United States Patent

Barger

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[54] GRAIN GRINDER

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[52] **U.S. Cl.** **241/255**, 241/296

[51] **Int. Cl.** **B02c 7/06**

[58] **Field of Search** 241/245, 248, 255, 256, 296

[56] **References Cited**

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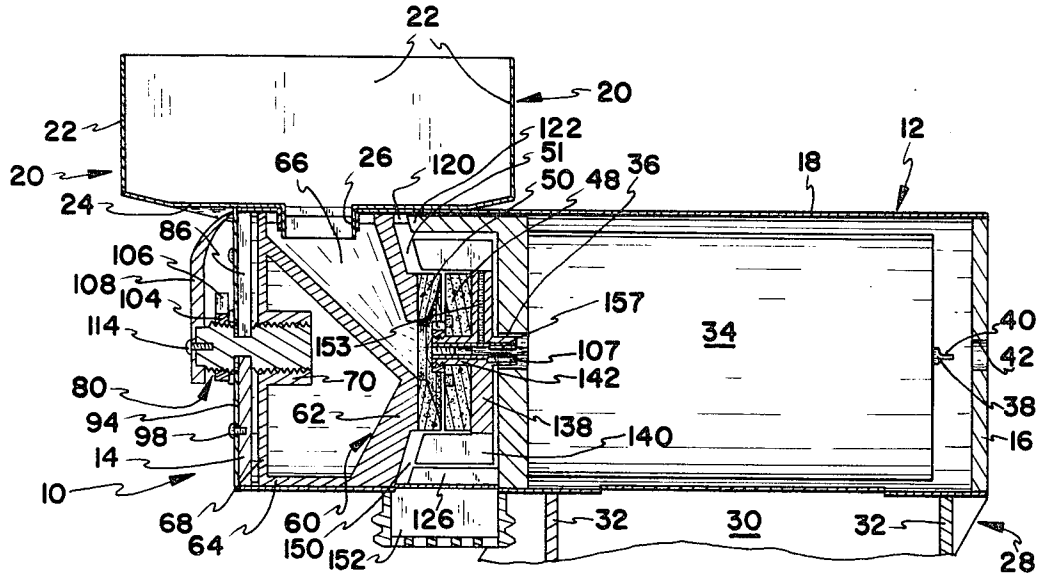
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[57] **ABSTRACT**

A grain grinder having a rotor stone rotated by a power source and a stationary stator stone. The rotor stone has novel tapered and spirally configurated grooves therein for evenly distributing grain about the rotor stone so that grinding takes place uniformly around the periphery of the stone. Novel external adjustment structure is provided to vary the clearance between the stator stone and the rotor stone so that various grains may be ground to a desired texture by selecting a position on an indicator or display device which visually displays the clearance set between the rotor stone and the stator stone.

9 Claims, 5 Drawing Figures



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SHEET 1 OF 2

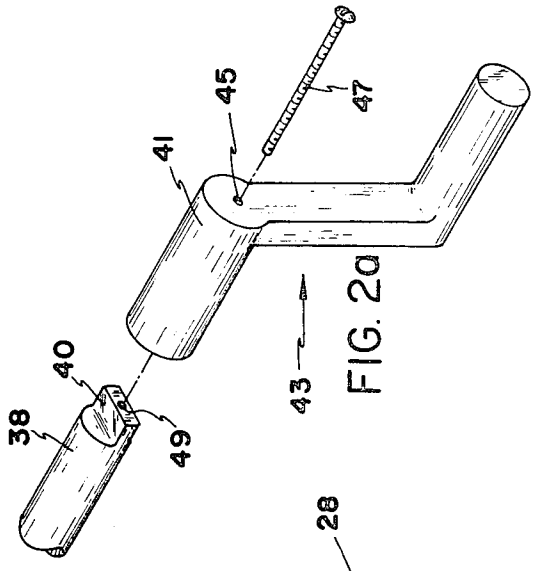


FIG. 2a

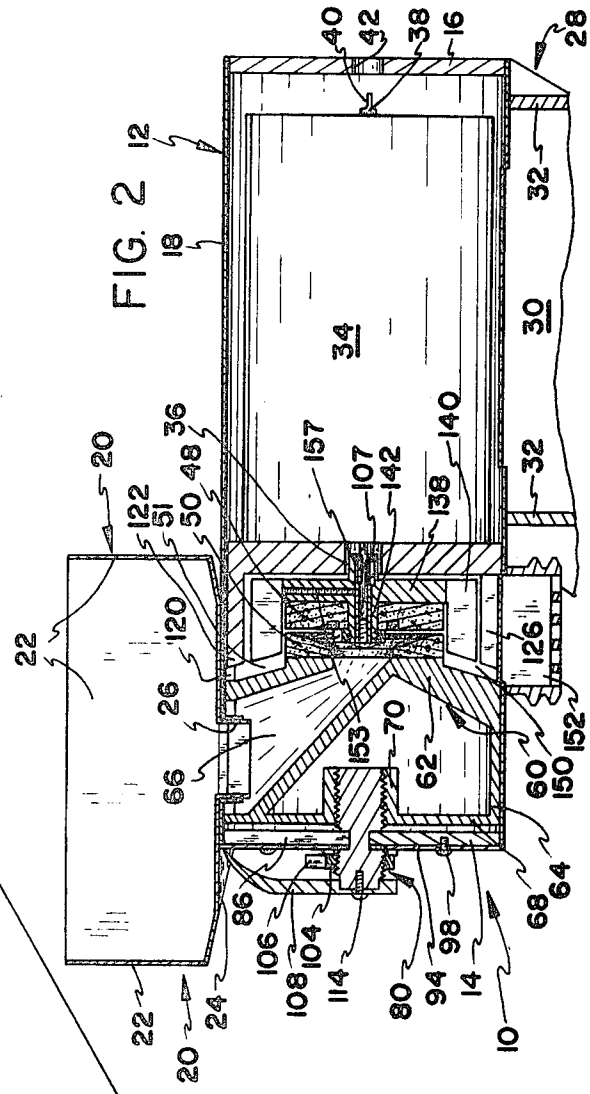


FIG. 2

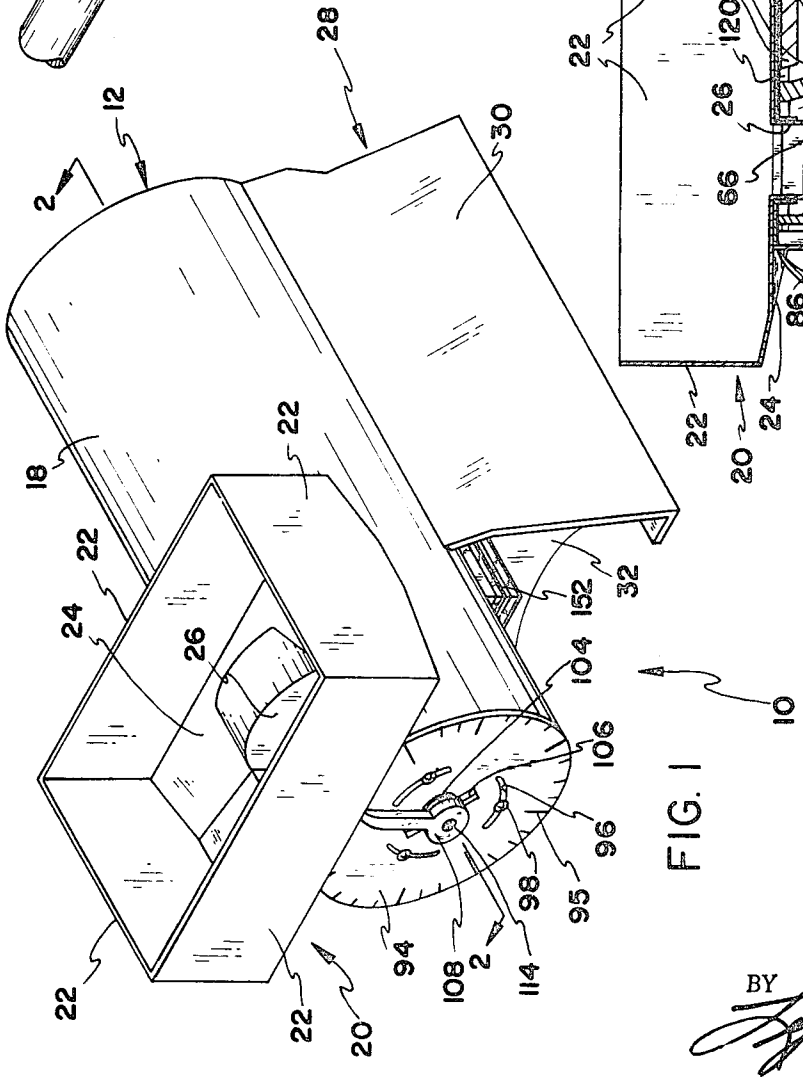


FIG. 1

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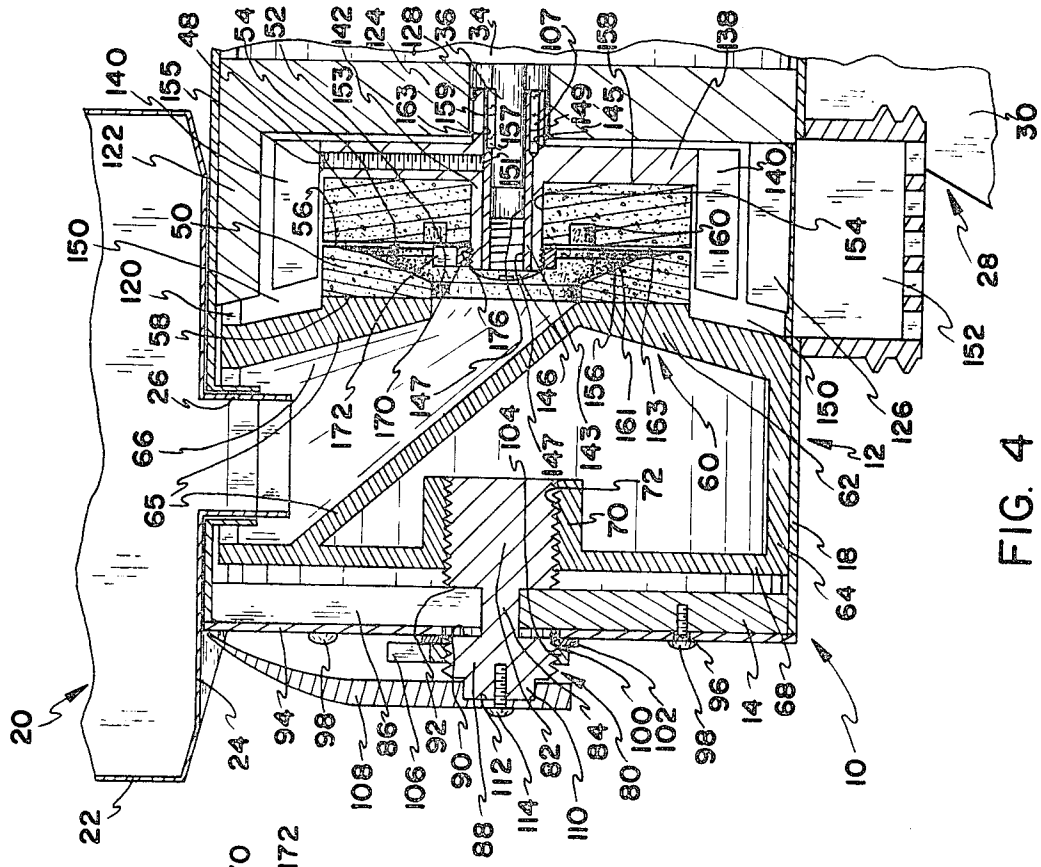


FIG. 4

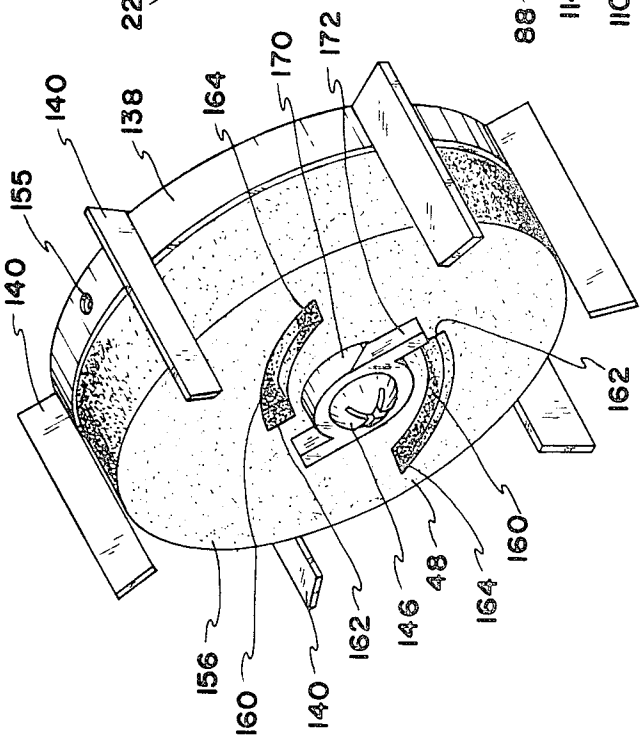


FIG. 3

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GRAIN GRINDER

BACKGROUND

1. Field of the Invention

The present invention relates generally to grain grinders and, more particularly, to a grain grinder forming a grain product of selected uniform texture.

2. The Prior Art

It is desirable, when grinding various size grains, to be able to regulate or vary the clearance between the rotating and stationary grinding stones so that desired texture of the resulting flour or granular product can be obtained. Conventional grinders provide adjustment between the rotor and stator grinding stones only by complicated adjustment internal of the grinder. Normally, some disassembly of the grinder is required before the adjustment structure is accessible.

Moreover, conventional grain grinders frequently experience failures of the bearings supporting the rotating stone because of concentrated, nonuniform grinding action occurring primarily at one radial grinding location between the stones. This results in uneven forces imposed upon the stone and causes bearing failure. Various devices such as blowers or fans have been used in an effort to distribute the grain more evenly around the stone so that grinding takes place more uniformly. Furthermore, when grinding occurs primarily in one location, the stationary stone at that location has a tendency to wear more rapidly and requires replacement sooner than had the grinding taken place uniformly over the grinding surface of the stones.

BRIEF SUMMARY AND OBJECTS OF THE INVENTION

The presently preferred grain grinder embodiment of the invention provides a novel grinding stone which evenly distributes granular material between the grinding surfaces of the stator and rotor grinding stones. Improved adjustment structure is also provided exterior of the grinder for selectively varying the separation between the stator and rotor stones to accommodate facile selectivity of the texture of the ground grain product.

It is, therefore, a primary object of the present invention to provide an improved grain grinder.

It is another valuable object of the present invention to provide novel readily accessible structure for adjusting the separation between grinding stones.

One still further object of the present invention is to provide a novel grinder which provides a uniformly textured ground product.

These and other objects and features of the present invention will become more fully apparent from the following description and appended claims taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top perspective view of a presently preferred embodiment of the invention;

FIG. 2 is a cross-sectional view taken along lines 2—2 of FIG. 1;

FIG. 2*a* is a fragmentary perspective illustrating the manner in which a manual crank may be coupled to the shaft of the motor;

FIG. 3 is a perspective view of a presently preferred rotor stone embodiment of the invention; and

FIG. 4 is an enlarged fragmentary cross-sectional elevation of the grinding stone assembly and adjustment mechanism of FIG. 2.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

A presently preferred embodiment of a grain grinder **10** is illustrated in FIG. 1. The grain grinder **10** comprises a housing **12** having a front face **14** (FIG. 2) and a rear face **16** joined by cylindrical center portion **18**. Above the housing **12** is a hopper **20** which is suitable for holding grain prior to grinding. The hopper **20** has four sides **22** which connect to a bottom **24** tapering to an opening **26** formed in the bottom. The hopper **20** rests on and is supported by the housing **12**. A stand **28** is secured to the lower portion of the housing **12**, stand **28** having legs **30** and cross-supports **32**. The stand **28** supports the housing **12** on a suitable surface such as a table (not shown).

The interior of the cylindrical portion **18** of the housing **12**, best shown in FIG. **2**, contains a motor **34** which may be any suitable conventional electric motor. The motor has a front driving shaft **36** which connects to a rotor grinding wheel **48** as will be hereinafter more fully described. A rear shaft **38**, integral with shaft **36**, has a male end with a flat extension **40** adapted to receive a mating female socket portion **41** of a hand crank **43** (FIG. 2*a*). The socket portion **41** of the crank **43** is inserted through an opening **42** in the rear face **16** of housing **12**. The right hand end of the socket portion **41** comprises a small aperture **45** through which a capscrew **47** may loosely pass. When the crank **43** is appropriately coupled to the flat extension **40**, as when the motor **34** is temporarily of permanently incapacitated, the capscrew **47** may be fitted through the aperture **45** and threadedly secured in a threaded blind bore **49** of the flat extension **40**. In this way, the crank **43** is secured to the motor shaft **38** for manual rotation thereof to accommodate grinding of grain.

The motor **34** is secured to mounting plate **124** (FIG. **4**) attached by suitable fasteners to the housing **18**. Plate **124** has an opening **128** through which shaft **36** rotatably passes. Grain deflectors **126** are radially spaced around the periphery of the plate **124** and project away from the mounting plate **124**. The grain deflectors **126** form an annular passageway **150** which is in open communication with discharge conduit **152**.

As heretofore mentioned, the shaft **36** of the motor **34** connects to a rotor stone **48**. A fan or turbine plate **138** having turbine blades **140** secured to the periphery thereof is nonrotatably mounted upon the shaft **36** between the mounting plate **124** and the rotor stone **48**. The blades **140** project away from the turbine plate **138** so as to be radially spaced around the peripheral edge of the rotor stone **48**. The blades **140**, when rotated, tend to draw milled grain from between the stones **48** and **50** into an annular passageway **150** and, thereafter, to the collector or bag hanger **152** located at the bottom of housing **12**, as will be subsequently more fully described.

The center portion of the turbine plate **148** comprises a hub **142** (FIG. **4**) which telescopes over shaft **36**. The hub **142** nonrotatably receives a sleeve **143** at the hollow interior thereof, the sleeve **143** being held against rotation in respect to the hub by a key **107** which fits within aligned grooves **145** and **149** of the hub and sleeve, respectively. The sleeve is restrained against axial displacement relative to the hub by a set screw **153** which forcibly engages sleeve **143** at location **151**, the setscrew **153** being threadedly carried in radial bore **155** of the turbine plate **148**. The motor shaft **36** telescopes within the hollow bore **147** of the sleeve **143** and is nonrotatably held in that relation by a key **157** snugly interposed in aligned grooves **159** and **163** of the shaft **36** and sleeve **143**, respectively. The left end of the sleeve **143** is threaded at the bore **147** and receives a capscrew **146**. In this way the bore **147** is closed to prevent entry of grain, etc.

The rotor stone **48** has a through bore **154** into which the hub **142** is integrally secured. The stone **48** has a front grinding surface **156** and a rear surface **158**. The rear surface **158** is bonded or otherwise suitably secured to the plate **138**. The grinding of the grain occurs principally near the outer periphery of surface **156** as will be hereinafter more fully described. It should also be observed that the turbine blades **140** are greater in axial length than the thickness of the rotor stone **48** so as to project beyond the grinding surface **156** (see FIG. **3**). Also, rotor stone **48** is maintained upon the hub **142** by a nut **170** secured to a threaded portion **176** of the hub **142**. The nut **170** has tangentially projecting wings **172** (best shown in FIG. **3**) which aid in distributing the grain over the grinding surface **156**.

Grooves **160** have been provided in the grinding surface **156** of rotor stone **148**. As shown in FIG. **3**, the grooves **160** are spirally configurated and taper from a relatively deep center portion **162** to become flush with grinding surface **156** at **164**. The deep portion **162** may have a greater width than shallow portion **164** or, if desired, the width of grooves **160** may be uniform. For example, one presently preferred embodiment has been found to adequately distribute grain over the entire grinding surface when grooves **160** have a maximum depth of one-eighth inch, a uniform width of one-fourth inch and traverse and arcuate path 2⅝ inches in length.

When grain is supplied to the center portion of the rotor stone **48**, grain enters the grooves **160** and because of centrifugal force due to the rotation of stone **48**, the grain is dispensed at **164** generally uniformly over the periphery of the stone **48**. Thus, grinding can occur uniformly over the grinding surface of the stone **48** rather than only in one radial location.

The grinding surface **156** of rotor stone **48** is closely spaced from a stator stone **50**. The grinding of the grain or like takes place between the grinding surface **56** of stator stone **50** and the grinding surface **156** of the rotor stone **48**.

Stator stone **50**, in the illustrated embodiment, is generally disc-shaped and has an annular central opening **52** through which grain can flow. A sloped composite face **54** is juxtaposed to the stone **50** to form an outwardly converging grain passageway therebetween. The opening **52** of the stone **50** merges with a first surface **161** having a relatively steep taper. The surface **161** merges into a more moderately tapered surface **163** which in turn merges into a surface **56** which is normal to the axis of the opening **52**. By reason of the composite face **54**, grain is fed through the space between the stones **48** and **50** at a confined rate to insure proper grinding. The stone **50** has a back surface **58** which may be secured such as by bonding to a stator plate generally designated **60**.

The stator plate **60**, in the illustrated embodiment, has mounting **62** and a bottom **64** which supports the weight of the stator stone and stator plate on the housing **12**. The stator plate **60** also has a chute portion **65** which forms a passageway **66** through which the grain may flow from hopper opening **26** to the opening **52** in the stator stone. The chute portion **65** and the bottom **64** are joined to a front wall **68** which has a boss **70** directed inwardly toward the mounting **62**. The boss has a threaded bore **72**. The stator stone and stator plate are axially displaceable in the housing **18**, but prevented from rotating relative to the housing **18** by a male coupling **120** (FIG. **4**) which couples with mating female coupling (not shown) in projection **122** of motor-mounting plate **124**.

As can be observed in FIG. **1**, a screw **80** having a diametrally enlarged portion **82** engages the threaded bore **72** in the stator plate **60**. The screw **80** further has a diametrally reduced portion **84** which fits within a vertically oriented U-shaped slot **86** formed in the front plate **14**. The screw **80** has another diametrally enlarged portion **88**. The screw **80** can be rotated in the U-shaped slot and is held in position by shoulders **90** and **92** of the diametrally enlarged portions **82** and **88**, respectively. Rotation of the screw **80** causes the diametrally enlarged threaded portion **82** to rotate in the threaded bore **72** and thus will axially displace the stator plate **60** and stator stone **50** to and fro relative to the rotor stone **48** to selectively vary the clearance between the stator and rotor stones. Thus, it is possible to adjust the clearance between the stator stone and rotor stone in order to regulate or control the texture of the ground grain product after grinding.

As shown in FIGS. **1** and **4**, an indicator plate **94** having graduations **95** is secured to the face **14** such as with screws **98**. Screws **98** are disposed through elongated, arcuate slots **96** in the plate, which slots allow selective adjustment of the plate **98** to calibrate the graduations **95** and actual spacing of the rotor and stator stones. The indicator plate **94** has an opening **100** through which the diametrally enlarged portion **88** of screw **80** passes when plate **94** is removed. A washer **102** is secured by a locknut **104** having radially projecting wings **106** to the screw **80**. The locknut **104** provides a way of holding or retaining the adjustment between the rotor stone **48** and the stator stone **50** by locking or fixing the axial position of screw **80**.

To facilitate adjustment of the clearance between the stones, an adjustment handle-pointer **108** is secured to a square leading and **110** of screw **80**. The handle-pointer **108** has a square aperture **112** adapted to receive the square leading end **110** of the screw **80**. The handle-pointer **108** is further secured to the screw **80** with threaded screw **114**. Since the handle-pointed is exterior of the housing **18**, it is convenient and easy to rotate the handle-pointer to vary the clearance between the rotor and stator stones. Further, the position of the handle-pointer **108** relative to the graduations **95** on the indicator plate **94** displays the clearance set between the rotor and stator stones **48** and **50**, respectively.

In the operation of the grinder **10**, grain is introduced into the hopper **20** and flows through the opening **26** in the hopper **20** through the passageway **66** and into the aperture **52** of the stator stone. The grain is guided by the wings **172** of the nut **170** into the grooves **160** and, thereafter, centrifugal force of the moving rotor stone will cause the grain in the grooves **160** to be uniformly distributed over the grinding surface **156** of the rotor stone **48**.

When the grain has been properly ground into flour, meal or the like, turbine blades **140** complement the centrifugal force developed by rotor stone **48** to draw the ground grain product into the annular passageway **150**. The ground product thereafter collects at the bottom of annular passageway **150** and falls through the conduit **152**.

Preferably, conduit **152** is disposed within the opening of a bag or jar used to collect the grain product.

When the texture of the grain product is to be varied, the handle-indicator **108** may be manually rotated to any one of a plurality of radial positions indicated by graduations **95** so that the spacing between grinding stones **48** and **50** is changed.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the range and equivalency of the claims are therefore to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a grain grinder comprising a housing and a stator stone, the improvement comprising a rotor stone having a grinding portion and a feeding portion, said feeding portion being in open communication with a supply of grain and having at least one groove of substantially uniform width therein adapted to assist the transportation of said grain from said feeding portion to said grinding portion, said groove beginning at a point adjacent but spaced from the central opening of the stone and spiraling toward the periphery of the stone, and power means for rotating the rotor stone relative to the stator stones.

2. A grain grinder as defined in claim **1** wherein said stator stone comprises:

a central opening through which grain is supplied to the feeding portion of the rotor stone,

a first surface extending about the periphery of said opening and tapering outwardly from said opening at a relatively steep angle,

a second surface extending about the periphery of said first surface and tapering outwardly from said first surface at a relatively moderate angle, and

a third surface extending about the periphery of said second surface normal to the axis of said opening.

3. In a grain grinder as defined in claim **2**, wherein said rotor stone further comprises blower means comprising a plurality of turbine blades radially spaced around the periphery of the rotor stone to assist in transporting grain product after it has been ground.

4. In a grain grinder having a housing, a stator stone and a rotor stone, the improvement comprising an axially displaceable mounting plate upon which the stator stone is mounted, the weight of the plate being carried by the housing and externally adjustable means comprising a single screw rotatably secured to the housing and threadedly engaging the stator stone mounting plate so as to axially displace the mounting plate and thereby vary the clearance between the stator stone and the rotor stone when the screw means is rotated.

5. A grain grinder as defined in claim 4 wherein said screw means comprise a handle-pointer manually displaceable to rotate the screw means and an indicator plate having indicia thereon to visually indicate the clearance between said stones.

6. In a grain grinder as defined in claim 5 wherein said indicating plate is adjustable relative to the stator stone to accommodate calibration between the separation of the rotor and stator stones and the indicia.

7. In a grain grinder as defined in claim 4 wherein said adjustable means further comprises locking means to maintain a predetermined clearance between the stator and rotor stones.

8. In a grain grinder as defined in claim 4 wherein said mounting plate comprises a chute portion adapted to feed grain from a grain source to the clearance between the rotor and stator stones.

9. A grain grinder comprising a housing, a rotor stone mounted for rotation in a vertical plane, means for rotating the stone, a stator stone spaced from and in general alignment with the rotor stone, means coupled to the stator stone for delivering grain through an opening in the stator stone to a grinding location between the stator and rotor stones, and externally adjustable means for varying the space between the rotor and stator stones, said adjustable means comprising horizontally oriented screw means rotatable to axially displace the stator stone relative to the rotor stone, said rotor stone having at least one groove in the grinding face thereof to generally uniformly distribute grain to the periphery of the rotor stone for grinding, said stator stone having a tapered surface extending outwardly about the periphery of said opening and a second surface extending about the periphery of said tapered surface normal to the axis of said opening in facing relation with the grooved surface of said rotor stone.

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