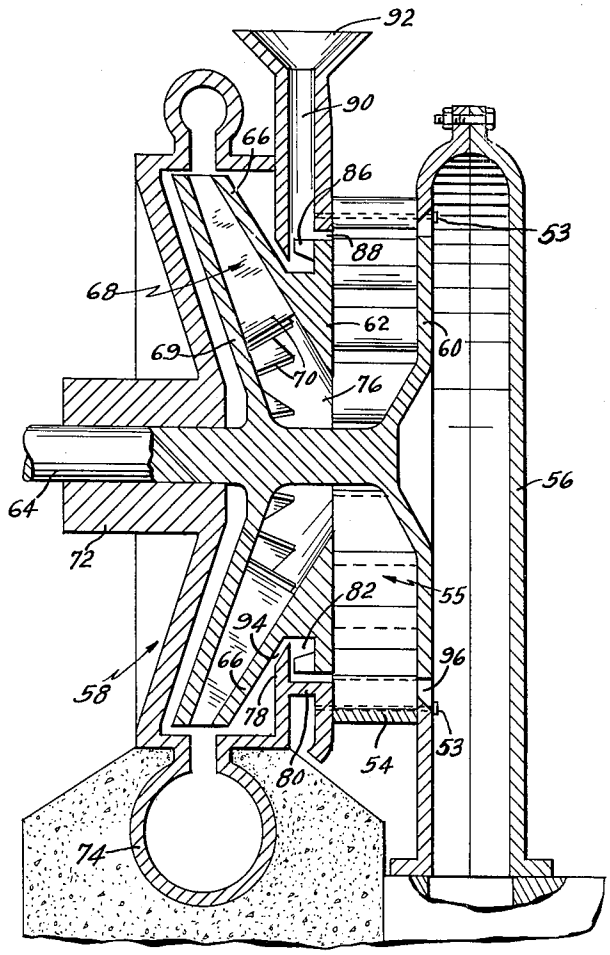
March 27, 1956 F. KAISER 2,739,709

SPIRAL SEPARATORS

Filed Jan. 11, 1952

FIG. 1



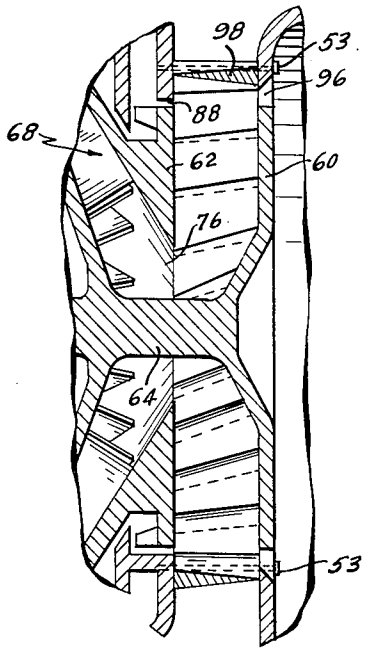


FIG. 3

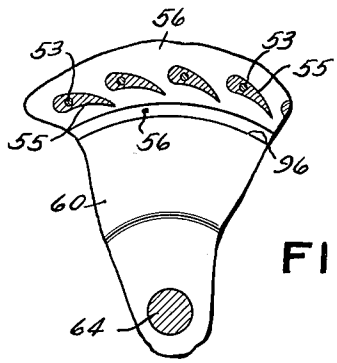


FIG. 2

INVENTOR
Fritz Kaiser

BY
Dennis, Edmonds, Morton, Barrows and Taylor
ATTORNEYS

United States Patent Office 2,739,709
Patented Mar. 27, 1956

2,739,709

SPIRAL SEPARATORS

Fritz Kaiser, Augsburg, Germany, assignor to Alpine Aktiengesellschaft, Eisengiesserei und Maschinenfabrik, Augsburg, Germany, a company of Germany

Application January 11, 1952, Serial No. 266,053

Claims priority, application Germany January 19, 1951

9 Claims. (Cl. 209—144)

This invention relates to spiral separators in which a separating chamber is spirally traversed from the periphery to the center by a liquid or gaseous suspension medium for the classification of finely divided material according to size or specific gravity and especially for the scavenging of the coarse material of adhering fine particles. The invention relates more particularly to the provision in such separators of means for adjustable and uniform feed of the material to be classified over the entire periphery of the separating chamber and to the provision of means for controlling the length of exposure of the material to be separated to the classifying and scavenging action of the suspension medium.

Separators are known in which the material to be classified is delivered to one or more points at one end of a cylindrical chamber provided with a circumferential array of inwardly directed blades. The material moves progressively over the interior of the chamber in substantially helical paths while undergoing continuous agitation by clean suspension medium until it leaves the separating space as cleaned coarse material freed from fines through a circular slot in the other end of the chamber. Separators of this type however are subject to the disadvantage that the inner surface of the chamber is very heavily loaded in the vicinity of the feed point or points. The material distributes itself fanwise over the interior surface of the chamber. A large part of the material to be classified accordingly travels a relatively steep helical path over the enclosure and consequently remains within the separating space for a shorter time than material which travels a longer distance to the outlet through flatter helical paths. The result is either a very uneven and hence incomplete separation of the coarse material from fine or else a very low throughput.

The object of the invention therefore is to increase substantially the throughput while retaining an optimum separation of the coarse material from fines adhering thereto so as to achieve an optimum separation.

To this end there is provided according to the invention a circular slot or aperture about the separating space at its input end together with means to distribute the material uniformly around this slot. The coarse material leaves the separating space at the other end through another circular slot.

By virtue of the uniform delivery of the material about the periphery of the separating space, there result for all particles of the material to be sorted substantially equal helical paths over the enclosure to the separating space with consequently approximately equal dwell times within the chamber. In this way it is possible to raise the throughput of material to the optimum and to make better use of the stream of suspension medium passing through the separator.

These and other features of my invention will be better understood from the following detailed description of two exemplary and preferred embodiments, taken in conjunction with the accompanying drawings in which

Fig. 1 is a vertical section of a separator according to

a preferred embodiment of my invention employing a cylindrical separating chamber disposed about a horizontal axis and including rotating end walls for the separating chamber, to one of which is coupled means to effect a uniform distribution of the material to be separated about a peripheral input slot;

Fig. 2 is a broken vertical sectional view taken on the line 2—2 of Fig. 1, and

Fig. 3 is a partial view similar to that of Fig. 1 but showing a modified form of construction for the spiral blades by which an axial component of motion is imparted to the material to be separated within the separating chamber.

Figs. 1 and 2 show an embodiment of the invention in which the separating chamber is disposed about a horizontal axis and in which both end walls of the chamber rotate to minimize boundary layer interference with the classifying action. The rotating end walls are coupled to an exhaust blower for drawing the suspension medium through the separator, and the inlet slot is located between the blower and the adjacent rotating end wall.

In the embodiment of Figs. 1 and 2 the separating chamber 55 is bounded circumferentially by an array of spirally directed blades 54 supported by bolts 53 between an output chamber 56 and a blower frame generally indicated at 58 in which the rotating elements of the separator are journaled. The blades maintain the chamber 56 and frame 58 in proper relative position. No surrounding casing is shown although one may be provided if desired, for example if the suspension medium to be employed is a fluid one other than the surrounding atmosphere.

The classifying chamber is bounded endwise by rotating end walls 60 and 62. These are coupled to a shaft 64 which may be rotated by any suitable source of energy. In the embodiment shown the end wall 62 is integral with a flange 66 of the exhaust blower generally indicated at 68. Flange 66 connects via the blower vanes 70 with the flange 69 which in turn is coupled to the shaft 64. The shaft 64 is journaled in a bearing member 72 fixed with reference to the frame 58 which also supports the exhaust housing 74 of the blower. In operation therefore the suspension medium is drawn through the array of blades 54 into vortical motion within the chamber 55 and through a central aperture 76 in the end wall 62 to be exhausted through the blower.

The exhaust housing 74 is continued into circumferential flanges 78 and 80 which cooperate with the end wall 62 to form an annular conduit 82. To the face of the wall 62 remote from the separating chamber there is affixed a plurality of blades or beaters 86 which turn within the annular space 82 to effect distribution of the material to be separated about the inlet slot 88 between the end wall 62 and the flange 80 of the blower housing. An input conduit 90 gives access to the space 82 so that the material to be separated poured in at the communicating funnel 92 is immediately dispersed about the circumference of the end wall 62 for uniform distribution of the material to the inlet slot 88. A clearance 94 between the flange 78 of the blower housing and the rotating flange 66 of the blower permits passage of the suspension medium under pressure into the annular spaced 82 from which it carries the material to be separated through the inlet slot 88 into the separating chamber. Within the chamber the material to be separated migrates in spiral paths over the inner surface of the volume within the blades 54 until the coarse material passes into the output chamber 56 through the outlet slot 96 between end wall 60 and the wall of the output chamber, while the fine material is withdrawn with the suspension medium through the central aperture 76 in the opposite end wall 62 and into the blower.

The completeness of separation effected depends upon the time for which the material is exposed to the agitating action of the suspension medium within the separating chamber. The necessary time of exposure depends upon the nature of the material to be classified, too short a time resulting in the incomplete classification and too long a time representing a waste of energy through the forcing of an excessive quantity of suspension medium through the separator. According to the invention, the time of dwell of the material to be classified is controlled by choice of the shape of the separating space, i. e., by choice of the slope and apex angle of the conical surface to which the inner surface of the array of blades 54 conforms, by radial adjustment of the position or width of the outlet slot 96, and by suitable choice of the shape of the blades 54 with respect to their extension axially of the separating chamber, or by any one or more of these means. With a blade array envelope to the classifying space increasing in diameter from the inlet to the outlet ends of the separator, the material passes more rapidly through the chamber, and conversely, with an array conforming to a cone converging towards its apex in the direction from the inlet to the outlet ends of the chamber, the material progresses more slowly.

The rate of progress of the coarse material undergoing scavenging action through the separating chamber 55 depends among other things on the configuration of the vortex blades 54 with respect to their extension lengthwise of the separating chamber, i. e. along its axis of symmetry. By giving to the blades not only the spiral section in planes perpendicular to the axis of the separating chamber but also a helical extension lengthwise of the chamber as illustrated by blades 98 in Fig. 3, the time of dwell within the chamber of the material undergoing separation can be lengthened or shortened according as the helical extension of the blades is in the same or opposite sense as the helical paths of the material within the separating chamber. The sense of the helical paths of the material depends upon the sense of the vortex motion imparted to the suspension medium by the inwardly spiraling extension of the blades. If desired the spiral orientation of the blades may be made adjustable by adjustable means, such as the bolts 53 on which they are supported.

The end walls of the separating chamber are generally substantially plane but may also assume a different form as f. i. a slightly conical or parabolical form, without interfering with the result of the separator.

While I have illustrated and described herein what I believe to be preferred embodiments of my invention, it will be understood that these embodiments are exemplary only and that modifications thereof may be made within the scope of my invention as set forth in the appended claims.

I claim:

1. A spiral separator for classifying solid particles into coarse and fine particles by means of a suspension medium, comprising a free flat substantially cylindrical and rotationally symmetrical separating chamber, said separating chamber being limited at its circumference by a plurality of blades disposed in a rotationally symmetrical stationary array for giving said suspension medium movement in a spiral direction, said chamber being limited at its ends by substantially plane rotatable end walls transverse of the axis of said array, one of said end walls being of smaller diameter than the inner diameter of said array, the periphery of said wall defining the inner edge of an annular inlet aperture for the material to be classified, means for supplying the material to be classified to said inlet aperture, a chamber for receiving the separated coarse particles located close to the other rotating end wall and communicating with an annular outlet aperture for the coarse particles located between the periphery of said other end wall and said array, one of the end walls having a central outlet aperture for the suspension medium carrying the fine particles, and means for causing a suspension medium to flow through said array of blades into the separating chamber.

2. A spiral separator for classifying solid particles into coarse and fine particles by means of a suspension medium, comprising a free flat substantially cylindrical and rotationally symmetrical separating chamber, said separating chamber being limited at its circumference by a plurality of blades disposed in a rotationally symmetrical stationary array for giving said separating fluid a movement in a spiral direction, said chamber being limited at its ends by substantially plane rotatable end walls transverse of the axis of said array, one of said end walls being of smaller diameter than the inner diameter of said array and defining the inner periphery of an annular inlet aperture for the material to be classified, a housing cooperating with said rotatable wall to enclose an annular space close to said annular inlet aperture, a plurality of blades affixed to said rotatable end wall within said annular space, means for supplying the material to be classified to said annular space and from it through said inlet aperture to the separating chamber, a chamber for the separated coarse particles close to the other rotatable end wall and communicating with an annular outlet aperture for the coarse particles located between said other end wall and said array, one of said rotatable end walls having a central outlet aperture for the suspension medium carrying the separated fine particles, and means for causing a suspension medium to flow through said array of blades into the separating chamber.

3. A spiral separator for classifying solid particles into coarse and fine particles by means of a suspension medium, comprising a free flat substantially cylindrical and rotationally symmetrical separating chamber, said separating chamber being limited at its circumference by a plurality of blades disposed in a rotationally symmetrical stationary array for giving said suspension medium a movement in a spiral direction, said chamber being limited at its ends by substantially plane rotatable end walls transverse of the axis of said array, one of said rotatable end walls being of smaller diameter than the inner diameter of said array and defining an annular inlet aperture for the material to be classified, means for supplying the material to be classified to said inlet aperture, one of said rotatable end walls having a central outlet aperture for the suspension medium carrying the separated fine particles, an exhaust blower supported coaxially with said array and communicating on its low pressure side with said central outlet aperture, said blower being coupled with said rotatable end wall, and a chamber for receiving the coarse particles located close to the other rotatable end wall and communicating with an annular outlet aperture for the coarse particles between said other end wall and said array, said blades being spaced apart to permit the flow of suspension medium through the array into the separating chamber.

4. A spiral separator as claimed in claim 3, in which the blades of the array extend helically lengthwise of the separating chamber.

5. A spiral separator as claimed in claim 3, in which the blades of the array have a longitudinal slope with respect to the axis of the separating chamber.

6. A spiral separator as claimed in claim 3, in which the blades of the array have a spiral section in planes perpendicular to the axis of the separating chamber.

7. A spiral separator as claimed in claim 1, including means for controlling the length of exposure of the material to be separated to the classifying and scavenging action of the suspension medium.

8. A spiral separator as claimed in claim 1, including adjustable means for varying the time of dwell of the material to be classified in the separating chamber.

9. A spiral separator as claimed in claim 1, in which the means for supplying the material to be classified in-

cludes means for uniformly distributing the material to be classified to the annular inlet aperture.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 11,644	Landis	Dec. 28, 1897
1,660,683	Stebbins	Feb. 28, 1928
1,698,361	Dreisbach	Jan. 8, 1929
1,770,850	Hartman	July 15, 1930
1,897,195	Howden	Feb. 14, 1933
1,905,458	Gaffney	Apr. 25, 1933
2,046,442	Baldwin	July 7, 1936
2,128,166	Schmidt	Aug. 23, 1938
2,276,761	Carey	Mar. 17, 1942

FOREIGN PATENTS

154,357	Austria	Apr. 15, 1938
497,966	Great Britain	Jan. 2, 1939
695,328	Germany	Aug. 22, 1940