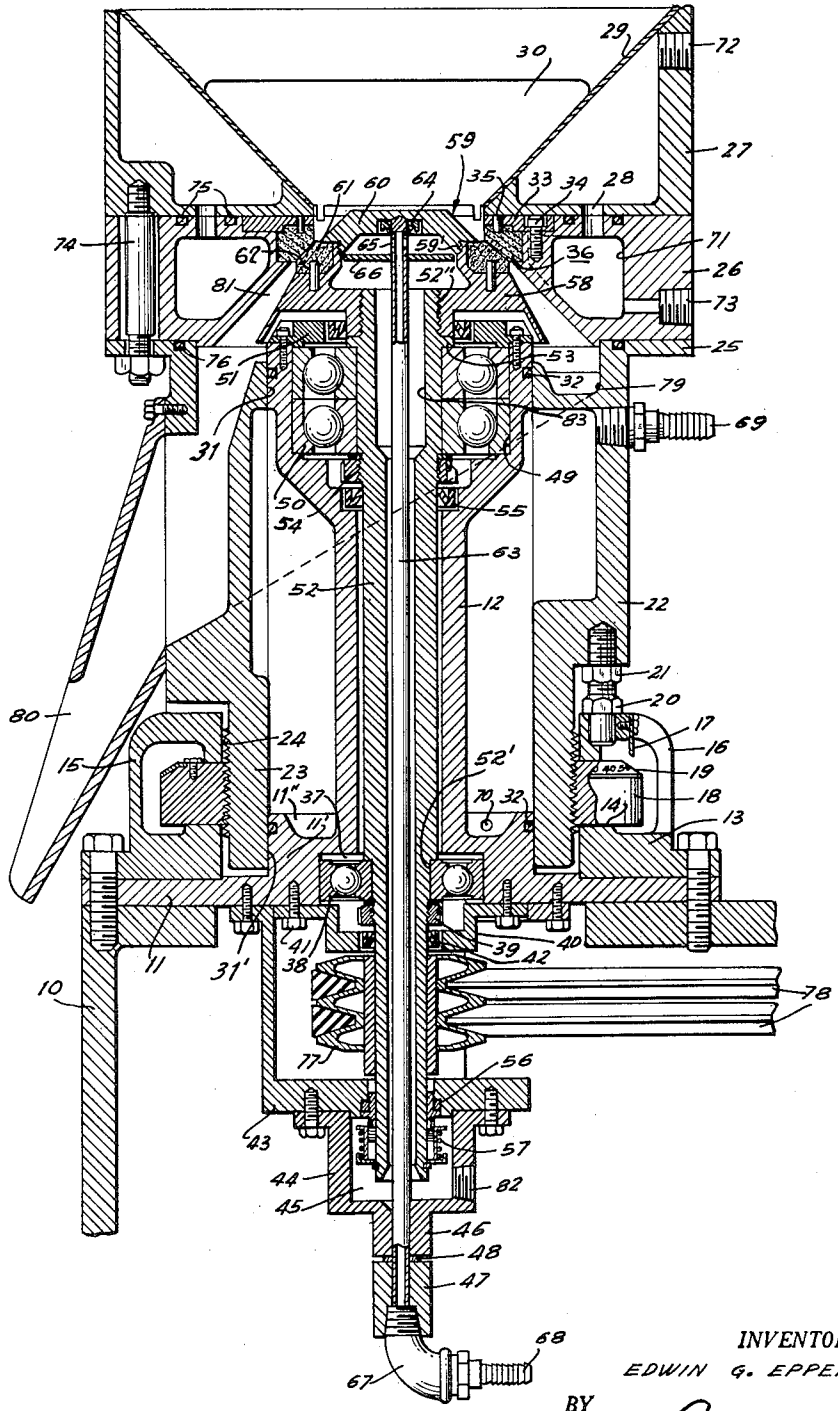
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COLLOIDAL MILLS

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COLLOIDAL MILLS

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This invention relates broadly to improvements in colloidal mills or the like, designed to disintegrate or comminute substances either in dry form or in a colloidal mixture or substances which would otherwise not be miscible in fluid suspension.

Devices for disintegrating or comminuting various substances are well known in the art and are usually designated as colloidal mills. Such known colloidal mills employ stator and rotor members designed to crush materials to substantially coarse degrees. However, in order to comminute material to the very finest degree, the cooperation between the rotor and stator must be such that their milling surfaces can be securely operated at a very close proximity to one another. The material to be milled or comminuted entering between the two surfaces, intimately contacts these surfaces, thus creating friction which results in the production of substantial heat. Such heat may become detrimental to the material to be milled. It may burn, may melt or may be spoiled. Excessive heat may also cause clogging of the mill. Consequently friction produced heat must be effectively reduced to a point at which possible damage to the material to be milled and to the milling operation is prevented.

One of the objects of the present invention is to provide a mill structure in which both the stator as well as the rotor are effectively cooled, thereby enhancing the overall efficiency of the mill.

Another object of this invention is the provision of a mill structure wherein the cooperating surfaces of the stator and rotor are not only effectively cooled but also are adjustable relative to one another so that the thinness of the movable film carrying material to be comminuted may be exactly determined to the best advantage, and wherein the adjustment of the milling elements can be fixated.

Another object of the present invention is the provision of a mill structure wherein not only the temperature of the stator and rotor can be effectively controlled, but wherein the material to be milled is kept at a desired temperature prior to the milling operation, and wherein means are provided at the place from which the material is fed to the milling elements to prevent swirling of the material or its undue accumulation prior to being fed to the rotor and stator, whereby all of the material can be effectively and uniformly cooled, prior to entering between the milling elements.

One of the specific objects of the present invention is the provision in a mill structure of a rotor having a hollow interior, and wherein means are provided to convey fluid into that hollow rotor interior, and wherein additional means are provided to spread fluid entering the rotor and directing it against the inner wall surface thereof.

The foregoing and numerous other important objects and advantages of the present invention will become more fully apparent from the ensuing description, in conjunction with the accompanying drawing.

The figure shown in the drawing represents a vertical

cross section through a typical mill structure in accordance with the present invention.

While only a single embodiment of the mill structure is illustrated, the same is intended to serve for explanatory purposes only, and it shall be quite readily understood that in the course of manufacturing the device variations and changes may have to be made to facilitate production. Such variations or changes, however, shall be deemed to be included within the broad principle of this invention as defined in the appended claims.

In more specifically describing the present invention with the aid of the drawing, numeral **10** represents a fixed base, to which is removably secured mounting disc **11** provided with a central boss or extension **11'**, from which latter extends a hollow combination shaft and bearing housing **12**. Resting against disc **11** is a nut housing **13**, having a nut resting surface **14**. At the upper hollow structure **15** of the nut housing there is a spare-out **16** and in which spare-out is mounted an indicator or pointer **17**. Resting against nut rest **14** is an adjustable nut **18** provided with an indiced scale **19** opposite indicator **17**. Mounted at the upper face of housing **16** are adjusting studs **20** provided with lock nuts **21**.

In engagement with the outer surface of central boss **11'** is the lower hollow portion **22** of the stator support. Its lowermost end **23** is reduced and is provided with an external thread **24** which is engaged by adjusting nut **18**.

The upper end of stator support portion **22** terminates in an annular flange **25**, upon which rests the hollow upper portion **26** of the stator support, and upon the latter rests a hollow angular hopper structure **27**. Upper stator support **26** and hopper structure **27** are interconnected with one another by means of drill holes **28**. The angular portion of the hopper structure is water-tightly covered by a funnel **29** and within that funnel there is located a swirl arrester **30**, which latter, while shown stationary, may be rendered movable by suitable means, not shown. This swirl arrestor is intended to prevent material from unduly accumulating at different areas of funnel **29**.

The interior upper end of the stator support portion **22** engages the top end of combination shaft and bearing housing **12** as indicated at **31**. The interior surface at the lower end of stator support portion **22** engages the outer surface of boss **11'** at **31'**. The surfaces of the upper end of housing **12** and of boss **11'** engaged by the interior surfaces of the lower stator support portion **22** are provided with sealing rings **32**.

Between hopper structure **27** and upper stator support **26** is mounted a stator holding ring **33** which is fixedly held in position by screw **34**, securing it against upper stator support **26**. In this ring are also provided stator holding pins **35**. Held between ring **33** and a lip formation provided in upper stator support portion **26**, is stator element **36** which may be of any suitable construction but preferably is either of stone or is of a ceramic structure.

The lower interior end of boss **11'** is provided with a bearing-receiving recess **37** in which is mounted a bearing **38** held in position by lock nut **39**. Covering nut **39** and bearing **38** is a cap **40** secured by way of its flange and screws **41** to disc **11**. Within cap **40** there is provided a sealing ring **42**.

Depending from disc **11** is a pulley or drive housing **43**, and secured at the lower end of that housing is a rotary seal housing in the form of a cap **44** forming a hollow chamber **45**. Cap **44** is provided with a central extension **46** and below that extension is shown the cross section of a yoke **47** which is attached to extension **46** (not illustrated). Between the yoke and extension **46** there is a gasket **48**.

At the upper end of the combination bearing and shaft

housing 12 there is provided a recess 49 in which is mounted a thrust bearing 50, held in place by an annular cover 51 secured to the upper end of housing 12.

Passing through combination shaft and bearing housing 12 is a hollow rotor shaft 52, the upper end of which is provided with a flange 53, against which seats bearing 50. Below the bearing, shaft 52 is recessed and threaded and its threaded portion is engaged by lock nut 54 which holds bearing 50 in place. Just below lock nut 54 housing 12 is recessed to receive a sealing ring 55.

The lower end of shaft 52 is recessed at 52', and against that recessed portion is seated bearing 38, which is engaged by lock nut 39. The reduced end of shaft 52 passes through pulley housing 43 and into chamber 45 formed in cap 44. A suitable gasket 56 is held under tension by spring 57 and seals the opening through which the reduced end of shaft 52 passes into chamber 45.

The upper end of hollow shaft 52 is threaded at 52'' and is engaged by the lower portion 58 of rotor head 59. The rotor head is hollow and its upper end 59' is threaded to accommodate upper hollow rotor head portion 60. Between the latter and the lower rotor head portion 58 is mounted a rotor element 61, secured against rotation relative to the rotor head by pins 62 extending from head portion 58 into element 61. Rotor element 61 is again preferably made of stone or ceramics.

Through the hollow interior of shaft 52 extends a fluid-conveying element 63 in the form of a pipe, which is held centrally within the upper rotor head 60 by means of centering gasket 64. It is also spaced from the interior wall of hollow rotor shaft 52. Just below the centering gasket, pipe 63 is provided with apertures 65 and below these apertures is mounted a fluid-distributing disc 66. Pipe 63 passes through the full length of shaft 52 and through chamber 45 and into yoke 47 where it is fixedly held. Attached to yoke 47 is a reducing elbow 67 equipped with hose connection 68.

Referring again to the lower portion 22 of the hollow stator support, it will be noted that at its upper end is provided hose connection 69, while within the recess 11'' of boss 11' there is an aperture 70, adapted to be suitably equipped with a hose connection (not shown) similar to hose connection 69, so that cooling water can be circulated within the interior of lower stator member 22. The interior of the upper stator supporting portion 26 is hollow, as indicated at 71, which interior area is connected by means of holes 28 with the interior of hopper structure 27. It will be noted that the latter is provided with a threaded opening 72, while the upper stator support portion 26 has a threaded opening 73. These openings serve for the attachment of suitable supply conduits for fluid matter.

As will be seen at the left upper portion of the drawing, hopper structure 27 is connected to flange 25 of the lower stator support portion 22 by means of bolt 74 which not only connects these two parts, but also holds between them the upper stator support portion 26. Thus the upper stator support 26 is removably connected to the lower stator support 22 by means of bolt 74, one end of which is threaded into hopper 27. Suitable sealing rings 75 are provided between upper stator support portion 26 and hopper structure 27, and another sealing ring 76 provides a watertight seal between the lower stator support portion 22 and upper stator support portion 26.

To the lower portion of hollow shaft 52, which passes through pulley housing 43, there is secured a pulley 77 driven by means of belts 78 from any suitable power source, such as a motor, not shown.

Referring to lower stator support portion 22, it will be noted that the latter is provided with a circumferential spillway indicated at 79, terminating in an outlet spout 80. Spillway 79 is located beneath the rotor and stator discharge 81.

Referring now to hollow cap 44, it will be noted that there is provided a threaded outlet 82 to which a discharge hose, not shown, may be connected.

Operation

Depending upon the material to be milled, the spacing between the stator and rotor surfaces has to be determined. It will be seen that the rotor mounted on shaft 52 remains at its mounted position since it cannot move axially as it is held between lower bearing 38 and upper bearing 50. The adjustment between the rotor and stator is effected by the adjustability of the stator support. By rotating adjusting screw 18 on its seat 14, lower stator support 22 can be moved either upwardly or downwardly. When the proper adjustment is reached, studs 20 are adjusted and are locked by nuts 21 in adjusted position, thus holding the stator at its adjusted position. While only one of the adjustable studs 20 and lock nuts 21 are shown, there are at least three such adjusting instrumentalities provided in the present mill structure.

After adjustment the milling operation may commence, although adjusting during the milling operation may be effected if deemed necessary. Before commencement of the milling operation it is preferred that the interior of the lower stator support portion as well as that of the upper stator support portion and of the hopper are properly connected with fluid supply means. Similarly pipe 63 is connected with a fluid source by means of connector 68 and elbow 67, so that fluid passes through tube 63 and out through openings 65 against disc 66, from which it is splashed against the interior surface of the rotor head. As the fluid passes beyond the periphery of disc 66, it gathers in the enlarged interior 83 at the upper end of shaft 52 and flows through the shaft into chamber 45 from which it is discharged through a conduit connected to threaded opening 82 provided in cap 44. Thus while the mill is in operation both the stator as well as the rotor are being effectively supplied with fluid to keep them at a desired temperature, thereby preventing damage not only to the material to be milled, but to the grinding elements as well.

While the mill of the present invention is primarily designed to provide cooling fluid to the grinding elements, the same arrangement can be used for keeping these elements at any desired temperature.

As stated previously, while only a single illustration of the present mill structure is shown, and while its components are specifically described, it is obvious that in the course of producing the mill commercially, various changes and improvements may have to be incorporated to facilitate production, such changes and improvements being deemed to reside within the scope of the present invention, as defined in the annexed claims.

What is claimed as new is:

1. A mill structure comprising in combination a vertically disposed fluid-supplied internally spacious stator support composed of lower and upper members, a stator removably secured in the upper member a combination shaft and bearing housing passing through the lower stator member, a hollow rotor shaft operative in said housing, a hollow rotor head secured to said rotor shaft, a fluid-supply member spaced from the interior wall of and passing through said hollow rotor shaft and terminating with its upper end within said hollow rotor head, a fluid spreader supported by said fluid-supply member within said rotor head for directing fluid against the interior surface of the rotor head, and a calibrated adjusting nut engaging the lower end of said lower stator member for axially adjusting the latter.

2. In a mill structure, a fluid-holding internally spacious stator support, calibrated adjusting means at its lower end, a combination shaft and bearing housing in the stator support interior provided with upper and lower shaft bearings, a hollow rotor shaft operative between said bearings in said housing, a hollow rotor head mounted on said hollow shaft, a fluid supply member disposed

within, extending through and being spaced from the interior surface of said shaft, a fluid distributor secured to said fluid supply member within the hollow rotor head and adapted to direct fluid against the periphery of the interior surface of said hollow rotor head.

3. In a mill structure according to claim 2, and wherein said stator support comprises removably connected hollow lower and upper portions, a hopper mounted on the upper stator support portion, a stator holding ring between the upper stator support portion and the hopper and a stationary comminuting stator element removably secured to said ring.

4. In a mill structure according to claim 3 and wherein said hollow rotor head comprises lower and upper members, the lower member being removably connected with said hollow rotor shaft, the upper member being removably secured to the lower member, and a rotor element fixedly but removably held between the two rotor members, and means for preventing rotation of said rotor element relative to said lower rotor head member, said means extending from the latter into said rotor element.

5. In a mill structure according to claim 4, and wherein a drive housing depends from said stator support, a rotary seal housing depending from said drive housing and having a fluid-receiving chamber provided with a discharge outlet, said hollow rotor shaft passing through said drive housing and terminating within said chamber, said fluid supply member passing through said hollow shaft and extending through and beyond said rotary seal housing, and drive means for the shaft located in said drive housing.

6. In a mill structure comprising a fixed base, a mounting plate and a hollow nut housing removably secured to the base, an adjusting nut for the structure operative within the housing, said mounting plate having a central boss from which extends a combination shaft and bearing housing; a stator support composed of an internally spacious lower member and an upper member removably secured

to the lower member, said adjusting nut being calibrated and engaging said lower member to provide the latter's axial adjustment, the upper stator support member being fixedly but removably secured to said lower member, a hollow hopper removably secured to and being inter-connected with both stator support members, a stator mounting ring held between that latter member and said hopper, a stator element removably secured to said ring; a hollow rotor shaft operative within said combination shaft and bearing housing, a hollow rotor head composed of lower and upper rotor portions removably associated with said rotor shaft, a rotor element removably held between said rotor portions; a drive housing depending from said base, a fluid-receiving rotary seal housing depending from the drive housing, said seal housing having an outlet, said hollow shaft projecting through said drive housing and into said seal housing, a fluid-conveying member extending through said seal housing and into said hollow shaft and terminating at its upper end within the hollow rotor head, apertures provided near the upper end of said fluid-conveying member, and a spreader disc secured thereto beneath said apertures.

7. In a mill structure according to claim 6, and wherein the lower stator support member is provided with a peripheral spillway beneath the stator and rotor elements, and wherein said stator element is rendered adjustable relative to said rotor element by way of said stator support and said adjusting nut.

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