June 8, 1937. S. K. NESTER 2,083,171

ADJUSTABLE COLLOID MILL STATOR

Original Filed Aug. 27, 1930

FIG. 2.

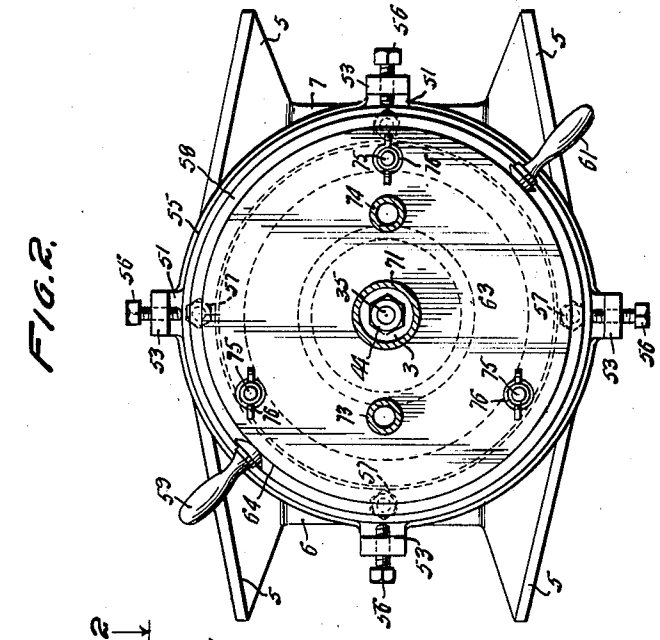
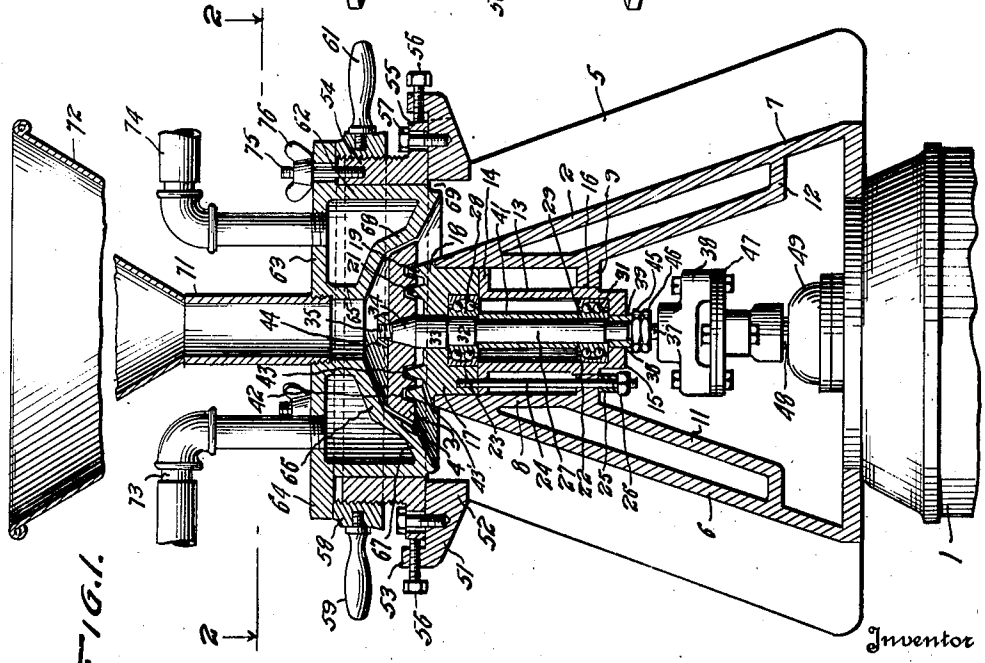


FIG. 1.



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ADJUSTABLE COLLOID MILL STATOR

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9 Claims. (Cl. 83—13)

This invention relates in general to disintegrating machinery and more particularly has reference to a colloid mill.

The present application is a continuation in part of my copending application Serial No. 231,040 filed November 4, 1927 for Colloid mills. The stator shown in my pending application is axially adjustable through vertical movement by rotation in a horizontal plane. The stator in the present application is further adjustable in a plane perpendicular to the axis to provide for centering of the stator with respect to the rotor.

It will be appreciated that in the operation of a colloid mill, where the rotor and stator surfaces are closely spaced, that the fine adjustment of the spacing between the stator and rotor surfaces must be maintained in order to insure the efficient disintegration of the material fed into the mill. Previous to this time it has been difficult, if not impossible, to maintain this fine adjustment as heat generated by the mill in operation has often had a tendency to warp either the rotor or stator surfaces, and wearing of the bearings carrying the rotor as well as the thrust of the rotor in operation, disturbing the adjustment. The axial adjustment of the stator surface with respect to the rotor through vertical movement of the stator by rotation in a horizontal plane, shown in my copending application, has made it possible to compensate for changes in the axial adjustment of the stator and rotor surface, and to change the spacing between the same for treatment of different materials.

In the past, however, no provision has been made for centering the stator with respect to the rotor if the axes of the same become disaligned. The inestimable advantage of providing for this adjustment of the rotor and stator in the plane perpendicular to the axes of the same will be apparent. Unless the axes of the rotor and stator surfaces coincide, a mill will be totally inoperative in that the surface is usually so fine that the slightest disalignment of the axes of the same will often cause actual contact of the surfaces. It not only renders the mill inoperative but is liable to cause irreparable damage to the rotor and stator elements.

An object of this invention is to provide a colloid mill in which the rotor and stator elements may be adjusted with respect to one another in a plane perpendicular to the axes of the same.

Another object of this invention is to provide a colloid mill in which the axes of the stator may be adjusted with respect to the axes of the rotor and a plane perpendicular with the axes.

A further object of this invention is to provide a colloid mill in which the alignment of the axes of the rotor and stator elements may be maintained.

With these and other objects in view, which may be incident to my improvements, the invention consists in the parts and combination to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising my invention may be varied in construction, proportions and arrangement without departing from the spirit and scope of the appended claims.

In order to make my invention more clearly understood, I have shown in the accompanying drawing, means for carrying the same into practical effect without limiting the improvements in their useful applications to the particular constructions which, for the purpose of explanation, have been made the subject of illustration.

The colloid mill shown in my copending application, as hereinbefore set forth, includes provision for axial adjustment of the stator with respect to the rotor through vertical movement of the stator by location in a horizontal plane.

The colloid mill, shown in my copending application also provides for a constant unidirectional thrust on the rotor so that pressure between the rotor and stator surfaces, the operation provides for resultant changes in the direction of the force of gravity, thus eliminating the disturbance of the adjustment encountered in previous mills where the resultant force caused by the pressure between the rotor and stator surfaces has been opposed to the force of gravity on these elements; firm fixing of the rotor for rotation in a predetermined fixed relation to the supporting frame, for compensating for wear in the rotor bearings and for more equal adjustment of the rotor and stator surfaces; removal of the rotor assembly without dismantling of the mill for cleaning and inspection; cooling of the stator surface and the construction of the rotor of material not affected by heat, for maintaining the rotor and stator surfaces at predetermined temperatures and through the elimination of the expanding or contracting of the elements due to temperature changes, if any changes in clearance between the rotor and stator surfaces; feeding the materials undergoing treatment by the force of gravity and providing for unimpeded exit of the materials operated upon to insure the uninterrupted passage of the same from the mill to prevent crash of a head often heretofore retarding the passage of materials fed into the mill.

My present invention may include all of these features and provides an addition for the adjustment of the stator surface and a plane perpendicular to the axes of the stator and rotor to allow for centering of the same in the event that the axes of the rotor and stator worked out of alignment.

In the drawing forming a part of this specification:

Fig. 1 is a sectional view of the mill showing the rotor and stator elements.

Fig. 2 is a plane view partly in section taken on line 2—2 of Fig. 1.

Referring more particularly to the numerals to the drawing, my mill comprises a rotor casing 1 suitably mounted on a supporting surface on which is superimposed a frame 2, carrying a rotor 3 and supporting a stator 4.

The frame 2 is formed with a plurality of fins 5. The fins, as shown in Fig. 2, consist of obliquely inclined uprights forming spillways 6 and 7 on the walls of the frame 2 frusto-conical in form. The frame is provided in addition with downwardly extending, integrally formed cylindrical neck 8 terminating at an integral bottom 9 and having an integral extension 11 frusto-conical in form parallel with the walls of the frame 2 terminating in a horizontal angular flange 12, integrally connected to the inner surface of the frusto-conical frame 2.

A cylindrical housing 13, having an integral top outwardly extending horizontal flange 14, is fitted in the neck 8 with the rim of the flange 14 contacting therewith. The casing 13 is formed with an integral bottom 15, and is adapted to extend through a central aperture provided in the bottom 9 of the neck, the periphery of the casing 13 being formed with an integral peripheral portion of increased diameter 16, fitting within the aperture in the bottom of the neck 8. A cylindrical block 17 having a shoulder 18 formed on the top and an annular extension 19, having the outer wall in alignment with the wall of the frusto-conical casing 2, is fitted in the top of the cylindrical neck 8 with the shoulder 18 resting on the rim thereof, the size of the extension 19 forming a continuation of the side walls of the frame 2. The top face of the block 17 is further provided with an annular bead 21 corresponding in form to the extension 19, above the plane of the face of the block. The beads are adapted to prevent the material operated upon from working into the top bearing and interfering with the operation of the mill.

A lower outer ball race 22 is fitted in the casing 13 on the bottom 15, and a top outer ball race 23 is fitted in a centrally formed seat provided in the bottom of the cylindrical block 17, against which is fitted the flange 14 on the casing 13.

In this connection it will be particularly noted that the top, outer, ball race 23 is of greater diameter than the opening in the casing 13, so that the inner edge of the flange 14 fits thereagainst and holds the same seated in the recess formed in the block 17. The casing 13 is fixed to the block 17 by a series of bolts 24, having their top ends extending through apertures provided in the flange 14 of the casing, and screwed in threaded apertures in the bottom of the block 17, and the bottom ends extending through apertures in the bottom 9 of the neck 8, fitted with collars 25 and the ends threaded receiving nuts 26. The tops of the collars fit against the lower surface of the bottom 9 and the bottom 9 of the portion of increased diameter around the periphery of the casing 13.

A spindle 27 is fitted in top and lower, inner ball races 28 and 29 within the outer races 22 and 23 with a plurality of pairs of ball bearings 31 interposed therebetween. The inner faces of the top and lower, outer ball races are formed with a central annular groove and the top and bottom inner ball races with a pair of annular grooves each for receiving the pairs of ball bearings. The configuration of the grooves in the outer ball race for receiving both pairs of ball bearings, is adapted to equalize the thrust so as to prevent vertical movement of the spindle.

The spindle is formed with a portion of increased diameter 32 on its periphery adjacent the top, fitted in the top, inner ball race 28 and a further portion 33 of increased diameter on its periphery operating in a central aperture provided in the block 17, the portion 33 of the spindle adjacent the top face of the block being tapered as at 34 and terminating in a threaded extension 35. The bottom of the spindle is fitted in the lower, inner ball race 22 and is formed with a reduced extension 36 extending through an aperture provided in the bottom 15 of the casing 13, and a further reduced extension 37 having the end connected to a coupling piece 38.

The reduced portion 36 of the spindle operates in a sleeve 39 fitted in the aperture in the bottom 15 of the casing 13. The body portion 27 of the spindle operates in a sleeve 41 acting as a spacer for the top and lower ball races.

The rotor 3 is formed with a pair of concentric annular grooves 42 and 43, adapted to fit over the annular beads 19 and 21 formed on the block 17, out of contact therewith, the rotor being further provided with a central frusto-conical aperture adapted to receive the tapered extension 34 on the spindle, and secured on the spindle by a nut 44 screwed on the threaded extension 35. A series of sloping holes 43' may be drilled through the bead 42 to allow drainage of any material collected between the beads. The rotor is preferably keyed to the spindle to prevent relative movement therebetween. The reduced extension 37 on the lower part of the spindle is threaded for receiving a pair of nuts 45 and 46, and the end of the extension is connected in the coupling piece 38 by a sliding key. In this manner the spindle may be withdrawn from the coupling piece but with the key registering with the vertical slot in the journal of the coupling piece, relative movement therebetween will be prevented. It will be apparent that by thus connecting the spindle to the coupling piece that the rotor assembly may be easily removed from the framework by removal of the nuts 26 threaded on the bolts 27 allowing the block 17 and the casing 13 to be lifted out and the reduced portion 37 of the spindle withdrawn from the journal in the coupling piece 38.

The rotor assembly is so constructed that the spindle will be firmly held against all movement except rotation in a horizontal plane. Downward movement of the block 17 is prevented by the shoulder 18, formed integral with the same engaging the rim of the frame wall 2. Upward movement of the block, and upward or downward movement of the casing 13 is prevented by the bolts 24, fixed in the bottom face of the block and held to the bottom 9 of the neck 8, integral with the casing by the collars 25 at bolts 23, the collars engaging the bottom edge of the portion

of increased diameter 16, formed on the periphery of the casing 13.

The downward movement of the spindle is prevented by the lower edge of the portion of increased diameter 33 resting on the upper face of the top inner ball race 28, and the lower edge of the body portion of the spindle 27, resting on the top of the sleeve 39. The top outer ball race is held in the seat in the bottom face of the block 17 by the rim of the casing 13, and the inner top and bottom ball races, spaced as previously mentioned by the sleeve 41. Upward movement of the spindle is prevented by the nut 45 engaging the lower portion of the sleeve 39, upward movement of which is prevented by contact with the bottom of the lower inner ball race 29, adapted to be locked by the nut 46.

The coupling piece 38 is bolted to an adjacent coupling piece 47. The coupling piece 47 is keyed to a shaft 48 which may be an extension of, or connected to, the drive shaft of the motor mounted in the casing 1, for driving the rotor.

An annular, outwardly extending, horizontal, flange 51 is formed integral with the top of the upright supports 5, constructed integral with the walls of the frame 2. The lower portion of the flange 51 is reinforced by a portion of increased thickness tapered inwardly and downwardly as at 52, while the rim of the flange is formed with an integral, annular, vertical projection 53, the collar 54 having a bottom outwardly extending, horizontal flange 55, formed integral therewith, is seated on the top of the flange 51, the rim of the flange on the collar 54 being spaced from the inner rim of the bead on the flange 51 so that longitudinal movement of the collar with respect to the flange is allowed within the confined space between the inner edge of the bead 53, and the rim of the flange 55, although the collar 54 and the flange 52 are substantially concentric.

The periphery of the bead 53 is provided with a series of horizontal, threaded apertures for receiving set screws 56 for positioning the axis of the collar 54 with respect to the axis of the frame, by contact of the ends of the screws with the edge of the flange 55, formed on the collar resting on the top of the flange 51, formed concentric with the frame. The flange 55 on the collar 54 is provided with a series of vertical slots through which bolts 57 are adapted to be fitted for engaging threaded apertures provided in the top face of the flange 51 on the frame. The bolts 57 are intended to hold the collar 54 in place on the flange 51 after the position of the collar has been determined by the seated screws, the slots in the flange 55 being of sufficient dimension to allow relative movement by the collar of the flange 51 without removal of the bolts 57. The outer periphery of the collar 54 is threaded for receiving a threaded ring 58 having horizontal handles 59 and 61, provided with reduced threaded extensions screwed in oppositely disposed threaded apertures provided in the periphery of the collar 54. The stator 4 is adapted to be inserted in the collar 54. In this connection it is to be observed that the inner periphery of the collar is of slightly smaller dimensions than the inner rim of the flange 51, so that while the body portion of the stator fits flush with the inner walls of the collar, the portion extending below the lower rim of the collar is spaced from the inner edge of the flange 51.

The stator 4 is formed with side walls 62 cylindrical in form, adapted to fit against the inner wall of the collar 54 and a top 63 provided with an outwardly extending flange of increased thickness 64, adapted to normally rest on the top of the ring 58 screwed on the collar 54. The top 63 is provided with a central threaded aperture terminating in a downwardly extending, cylindrical neck 65. The bottom of the neck is formed with an integral outwardly extending flange 66, and the bottom of the side walls of the stator with an inwardly extending, angular flange 67 parallel to the flange 66, formed on the neck. The edges of the flanges 66 and 67 are connected by an integral piece 68 angularly positioned with respect to both flanges and with respect to the horizontal, presenting an outer face normally parallel to the face of the rotor 3 in cross section, adapted to provide a stator surface adjacent to the rotor surface. The bottom edge of the walls of the stator, and the lower rim of the flange 67 is cut away as at 69 to further space the portion of the stator extending below the collar 54 from the inner wall of the flange 51.

A conduit 71, provided with threaded ends, is screwed in the threaded aperture in the top 63 of the stator, communicating with the neck 65. An opening 72 is attached to the top of the conduit for admitting material to the mill. The top 63 of the stator is further provided with a pair of oppositely disposed threaded apertures for receiving the threaded ends of inlet and outlet lines 73 and 74 for permitting the circulation of a cooling fluid in the chamber formed in the stator by the top 63, the side walls 62, integral with the flange 67, the stator surface 68, the end of the flange 66 integral with the neck 65, formed integral with the top 63.

The flange 64, formed on the stator, is held on the top of the collar 54 by a plurality of bolts 75 having threaded ends screwed in threaded apertures provided on the top of the collar and extending through slots provided in the flange 64, secured by thumb nuts 76. By removal of the thumb nuts, the stator may be lifted from the collar 54 without disturbing the axial adjustment of the collar through the two screws carried by the bead 53 on the flange 51 of the frame, with respect to the axis of the frame which is coincident with the axis of the rotor.

The operation of my invention will be readily understood. The spindle assembly is mounted in the frame 2 as has already been fully described, the reduced extension provided with a key on the end of the spindle being inserted in the journal of the coupling piece 38 to register with the slot therein. The nut 45 on the reduced extension of the spindle is then screwed up against the sleeve 39 and locked by the nut 46 to insure against vertical movement of the spindle, the nut 26 having been screwed up on the bolts 24 to fix the bearing assembly in place. With the rotor thus mounted on the frame the stator is inserted in the collar 54 and centered by loosening the bolts 57 holding the flange 55 of the collar 54 on the face of the flange 51 so that by manipulation of the seated screws 56, the axis of the stator may be made to coincide with that of the rotor. When the longitudinal relation of the stator to the rotor is thus adjusted, bolts 57 are tightened to fix the longitudinal position of the stator by preventing movement of the collar with respect to the flange 51 of the frame.

The clearance between the stator and the rotor is controlled by the ring 58, carrying the stator, screwed on the collar 54. By screwing or unscrewing the ring, the stator is lowered or raised

to provide the desired clearance between the stator and the rotor, the thumb nuts 76 being unscrewed to allow vertical movement of the stator with respect to the collar 54. When the position of the ring on the collar has been adjusted to provide the desired clearance between the stator and the rotor, the nuts 76 are tightened to prevent relative vertical movement between the stator and the collar.

The stator having been centered with respect to the flange 51, and the clearance between the stator and rotor surfaces having been determined by the relative vertical movement between the stator and the collar, the collar is locked on the frame by the bolts 57, and the stator on the collar by the nuts 76. The motor is then set in operation to drive the rotor and the material introduced into the hopper. A cooling fluid is circulated in the cavity provided in the stator to the inlet and outlet lines 73 and 74 to equalize the temperature of the stator and prevent expansion or contraction of the same.

The mill is so constructed that the material fed between the rotor and stator surfaces and finding exit down the spillways is unimpeded in its travel so that no head will be created to impede the flow. The surfaces are, moreover, continuous and do not present any crack or crevices for collection of the material. Backing of the material passing between the rotor and stator surfaces under the rotor is prevented by the beads provided on the top of the block registering in outlet grooves formed in the rotor. If in the course of operation it becomes desirable to change the clearance between the rotor and the surfaces, or to center the stator with respect to the rotor, these adjustments may be made as has already been described in connection with the assembly of the mill.

There is accomplished by this invention a colloid mill in which the stator element may be horizontally and vertically adjusted with respect to the rotor element, and the stator and rotor element assemblies entirely removed for inspection and cleaning without necessity of dismantling the mill.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details of construction herein set forth by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art without departing from the spirit of the invention, or exceeding the scope of the appended claims.

I claim:

1. A colloid mill comprising a frame, a rotor carried thereon, a stator receiving ring positioned on the frame and firmly affixed thereto, a stator having a peripheral flange at the top, telescoped in the ring above the rotor and a band screwed on the ring engaging the flange on the stator for vertically adjusting the stator with respect to the rotor, and means to hold the stator in definite relationship to the rotor.

2. A colloid mill comprising a frame, a rotor carried thereon, a horizontally adjustable stator receiving ring positioned on the frame and firmly affixed thereto, a stator having a peripheral flange at the top, telescoped in the ring above the rotor, a band screwed on the ring engaging the flange on the stator for vertically adjusting the stator with respect to the rotor and means to fix the position of the stator with respect to the receiving ring, and means to hold the stator in definite fixed relationship to the rotor.

3. A colloid mill comprising a frame, a rotor mounted thereon, a stator receiving ring carried on the frame and firmly affixed thereto, a stator having a peripheral flange at the top telescoped in the ring, a band screwed on the ring engaging the flange for vertically adjusting the stator with respect to the rotor, means to hold the stator in definite fixed relationship to the rotor, and an aperture in the stator to admit material to the rotor.

4. A colloid mill comprising a frame, a rotor mounted thereon, a stator receiving ring carried on the frame and firmly affixed thereto, a stator having a peripheral flange telescoped in the ring above the rotor, a band screwed on the ring engaging the flange on the stator to vertically adjust the position of the stator with respect to the rotor, means to definitely hold such adjustment once it has been made, an aperture in the stator to admit material to the rotor, and spillways on the side walls of the frame for the discharge of material passing bewteen the rotor and the stator.

5. A colloid mill comprising a frame, a rotor carried thereon, a stator receiving ring positioned on the frame and firmly affixed thereto, a stator having a peripheral flange at the top telescoped in the ring above the rotor, a band screwed on the ring engaging the flange on the stator for adjusting the stator with respect to the rotor substantially along the lines of the axis of rotation of the rotor, means to hold the rotor and stator in definite fixed relationship once adjustment has been made, and means to adjust the clearance of the stator and rotor in a plane substantially at right angles to the axis of rotation of the rotor.

6. A colloid mill comprising a frame, a horizontally positioned rotor carried thereon, a stator receiving ring positioned on the frame, a hollow stator having a peripheral flange on the top telescoped in the ring above the rotor, a band screwed on the ring engaging the flange on the stator for vertically adjusting the stator with respect to the rotor, means to circulate a cooling fluid through the stator and means to adjust the clearance of the stator and rotor in a plane substantially at right angles to the fixed adjustment.

7. A colloid mill comprising a frame, a rotor, a stator receiving ring carried on the frame, a stator having a peripheral flange at the top telescoped in the ring, a band screwed on the ring engaging the flange on the stator for vertically adjusting the stator with respect to the rotor, an aperture in the stator to admit material to the rotor, and means permitting adjusting of the clearance of the stator and rotor in a plane substantially at right angles to the axis of rotation of the rotor in order to make uniform the clearance between the stator and the rotor.

8. A colloid mill comprising a frame, a rotor mounted thereon having a conical working surface, a stator receiving ring carried on the frame, a stator having a conical working surface adapted to cooperate with the working surface of the rotor, said stator having a peripheral flange, a band screwed on the ring engaging the flange on the stator to vertically adjust the position of the stator with respect to the rotor, an aperture in the stator to admit material to the rotor, spillways on the side of the frame for the discharge of material passing between the working surfaces and means to adjust the clearance of the stator and rotor by relative movement thereof in a plane

substantially at right angles to the axis of rotation of the rotor.

9. A colloid mill comprising a frame, a rotor carried thereon, a stator receiving ring positioned on the frame, a stator telescoped in the ring above the rotor and having a peripheral flange at the top, the band screwed on the ring engaging the flange on the stator for axially adjusting the stator with respect to the rotor, and means to adjust the stator receiving ring in a plane substantially at right angles to the rotor axis.

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