Aug. 28, 1928. 1,682,285

G. KEITH

CENTRIFUGAL APPARATUS FOR DUST SEPARATION

Filed March 26, 1926 6 Sheets-Sheet 1

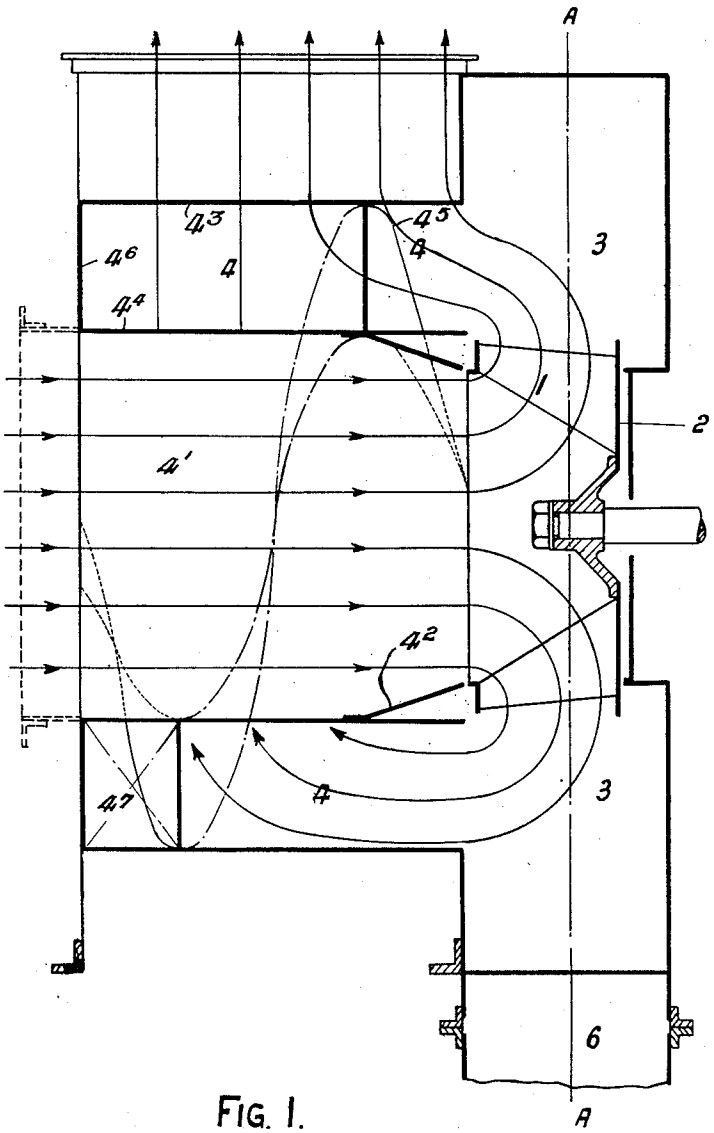


FIG. 1.

Inventor
George Keith
By
Pennie, Davis, Marvin & Edmonds
Attorneys

Aug. 28, 1928. 1,682,285

G. KEITH

CENTRIFUGAL APPARATUS FOR DUST SEPARATION

Filed March 26, 1926 6 Sheets-Sheet 2

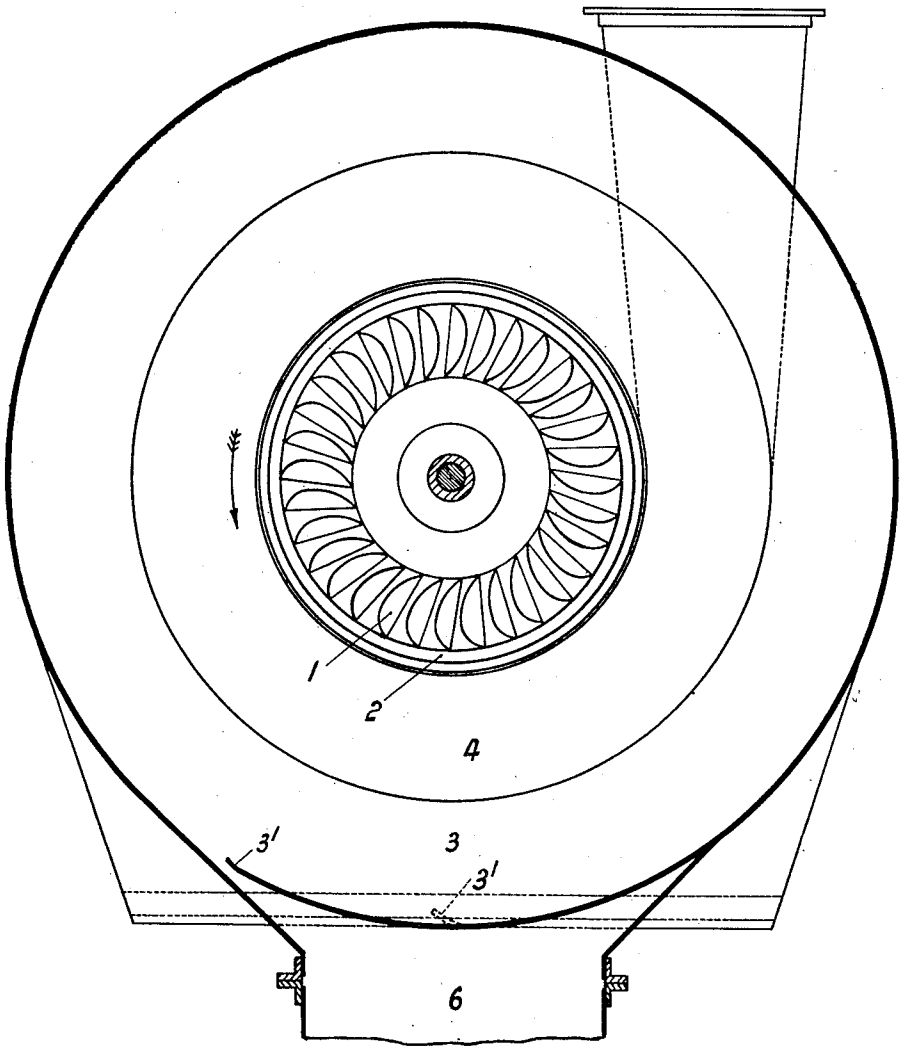


FIG. 2.

Inventor
George Keith
By
Pennie, Davis, Marvin & Edmonds
Attorneys

Aug. 28, 1928. 1,682,285

G. KEITH

CENTRIFUGAL APPARATUS FOR DUST SEPARATION

Filed March 26, 1926 6 Sheets-Sheet 3

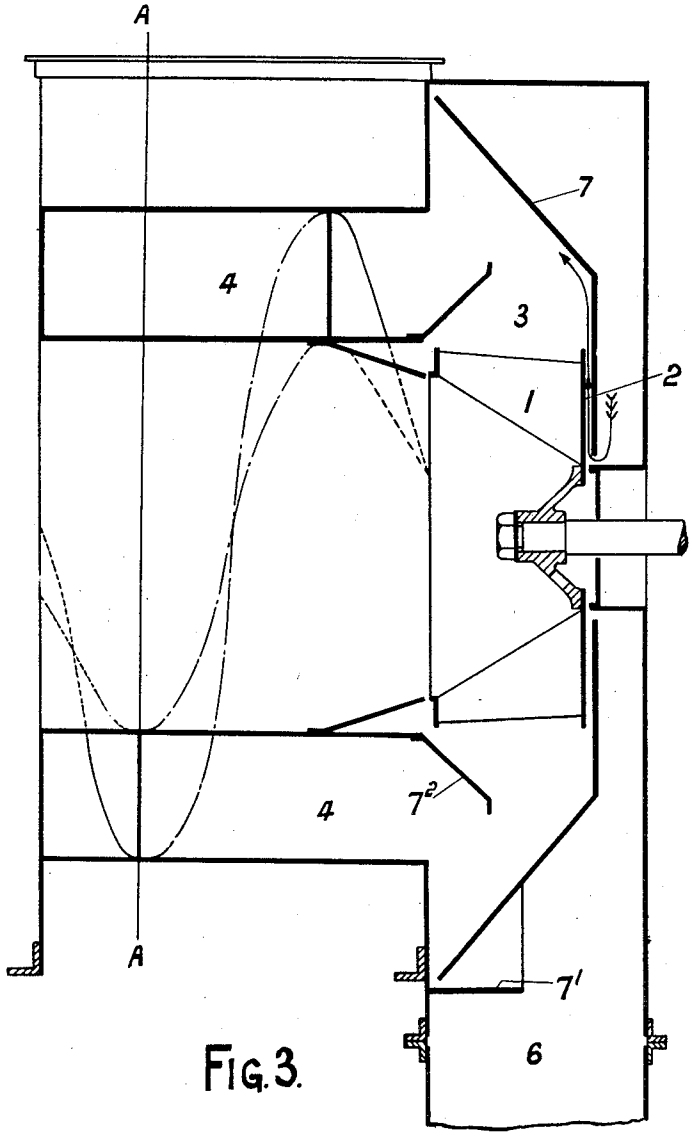


FIG. 3.

Inventor
George Keith
By
Pennie, Davis, Marvin & Edmonds
Attorneys

Aug. 28, 1928. 1,682,285

G. KEITH

CENTRIFUGAL APPARATUS FOR DUST SEPARATION

Filed March 26, 1926 6 Sheets-Sheet 4

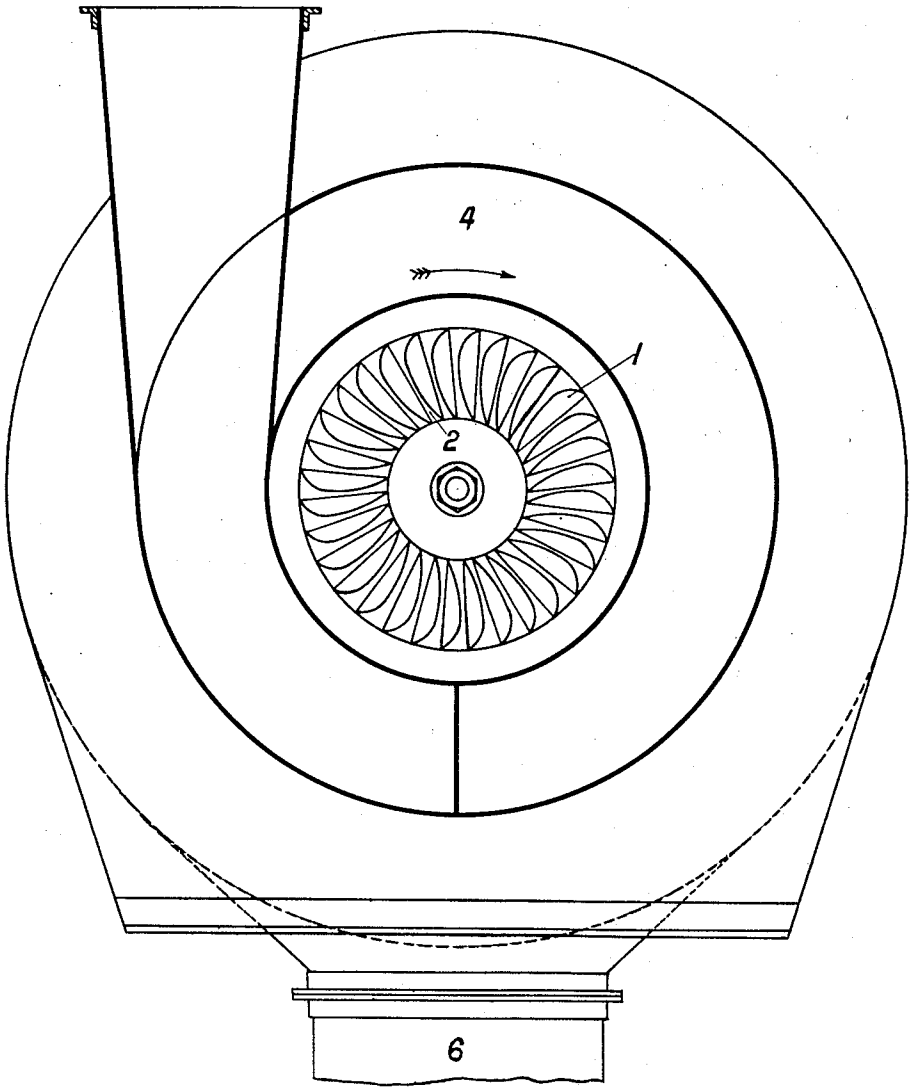


FIG. 4.

Inventor
George Keith
By
Pennie Davis Marvin & Emrich
Attorneys

Aug. 28, 1928. 1,682,285

G. KEITH

CENTRIFUGAL APPARATUS FOR DUST SEPARATION

Filed March 26, 1926 6 Sheets-Sheet 5

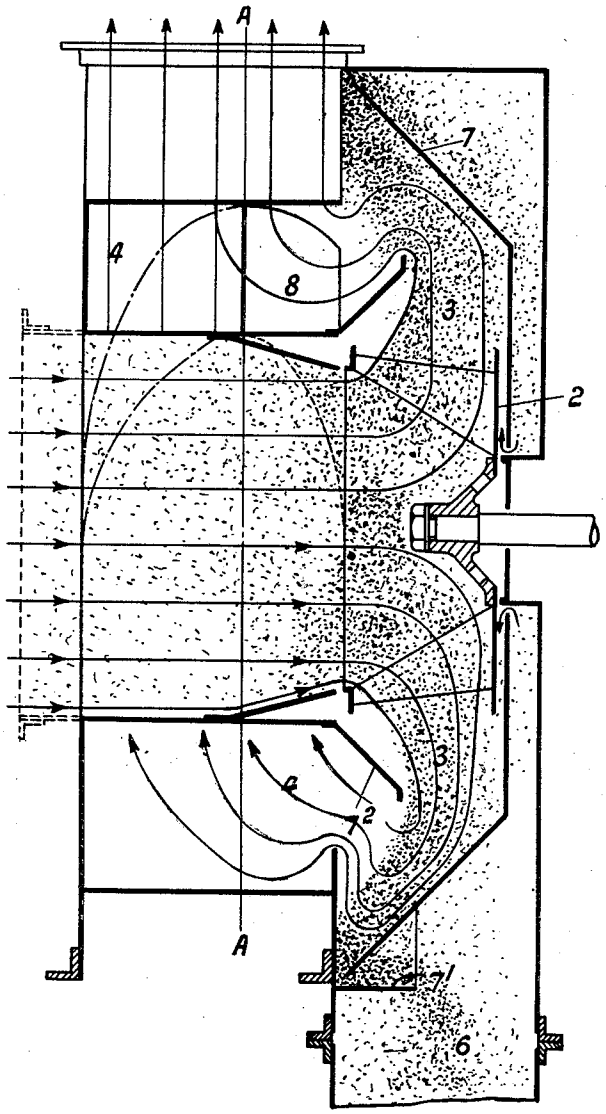


FIG. 5.

Inventor
George Keith
By
Pennie, Davis, Marvin & Edmonds
Attorneys

Aug. 28, 1928. 1,682,285

G. KEITH

CENTRIFUGAL APPARATUS FOR DUST SEPARATION

Filed March 26, 1926 6 Sheets-Sheet 6

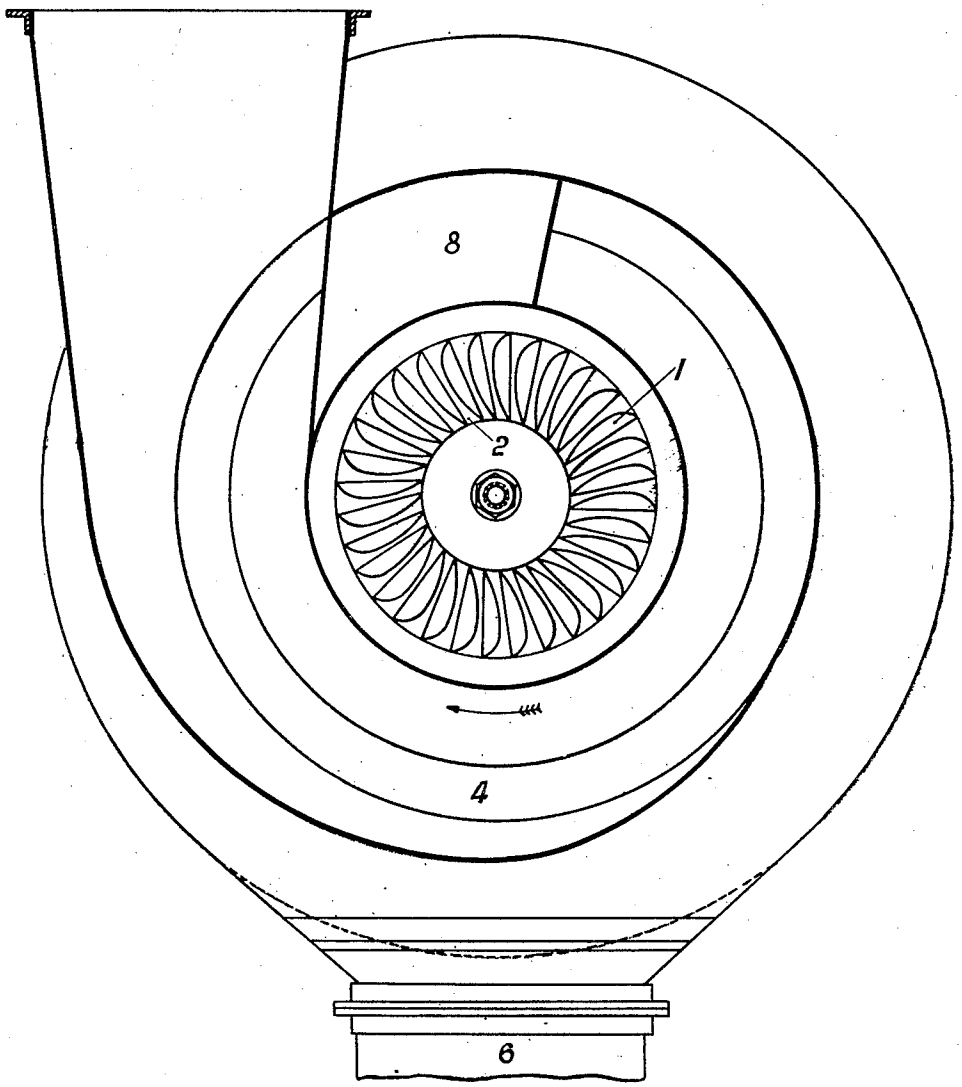


FIG. 6.

Inventor
George Keith
By Penning, Davis, Marvin & Edmonds
Attorneys

Patented Aug. 28, 1928. 1,682,285

UNITED STATES PATENT OFFICE.

GEORGE KEITH, OF LONDON, ENGLAND, ASSIGNOR TO JAMES KEITH & BLACKMAN COMPANY, LIMITED, OF LONDON, ENGLAND, A CORPORATION OF GREAT BRITAIN.

CENTRIFUGAL APPARATUS FOR DUST SEPARATION.

Application filed March 26, 1926, Serial No. 97,524, and in Great Britain March 27, 1925.

This invention relates to centrifugal apparatus for dust separation, i. e., for separating dust from air or gases, say, flue dust from gases or waste gaseous products of combustion.

In essence, the apparatus of the invention comprises cased fan arranged to function as a centrifugal separator, the casing of which comprises an impeller chamber of non-volute form in which the heavily dust-laden fraction of the air or gas is separated from the relatively dust-free fraction and a volute or quasi-volute chamber into which the non-volute chamber opens axially and into which is led the relatively dust-free fraction.

The fan impeller employed is preferably of the multi-vane type, comprising blades united to a back plate and rotating within the non-volute chamber of the fan casing.

Conveniently the volute or quasi-volute chamber is at the inlet end of the casing, i. e., that most remote from the back plate of the impeller, but it may be at the opposite end.

Within the impeller chamber may be arranged a skimmer or skimmers to take off the concentrated dust-laden air or gas which may be conveyed to an auxiliary separator or to a settling chamber in known manner while the great bulk of the air or gas flows axially into the volute or quasi-volute chamber while receiving a whirling movement in the direction of rotation of the impeller.

Conveniently the casting may be stepped, the entrance to the volute or quasi-volute chamber being of less external diameter than the impeller chamber.

In a preferred construction, there is fixed in co-axial relation with the impeller a stationary frusto-conical shell converging to the rear of the impeller, the dust impinging on this shell and being carried towards the end of larger diameter by centrifugal action and by the action of the air or gas, and passing around the forward edge of the shell into the space between the back of the shell and the casing from which it is discharged; or the shell may form the end wall of the casing in which event it may be jacketed by a dust chamber.

It may in certain cases be found necessary to pass a small volume of air or gas with the dust into the dust chamber. As such air or gas is dust-laden and should not be discharged into the atmosphere or the chimney, it may conveniently be discharged by way of a duct terminating at the inlet opening or eye of the fan, so that such dust-laden air or gas is re-passed through the separator; or the back plate of the impeller may be formed with an opening or openings permitting the air or gas to return to the inlet side of the fan; or air or gas from the dust or dust chamber at the back of the frusto-conical shell may be allowed to flow into the space between the back plate of the impeller and the shell, the frictional drag caused by the back plate (which may have shallow blades on its rearward face) providing sufficient centrifugal effect to cause a flow of the dust-laden air or gas the dust carried by which is discharged at a favorable point on the shell so that it will be carried back into the dust chamber.

If desired, water in spray form may be introduced into the separator, or a jet or jets of water may be caused to impinge on the centre of the impeller to be broken up into spray thereby and distributed over the shell.

In the accompanying drawings which illustrate the invention Fig. 1 is a longitudinal section and Fig. 2 a section on the line A—A of a simple embodiment, Figs. 3 and 4 and Figs. 5 and 6 are like views showing modifications.

The apparatus shown in all the figures includes a fan impeller of known type, comprising blades 1 united to a back plate 2.

Referring first to Figs. 1 and 2, it will be seen that the chamber 3 in which the impeller rotates is of non-volute form but opens axially into a quasi-volute chamber 4 of helical form of less external diameter than the chamber 3, said chamber 4 enclosing a cylindrical continuation $4'$ of the conduit for dust-laden air at the terminus of which continuation is a truncated conical guide 4^2 the narrower end of which registers with the eye of the fan impeller. The boundaries of the helical chamber 4 are constituted by cylindrical walls 4^3 and 4^4, an interposed helical wall 5^5 and an end wall 4^6. 4^7 represents a dead space complemental to the chamber 4.

The path of the air is indicated by arrows.

The dust tends to accumulate at the periphery of the chamber 3 where there are skimmers $3'$ to take off the concentrated

dust-laden air or gas which may be conveyed by the connection 6 to an auxiliary separator or to a settling chamber in known manner while the great bulk of the air or gas flows axially into the chamber 4 while receiving a whirling movement in the direction of rotation of the impeller.

In the form shown in Figs. 3 and 4 there is fixed in co-axial relation with the impeller a frusto-conical shell 7 converging to the rear of the impeller, the dust impinging on this shell and being carried towards the end of larger diameter by centrifugal action and by the action of the air, and passing around the forward edge of the shell and thence rearwards into the space between the exterior of the shell and the casing, it being found important that the direction of travel of the dust-laden air be substantially reversed. To assist in guiding the dust-laden air a shelf 7′ may be fitted to surround all or part of the periphery of the shell 7. Provision is made whereby air or gas from the dust chamber at the back of the shell may be allowed to flow as indicated by arrows into the space between the back plate 2 and the shell 7 to discharge any dust recirculated at a favorable point on the shell 7.

A cone 7^2 at the eye of the fan obviates any tendency of dust-laden air discharged by the fan to follow a direct route to the chamber 4.

In the form shown in Figs. 5 and 6, which is otherwise similar to that shown in Figs. 3 and 4 but in which the chamber 4 is in effect of volute form, the first quarter of the volute is practically of uniform diameter, merging into a radially diverging portion, a tongue 8 being provided to guide the air or gas in sidewise from the impeller.

The term "quasi-volute chamber" as used herein is intended to designate a helical or spiral or approximately helical or spiral chamber as distinguished from a volute or true spiral chamber.

I claim:—

1. A centrifugal apparatus for dust separation comprising a fan impeller and a fan casing comprising an impeller chamber of non-volute form in which the heavily dust-laden fraction of fluid being treated is separated from the relatively dust-free fraction, and a spiral chamber coaxial with the impeller chamber, into which spiral chamber the impeller chamber opens axially to permit the passage of the relatively dust-free fraction to the spiral chamber.

2. A centrifugal apparatus for dust separation comprising a fan impeller, and a fan casing, said casing being stepped and comprising an impeller chamber of non-volute form in which the heavily dust-laden fraction of fluid being treated is separated from the relatively dust-free fraction, and a spiral chamber coaxial with the impeller chamber of less external diameter than the impeller chamber, into which spiral chamber the impeller chamber opens axially to permit the passage of the relatively dust-free fraction to the spiral chamber.

3. A centrifugal apparatus for dust separation comprising a casing comprising an impellar chamber of non-volute form in which the heavily dust-laden fraction of fluid being treated is separated from the relatively dust-free fraction, an impeller in said chamber, a spiral chamber coaxial with said impeller chamber, said spiral chamber surrounding the intake eye of said impeller, said impeller chamber opening axially into said spiral chamber, a frusto-conical shell disposed within said casing coaxially with and converging rearwardly of said impeller, and a dust chamber beyond said shell, into which dust chamber dust may pass over the forward edge of said shell and thence rearwardly.

4. A centrifugal apparatus for dust separation comprising a fan casing comprising an impeller chamber of non-volute form in which the heavily dust-laden fraction of fluid being treated is separated from the relatively dust-free fraction, an impeller in said chamber, said impeller having a back-plate, a volute chamber coaxial with said impeller chamber, said volute chamber surrounding the intake eye of said impeller, said impeller chamber opening axially into said volute chamber, a frusto-conical shell disposed within said casing coaxially with and converging rearwardly of said impeller, a dust chamber beyond said shell, into which dust chamber dust may pass over the forward edge of said shell and thence rearwardly, and means for leading dust-laden fluid from said dust chamber to the space between said back plate and said shell.

In testimony whereof I have signed my name to this specification.

GEORGE KEITH.