call a mill, is shown at B. (See especially Figs. 1 and 2). This, in its general form, is the same as that shown in my patent aforesaid. The wall of this mill is formed of rings 1, polygonal in cross section, and having four regular spaced bosses 2, which, when the rings are in place, are in contact and hold the rings (as shown in Fig. 2^a) spaced from each other. These bosses also project outward and are notched to receive rods 3 which clamp and hold the rings in place. The inner faces of the rings form the inner rubbing or abrading surface of the wall of the mill, and the spaces 4 between the rings extend substantially all around the rings and are of such width as to permit the passage of air and fine particles, but not to permit the passage of grains, which are to be delivered at the spout. These rings and intervening spaces extend from top to bottom of the mill, as shown in Fig. 2. The whole rests upon a suitable casting C, supported by a floor D. Arranged axially with this cylindrical wall is a shaft E, stepped at 5, and driven by a power shaft F, through suitable bevel gears.

A flanged top plate 6 rests on and holds a top ring and between this and the flange of the casting C, the rings are securely clamped, so that the wall, composed of these rings, is held stationary on the floor. In this wall the central shaft revolves, carrying the

abrading and distributing mechanism. On the top plate 6 which covers the ring cylinder is fixed a hopper 7, the location of which is shown in Fig. 2 and in the reduced Fig. 7. This receives and directs the grain to the mill. Next underneath the hopper is a distributer disk 8 (Figs. 2 and 7). Below this is a plate 8^x. It has, like others of the series, teeth on its edge, which teeth are shown more clearly in Fig. 6, where in reduced size it is shown detached. Disk 8 has also, on its upper surface, radial ridges 9, as shown in Figs. 2 and 7. These, as the disk revolves under the hopper, carry the grain and its admixtures, around and impart to it centrifugal motion, thus driving it against the wall of the cylinder. The plain serrated disks 8^x are arranged one below the other continuing to the bottom. Their order in relation to the inner surface of the rings is shown on the larger scale in Fig. 2. It will be observed that between the serrated edges of the series of disks and the inner surface of the ring cylinder, there is an annular space, permitting the grains or other matters, thrown out by the centrifugal action, to fall toward the bottom. This space must be sufficient to permit the free passage of the kernels of grain under treatment without crushing or abrading, but as they pass, with the other substances, such as smut balls, garlic and the like, they are compelled to move past the succession of revolving plates, the teeth of which tear and abrade the softer substances, which rebound in their passage from the ring surface to the teeth, while the harder kernels are unaffected. These revolving plates arranged and moved as described, form substantially an interior revolving cylinder, coacting with the outer to abrade the passing charge of grain, which it serves also to keep between said cylinders, the interior cylinder also permitting the transverse passage of the blast.

The waste and impurities are usually lighter than the kernels of grain, and more easily comminuted, and before the grain reaches the bottom, are reduced to a dust or minute and light fragments. It will be noted that the disks with their spacing rings are splined upon the shaft E. They rest directly on a collar (Fig. 2) which in turn rests on a toothless disk 10, fixed to the shaft E, with an unoccupied space between its upper surface and the lower toothed disk. Similar radial ridges 9^x are shown on its surface, to throw out any grain that may have been scattered inwardly. From this the grain falls into the box of the casting C, in which are radial wings keyed to the shaft, which sweep the grain to the discharge spout 11. At this point all foreign substances under ordinary conditions, are so pulverized or reduced, as to be removable by air currents. In fact, this comminuting process begins at the top of the wall, and in order to remove the released smut from the smut balls, and the comminuted garlic, and other impurities from the grains, and thereby to prevent in the largest degree, contamination of the grain, I apply a practically continuous blast, throughout the abrading process.

It will be observed that the mill is inclosed in a box, the walls of which are indicated at 12, in Fig. 2. The bottom is formed by the floor and the top is shown at 13. This box is hermetically closed, except at the inlet and outlet and there is ample space for the circulation of the air between the inner walls of the box, and the periphery of the wall.

Air is admitted to the box on one side, as at apertures 14, Figs. 1, 2 and 3, (Fig. 2 being reversed), as viewed from the opposite side. By reason of the inclosed space surrounding the mill, air is admitted at all points on its exterior surface and may pass in through the spaces between the rings, and out on the other, assuming the draft opening in the box to be on the side opposite the inlet. This outlet is through a vertical slot 15 in the wall 12 (Fig. 2) and thence space is open to the axial intake 16 of the fan *c*, shown in part in said figure but more completely in Fig. 1.

The fan discharges peripherally through the passage 17 all the foreign material detached or reduced in the mill, and drawn through the spaces between rings, and through the exit slot 15 in the box. This has been gathered by the draft, transverse of the mill, and operating continuously across, from top to bottom, so that the refuse and contaminating stuff is snatched away and as soon as detached or reduced by the mill so as to be carried by the exhaust.

In order to relieve the mill and lessen its work, as much as possible, and in accordance with the principle of my method to detach and remove from the grain, impurities, at the earliest possible stage of the operation, I provide an outlet for chaff at 19′ at the lower end of the inclined screen 19, this outlet being in the form of a trough inclining downwardly and discharging laterally, and I provide an exhaust in connection with the inclined screen 19, through which the grain passes on its way to the mill. This is shown in side view in Fig. 2, and in end view in Fig. 1.

The screen receives the uncleaned grain in regulated quantities from the hopper 20, and delivers it comparatively free from chaff through the hopper 7 in the top of the mill, as shown in Figs. 1 and 3. The screen is reciprocated as usual, and the chaff, and other lighter screenings and loose materials pass away at its lower end along the outlet trough 19′. Any chaff which passes through the screen with the grain onto the imperfo-

rate plate 19'' beneath the screen is directed along the incline of the plate, together with the grain, which has passed through the screen, to the chute 22, this chaff being drawn off by the central fan. The opening into the chute is shown at 21. The direction of the air current is indicated by the arrow in Fig. 3. Chute 22 is continued through the box 23 on top of the fan casing, the air passing in the direction of the arrow, Fig. 4, down to the center of the fan on the side opposite to that which receives the dust drawn directly from the mill, as above described. This is shown in Figs. 1, 3 and 4. On its way, however, to the fan, the screenings pass over a receptacle 28× the bottom of which has a spring upheld trap door 24, which, when sufficient weight of chaff has accumulated, opens automatically and lets the screenings down to an outer chamber 25, provided with a like trap door opening outward to a suitable receptacle (not shown).

From the bottom of the mill the inclined chute 11 leads the grain into an uptake 27 above grain outlet 27′ through which the air is exhausted also to the intake of the fan. This takes off any fine materials which may be carried by the grain as it comes from the mill.

It will be understood that the moving parts of the apparatus are driven from the main power shaft F, the mill shaft through the bevel gears and the fan through the belt 30.

The discharge of the mill is regulated by a damper shown in Fig. 5, the damper disk being regulated through a handle 31. Suitable dampers 31′ may be placed where desired to regulate the draft.

The hopper 7 extends up outside of the main box 12 and the lower end of the chute 22 is located above and slightly separated from this hopper to provide an air intake at this point, the air flowing up the chute from this intake and acting upon the material falling through this chute to the mill.

I claim substantially as herein described:—

1. In an apparatus for separating impurities from grains and seeds, a vertical mill having an exterior wall provided with passages throughout its circumference and length, adapted to permit the passage of air and to exclude the grain or seeds, and having also an interior abrading surface, in combination with a revolving interior abrading cylinder having openings throughout its length for the transverse passage of air from side to side, means for distributing grains and seeds to the annular space and means for applying an air current across the mill throughout its length, substantially as described.

2. In an apparatus for cleaning grains and seeds, a vertical mill comprising an exterior wall composed of a series of rings having interior abrading surfaces, and spaces between said rings adapted to permit the passage of air and to exclude the grains, a central shaft carrying a series of disks thereon, having peripheral abrading surfaces adapted to coact with the wall, the upper disk having radial ridges for distributing grain, and comprising also means for maintaining a current of air across the mill, substantially as described.

3. In an apparatus for cleaning grain and seed, a vertical mill comprising an outer wall having interior abrading surfaces and an opening for the passage of air throughout its length, a shaft carrying abrading and distributing disks, said disks being separated to permit the passage of the air, an air box inclosing the wall in combination with a hopper for conveying the grain to the upper disk, a chute for conveying grain from the bottom of the mill and an exhaust fan connected with the box which incloses the mill for maintaining a current of air across the mill, said fan also having connections with the hopper and with the chute leading from the bottom of the mill, substantially as described.

In testimony whereof, I affix my signature in presence of two witnesses.

EZEKIEL B. COX.

Witnesses:
WM. T. SMITH,
W. AUBREY MERRICK.