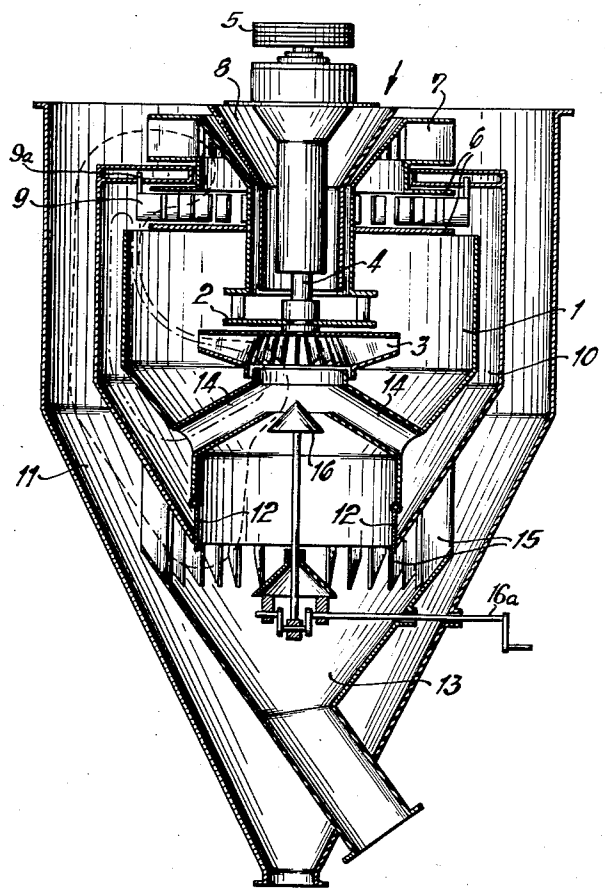
Dec. 27, 1960 H. JÄGER 2,966,265

AIR-CIRCULATION CLASSIFIER

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FIG. 1



INVENTOR

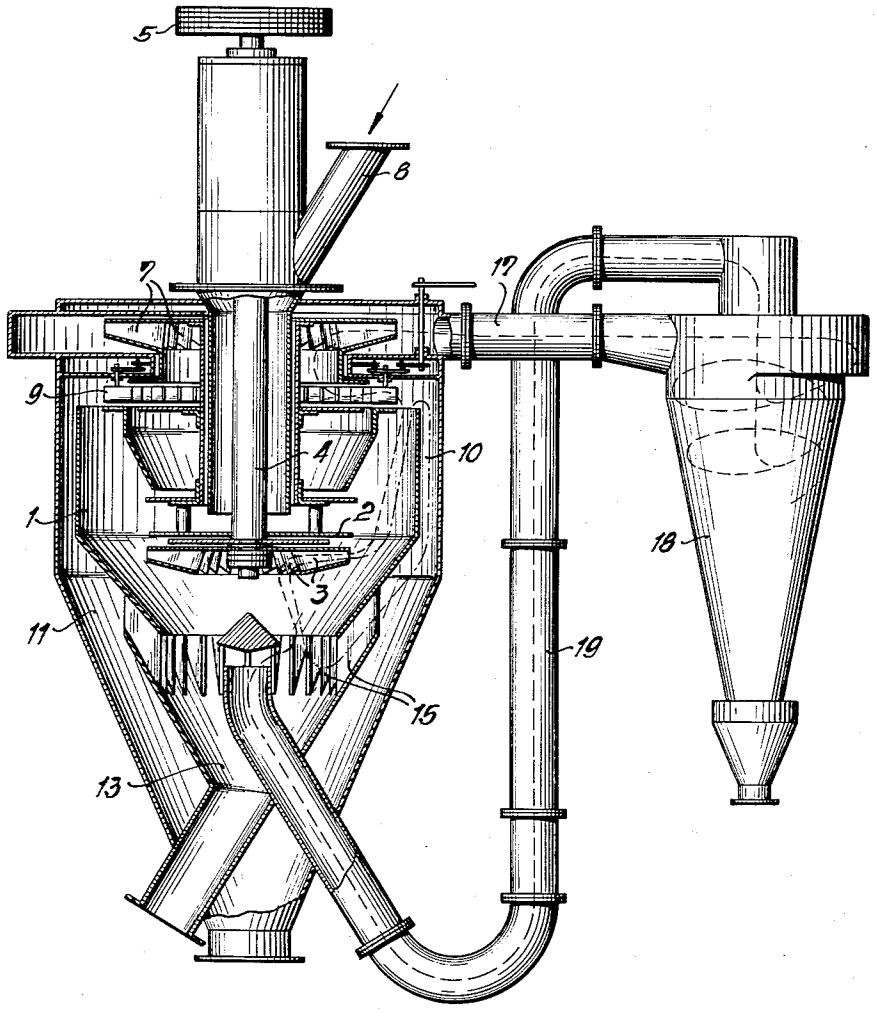
Heinz Jäger

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AIR-CIRCULATION CLASSIFIER

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FIG. 2



INVENTOR

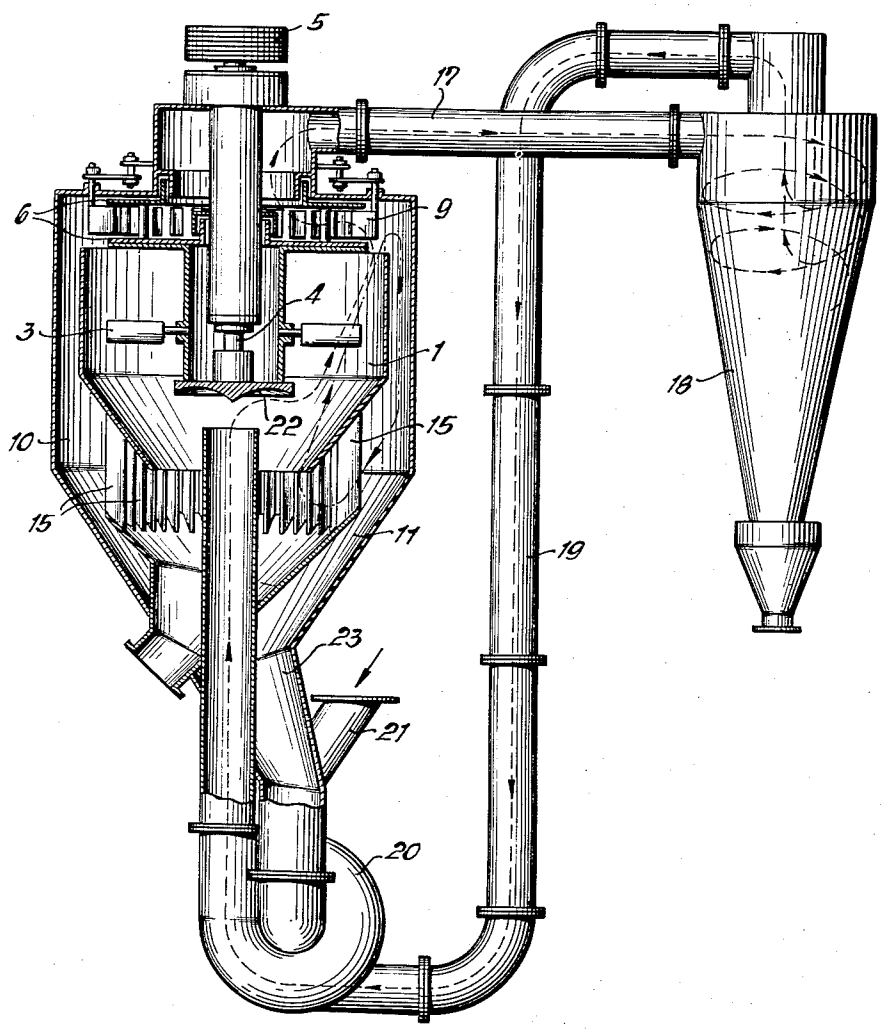
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FIG. 3



INVENTOR

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2,966,265

AIR-CIRCULATION CLASSIFIER

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6 Claims. (Cl. 209—139)

My invention relates to mechanical-air classifiers for sorting coarse and fine fractions of solid material under the action of centrifugal force and entrainment by air. In a more particular aspect, the invention concerns an air-circulation classifier in whose grading chamber the material to be classified is centrifugally distributed by means of a whirling plate and is subjected to an air current produced by a fan rotating within the chamber.

One of the known types of such classifiers is provided with discs rotating above the grading chamber and also with a second fan which inducts the material, liberated in the grading chamber from its coarser fractions, through the discs whereupon the air is circulated through a separator space back into the grading chamber. The whirling plate, fan, and discs are operated from a common drive or may be provided with separate drives. There is only one circulatory path for air within the shell of these known classifiers. Such classifiers are not suitable for sorting very fine fractions from the material.

It is an object of my invention to devise a circulatory-air classifier, generally of the above-mentioned type, which affords the separation of extremely fine constituents from the coarser fractions of the material to be classified.

According to the invention, I have found that such a classification down to extremely fine fractions is possible if the classifier is provided with two air circulation paths of which only one entrains the finest fraction in a controllable or regulatable manner.

According to a more specific feature of my invention, therefore, I provide adjustable throttle vanes at the entrance of the interspace between the rotating discs of which two or more may be present, and I provide a grit separating space around the grading chamber and let the bottom zone of that space communicate with the grading chamber. As a result, two circulatory air currents are produced of which one, after separation of the coarser particles within the grading chamber, entrains the medium-coarse and fine particles out of the grading chamber, whereas the other air circulation, cooperating with the throttle vanes ahead of the rotating discs, entrains only the finest particles to pass them away from the first-mentioned air circulation to a fines collecting space. The throttle vanes, in coaction with the rotating discs, prevent any whirled-away grits from entering into the air-entrained discharge of fines. The fines can be caught within another separating space surrounding the grading chamber as well as the grit separating space, or a separate fines separator in form of a cyclone or the like may be provided outside of the classifier proper for removing and collecting the air-entrained fines.

The above-mentioned second fan may be located above the rotating discs within the shell space of the classifier proper. However, according to another feature of the invention, the upper fan may be substituted by a separate air impeller located externally of the classified shell and preferably designed as a centrifugal-throw blower into which the material to be classified is charged and which flings the material, for example from below, into the grading chamber.

The foregoing and more specific objects and features of my invention will be apparent from the following description in conjunction with the embodiments illustrated by way of example on the accompanying drawings in which—

Fig. 1 illustrates a vertical section through a first embodiment in which both fans are mounted within the classifier shell.

Fig. 2 shows a vertical section through another embodiment equipped with a separate dust-from-air separator for collecting the fines.

Fig. 3 illustrates, partly in vertical section, another embodiment generally similar to that of Fig. 2 but provided with an external blower.

The classifier according to Fig. 1 comprises a grading chamber 1 in which a whirling plate 2 and a blade-type fan 3 are rotatable. Both are driven by a vertical center shaft 4 from a suitable drive or transmisison 5. Firmly joined with the rotatable parts 2 and 3 are two parallel discs 6 located above the grading chamber 1, and a second blade-type fan 7 mounted above the discs 6. The material to be classified is supplied through a central feeder tube 8. Mounted about the periphery of the discs 6 are a number of throttle vanes 9 each of which is pivoted at 9*a*. The vanes 9 are distributed about the periphery and are displaceable about their respective pivots in accordance with the desired degree of classification.

The grading chamber 1 is surrounded by a grit separating space 10 of annular shape which, in turn, is enclosed within the separator shell by a fines separator space 11, also of annular shape. The grit separator space 10 communicates through dampers 12 with the outlet opening 13 of the grading chamber 1 and also through ducts 14 with the suction inlet of the fan 3. The fines separating space 11 forms an outlet at its bottom and is connected with the suction inlet of the fan 3 through jalousie slats 15. The return flow of air through the fines separating space 11 can be adjusted by means of a throttle body 16 whose position is controlled with the aid of a crank mechanism 16*a*.

During operation of the classifier, the two fans operate to produce and maintain the two circulatory flows of air indicated by broken lines A and dot-and-dash lines B respectively. The circulation A, passing through the openings between the throttle vanes 9 when entering between the rotating discs 6, can be adjusted by means of the vanes 9 in any desired manner. Any grit material that may enter between the two discs 6 is centrifugally flung outwardly and either drops back into the grading chamber 1 or is entrained by the circulation B into the grit separating space 10.

Operation of the embodiment of Fig. 1 is as follows:

The material to be classified is fed into the center funnel according to the arrow near the top of Fig. 1, and then drops upon the whirling plate 2 which spreads the material in form of a broadly scattered pattern into the classifier space 1. The blower 3 located beneath the plate 2 produces an ascending current of air which entrains the finest grains and a portion of the excess-size grains. The coarser and heavier grain proportions of the material to be classified are flung outwardly and dropped down in the classifier space 1. The mixture of finest grain and grit II now reaches the throttle vane 9 and travels beyond it between the rotating discs 6 where this mixture is subjected to centrifugal action on the one hand and to the suction effect of the upper blower 7 on the other hand. The grain portions flung outwardly by centrifugal force drop downwardly into the ring space 10 through the flaps 12 and are discharged at 13. The finest

material, however, is precipitated in the outer space **11** and is discharged therefrom. The classifying air passes from space **10** to lower blower **3** along two circuitous paths, the first being indicated by a broken line through space **11**, through the regulatable throttle cross section at **16**, back up into the lower blower **3**; and the second path being indicated by a dash-dot line from space **1** through space **10**, through ducts **14**, and back into the blower **3**.

The classifier illustrated in Fig. 2 differs from that of Fig. 1 essentially only in the construction of shell portion which forms space **11**. Instead of forming an annular shell space around space **10**, in the embodiment of Fig. 2, space **11** is formed beneath space **10** and does not receive the fines for separation as in Fig. 1. In lieu thereof, the fines are passed by means of the fan **7** through a conduit **17** into an external fines separator **18** consisting, for example, of a cyclone. The fines collect at the bottom of separator **18**, whereas the clean air leaving the central top opening passes through a conduit **19** from below back into the grading chamber **1**.

In the embodiment of Fig. 2, the classifier operation is exactly the same as in Fig. 1, except that the finest grain is not precipitated in an outer housing surrounding chamber **1**, but is supplied to the remotely located cyclone **18** through the conduit **17**, in which cyclone it is precipitated, while the classifier air flows from cyclone **18** through conduit **19** back to the lower blower **3**.

The embodiment shown in Fig. 3 is similar to that of Fig. 2 in possessing a fines separator **18** outside of the classifier proper. According to Fig. 3, however, the upper fan **7** (Figs. 1 and 2) is substituted by an external air impeller **20** designed as a throw-type blower. The material to be classified is fed into the feeder inlet **21** of the blower **20** and is flung by the blower **20** from below into the grading chamber **1** of the classifier where it impinges upon the distributing whirling or baffle plate **22**. In this embodiment, the grit separating space **10** communicates through a conduit **23** with the feeder inlet **21** of the blower **20** for returning the medium-size particles back into the grading chamber, thus providing for continuous saturation of the grading chamber.

In the embodiment of Fig. 3, the classifying operation is again the same as in Fig. 1, except that the material is not supplied through a central feed hopper **8**, but this material is flung from below against the spreader plate **22** with the aid of the throwing blower **20**. The spreader plate **22** again spreads the material over the classifier space **1**. The throwing blower **20** simultaneously acts as a substitute for the upper blower **7** of Figs. 1 and 2. The finest grain in the embodiment of Fig. 3, like in the one shown in Fig. 2, is conducted out of the classifier and is precipitated in the cyclone **18**, whereas the classifier air blows back to the throwing blower **20**.

It will be obvious to those skilled in the art, upon studying this disclosure, that my invention permits of various modifications and may be embodied in devices other than those illustrated and described herein, without departing from the essential features of my invention and within the scope of the claims annexed hereto.

I claim:

1. A classifier, comprising a shell and having a grading chamber within said shell, a whirling plate and a fan coaxially rotatable in said chamber, inlet duct means for passing material to be classified to said plate, two discs rotatable above said chamber in coaxial relation to said plate and forming between each other a passage for air, one of said discs having an opening therein to provide a portion of a circulatory path for air into said passage and through the classifier, blower means communicating with said passage for forcing air to pass from said chamber through said passage, means forming a fines-settling space for material ejected from said plate, means forming further portions of said circulatory air path from said blower means to said fines-settling space and connecting said fines-settling space with the bottom of said grading chamber for circulating the air back through said chamber; adjustable throttle vanes mounted in front of said passage around the outer periphery of said discs for controlling the air current flowing through said passage and for directing the air along a spiral path therethrough, and partition means forming a grit settling space around said chamber within said shell, said grit-settling space communicating near the top thereof with said chamber at a location between said vanes and said blower means and also communicating at the bottom thereof with said grading chamber so as to form a second circulatory air path through said chamber.

2. In a classifier according to claim 1, said grading chamber having a circular top opening, one of said two discs being located in said opening and covering it except for an annular gap at the periphery of said disc, said other disc being located axially above said one disc and forming said opening therein through which the air, entering from the periphery of said passage, can flow upwardly out of said passage to said blower means.

3. In a classifier according to claim 1, said plate and said fan and said two discs having a coaxial drive shaft in common, said shaft extending vertically upward and out of said shell, and said inlet duct means for material to be classified comprising a centrally located conduit coaxially related to said shaft.

4. In a classifier according to claim 1, said blower means consisting of a second fan coaxially mounted in said shell above said two discs, said two fans having a single drive in common with said two discs and said plate.

5. In a classifier according to claim 1, said blower means being located outside of said shell, and said inlet duct means being connected with said blower means whereby said blower means throws said material into said chamber.

6. In a classifier according to claim 1, said fines-settling space being located remote from said shell, said means forming said further portion of said circulatory air path including conduit means extending from said shell to said fines-settling space and from said fines-settling space to said bottom of said grading chamber.

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