Jan. 2, 1962 T. A. ROZSA ETAL 3,015,393

CENTRIPETAL CLASSIFIER ROTOR DECK SELECTOR

Filed Aug. 14, 1959 4 Sheets-Sheet 1

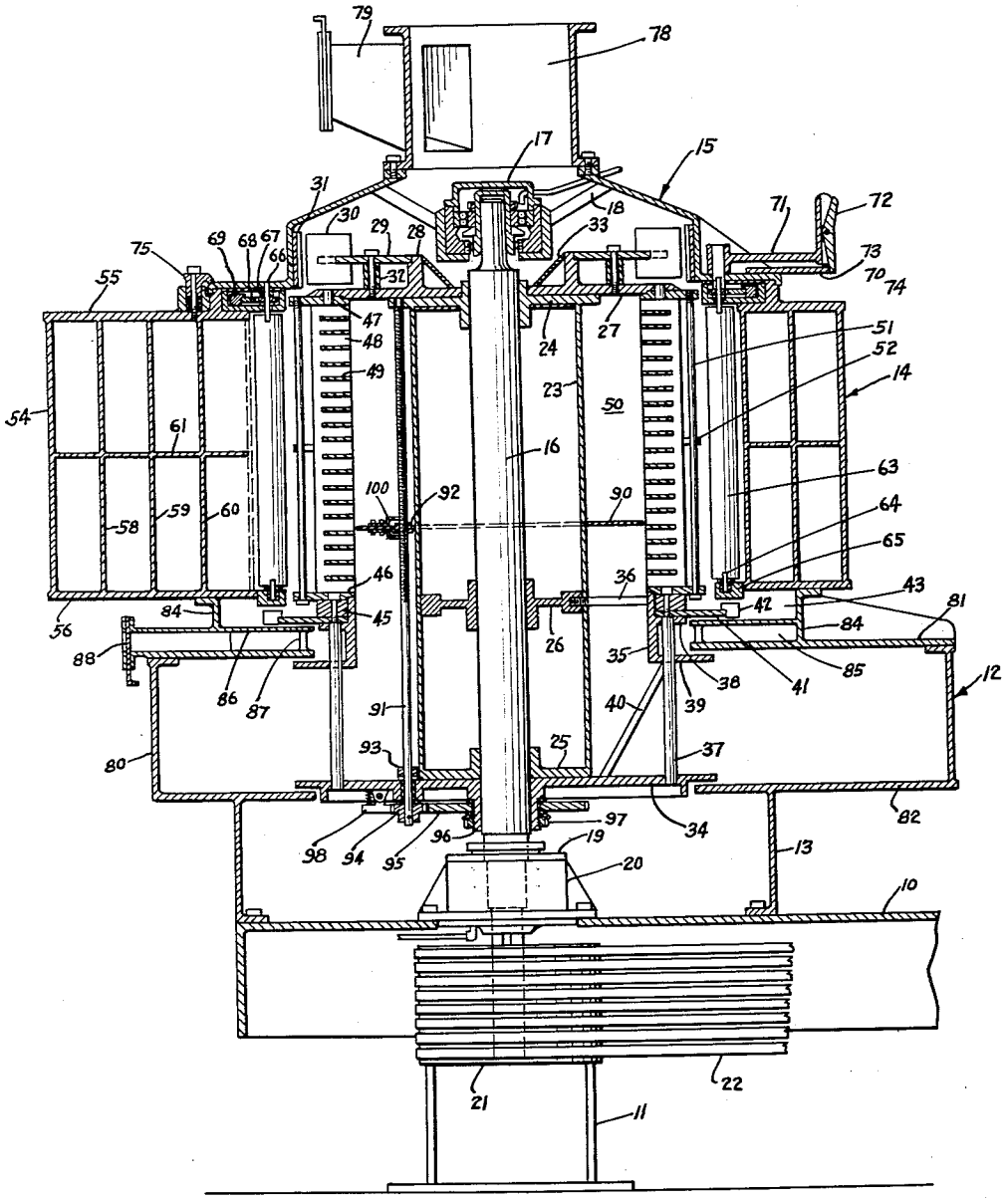


FIG. 1

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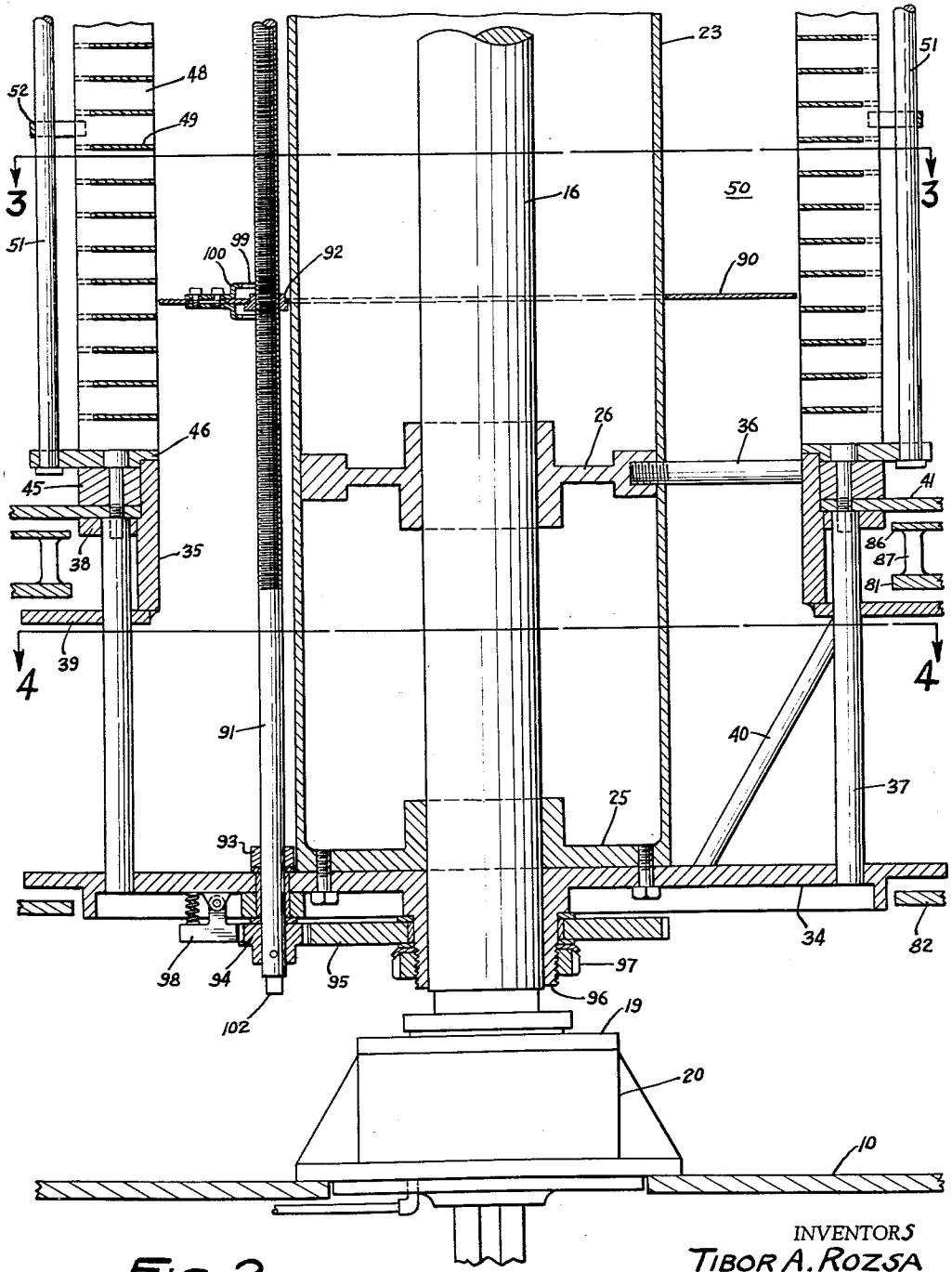


FIG. 2

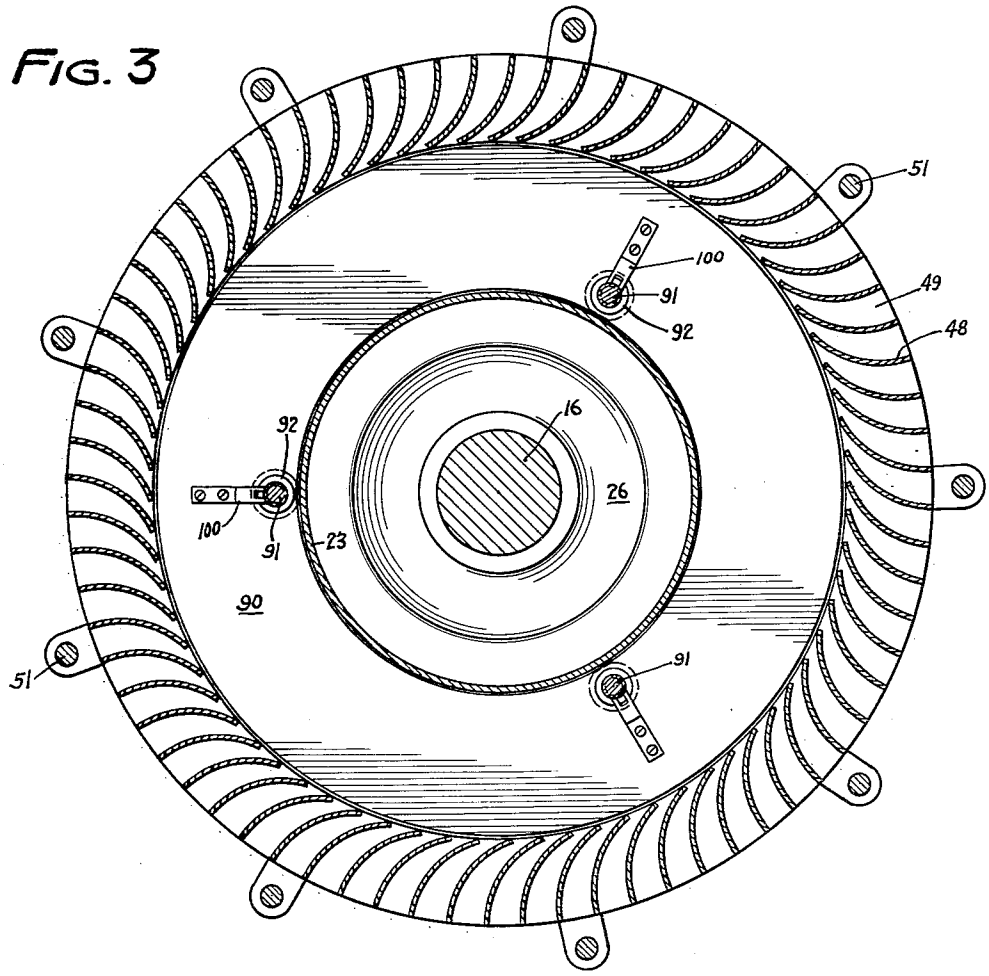
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FIG. 3



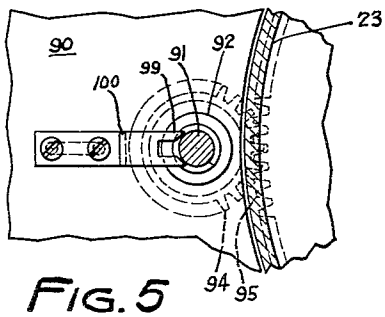


FIG. 5

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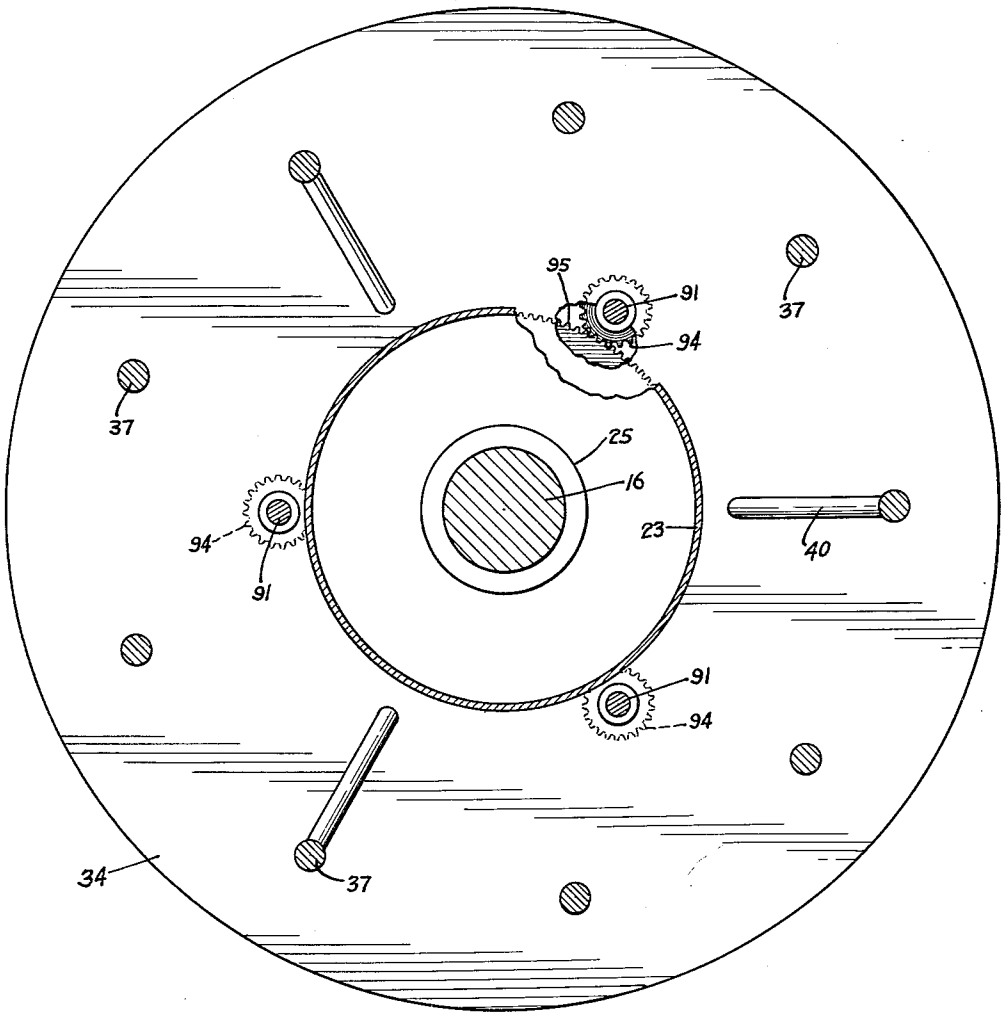


FIG. 4

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CENTRIPETAL CLASSIFIER ROTOR DECK SELECTOR

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Filed Aug. 14, 1959, Ser. No. 833,772
11 Claims. (Cl. 209—144)

This invention relates to a deck selector device for use in the rotor of certain centripetal classifier machines for varying the effective length of those rotors. More particularly, this invention relates to a deck selector means for certain peripheral inlet-axial outlet centripetal extraction classifier rotors.

In the art of grinding and classifying dry solid material in the subsieve particle sizes, there has developed a series of classifying machines utilizing a peripheral inlet-axial outlet centripetal extraction classifier rotor including a plurality of spaced apart annular elements mounted together for rotation on a shaft and including an annular axial duct defined generally by the inner peripheries of the annular rotor members. Exemplary of such classifying machines and rotors are those disclosed in United States Patent No. 2,754,967 issued to Henry G. Lykken; United States Patent No. 2,762,572 issued to Henry G. Lykken and Tibor A. Rozsa and applications for United States Letters Patent Serial No. 539,638 filed by Ralph Gracza; Serial No. 615,923, now Patent No. 2,953,307 and Serial No. 658,455, now Patent No. 2,969,191 filed by Henry G. and William H. Lykken; Serial No. 833,771 filed August 14, 1959 by the present inventors; and others.

The deck selector means of this invention is adapted for use in the annular axial ducts of the classifier rotors of the classifiers of any of those patents or applications for the purpose of increasing the versatility of the classifiers by providing means for varying the effective length of the classifying section of those rotors. The reasons for which one would desire to vary the effective length of the rotor classifying sections are, for example, to vary the capacity of the classifier machine or to vary the cut size characteristics of the classified product under a given set of operating conditions without the necessity of dismantling and modifying the machine, and the like.

A principal object of this invention is to provide means by which the effective height or length of a centripetal classifier rotor may be varied.

A further object of this invention is to provide annular deck selector means movable within the axial annular outlet duct of a centripetal classifier rotor.

Other objects of the invention will become apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, this invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

The invention is illustrated by the drawings in which the same numerals refer to corresponding parts and in which:

FIGURE 1 is an elevation, in section, of one exemplary

form of classifying apparatus having a classifier rotor incorporating the deck selector means of this invention;

FIGURE 2 is an enlarged detail elevation, in section, showing a portion of the classifying apparatus of FIGURE 1 including the portion of the classifier rotor incorporating the deck selector means;

FIGURE 3 is a horizontal section taken on the line 3—3 of FIGURE 2 and in the direction of the arrows;

FIGURE 4 is a horizontal section taken on the line 4—4 of FIGURE 2 and in the direction of the arrows, with portions broken away to show hidden structural details; and

FIGURE 5 is an enlarged horizontal section of a portion of FIGURE 3 showing in greater detail a stabilizing and thread cleaning mechanism of the rotor deck selector means.

Referring to the drawings, the vertical classifier of this invention comprises generally a base platform 10 mounted on supports 11, a fan housing 12 spaced above base platform 10 and supported by an annular plate 13, an air inlet scroll 14, whose inside periphery forms a housing for the classifier rotor, and a top cover and material feed housing indicated generally at 15. A vertical shaft 16 extends generally from the top to the bottom of the apparatus through the classifying and fan housing sections. The top end of shaft 16 is journaled in a suitable bearing structure 17 supported in a spider structure 18 mounted within the top cover and material feed housing 15. The lower end of shaft 16 is journaled in a suitable bearing structure 19 supported in a ring mount 20 on platform 10. A multiple drive pulley 21 is keyed to the lower end of shaft 16 adapting the shaft to be driven by belts 22 from any suitable motor means.

Vertical shaft 16 is enlarged and reinforced through the part of its length that extends through the classifying and fan housings by a cylindrical tube 23 supported by annular rings 24 and 25 secured to the shaft. The tube structure is reinforced by a further intermediate annular ring 26 secured to the shaft for supporting rotor elements, as described in greater detail hereinafter. An annular top plate 27 is mounted on the top annular ring 24 around the shaft. The top surface of plate 27 is provided with an annular flange 28 having a shoulder at its upper and outer edge which supports the inner periphery of an annular ring 29. The outer periphery of ring 29 is fitted with a plurality of vertical radiating blades 30 adapted to distribute material feed uniformly for introduction to the classifying zone and, in cooperation with a corrugated lining 31 of housing 15, to break up and reduce agglomerated masses of pulverulent material. Annular ring 29 is maintained rigid and stable by means of a plurality of spacer blocks 32 through which the annular ring is secured to top plate 27. A conical shield 33 is provided to prevent accumulation of material within flange 28 and possible unbalance of the rotor thereby.

An annular bottom plate 34 is disposed about the shaft 16 secured to annular ring 25. A flanged ring 35 is disposed about the shaft 16 and tube 23 between the top and bottom plates 27 and 34. Flanged ring 35 is supported in part by a plurality of radiating spline members 36 whose threaded inner ends extend through tube 23 and are secured around the periphery of the intermediate annular ring 26. A plurality of vertical pegs or rods 37 are disposed about the shaft 16 and tube 23

to form fan means in the fan housing 12. The pegs or rods 37 extend through and are supported by the upper flange 38 and lower flange 39 of ring 35 and bottom plate 34. To impart additional rigidity to the fan structure, diagonal brace members 40 are desirably used to strengthen the peg or rod members 37.

An annular ring disc 41 is supported on the upper flange 38 of ring 35. A plurality of vertical radiating blades 42 are carried by the periphery of ring disc 41 for the purpose of inducing a slight negative pressure in the annular chamber 43 below the air scroll housing 14 in which the disc and blades rotate. A heavy mounting ring 45 is disposed about the outer periphery of flanged ring 35 supported by the upper flange 38 on top of the ring disc 41. An annular end plate 46, which forms the bottom plate of the rotor classifying section, is supported by and secured to the mounting ring 45. An annular plate 47, which forms the top plate of the rotor classifying section, is supported on the bottom surface of rotor top plate 27.

The rotor classifying section supported between the bottom rotor plate 46 and the top rotor plate 47 includes a plurality of slotted vertical blade members 48 interlocked with a plurality of slotted horizontal spaced apart annular disc members 49. The inner edges of the vertical classifier blades and the inner peripheries of the horizontal classifier discs define the outer periphery of an annular chamber 50 around tube 23 which serves as an axial discharge duct through which classified fine particles are conveyed after separation by the classifying section of the rotor to the fan housing for discharge.

A plurality of vertical rod members 51 are supported between the bottom rotor plate 46 and the top rotor plate 47 to form a cage structure surrounding and spaced outwardly from the grill structure of the classifier drum formed by the vertical blades and horizontal discs. Additional rigidity is imparted to the cage structure by means of intermediate support brackets 52 spaced about the periphery of the drum structure between the classifying section top and bottom plates.

The air inlet scroll housing 14 surrounds the classifier section of the rotor and is substantially co-extensive in height with it. The air inlet housing comprises an outer scroll housing wall 54 held between a top housing wall 55 and a bottom housing wall 56. A plurality of interior vertical scroll baffle members 58, 59 and 60 disposed within the air inlet housing and extending successively lesser distances within the housing effectively divide the inner periphery of the inlet housing into a plurality of substantially equal areas to insure simultaneous and substantially equal delivery of air to all portions of the periphery of the classifier section of the rotor. One or more horizontal baffle members 61 similarly divide the air inlet housing into vertical sections to insure simultaneous and substantially equal distribution of air vertically along the classifying section of the rotor.

In order that the flow of air from the air inlet housing to the classifying section of the rotor may be uniformly directed, an annular louver curtain wall is disposed in the space between the inner periphery of the air inlet housing and the outer periphery of the classifying section of the rotor. The louver curtain wall comprises a plurality of individual louvers 63 which may be stationary or preferably, as shown in the drawings, adjustable as to pitch. The bottom end of each vertical louver element is provided with a pivot or pin structure 64 by which it is journaled for rotation in an annular ring 65 supported by the inner periphery of the air inlet housing bottom wall 56. The upper end of each louver element 63 is provided with a top pin 66.

The top pin of each louver element is provided with a small spur gear 67, each of which meshes with the teeth of a ring gear 68 journaled for rotation in a ring bearing 69 supported within a ring flange 70 on the top of the top plate 55 of the air inlet housing. One of the louver elements is fitted with a crank 71. Rotation of crank 71 causes rotation of the gear 67 which in turn causes rotation of the ring gear 68 and a corresponding rotation of each of the other louver elements. Crank 71 is provided with a pivoted latch 72 adapted to engage a notched latch plate mounted on the top housing 15. The notches in the latch plate 73 correspond to predetermined pitch angles and permit locking the louver members in the desired predetermined positions. The classifier top housing 15 rests upon the ring flange 70 on the top wall 55 of the air inlet housing 14 secured by a plurality of clamping fastening means 75 for easy removal when desired. The top housing is provided with a material feed inlet fitted with one or more feed supply ducts 79.

The fan housing 12 is in the form of a scroll housing having a vertical outer housing wall 80 held between a top housing wall 81 and a bottom housing wall 82. The top plate 81 of the fan housing is provided with a circular opening in which the flanged ring 35 of the rotor is disposed for rotation and the bottom plate 82 is provided with a similar circular opening in which the flanged bottom plate 34 of the rotor is disposed for rotation. A vertical scroll housing wall 84 extending between the top plate 81 of the fan housing and the bottom plate 56 of the air inlet housing forms the outer housing wall for both the coarse discharge chamber 43 and a pneumatic seal chamber 85. The coarse discharge chamber 43 and pneumatic seal chamber 85 are separated by a horizontal plate 86 which forms a common wall of the two chambers.

To avoid vibration of the inner peripheries of plates 81 and 86, they are desirably secured together at intervals by spacer posts 87. The pneumatic seal chamber 85 is provided with one or more dampered inlet openings 88 for controlled admission of air to the pneumatic seal chamber. The inner periphery of the pneumatic seal chamber presents the appearance of an annular slot open except where its top and bottom wall members are made rigid by posts 87. That annular slot surrosnds the rotor structure in the annular space between the bottom of ring disc 41 and the upper surface of flange 39.

The deck selector means makes it possible for the operator to utilize as much or as little of the axial height of the classifying section of the rotor as necessary or desirable for the particular operating conditions or the particular desired product characteristics. The deck selector means includes an annular ring disc 90 disposed in and adapted to be moved vertically with a sliding fit in the annular axial chamber 50 between the outer surface of shaft tube 23 and the inner periphery of the classifier drum structure. The deck selector disc 90 is supported horizontally for vertical travel within the axial duct 50 by a plurality of threaded shafts 91 disposed symmetrically about and spaced from the shaft tube 23.

The deck selector disc 90 is mounted for movement along the threaded shafts 91 by virtue of threaded collars 92 supported on or in the deck selector disc in number and position corresponding to the number and location of the threaded shafts 91. The upper end of each threaded shaft 91 is journaled for rotation adjacent the outer periphery of annular ring 24. The lower end of each of the threaded shafts 91 passes through the bottom rotor plate 34 but is held against dropping through the bottom plate by virtue of a collar 93 on the shaft immediately above the top surface of the bottom plate 34. To minimize friction bottom plate 34 is preferably provided with sleeves of bearing material in which the shafts 91 rotate and collar 93 preferably bears against a collar or washer of bearing material.

A small pinion gear 94 is keyed to the end of each of the shafts 91 which extends below the bottom plate 34. A sun gear 95 is carried by the collar or sleeve 96 extending from the bottom surface of the bottom rotor

plate 34 and is secured by a locking nut or threaded collar 97. The gear 95 is journaled for rotation with the end plate 34 and the rest of the rotor structure but at the same time is adapted for rotation with respect to the rotor for adjustment of the level of the deck selector disc. The teeth of each of the pinion gears 94 mesh with the teeth of the sun gear 95 to form a planetary gear system. Thus when the sun gear 95 is rotated relative to the main shaft 16, each of the planetary pinion gears 94 is rotated to cause rotation of the vertical threaded shafts 91. The lower end 102 of at least one of the threaded shafts is squared or otherwise provided with keying means facilitating rotation of the shafts with a crank or wrench. By virtue of the rotation of the threaded shafts, the threaded collars 92 on those shafts supporting the deck selector disc are caused to move vertically up or down along the shaft depending upon the direction of rotation and carry the deck selector disc along with them. The rotation of one threaded shaft causes uniform rotation of each of the other shafts.

When the deck selector disc is at the proper desired level, it is maintained at that level by locking one of the planetary pinion gears 94 against rotation by virtue of a locking latch means 98. When one pinion 94 is thus locked in position, the gear 95 rotates with the main shaft 16 but since there is no relative movement between the gears 95 and 94, the deck selector disc remains at the predetermined height. The deck selector disc is solid and imperforate. When it is in position, all of the classifying section of the rotor above the deck selector disc is rendered non-operating. By use of this means, the rotor capacity can be varied without dismantling the apparatus. For a given set of operating conditions, the classification cut can be varied to permit the separation of smaller or larger particles by moving the deck selector upwardly or downwardly.

Easy up and down movement of the deck selector disc in the rotor duct is facilitated by the engagement of the tines 99 of a bifurcated fork member 100 by the threads of the threaded shafts 91 for the purpose of removing any accumulated particulate material. Desirably two of the members 100 are employed with one being disposed on the upper surface of the selector disc 90 and the other disposed on the lower surface. The bifurcated ends of the thread cleaning members 100 are bent to lift the forked end out of the plane of the base but parallel to it to permit the forked end to engage the threaded shaft above or below threaded collar 92. The forked scraping member is preferably secured to the annular selector disc through a radial slot in the disc to permit adjustment of the member with respect to the threaded shaft. The ends of the tine members 99 are preferably beveled to better engage the threads of the shafts 91 and at the same time are tapered inwardly so that a portion of the periphery of the shafts is engaged between the tine members. The annular deck selector disc is maintained substantially perpendicular to the rotor axis and the forked portion of the member is parallel to the disc. Because of the pitch of the threads of the shafts, one of the tine members 99 of each of the forked members is bent slightly out of line with respect to its cooperating tine member. This causes additional tension to be placed on the threaded shafts and improves the effectiveness of the cleaning elements.

It is apparent that many modifications and variations of this invention as hereinbefore set forth may be made without departing from the spirit and scope thereof. The specific embodiments described are given by way of example only and the invention is limited only by the terms of the appended claims.

We claim:

1. In a centripetal classification apparatus comprising a housing, material inlet means to and product discharge means from said housing, air inlet means and means for inducing a flow of air through said housing, a centripetal extraction classifier rotor including a plurality of parallel spaced apart annular elements mounted together for rotation on a shaft within said housing and having an annular axial duct formed in the space between the inner peripheries of said annular members and the shaft, said axial duct being in communication with the spaces between said annular elements and said product discharge, rotor deck selector means comprising an annular disc in said axial duct perpendicular to the axis of said rotor and means associated with the annular disc for moving said annular disc axially in said duct.

2. Rotor deck selector means according to claim 1 further characterized in that said means for moving the annular deck selector disc includes a plurality of threaded shafts journaled for rotation parallel to and spaced about the rotor shaft, a plurality of threaded collar means on said shafts supporting said annular disc and means associated with the threaded shafts for rotating said threaded shafts relative to said rotor shaft.

3. Rotor deck selector means according to claim 2 further characterized in that said threaded shafts are provided with means associated therewith for rotating each of said shafts simultaneously relative to said rotor shaft.

4. Rotor deck selector means according to claim 3 further characterized in that a planetary pinion gear is keyed to each of said threaded shafts and a sun gear whose teeth intermesh with the teeth of each of said planetary gears is journaled for rotation about said rotor shaft.

5. Rotor deck selector means according to claim 2 further characterized in that scraping means associated with said threaded shafts are provided for cleaning accumulated particles from the threads of said threaded shafts during rotation of said shafts.

6. Rotor deck selector means according to claim 5 further characterized in that said scraping means includes bifurcated bar means mounted on said annular selector disc, said bifurcated bar means including a pair of spaced apart tines engaging the threads of said threaded shafts.

7. Rotor deck selector means according to claim 6 further characterized in that the tines of said bifurcated means are tapered inwardly to form a V-notch and the ends of said tines are beveled.

8. Rotor deck selector means according to claim 4 further characterized in that latch means associated with at least one of said gears are provided for locking said gears against movement relative to said rotor shaft during rotation of said rotor.

9. In a centripetal classification apparatus comprising a housing, material inlet means to and product discharge means from said housing, air inlet means and means for inducing a flow of air through said housing, a peripheral inlet-axial outlet centripetal classifier rotor including a plurality of parallel spaced apart annular elements mounted together for rotation on a shaft within said housing and having an annular axial duct in the space between the inner peripheries of said annular members and the shaft, said axial duct being in communication with the spaces between said annular elements and said product discharge, rotor deck selector means comprising an annular disc having an outside diameter smaller than the inside diameters of said rotor annular members such that said annular deck selector disc fits with a slide fit in said axial duct perpendicular to the axis of said rotor and means for moving said annular disc axially in said duct comprising a plurality of threaded shafts arrayed in the duct about the rotor shaft, each threaded shaft journaled for rotation about an axis parallel to the axis of the rotor shaft, a plurality of threaded collar means on said shafts supporting said annular disc, a planetary pinion gear keyed to one end of each of said threaded shafts and a gun gear journaled for rotation about said rotor shaft, the teeth of said sun gear intermeshing with the teeth of each of said planetary gears, whereby each

of said threaded shafts may be rotated relative to said rotor shaft simultaneously for causing axial movement of the deck selector disc.

10. Rotor deck selector means according to claim 9 further characterized in that latch means associated with at least one of said gears are provided for locking said gears against movement relative to the rotor shaft during rotation of said rotor.

11. Rotor deck selector means according to claim 9 further characterized in that scraping means are provided for cleaning accumulated particulate material from the threads of said threaded shafts during rotation of said shafts, said means including bifurcated bar means mounted on said annular selector disc, said bifurcated bar means including a pair of spaced apart tines engaging the threads of said threaded shafts, the tines of said bifurcated means being tapered inwardly to form a V-notch and the ends of said tines being beveled.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,015,393 January 2, 1962

Tibor A. Rozsa et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 41, for "surrosnds" read -- surround --; column 6, line 73, for "gun" read -- sun --.

Signed and sealed this 8th day of May 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents