Aug. 13, 1946. L. E. EGEDAL 2,405,561

GRAIN PROCESSING MACHINE

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FIG. 1

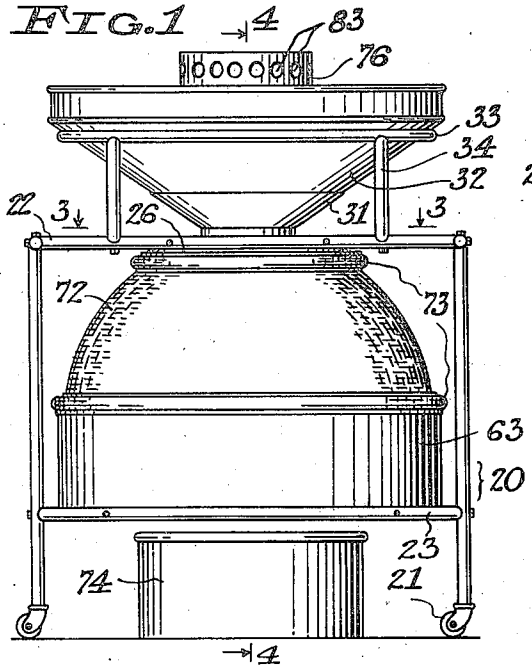


FIG. 2

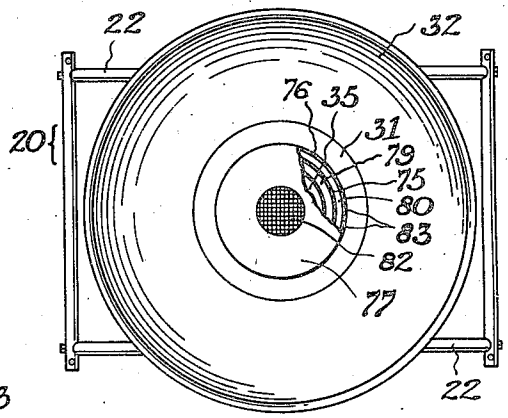


FIG. 3

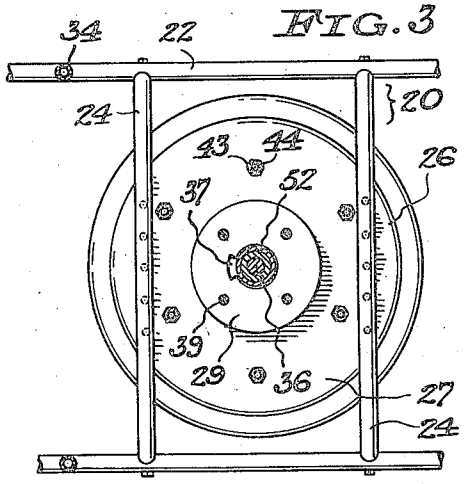


FIG. 8

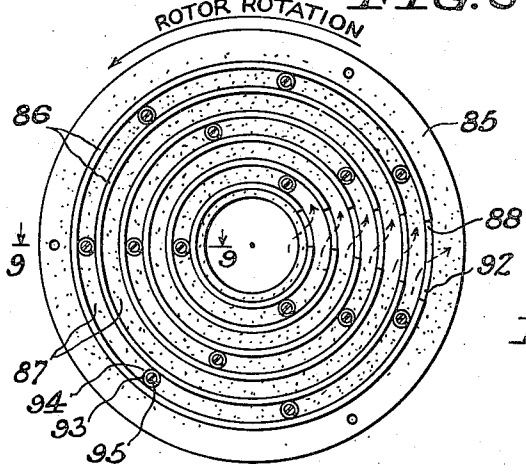


FIG. 9

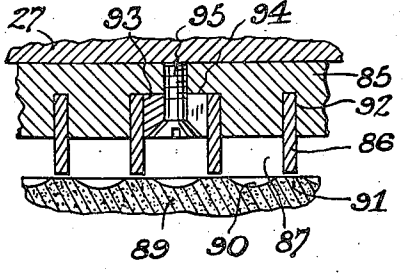


FIG. 12

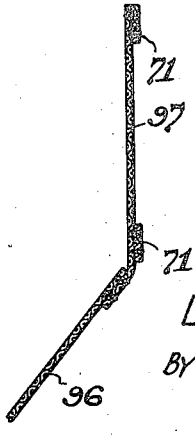


FIG. 10

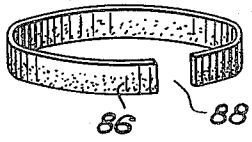
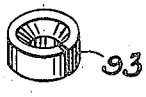


FIG. 11



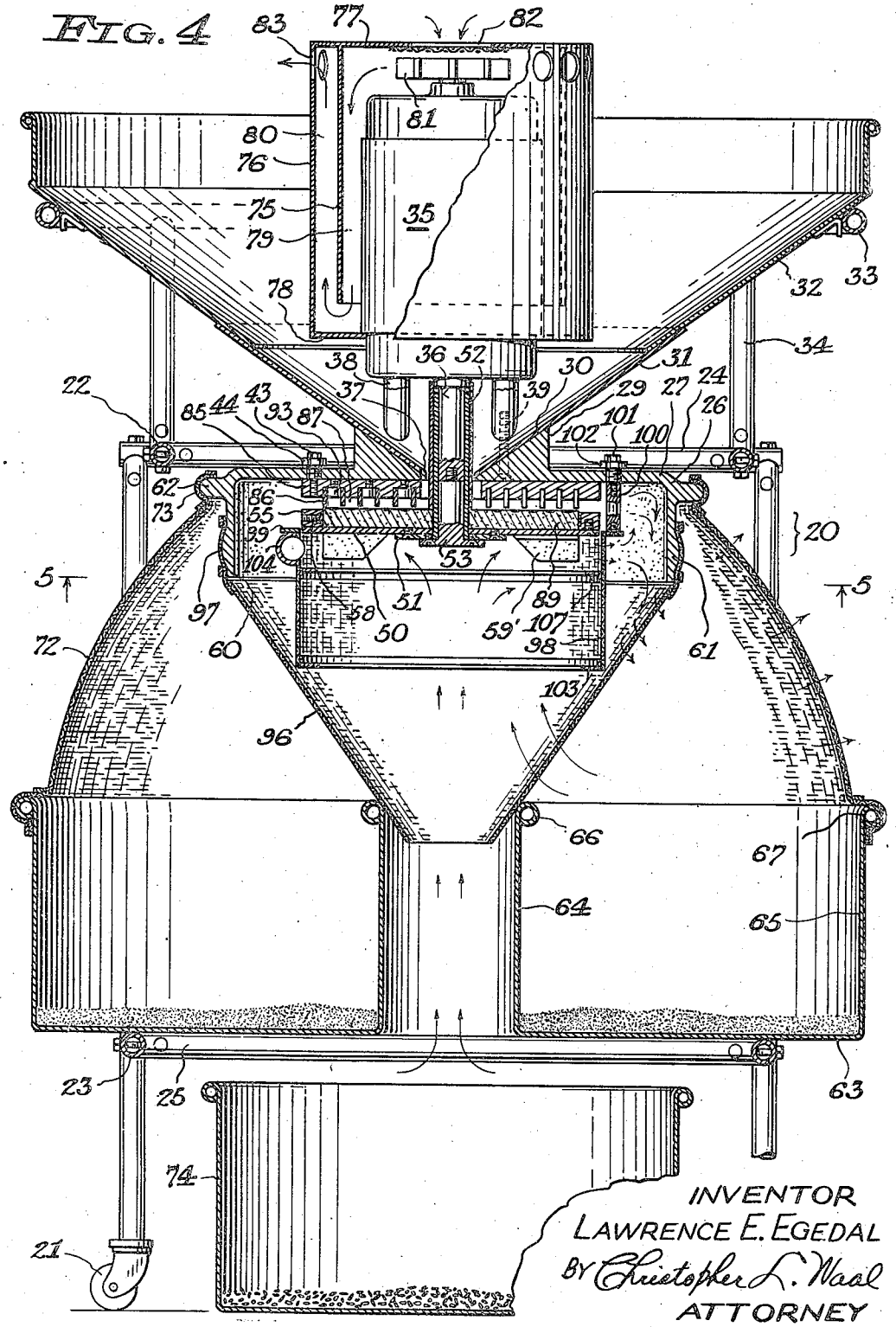
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GRAIN PROCESSING MACHINE

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FIG. 4



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GRAIN PROCESSING MACHINE

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FIG. 5

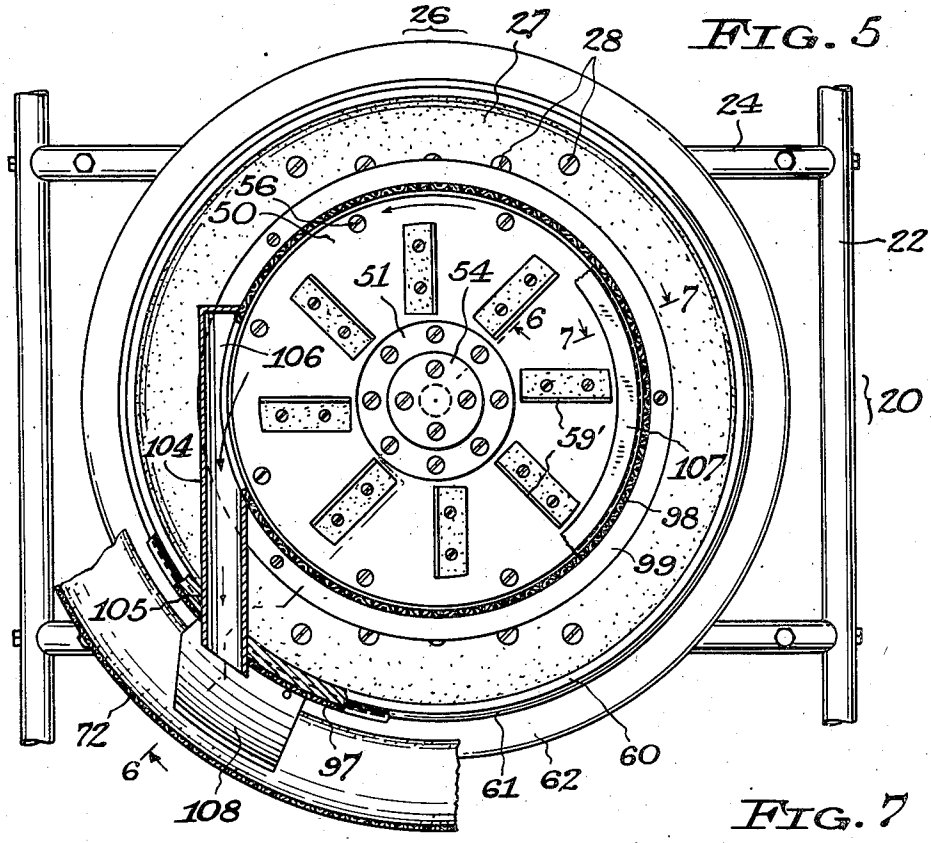


FIG. 7

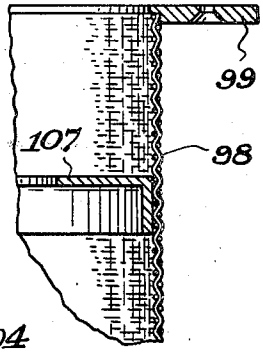
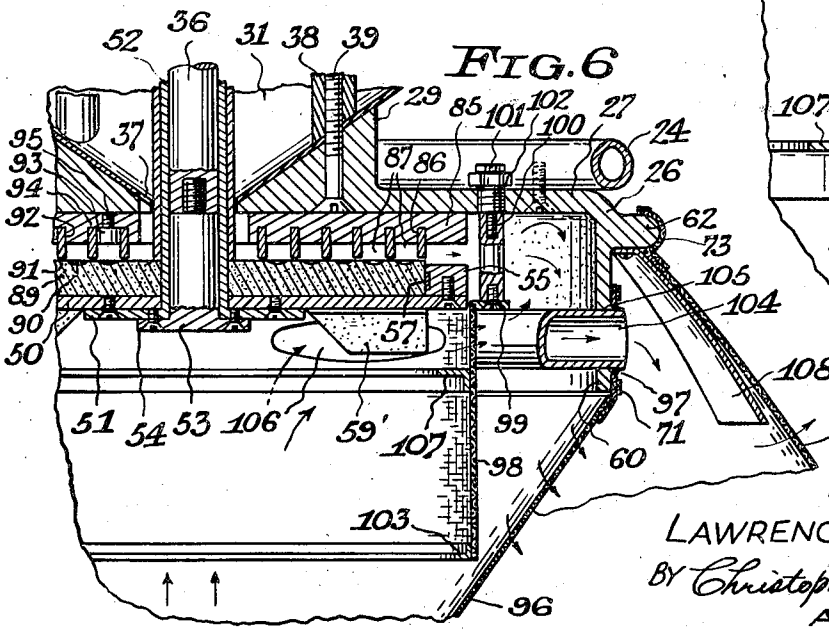


FIG. 6



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GRAIN PROCESSING MACHINE

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FIG. 13

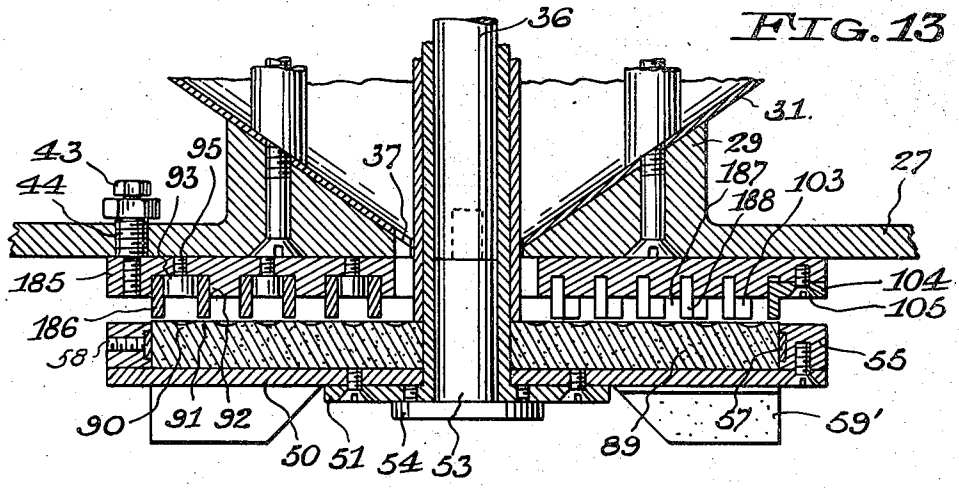


FIG. 15

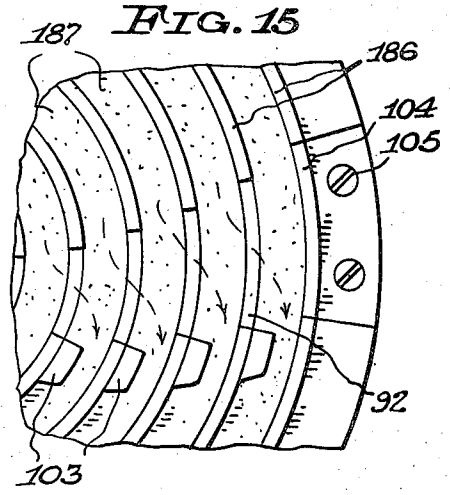


FIG. 14

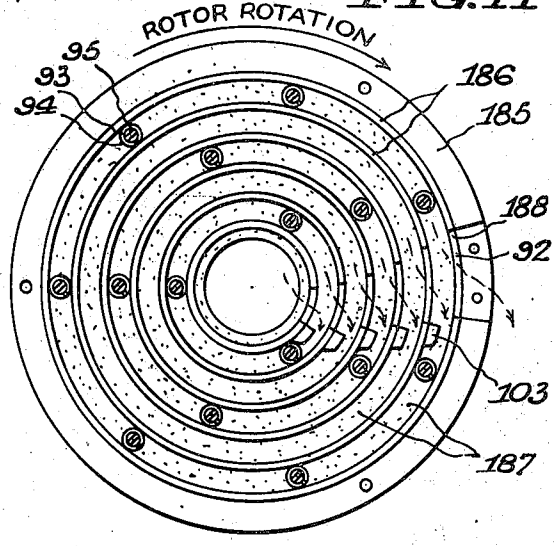


FIG. 16

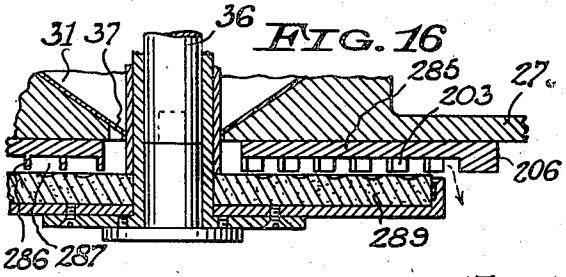


FIG. 17

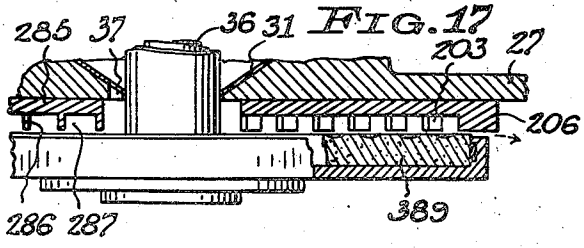
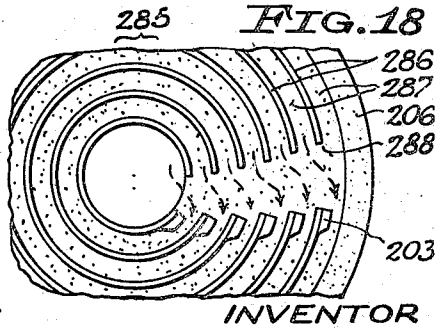


FIG. 18



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Patented Aug. 13, 1946

2,405,561

UNITED STATES PATENT OFFICE

2,405,561

GRAIN PROCESSING MACHINE

Lawrence E. Egedal, Milwaukee, Wis.

Application August 2, 1943, Serial No. 497,023

11 Claims. (Cl. 241—162)

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The present invention relates to machines for processing grain and other materials, as by abrading, reducing and separating, this application constituting a continuation-in-part of my copending application for Grain processing apparatus, Serial No. 415,192, filed October 16, 1941, now Patent 2,365,179, issued December 19, 1944.

An object of the invention is to provide an improved machine adapted for abrading granular material and more particularly for scouring, cleaning and grinding wheat and other cereal grains.

Other objects are to perfect details of construction generally and to provide a structure which is capable of inexpensive manufacture.

The invention further consists in the several features hereinafter described and claimed.

In the accompanying drawings,

Fig. 1 is a side elevation of a grain processing machine constructed in accordance with the invention and arranged to form a grain scourer;

Fig. 2 is a top view of the machine, parts being broken away and parts being shown in section;

Fig. 3 is a detail sectional view taken generally on the line 3—3 of Fig. 1;

Fig. 4 is a sectional elevation of the machine taken generally on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view taken generally along the line 5—5 of Fig. 4;

Fig. 6 is a sectional elevation taken generally along the line 6—6 of Fig. 5;

Fig. 7 is a detail sectional elevation of a screen member taken generally along the line 7—7 of Fig. 5;

Fig. 8 is a detail bottom view of a stationary grain scouring member;

Fig. 9 is a detail sectional elevation taken generally along the line 9—9 of Fig. 8, and also showing a cooperating rotary scouring member;

Fig. 10 is a perspective view of one of the ribs of the stationary scouring member of Fig. 8;

Fig. 11 is a perspective view of a rib-clamping plug for the grain scouring member;

Fig. 12 is a detail sectional elevation of a grain-abrading sieve member;

Fig. 13 is a sectional elevation generally similar to the intermediate portion of Fig. 4, but showing a modified form of abrading means arranged for grinding flour;

Fig. 14 is a detail bottom view of a stationary channel plate for the abrading means of Fig. 13, arranged for scouring grain;

Fig. 15 is an enlarged bottom view of the stationary channel plate of Fig. 14, arranged for grinding flour;

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Fig. 16 is a sectional elevation similar to Fig. 13 but showing another modified form of abrading means arranged for scouring grain;

Fig. 17 is a similar sectional elevation showing the abrading means of Fig. 16 arranged for grinding flour, and

Fig. 18 is a detail bottom view of the stationary channel plate for the abrading means of Figs. 16 and 17.

In these drawings, 20 designates a legged rectangular frame here shown to be formed of metal tubing and mounted on casters 21. The frame includes upper and lower pairs of parallel horizontal bars 22 and 23, the upper bars 22 being connected by a pair of parallel cross bars 24, and the lower bars 23 being connected by a pair of parallel cross bars 25.

A housing 26, preferably in the form of an inverted cup, includes a horizontal top wall 27 which extends below the cross bars 24 and is rigidly secured thereto by bolts 28. The housing is provided at its upper side with a central embossment 29 extending upwardly between the cross bars 24 and having a downwardly converging conical seat 30 on which is rigidly mounted a conically formed hopper member 31 to hold grain or other granular material. The hopper member 31 detachably supports thereon a considerably larger upper hopper member 32 which is further supported in centered position by a ring bar 33 having legs 34 detachably secured to the frame bars 22.

An electric motor 35 extends centrally within the hopper and has a vertical shaft 36, the projecting lower end of which extends downwardly through a central aperture 37 in the housing embossment 29. The motor casing has downwardly projecting legs 38 which are rigidly secured to the housing by bolts 39, the lower hopper member 31 being clamped between the housing and the motor-supporting legs 38.

A centrally apertured disk or plate 85 is detachably and adjustably secured to the under side of the housing wall 27, as by screws 43 passing through bushings 44 screwed into the housing. The disk 85 has at its under side a series of concentrically arranged ribs 86 forming annular grain channels 87 between them. If desired, these grain channels may have abrasive surfaces. Each rib has a gap 88 to permit the outward passage of grain. Preferably, the several gaps are arranged approximately in line at one side of the disk, as shown in Fig. 8.

A rotatable centrally apertured grinding member 89, preferably in the form of a grooved abra-

sive disk, lies below the ribbed stationary disk 85 and is sufficiently close to the lower edges of the ribs 86 to prevent the passage of grain under the ribs. The abrasive member 89 is carried on a metal disk 50 secured to the annularly flanged lower end 51 of a tubular hub member 52 which fits on the motor shaft. The hubbed disk 50 is detachably secured to the motor shaft as by a coupling member 53 fitting in the lower end of the hub member 52 and having a reduced upper end screw-threaded into the lower end of the motor shaft, the lower end of the coupling member having an annular flange 54 which is secured, as by screws, to the flanged lower end of the hub member. The direction of rotation of the motor shaft is such as to tighten the screwed connection between the shaft and the coupling member. The rotary grinding member 89 is detachably secured to the supporting disk 50, as by a surrounding retaining ring 55 adjustably fastened to the disk by screws 56, and by a clamping ring 57 set into the retaining ring 55 and urged inwardly against the periphery of the grinding member by radial screws 58.

The rotary disk 89 is preferably provided at its flat upper surface with a series of shallow concentric grooves 90 to increase the abrasive area, the lower edges of the stationary ribs 86 being centered over flat annular concentric lands 91 formed between these grooves. The ribbed stationary disk or plate 85 is accurately positioned with respect to the rotary abrasive disk by the screw devices 43, 44. The ribs 86 are here shown in the form of strips, Figs. 9 and 10, such as of resilient metal, let into respective narrow annular grooves 92 formed in the disk 85. The ribs are suitably anchored in place as by a series of longitudinally split expansion plugs 93 set into vertical bores 94 formed in the disk 85 between the grooves 92, each bore laterally communicating with adjacent grooves and having a diameter substantially equal to the distance between the adjacent grooves, so that the opposite sides of each plug will laterally engage the adjacent ribs and firmly hold them in adjusted position. Each plug is secured to the disk 85 by a screw 95 which also serves to expand the plug. Any desired distribution of the grain within the channels 87 can be obtained by varying the width of the channels and the width and location of the rib gaps 88.

The disk 50 is provided with radial vanes 51' on its lower face to produce a fanning action as hereinafter more fully described. The housing 26 includes a downwardly projecting marginal skirt 60 which preferably extends lower than the fan vanes on the rotary disk, the skirt having a wide bead or bulge 61 around its lower edge portion. The housing also has a peripheral bead or flange 62 near its upper portion. If desired, the skirt may have an abrasive inner surface so as to have an attritional action on the material thrown outwardly from the rotary grinding member.

The placement of the motor 35 within the grain hopper not only lowers the center of gravity of the machine, but also avoids the use of an excessively long driving shaft for the abrading rotor. Since the driving motor extends well into the grain hopper and is surrounded by grain during a large part of a milling run, it is desirable to provide means for adequately cooling the motor. For this purpose the motor casing carries an enclosure comprising spaced concentric cylindrical inner and outer shells 75 and 76, respectively, the outer shell extending above the motor casing and being closed by a top wall 77 and a bottom wall 78, and the inner shell extending to the top wall but being spaced from the bottom wall. The annular space 79 between the inner shell and the motor forms an air passage which communicates at its lower end with an annular passage-forming space 80 between the inner and outer shells. The upper end of the motor shaft carries a fan 81 which draws cooling air downwardly through a central screen 82 in the top wall 77 and forces the air outwardly and downwardly through the annular space 79 between the inner shell and the motor to cool the motor, and then upwardly through the passage 80 between the inner and outer shells, the air leaving through openings 83 formed in the upper portion of the outer shell above the level of the top of the upper hopper member 32.

It is usually desirable to make the frame of the machine of such width that it will pass through an ordinary doorway. The upper hopper member 32, the supporting ring bar 33 therefor, and the receptacle 63 are here shown to have diameters which are greater than the width of the frame, but these members can readily be removed from the frame when it is necessary to move the machine through doorways or narrow passages.

In the operation of the machine, a quantity of wheat or other granular material to be cleaned or scoured is placed in the hopper 31, 32, and the motor is set in rotation, driving the rotary abrasive member 97 at a high speed, for example a peripheral speed of 10,000 feet per minute. The grain descends from the hopper through the aperture 37 and passes through the open center of the ribbed disk 85 onto the rotary abrasive disk 89. The grain kernels are abraded by the grooved rotary disk, removing fuzz and dirt from the kernels and also removing the woody outer portions of the kernels. The high speed rotary disk has a light contact with the kernels, and removes the dirt-laden outer coating of the kernels without danger of cracking them. The ribs 86 of the stationary disk retard the outward passage of the kernels and also have some abrading action. The grain kernels travel around the channels 87 of the stationary disk under urge of the rotating disk and pass from each channel to the next outer channel through the gap 88 in the rib between the channels, as indicated by arrows in Fig. 8. Some of the grain may make more than one circuit in each channel before passing to the next channel. The grain kernels are finally discharged from the rotor through the gap in the outermost rib, and drop onto the conical metal sieve 96, being swept around the sieve by air currents to cause a further abrading action. The air currents are produced mainly by the rotating vanes 59' which draw air upwardly through the tube 64 and cause its movement in the direction indicated by arrows in addition to a swirling or rotary motion about the vertical axis of the sieve 96. The rotation of the grinding member may also draw some air down through the mass of grain in the hopper and discharge it from the periphery of this member. In some instances there may be an inward and upward passage of air through the lower portion of the sieve 96, as indicated by arrows in Fig. 4. The fuzz, dirt, dust and other fine removed material discharged from the rotor pass outwardly through the sieve meshes and fall into the receptacle 63, while the cleaned grain kernels fall through the tube 64 and into the container 74. The passage of the kernels along the sieve aids in keeping the meshes open. Any sticks, straws, joints or other light

foreign objects in the grain which do not or cannot pass through the sieve meshes will descend along the conical walls of the sieve, and after passing the lower edge of the cylindrical screen 93 will be swept upwardly within the screen by the rising air currents and will be blown outwardly by the fan blades through the delivery tube 104, so that they will be deposited in the receptacle 63. By changing the size and number of the fan blades, any desired degree of buoyant separation can be obtained.

While the machine of the invention is more particularly intended for use in the processing of grain, it is also capable of use in the treatment of other materials. By suitable changes the machine may be used for grinding flour, as described in my aforesaid copending application for Grain processing apparatus, Serial No. 415,192.

The modified form of abrading means shown in Figs. 13 to 15, is adapted for scouring grain and grinding flour. A grooved centrally apertured plate 185, generally similar to the plate 85 of Figs. 4 and 6, has concentric interrupted ribs 186 with terminal shoulder-forming projections 103 at their outer sides, the projections being at the rib ends facing the oncoming grain. The ribs form grain channels 187 and have gaps 188 between the channels. The gap 188 in the outermost rib is adapted to be closed by a detachable gate or closure 104 secured to the plate 185 as by screws 105, the gate forming, in effect, a part of the rib. The abrading means is otherwise similar to that of Figs. 4 and 6. With the gate 104 in place, as seen in Figs. 13 and 15, the abrading device is adapted for grinding flour, the gate preventing the escape of grain kernels, and the outermost rib and the gate forming with the underlying abrasive disk a continuous slit for the escape of flour. With the gate removed, as shown in Fig. 14, the device is adapted for scouring grain, the gap in the outermost rib permitting the escape of grain kernels.

In the operation of the abrading means of Figs. 13 to 15, grain passes outwardly through the labyrinth formed by the communicating grain channels 187. After a certain quantity of grain has been deposited in each channel, any additional grain introduced will collect at the projection 103 at the entrance to the channel, thus blocking the entrance and avoiding the presence of an excessive amount of grain in the channel. The limited quantity of grain in the channel is free to roll, tumble and bounce about, so as to permit effective scouring of the grain.

The further modified form of the invention shown in Figs. 16 to 18 is also arranged for scouring grain and grinding flour. A grooved plate 285, generally similar to the plate 185 of Figs. 4 and 6, is secured to the housing 26 and has arcuate ribs 286 forming channels 287 between them, the ribs having gaps 288 and having terminal projections 203. The ribs are here shown to be integral with the plate although they may be separate members. The ribbed plate may be formed of metal or abrasive material. The plate has a continuous peripheral flange 206, and is used without alteration for both scouring and grinding. When grain is to be scoured, a rotary abrading disk 289, Fig. 16, similar to the disk 89, is mounted on the motor shaft, the disk underlying the outermost rib 286 but being of smaller diameter than the inner diameter of the flange 206 so as to permit free downward escape of the scoured grain kernels. When flour is to be ground the rotary abrading disk 289 is replaced by a similar disk

389 of slightly larger diameter, the peripheral portion of the disk underlying the peripheral flange 206 of the stationary plate and forming therewith a continuous slit for the escape of flour.

Certain specific embodiments of the invention have been shown and described but it will be understood that changes and modifications may be made therein within the spirit of the invention.

What I claim as new and desire to secure by Letters Patent is:

1. A device of the character described, comprising a rotary abrasive disk having a generally vertical axis of rotation and having a substantially flat abrasive upper surface, a member above said disk and having a channeled bottom surface adjacent to the upper face of said disk to provide a passage for granular material, said member having ribs extending about the axis of rotation, said ribs defining annular channels between them and each rib having a single gap to permit the outward movement of the granular material from one channel to the next.

2. A device of the character described, comprising a rotary abrasive disk having a generally vertical axis of rotation and having a substantially flat abrasive upper surface, a member above said disk and having a channeled bottom surface adjacent to the upper surface of said disk to provide a passage for granular material, said member having ribs extending about the axis of rotation, said ribs defining annular channels between them and having gaps to permit the outward movement of the granular material from one channel to the next, the upper surface of said disk having shallow concentric annular grooves in register with said channels.

3. A device of the character described, comprising a rotor having an abrasive upper surface and having a generally vertical axis of rotation, a member above said abrasive surface and having a channeled bottom surface adjacent to said abrasive surface, said member having channel-forming ribs extending about the axis of rotation and having grooves receiving said ribs, and rib-fastening means comprising an expansible clamping member secured to said member and laterally engaging an adjacent rib.

4. A device of the character described, comprising a rotary abrasive disk having a generally vertical axis of rotation and having a substantially flat abrasive surface, a member above said disk and having a channeled bottom surface adjacent to the upper face of said disk to provide a passage for granular material, said member having ribs extending about the axis of rotation, said ribs defining annular channels between them and each rib having a single gap to permit the outward movement of the granular material from one channel to another, and said gaps being at the same side of the axis of rotation.

5. A device of character described, comprising a rotor having an abrasive upper surface and having a generally vertical axis of rotation, a member above said abrasive surface having grooves extending about the axis of rotation and having an opening between said grooves, channel-forming ribs extending in said grooves and having their lower edges adjacent to the abrasive surface of the rotor, and rib-fastening means comprising an expansible clamping member disposed in said opening and laterally engaging the adjacent ribs.

6. A device of the character described, com-

prising a rotor having an abrasive upper surface and having a generally vertical axis of rotation, a member above said abrasive surface having grooves extending about the axis of rotation and having a bore between said grooves, channel-forming ribs extending in said grooves and having their lower edges adjacent to the abrasive surface of the rotor, and rib-fastening means comprising a split expansion plug fitting in said bore and laterally engaging the adjacent ribs.

7. A device of the character described, comprising a rotor having an upper abrasive surface and having a generally vertical axis of rotation, a member above said rotor having a channeled bottom adjacent to the upper face of said rotor to provide a passage for granular material, said member having ribs extending about the axis of rotation, said ribs defining channels between them and having gaps to permit the outward movement of the granular material from one channel to the next, some of said ribs having material-blocking projections at their outer sides adjacent to the downstream ends of said gaps to limit the quantity of granular material collecting in said channels.

8. A device of the character described, comprising a rotor having an upper abrasive surface and having a generally vertical axis of rotation, a member above said abrasive surface having channels extending about the axis of rotation and having an opening between said channels, there being a gap in the outer wall of the outer channel to permit the escape of granular material, and a detachable closure for said gap secured to said channeled member to limit the size of the abraded particles discharged from the device.

9. A device of the character described, comprising a rotor having a substantially flat upper abrasive surface and having a generally vertical axis of rotation, a member above said rotor having a channeled bottom adjacent to the upper face of said rotor to provide a passage for granular material, said member having channels extending about the axis of rotation and there being openings between said channels, said openings forming gaps extending to said flat abrasive surface of the rotor, the outer wall of the outermost channel being continuous, said rotor having a peripheral portion underlying the peripheral portion of said channeled member to limit the size of the abraded particles discharged from the device.

10. A device of the character described, comprising a rotary abrasive disk having a generally vertical axis of rotation and having a substantially flat abrasive surface, and a member above said disk and having a channeled bottom surface adjacent to the upper face of said disk to provide a passage for granular material, said member having ribs extending about the axis of rotation, said ribs defining annular channels between them and each rib having a gap to permit the outward movement of the granular material from one channel to the next, and said ribs being of substantially uniform width throughout their length.

11. A device of the character described, comprising a rotor having a generally vertical axis of rotation and having a substantially flat abrasive upper surface adapted to support granular material thereon, said surface having shallow concentric grooves, a stator member above said rotor and having a bottom surface with annular ribs concentric with the rotor axis and defining annular channels between them, the lower edges of said ribs being adjacent to the abrasive surface of said rotor, and each rib having a single gap to permit the outward movement of the granular material from one channel to the next, said rotor grooves being disposed intermediate the lower endges of adjacent pairs of stator ribs, the rib gaps being at the same side of the axis of rotation and being approximately in radial alignment.

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