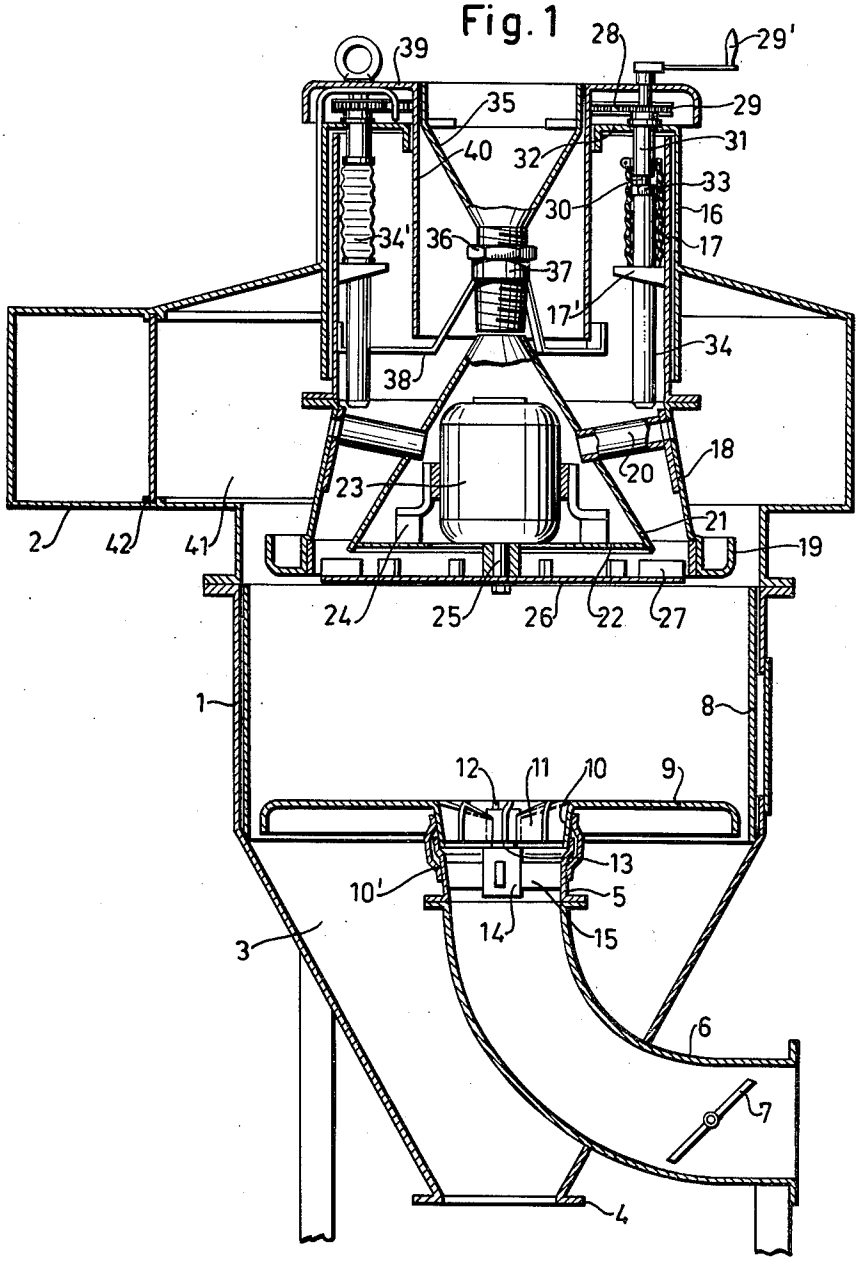
May 29, 1962 B. G. E. MÅNSSON ETAL 3,036,709

CENTRIFUGAL AIR CLASSIFIER

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Fig. 1



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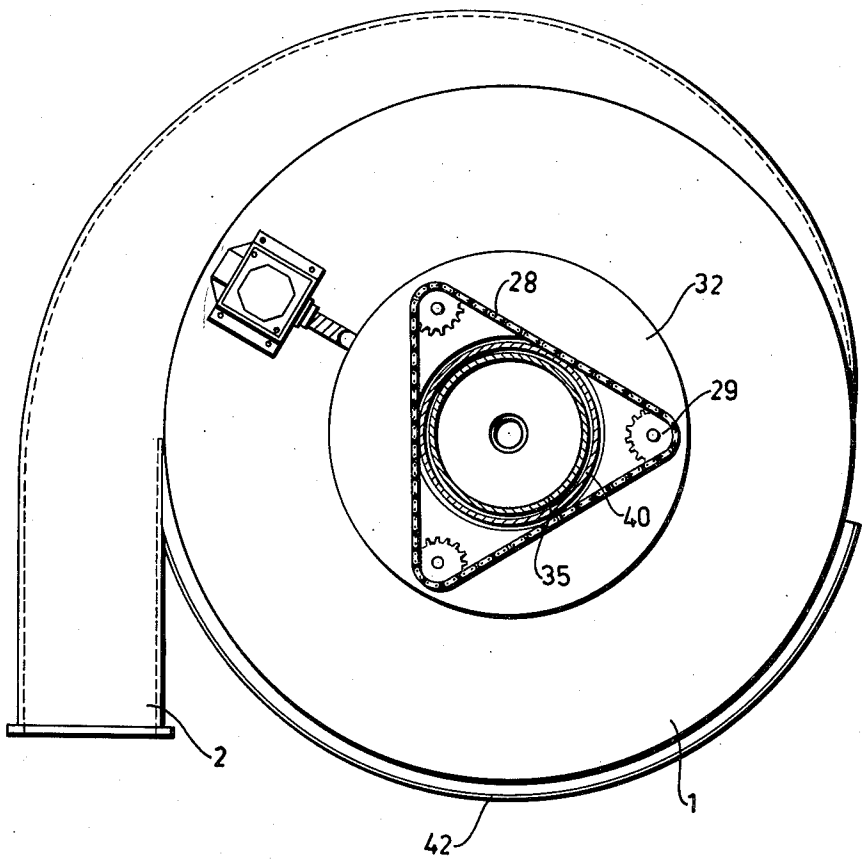
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Fig. 2



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United States Patent Office 3,036,709
Patented May 29, 1962

3,036,709

CENTRIFUGAL AIR CLASSIFIER

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Filed Mar. 8, 1960, Ser. No. 13,485
Claims priority, application Sweden Mar. 12, 1959
2 Claims. (Cl. 209—144)

The invention relates to a centrifugal wind classifier for separating or fractionating granular or pulverulent material by the aid of a gas current. More particularly, the invention relates to a wind classifier of the type wherein the material to be classified is admitted, in the form of an annular curtain, into a cylindrical separating chamber with a vertical axis and is separated therein into a coarser and a finer fraction with the aid of a current of gas, this gas being admitted into a jacket surrounding the separating chamber through a tangentially-arranged inlet, so as to have imparted to it a rotary motion, the gas then entering the separating chamber along the perimeter thereof and leaving the separating chamber through a central outlet in one of the horizontal walls of the chamber.

One object of the invention is to improve the accuracy of separation of this type of centrifugal classifier, i.e. to construct the classifier so that the least possible part of finer material (material with a particle size below a certain required limit) accompanies the coarser material and vice versa. This is achieved by mounting the separating chamber wall having the central air outlet rotatably and arranging it to be rotated by the current of gas flowing out of the central outlet by means of a turbine wheel, placed in the outlet and driven by the outgoing air.

The accuracy of a centrifugal wind classifier is dependent on several factors. One of these is the thickness of the boundary layer at the top and bottom walls of the separating chamber. Dust particles which come into the boundary layer are subjected to substantially reduced forces and are therefore not separated in the same way as particles outside the boundary layer.

Boundary layer thickness is a function of the Reynolds number, which in its turn is directly proportional to the relative velocity between the mass of gas and the wall, and of the length of flow along the wall. If this relative velocity, for a given tangential velocity of the gas flow, can be reduced by making the wall rotate at a velocity which, as measured at a distance from the center equal to the radius of the annular curtain of material, i.e. in the annular separating zone, is approximately equal to the tangential velocity of the gas at this point, the thickness of the boundary layer will be mainly dependent on the radial velocity of flow, which has been proved to substantially contribute to a more accurate classification.

It has been proposed that the horizontal separating chamber wall, through which the material is fed in, should be constructed as a revolving disc driven by a motor. The function of this motor-driven disc is to impart to the material to be classified as it is admitted into the chamber an initial tangential velocity, which is approximately equal to that of the gas, but naturally this arrangement will also improve the boundary layer conditions adjacent the disc, by reducing the relative velocity of gas and disc.

A similar solution is also conceivable for the opposite wall, through which the air leaves, but greater advantages will be obtained if, in accordance with this invention, the disc is driven by the revolving gas current whilst this is passing out of the central part of the separating chamber through the outlet in the chamber wall. By constructing the driving means in a suitable manner and by designing

the bearings and seals so that friction losses will be small, the tangential velocity of the disc in the separating zone can be made substantially equal to the tangential velocity of the gas at this point. In this connection it is an advantage that the tangential velocity of the disc will follow that of the gas when the tangential velocity of the latter is altered by adjusting the size of the tangential inlet. Further, it is an advantage that the rotational dynamic energy of the gas is used to drive the disc in the outlet, where the air is still rotating, although this rotation no longer makes any contribution to the classifying action.

The invention is described in more detail in conjunction with an embodiment thereof illustrated on the attached drawings. FIG. 1 shows a vertical section of the apparatus and FIG. 2 shows a plan view of the apparatus with the cover removed.

The centrifugal wind classifier shown in the drawing is contained in a housing formed by a mainly cylindrical casing **1** with a tangentially-arranged air inlet **2** and with a funnel-shaped bottom part **3**, which constitutes a hopper for collecting the separated coarser material and has an outlet **4** for this. An air outlet **5** is provided centrally in the upper portion of the funnel-shaped bottom part and is connected by means of a pipe **6**, passing through its wall, to a conduit leading to a fan (not shown). A damper **7** is fitted in pipe **6** for regulating the rate of air flow.

The separating chamber itself is defined laterally by an attrition liner **8** inserted in casing **1**. At the bottom the chamber is defined by a rotary circular disc **9**, which has a central annular flange **10** fitting into outlet **5**. The outer ends of blades **11** are fixed to this flange, the inner ends thereof being attached to a hub **12**, which is provided with a journal **13**. This is carried in a bearing **14**, which is secured in outlet **5** by means of a spider **15**. A sealing ring **10'** is fitted at the outer wall of flange **10** and surrounds the upper end of outlet **5**.

The top of the housing of the apparatus is in the form of a cylinder **16** of smaller diameter than casing **1**. Inside cylinder **16** there is a vertically-adjustable inner cylinder **17**, which carries a frusto-conical casing **18**, the bottom of which is connected to a curved annular flange **19** forming the outer portion of the upper defining wall of the separating chamber. A conical casing **21** with a bottom plate **22** is fixed in conical casing **18** by means of tubular stays **20**. An electric motor **23** is mounted inside conical casing **21** by means of bottom plate **22** and suitable brackets **24**. A disc **26**, mounted on the end of motor shaft **25**, forms the inner, larger portion of the upper defining wall of the separating chamber. Disc **26** is fitted with blades **27** on its upper side.

The assembly consisting of cylinder **17** and the parts carried thereby is arranged to be raised or lowered to vary the height of the chamber and hence the radial velocity of the air flow in the chamber. This is achieved by means of a chain **28**, passing over sprockets **29**, one of which is provided with a crank **29'** for rotation. Sprockets **29** are fixed to threaded spindles **30**, which pass through sleeves **31** attached to the roof **32** of the housing, and are threadedly received in nuts **33**, fixed to tubes **34**, which are secured to brackets **17'** on cylinder **17**. Rotation of sprockets **29** by means of crank **29'** and chain **28**, produces a raising or lowering of cylinder **17**. The connection between spindles **30** and tubes **34** is protected by rubber hoses **34'**.

The material to be classified is fed into the classifier by means of a funnel **35** arranged in axial alignment with cone **21**. The tubular outlet of the funnel is threaded externally and received in a nut **36**, secured by means of a socket **37**, which in its turn is attached to cylinder **17** by means of stays **38**.

A cover **39** is provided above the chains and sprockets and has a cylindrical part **40** which surrounds the infeed hopper **35**.

The width of the tangential inlet can be adjusted by means of a semi-cylindrical damper **41**, which is slidable in a groove **42**.

The material to be classified is fed in through funnel **35** and falls on to the outside of cone **21** and so on to the rotating disc **26**, which is designed to impart a tangential velocity component to the material before it enters the separating chamber. The speed of the motor is adjusted so that this velocity component is approximately equal to the tangential velocity component of the air stream when the width of the tangential air inlet is set at a mean value. The motor is cooled by air aspirated by the rotating disc through tubular stays **20**.

The quantity of inactive air can be set by displacing funnel **35** to alter the clearance between the lower end of funnel **35** and the top of cone **21**.

In the separating chamber, the material is separated into a coarse fraction, which is collected in bottom section **3**, and a finer fraction, which is carried out with the air stream through outlet **6**.

The limit of classification depends on the radial and tangential velocities of the air in the separating chamber. The latter can be adjusted by altering the width of the tangential inlet by means of damper **41**, and the former by alteration of the height of the separating chamber by raising or lowering the upper wall of the chamber using the crank, as previously described. It should be noted that the funnel **35** will also move, so that the clearance between funnel and cone is not altered when the height of the chamber is adjusted.

The current of air passing through outlet **5** drives turbine wheel **11**, **12** and thus also disc **9**. The arrangement is constructed so that the rotational speed of the disc will be such that its tangential speed at the material curtain will be approximately equal to the tangential velocity of the air at this point. It should be observed that a change in the tangential velocity of the air automatically produces a substantially corresponding alteration in the rotational speed of the disc, for which reason

the disc will automatically adapt itself to the tangential velocity of the air. The thickness of the boundary layer is thus kept down, which results in a corresponding improvement in fractionation accuracy.

I claim:

1. A centrifugal wind classifier comprising a vertical substantially cylindrical casing, upper and lower substantially horizontal walls disposed in said casing concentric therewith and spaced therefrom to define a separating chamber within said casing, said horizontal walls being mounted for rotation about the common axis, first driving means for rotating said upper wall, adjustable means for vertically displacing said first driving means and said upper wall for varying the height of said separating chamber, a centrally disposed gas outlet in said lower wall, a gas inlet tangentially intersecting said casing whereby a gas introduced to said casing through said tangential inlet has imparted to it a rotating movement and passes through said separating chamber and out through said central outlet, means for feeding material to be classified as an evenly distributed annular curtain into said separating chamber adjacent its circumference to cause separation of said material into coarse and fine fractions by said gas current, means for varying the width of said tangential inlet whereby the tangential velocity of the gas at the annular curtain may be varied, and second drive means independent of said first drive means for rotating said lower wall and responsive to variations in the velocity of the gas current for varying the speed of rotation of said lower wall to maintain the peripheral velocity of said lower wall equal to the tangential velocity of the gas current at the annular curtain.

2. A centrifugal wind classifier as defined in claim 1 wherein said second drive means comprises a turbine wheel coupled to said lower wall and situated in said centrally disposed gas outlet.

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