April 30, 1957 C. ALLANDER ET AL 2,790,508

APPARATUS FOR REMOVING DUST BY CENTRIFUGAL FORCE

Filed April 27, 1954

FIG. 2.

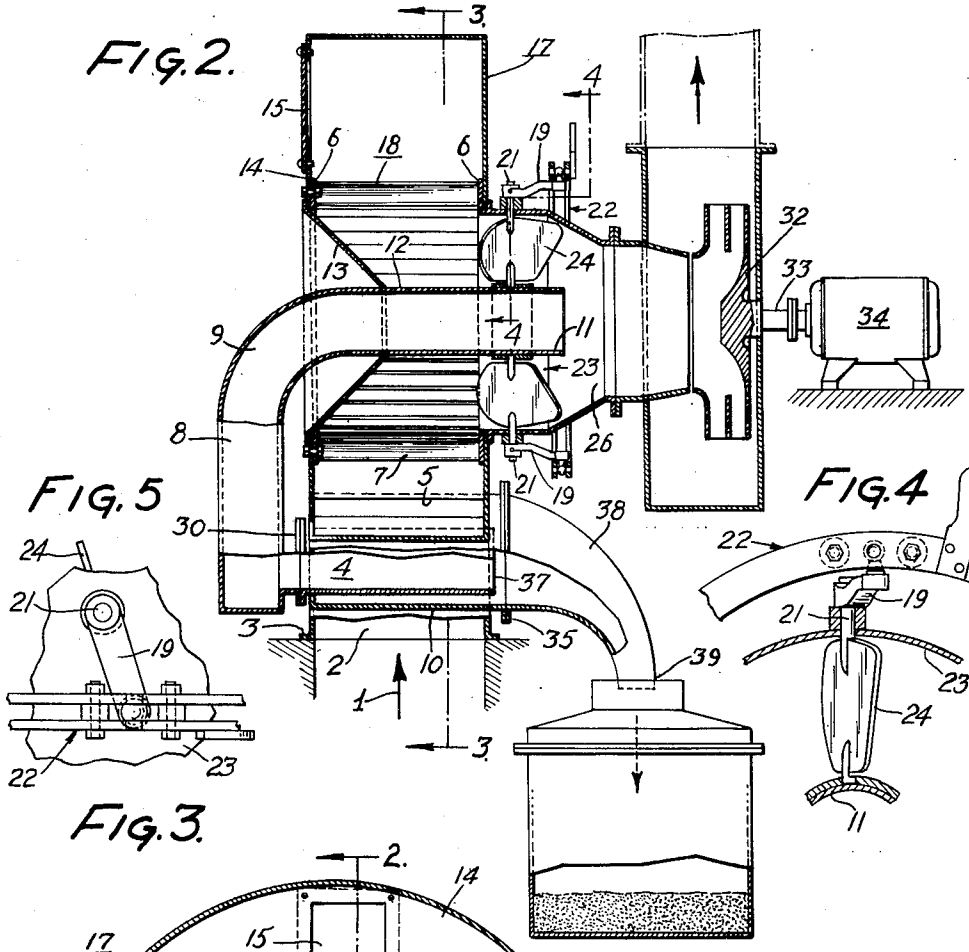
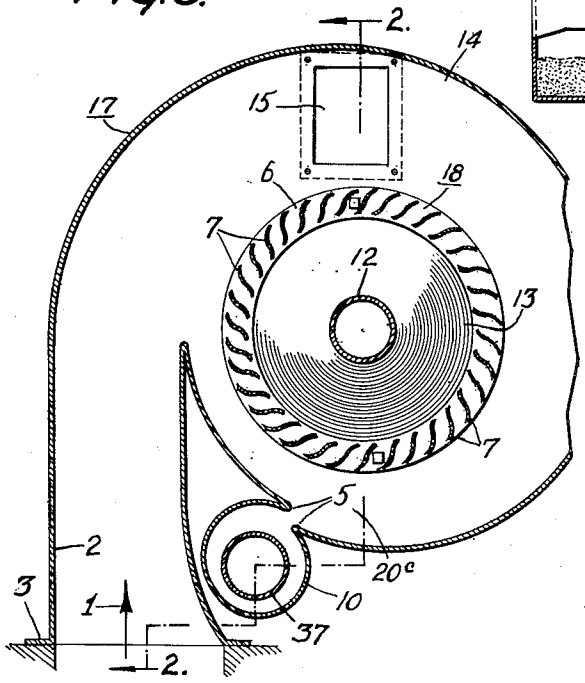


FIG. 5

FIG. 4

FIG. 3.



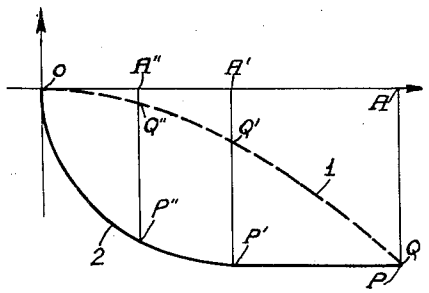


FIG. 1.

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United States Patent Office 2,790,508 Patented Apr. 30, 1957

2,790,508

APPARATUS FOR REMOVING DUST BY CENTRIFUGAL FORCE

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Application April 27, 1954, Serial No. 425,842

2 Claims. (Cl. 183—34)

The present invention relates to an apparatus for removing dust from dust-laden gas—"raw gas"—by centrifugal force, which apparatus consists of a primary separator having a spiral-shaped casing provided with an inlet for raw gas and a circular outlet for clean gas on one side of the casing. A circular grille parallel to the axis of the casing is arranged in the centre of said casing and comprises two rings with vanes between them acting as a primary separator for cleaning the raw gas rotating in the central part of such casing. A curved surface of the casing furthermore is provided with one or more openings for the discharge of the peripherally rotating raw gas to a succeeding secondary separator. Clean gas is exhausted from the centre of the casing through the circular outlet and through the last mentioned secondary separator by means of a suction fan connected to the outlet of the casing. It is known that with varying loads it is difficult to maintain the separation efficiency with this type of equipment with a decrease of the load, i. e. a diminishing quantity of dust-laden gas, the pressure difference between the inlet and the outlet of the primary separator will likewise decrease. This will also result in a smaller pressure difference between the inlet and the outlet of the secondary separator, which fact will reduce the total separating efficiency of the equipment. It is an object of the invention to eliminate this drawback.

The present invention is characterized by guiding means arranged in the outlet of the casing, said means having adjustable radial vanes for the suction fan, and by a duct, ending in the centre of the guiding means and connecting the centre of said secondary separator, being joined to one of the above mentioned openings in the curved surface of the casing. The invention is based upon the knowledge that with a decrease in the quantity of gaseous medium passing through the entire separator, adjustment of the guiding means will cause an increased whirling between the guiding means and the fan. This will result in a lowered static pressure in the centre of the space between the guiding means and the fan. The invention is further based on the knowledge that this decrease of static pressure can be used for compensating the reduction of the pressure drop over the secondary separator, which reduction would otherwise be the result of a lowered load of gas over the equipment. Thus the invention gives the benefit that an unchanged or somewhat increased quantity of gas will pass the secondary separator in spite of a smaller quantity of dust-laden gas passing through the main separator.

Other characteristic features of the invention will be evident from the attached claims and the following explanation of the drawings. The invention will now be described in greater detail in connection with the attached drawings where

Fig. 1 graphically shows the principle for the maintenance of the separating efficiency of the equipment;

Fig. 2 represents a section taken on the line 2—2 of Fig. 3 of the equipment according to the invention;

Fig. 3 is a sectional view along the line 3—3 in Fig. 2;

Fig. 4 is a fragmentary view in section taken on the line 4—4 of Fig. 2; and,

Fig. 5 is a fragmentary view in plan of the elements shown in Fig. 4.

In Fig. 1 the abscissa and the ordinate of the graph represent the quantity of gas and the pressure drop respectively in a separator made in accordance with the present invention. The curve 1 is the locus for points corresponding to different loads over the primary separator, assuming that no whirls will be caused in the space between the casing and the fan, i. e. the quantity of gas will be regulated simply by throttling. Point A represents a full load for the separator. Corresponding points for loads of 50% and 30% respectively are designoted A' and A''. The resulting pressure drops in these supposition cases are designated Q, Q' and Q''. As will be seen the pressure drop over the secondary separator will be rapidly reduced to 0 in the space located after the guiding means but before the fan.

The curve 2 represents the working conditions in the secondary separator according to the invention. In this case the various working conditions are illustrated by the points P, P' and P'' and the pressure drop is measured between the inlet of the secondary separator and the centre of the whirling gas behind the guiding means. With a full load the points P and Q will coincide. The vanes of the guiding means are then fully open. When the operation points are moving from point P to the left of the diagram the guiding means will be adjusted so that an increased whirling will be caused in the common outlet from the primary and secondary separators. This will mean that the pressure drop over the secondary separator can be maintained over an essential range between the limits of the working conditions. Not until the load over the separator, i. e. the supplied quantity of dust-laden gas, has decreased below 30% of the full load, will the pressure drop tend to grow less and accordingly the rate of separating efficiency tend to slow up.

In Figs. 2 and 3, the arrow 1 represents the direction of the supplied dust-laden gas which is caused to pass inwardly through the inlet 2 to a primary separator which essentially consists of a casing 17. The casing 17 is spiral-shaped similar to a fan housing, but the gas current is caused to rotate in an opposite direction as compared with the direction of the flow in a fan housing. In the casing 17 is arranged a dust separating device. The spiral-shaped casing with its slot 5 by itself constitutes the primary separator. The separating function of the casing can be improved by the insertion of a circular grille 18. This grille consists of two rings 6 between which a number of obliquely arranged vanes 7 are placed. The casing is on one of its sides provided with a small inspection door 15 through which it is possible to have access to the grille for inspection purposes. By dismounting a pair of locking bolts at the gable end 14 of the casing, the grille 18 can be easily turned in its position for examination and cleaning. The combination of a casing and an eventual dust grille and the connected fan can be suitably called "the concentrator" as the dust is concentrated at the periphery of the casing and the primary clean gas is exhausted through a duct 23 having guiding means 24 therein. At the end 20c of the spiral a secondary separator is directly connected, the inlet 5 of which separator extends over the entire width of the casing 17. Numeral 37 designates a central tube for this secondary separator.

In the present case this central tube 37 is in its turn connected to a secondary clean gas duct 4, 8, 9, 12 which leads from the secondary separator and passes through the conical gable end 13 of the casing 17 and terminates in an outlet 11 coaxially within the so called concentrator,

in the centre of the guiding means **24**. The guiding means **24** comprises a number of vanes rotatably mounted in the duct **23** by radial spindles **21**. The spindles **21** have crank arms **19** projecting axially of the duct into an adjusting ring **22**. By rotating the ring, the primary clean gas flow is throttled and the gas is given an increased whirling motion in the chamber **26**. The opposite end of the secondary separator is directly connected to a tapered outlet **38, 39**. The primary clean gas duct or outlet **23**, and chamber **26** of the so called concentrator also acts as housing for the guiding means, and is directly connected to a fan **32**. The axle of this fan is designated **33** and an electric motor is designated **34**. In accordance with one embodiment of this invention, the connection flanges **3** and **30, 35** respectively of both casings of the primary and secondary separators are designed similarly on both sides, whereby the conical gable **13** and the clean gas duct or outlet **23** of the concentrator and the secondary clean gas duct **8, 12** and the tapered outlet **38, 39** respectively can change places. This design renders it possible to always make the connections to the separating equipment and the installation in the best way. The tapered outlet **38, 39** should, however, always be connected at the same side as the primary clean gas duct or outlet **23**. The casing can also be turned so that it can be installed with different directions for the inlet with respect to its base.

The function of the separating equipment is as follows. The dust-laden gas is sucked by the fan **32** into the primary separator casing where it is set in violent rotation. By means of a centrifugal force the dust is thrown against the periphery of the casing, which results in a concentration of dust to a smaller quantity of gas, which through the slot **5** is conducted to the secondary separator **10** where the dust is effectively separated. The function of the grille **18** is well known. The dust grille will furthermore distribute the gas in an even flow into the guiding means **24**. The primary clean gas is exhausted through the duct **23**.

In passing the secondary separator **10** the gas having a high concentration of dust will be effectively cleaned by centrifugal force. Adjusting the guiding means **24** reduces the static pressure in the chamber **26** and gives the benefit of maintaining an almost constant pressure drop over the secondary separator from full load down to less than 30%. This means that the quantity of gas passing the secondary separator can be kept constant, in spite of a decrease in the supply of dust-laden gas, and thus the ratio between the quantity passing the secondary separator and the total supply will increase. This will result in a higher degree of separating efficiency in the secondary separator, which will compensate for the natural tendency in the primary separator to a reduction in separating efficiency when the load decreases. For the above mentioned reason the application of this invention thus gives the surprising technical effect of maintaining the separating efficiency of the whole equipment substantially constant with a decreasing load.

It is essential to make the connection **39** to the dust bin air-tight, and that the transport of dust from the equipment be carried out without letting air into the equipment.

What we claim:

1. In a dust separator comprising a spiral shaped casing having a tangential inlet for dust-laden raw gas and bounded by a peripheral wall and two substantially plane end walls, one of which has a central primary clean gas outlet connected to the suction side of a fan and having a circular dust grill arranged within said casing surrounding the clean gas outlet therein for primary separation of raw gas supplied tangentially to said casing, a secondary separator for the gas which has been concentrated with dust in the primary separator casing, said secondary separator having a dust-laden gas inlet, a secondary clean gas outlet, and a dust outlet, and constituting a separate cyclonic separator and means defining a slot in the peripheral wall of the spiral shaped casing of the primary separator through which gas concentrated with dust is discharged to said secondary separator dust-laden gas inlet; the improvement which consists in providing a chamber between the primary clean gas outlet and the fan, duct means connecting the secondary clean gas outlet to the interior of said chamber, and guiding means in the chamber comprising adjustable radial vanes disposed in the chamber intermediate the secondary clean gas outlet duct therein and said primary separator operable upon reduction in volume of the raw gas supplied to said casing to impart a whirling motion to said primary clean gas to reduce the static pressure in said chamber adjacent said clean gas outlet.

2. A dust separator as claimed in claim 1 wherein the duct means connecting the clean gas outlet of the secondary separator to the chamber passes coaxially through the primary separator clean gas outlet, and the guiding means is arranged in said outlet around the said duct means.

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