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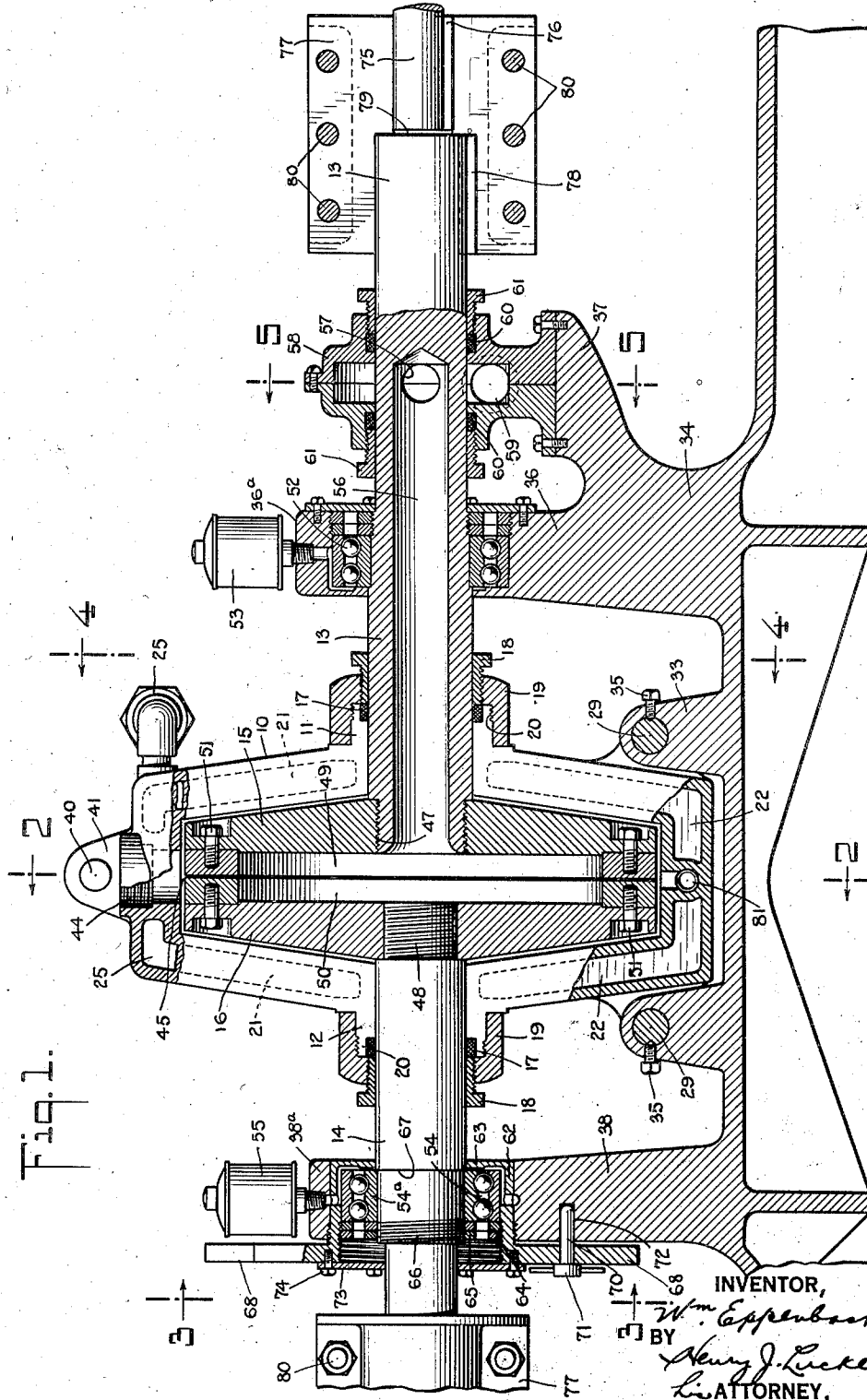
W. EPPENBACH

1,738,288

HOMOGENIZING MILL

Filed July 19, 1927

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Fig. 2.

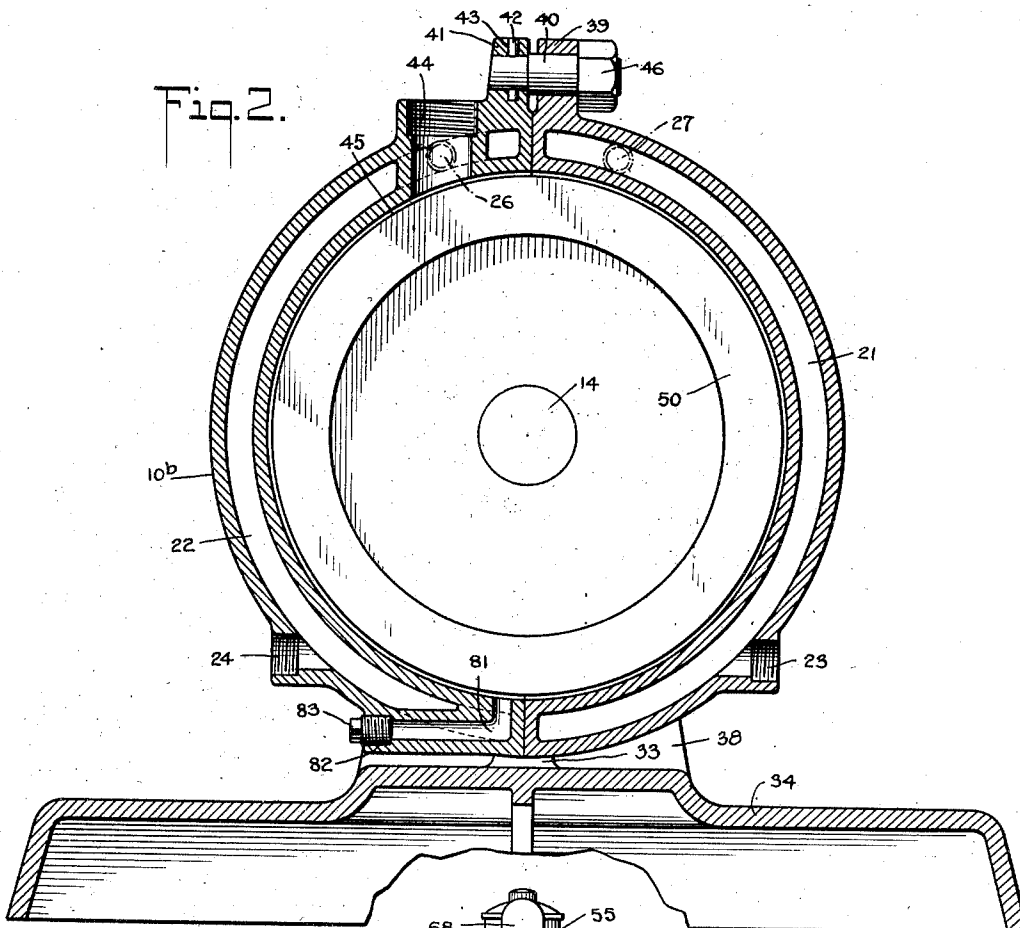
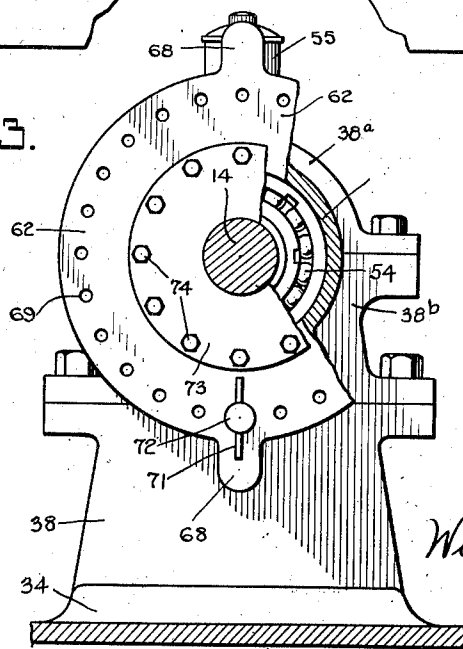


Fig. 3.



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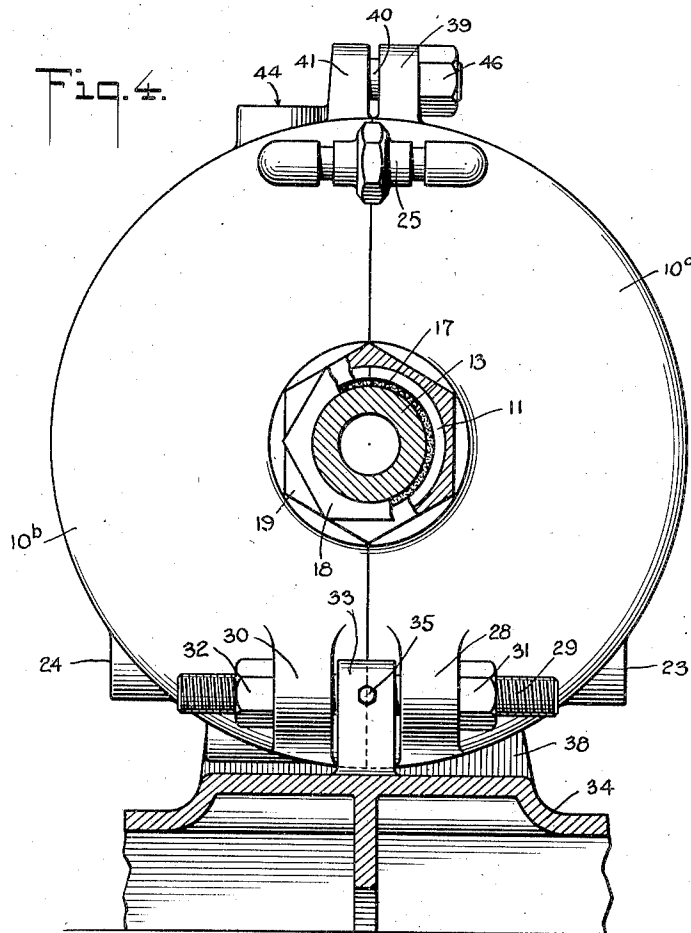
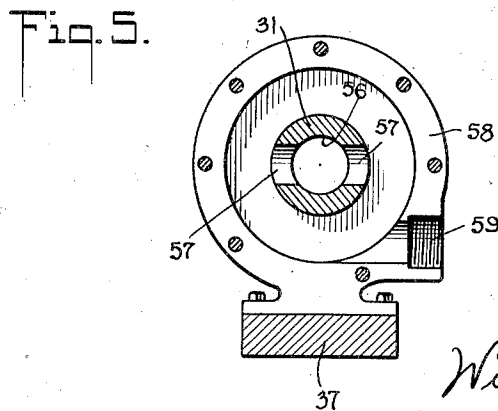
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

WILLIAM EPPENBACH, OF COLLEGE POINT, NEW YORK, ASSIGNOR TO UNITED STATES COLLOID MILL CORPORATION, OF LONG ISLAND CITY, NEW YORK, A CORPORATION OF DELAWARE

HOMOGENIZING MILL

Application filed July 19, 1927. Serial No. 206,969.

This invention relates to colloid and other homogenizing and emulsifying mills.

My invention is particularly adapted to colloid mills comprising rotating emulsifying surfaces which are relatively adjustable in the gap, i. e., the spacial relation of the surfaces from one another. Such surfaces are preferably smooth.

The rotor members for homogenizing, grinding and other treatment are preferably of ring or annular formation and the material to be treated is led to the rotor members peripherally outwardly of the rings or annuli, and pressure impressed upon the material to bring the material between the gap.

In the more simple types of the most preferred forms of my invention, two rotor members are employed and are rotated in opposite directions. The homogenizing or emulsifying rings or annuli are removably positioned on the two rotor members, to provide for the substitution of rings or annuli of varying radial extents of the effective surfaces, and thereby regulate the area and therewith the time interval of treatment for given dimensions of the gap between the effective surfaces. In such types of my invention, the shafts of the rotors may be driven by separate motors or belts, thus attaining economy in motor investment and in the consumption of current required.

In the use of two rotor members, one rotor only may be mounted to be axially adjustable, to thereby regulate the effective gap between the emulsifying or homogenizing surfaces.

My invention further includes improvements in the arrangement of the casing of the mill, to facilitate the assembly and disassembly of the casing and the exposure of the rotor members for cleansing and inspection purposes, and also for the substitution of the variable emulsifying or homogenizing surfaces.

My invention further embodies improvements in the construction of the parts serving for the discharge of the treated material, and particularly for attaining a continuous discharge during the stage of operation of the mill and also for precluding all possibility of contamination of the material by the lubri-

cation supplied to the bearings of the rotor shafts.

Further features and objects of the invention will be more fully understood from the following detail description and the accompanying drawings, in which

Fig. 1 is a vertical sectional elevation of a preferred form of my invention;

Fig. 2 is a sectional elevation on line 2—2 of Fig. 1;

Fig. 3 is a sectional elevation on line 3—3 of Fig. 1, with certain forwardly positioned parts broken away;

Fig. 4 is a sectional elevation on line 4—4 of Fig. 1, certain of the forwardly positioned parts being broken away; and

Fig. 5 is a sectional elevation on line 5—5 of Fig. 1.

Referring to the drawings, my mill is illustrated of the horizontally rotating type, and of such type comprises a casing 10 having laterally extending bosses 11, 12 for the extension therethrough of the respective horizontally extending shafts 13, 14 of the respective rotor members 15, 16, described more fully hereinafter.

Each boss 11, 12 is preferably provided with suitable packing means, such as a packing ring 17 seated in an annular recess in the boss and is secured in adjustable sealing relation with the shaft by means of the annular nut 18, the threading of which meshes with the packing ring 19, having threading 20 on its inner face meshing with corresponding threading on the outer face of the respective bosses 11, 12.

The casing 10 is conveniently formed of sectional parts, and preferably of halves, see Fig. 4, designated respectively 10^a, 10^b, abutting on a vertical plane passing substantially diametrically through the shaft 13, as appears in Fig. 4, and correspondingly relative to the shaft 14. Such arrangement enables the casing 10 to be readily opened up and cleansed during the stages of use of my mill, and similarly to be readily re-assembled, as is described more fully hereinafter.

Each casing section is preferably channeled to provide for the flow of temperature regulating fluids usually for cooling pur-

poses, in which instance water may be employed. The channel of the half section 10^a is designated 21, and extends to the right of the center line of the shaft 13, see Fig. 4, and provides for the cooling of the whole of the section 10^a. The channel of the left-hand section 10^b, see Fig. 4, is designated 22 and similarly provides for the cooling of the whole of the section 10^b.

10 The supply of the water or other temperature controlling fluid is connected to either opening 23 or 24, see Fig. 2, say the opening 24 of the left-hand casing section 10^b, in which event the water flows directly into the channel 22 of the left-hand section 10^b. The channel 22 is connected by the adjustable union 25 and connected nipples, see Figs. 4 and 1, with the channel 21 of the right-hand casing section 10^a, see also Fig. 2, the openings 26 of the channel 22 communicating with one end of the union 25 and the opening 27 of the channel 21 communicating with the opposite end of the union 25.

The sections are locked to one another by means of suitable coupling and preferably combined supporting means, such as a lug 28 on the opposite faces of the casing section 10^a for receiving the bolt 29 and similarly a lug 30 on the opposite faces of the casing section 10^b for receiving the opposite end of the bolt 29. The nut for one end of the bolt 29 is indicated at 31 and the nut for the opposite end of the bolt is indicated at 32.

35 Preferably, each bolt 29 is anchored in position, as by means of the lug 33 integral with or otherwise secured to the base 34 of my mill, see Figs. 1 and 2; each bolt 29 may be secured in position by means of a set-screw 35.

40 In such instance of vertically meeting sections of the casing 10, each packing ring 19 serves also to hold the sections in mutually sealing relation about the respective shafts 13, 14.

45 As appears in the drawing, the base 34 is preferably of an integral casting, which may be hollowed out for the purpose of attaining lightness of weight and rigidity. As appears more fully hereinafter, the base 34 preferably includes an integral extension 36 for supporting the right-hand bearing, i. e. of the shaft 13, see Fig. 1, and also an integral extension 37 projecting to the right for support of the discharge of the mill; the base 34 may also include an integral portion 38 for support of the left-hand bearing of my machine, namely for the shaft 14.

60 The upper abutting joints of the two-part, vertically abutting sections 10^a, 10^b are also preferably adjustably locked to one another, as by means of a lug 39 integral or secured to the casing section 10^a, having an opening for receiving a bolt or threaded pin 40, and a co-operating lug 41 integral or

otherwise rigidly secured to the casing section 10^b. The lug 41 is preferably formed to firmly retain a pin 40, as by means of a transverse pin 42 passing through a transverse opening 43 in the lug 41 and a suitable registering opening in the bolt 40. Such arrangement, see Fig. 2, is advantageous to provide for a clearance adjacent the inlet 44 in the casing section 10^b for the inflow of the material to be treated and communicating with the interior 45, see also Fig. 1, of the mill surrounding the emulsifying surfaces, as appears more fully hereinafter. The tightening nut for the threaded end of the pin 40 appears at 46, see Fig. 2.

80 The rotor members 15, 16 are preferably removably supported on their respective shafts 13, 14 as by screw-threaded connection therewith, indicated respectively at 47, 48. In the form of my machine illustrated in the drawings, one rotor 15 is preferably rotated in one direction and the other rotor 16 is rotated in the opposite direction, and accordingly the threadings 47, 48 respectively extend in directions opposite to the directions of rotation, to thereby more firmly seat the rotors in their respective opposite directions of rotation upon encountering frictional and other resistance in use.

90 The emulsifying or grinding face of the rotor member 15 is indicated at 49 and the emulsifying or grinding face of the rotor member 16 is indicated at 50; the faces 49, 50, are preferably respectively annular rings and removably mounted on their respective rotor members 15, 16, as by means of the securing bolts 51, passing through countersunk openings on the rear faces of the rotors 15, 16, and tapped into suitable threaded openings on the rear faces of the respective rings 49, 50.

110 The inflow of the colloid mixture or other material to be emulsified or otherwise treated is disposed at any suitable location. As indicated above, for a vertically abutting two-part casing, the inlet is preferably provided in one of the casing halves, such as the casing section 10^b, say, at the top, at the location 44, which may be adjacent the lug 41, employed, as above described, for the assembly and disassembly of the casing sections.

115 The bearing for the shaft 13 is indicated at 52, preferably of the ball or other anti-friction type; the bearing cage 52 is received within the bearing housing 36, which, as indicated above, may be integral with the machine base 34. An oil cup 53 is indicated for the bearing 52. The bearing cage for the shaft 14 is indicated at 54, having an oil cup 55 and is housed within the housing 38 carried by or integral with the base 33, as preferred. As is set forth more fully hereinafter, the bearing cage 54 is locked to the shaft 14 together with the adjusting ring, to thereby regulate the grinding gap between the 130

rings 49, 50 by movement of the ring 50 relative to the ring 49.

In the types of my invention as illustrated in the drawings, one of the shafts 13, 14, is hollowed, or otherwise provided with a passage for the discharge of the treated material from a central region between the rings 49, 50. In the drawings, I have shown the shaft 13 as hollowed, as is indicated at 56, see Fig. 1, by boring for a portion thereof extending beyond its bearing 52 to the discharge openings 57, see also Fig. 5. The openings 57 communicate with the interior of the hollow fixed housing 58, from which the treated material is discharged through its outlet 59 through suitable piping or otherwise. The packing rings 60 and adjustable nuts 61 are provided for sealing the shaft 13 on the opposite sides of the discharge openings 57.

It will be observed that the bearings 53, 54, for the respective shafts 13, 14 are disposed at materially spaced distances from the respective packing rings 17 and 60, thereby obviating all possibility of leakage of the lubrication along the outer surface of the shaft 13 into the interior of the casing 10 and the discharge housing 58.

One or both of the two rotor members 15, 16 are arranged to be adjustable relative to the other or relative to one another, for the purpose of regulating the degree of spacing between the grinding faces 49, 50. A convenient form of such adjustment is had by mounting the non-hollow shaft, this instance the shaft 14, to be axially adjustable and the hollow shaft, in this instance the shaft 13, substantially fixed in rotational position.

A convenient form of adjustable mounting for the shaft 14 comprises a bearing housing 62 one annular wall 63 of which abuts the bearing cage 54, and the opposite annular wall abuts the tightening nut 64 and its locking nut 64. The tightening and locking nuts 64, 65 screw-threadedly mesh with the threading 66 of the shaft 14, and the shaft 14 is reduced in diameter as is indicated at 67 to receive the inner bearing ring 54^a of the cage 54.

The bearing housing 62 at its outer face is flanged annularly and provided with one or more handles 68, see Figs. 1 and 3.

The bearing housing 62 is provided with suitable means for retaining the bearing cage 54 and therewith the shaft 14 at any desired axially set position. Such retaining means may comprise a series of apertures 69 in the outer flange of the bearing cage 62, co-operating with a pin 70 having a handle 71 and a recess 72 in the bearing mounting 38, or equivalent fixed location. The apertures 68 are preferably spaced definite distances from one another to thereby provide for definite variation of spacing between the adjustable ring 50 and the fixed ring 49. The circular plates 73, secured by screws 74 to the flange of the bearing housing 62, serves as a

closure for the central portion of the bearing housing 62. The circular plate 75 serves as a closure for the fixed bearing cage 52, and is secured in position by screws 76, tapped in the end face of the bearing 36.

For convenience, the upper ring portion 36^a of the bearing 36 is removably mounted by bolts, see Figs. 1 and 3, similarly the upper ring portion 38^a of the bearing 38, see Fig. 3, as well as the intermediate ring portion 38^b.

It will also be appreciated that in the use of my mill for homogenizing, say within the range from two one-thousandths of an inch to twenty thousandths of an inch and greater, the abutting or active surfaces of the rings 49, 50 become worn, and particularly for high speeds of from 300 R. P. M. and upwards, so that the adjustment of the adjustable grinding ring 50 relative to the fixed grinding face 40 serves also to compensate for such wear of the grinding surfaces.

Preferably, the effective surfaces of the rings 49, 50 are smooth, particularly when employed within homogenizing range of the gap. When my mill is employed for wider gaps, and in other instances, the rings may be provided with grooved or other non-smooth effective surfaces.

In the form of my mill as illustrated in the drawings, two driving motors are employed; the shaft of one motor is operatively connected with the shaft 14 and the shaft of the other motor operatively connected with the shaft 13. Preferably, each connection of the mill shafts with its motor shaft is by means of a coupling which provides for axial play between the motor shaft and its driven rotor shaft. Thus, as is illustrated in Fig. 1, the motor shaft designated 75 is keyed axially in one opening 76 of the two-part clamping coupling 77 and the outer end of the rotor shaft 13 is keyed in the other opening 78 of the coupling 77; the openings 76, 78, are respectively of diameters substantially of the respective coupled shafts 75, 13, and are disposed in axial alignment and substantially concentric with one another, the depths of the openings 76, 78 being sufficient to provide a clearance 79 for sufficient play between the ends of the shafts 75, 13. The two halves or parts of the coupling 77 are clamped to one another and to the respective shafts 13, 75, by the sets of bolts 80.

The coupling for the shaft 14 with the shaft of its motor, also designated 77, and indicated at the left-hand side of Fig. 1, is of similar construction.

By reason of the coupling 77 between the motor shaft 75 and the substantially fixed rotor shaft 13, the clearance 79 between the ends of the shafts may be set for a low spacing, and for the adjustable shaft 14 and its driving motor shaft, a larger clearance may be provided. When adjustment is made be-

tween coupled shafts, the screws of the clamping bolts 80 of the coupling 77 are loosened, to permit the shaft 14 to be freely moved axially of its length to attain desired setting, after which the bolts 80 of its coupling 77 are tightened.

I also provide an outlet for my mill for the removal of any sediment or other foreign substance, which may be in the form of a passage 81, see Figs. 1 and 2, disposed, say, within the casing section 10^b and extending downwardly and laterally to the discharge opening 82 having a plug 83.

The operation of my mill will be largely understood from the foregoing description.

Upon feeding the material to be treated, usually by means of a threaded pipe meshing with the threading of the inlet 44, the material is led to the region 45, see Figs. 1 and 2, peripherally exteriorly of the two annular rotor faces 49, 50, in advance of the entry of the material between the effective surfaces of the rings 49, 50. The treated material accumulates within the space between the body portions of the rotor members 15, 16 and is discharged through the hollow passage 56 of the hollow shaft 13, then through the openings 57 into the interior of the discharge housing 58, and thence through the outlet 59 through suitable piping leading to a tank or other reservoir for the treated material.

When my mill is employed for homogenizing gaps, pressure on the material in advance of its flow between the rings 49, 50 is required; such pressure may be had by a stand pipe for providing hydrostatic pressure or by means of a centrifugal or other pump for positively feeding the material under pressure into the inlet 44 of the mill.

The annular rings 49, 50, are provided as sets of two each, having substantially the same outer diameter but of different inner diameter, to thereby regulate the effective area and consequent time period of treatment of the material.

When it is desired to cleanse my mill, the supply piping to the inlet 44 may be disconnected; the nuts 31, 32 of the respective lower clamping bolts 29 are removed and the nuts 46 of the upper clamping pins 40 removed. The packing rings 19 and the union 25 are now removed, whereupon the two halves 10^a, 10^b of the casing 10 are readily separated from one another to fully expose all the surfaces of the same for cleansing. When the casing sections have been disassembled the rotor members with their emulsifying or homogenizing surfaces are also fully exposed for cleansing and inspection.

The removable feature of the emulsifying or homogenizing rings permits another set of rings of desired inner diameter and desired increased or decreased surface area to be substituted.

The removable mounting of the emulsify-

ing or homogenizing rings also attains the advantage of forming the body or other portions of cast steel and the rings of Monel or other hardened steel or other preferred material.

It will be observed that the construction of the casing sections, preferably abutting in a vertical plane, and jointly secured to one another and supported on a common base, enables the sections to be readily uncoupled for cleansing or inspection or substitution and readily assembled into sealed relationship.

Such common base construction preferably embodies or has integral therewith the bearings for the rotor shafts and the discharge housing thereby insuring accuracy and permanency of the relative rotation of the effective faces of the rotors at the gap to which the rotors are set.

The operation of my device will be understood largely from the foregoing description. The extent or width of the gap is determined by the nature of the treatment desired and dependent upon the character of the material treated. For grinding purposes the effective faces of the rotors may be non-smooth, whereas smooth faces are advantageous for emulsifying and homogenizing the material in film status, particularly at high speeds of relative rotation between the rotors and their narrow gaps. To determine the extent or width of the gap, the adjusting ring 62 is rotated, in the proper direction to cause the effective faces of the rotors to become in engagement, which sets the zero "reading." The adjusting ring 62 is turned in the opposite direction for the number of openings 69 corresponding to the extent or width of the gap desired. The arcuate spacing of the opening 69 determines the extent or width of the gap in terms of the pitch of the threading of the adjusting ring 62. Upon wear of the effective faces, which is substantially uniform over the effective area, the zero "reading" is correspondingly changed, and the same procedure of setting is carried out.

Whereas, I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. In a mill, the combination of a casing, a plurality of elements disposed in said casing and having co-operating surfaces adapted for emulsifying, grinding or homogenizing, shafts respectively for said elements, one of said shafts having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the ma-

material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

2. In a mill, the combination of a casing, a plurality of elements disposed in said casing and having co-operating surfaces adapted for emulsifying, grinding or homogenizing, shafts respectively for said elements, one of said shafts being disposed substantially horizontally and having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

3. In a mill, the combination of a casing, a plurality of elements disposed in said casing and having co-operating surfaces adapted for emulsifying grinding or homogenizing, shafts respectively for said elements, one of said shafts having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, means co-operating with said hollow shaft portion for the discharge of the treated material from said casing, means for rotating said shafts and means connecting said rotating means with said certain one shaft for providing axial adjustment between said certain one shaft and said rotating means.

4. In a mill, the combination of a casing, a plurality of elements disposed in said casing and having co-operating surfaces adapted for emulsifying, grinding or homogenizing, shafts respectively for said elements, one of said shafts having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, means co-operating with said hollow shaft portion for the discharge of the treated material from said casing, separate means for rotating said shafts and means disposed between said certain one shaft and its rotating means for providing axial adjustment between said certain one shaft and its rotating means.

5. In a mill, the combination of a casing, a plurality of elements disposed in said cas-

ing and having co-operating surfaces adapted for emulsifying, grinding or homogenizing, shafts respectively for said elements, one of said shafts being disposed substantially horizontally and having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, means co-operating with said hollow shaft portion for the discharge of the treated material from said casing, separate means for rotating said shafts and means disposed between said certain one shaft and its rotating means for providing axial adjustment between said certain one shaft and its rotating means.

6. In a mill, the combination of a casing, a plurality of rotors disposed within said casing, annular surfaces respectively carried by said rotors and co-operating with one another for emulsifying, grinding or homogenizing material to be treated, shafts respectively for said rotors, one of said shafts having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

7. In a mill, the combination of a casing, a plurality of rotors disposed within said casing, annular surfaces respectively removably carried by said rotors and co-operating with one another for emulsifying, grinding or homogenizing material to be treated, shafts respectively for said rotors, one of said shafts having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

8. In a mill, the combination of a casing, a plurality of rotors disposed within said casing, annular surfaces respectively carried by said rotors and co-operating with one another for emulsifying, grinding or homogenizing material to be treated, shafts respectively for said rotors, one of said shafts being disposed substantially horizontally and having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in

parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

9. In a mill, the combination of a casing, a plurality of rotors disposed within said casing, annular surfaces respectively removably carried by said rotors and co-operating with one another for emulsifying, grinding or homogenizing material to be treated, shafts respectively for said rotors, one of said shafts being disposed substantially horizontally and having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

10. In a mill, the combination of a casing, said casing being formed of sections abutting one another substantially in a vertical plane, a plurality of elements disposed in said casing and having co-operating surfaces adapted for emulsifying, grinding or homogenizing, shafts respectively for said elements, one of said shafts being disposed substantially in a horizontal plane and having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

11. In a mill, the combination of a casing, said casing being formed of sections abutting one another substantially in a vertical plane, each casing section having hollow walls for the flow therethrough of a temperature controlling medium, a plurality of elements disposed in said casing and having co-operating surfaces adapted for emulsifying, grinding or homogenizing, shafts respectively for said elements, one of said shafts being disposed substantially in a horizontal plane and having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

charge of the treated material from said casing.

12. In a mill, the combination of a casing, said casing being formed of sections abutting one another substantially in a vertical plane, each casing section having hollow walls, means connecting said hollow walls with one another for the flow therethrough of a common temperature controlling medium, a plurality of elements disposed in said casing and having co-operating surfaces adapted for emulsifying, grinding or homogenizing, shafts respectively for said elements, one of said shafts being disposed substantially in a horizontal plane and having a hollow portion extending to a region within said casing between said elements, means for rotatably mounting said shafts in parallel relation in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

13. In a mill, the combination of a casing, said casing being formed of sections abutting one another substantially in a vertical plane, a plurality of elements disposed in said casing and having co-operating surfaces adapted for emulsifying, grinding or homogenizing, shafts respectively for said elements, one of said shafts being disposed in substantially a horizontal plane and having a hollow portion extending to a region within said casing between said elements, the remaining shaft being substantially in alignment axially with said one shaft, means for rotatably mounting said shafts in said casing, means for axially adjusting one of said shafts, means for leading the material to be treated to a region in said casing peripherally exteriorly of said elements, and means co-operating with said hollow shaft portion for the discharge of the treated material from said casing.

In testimony whereof I have signed this specification this 24th day of June, 1927.

WILLIAM EPPENBACH.