

Oct. 3, 1933.

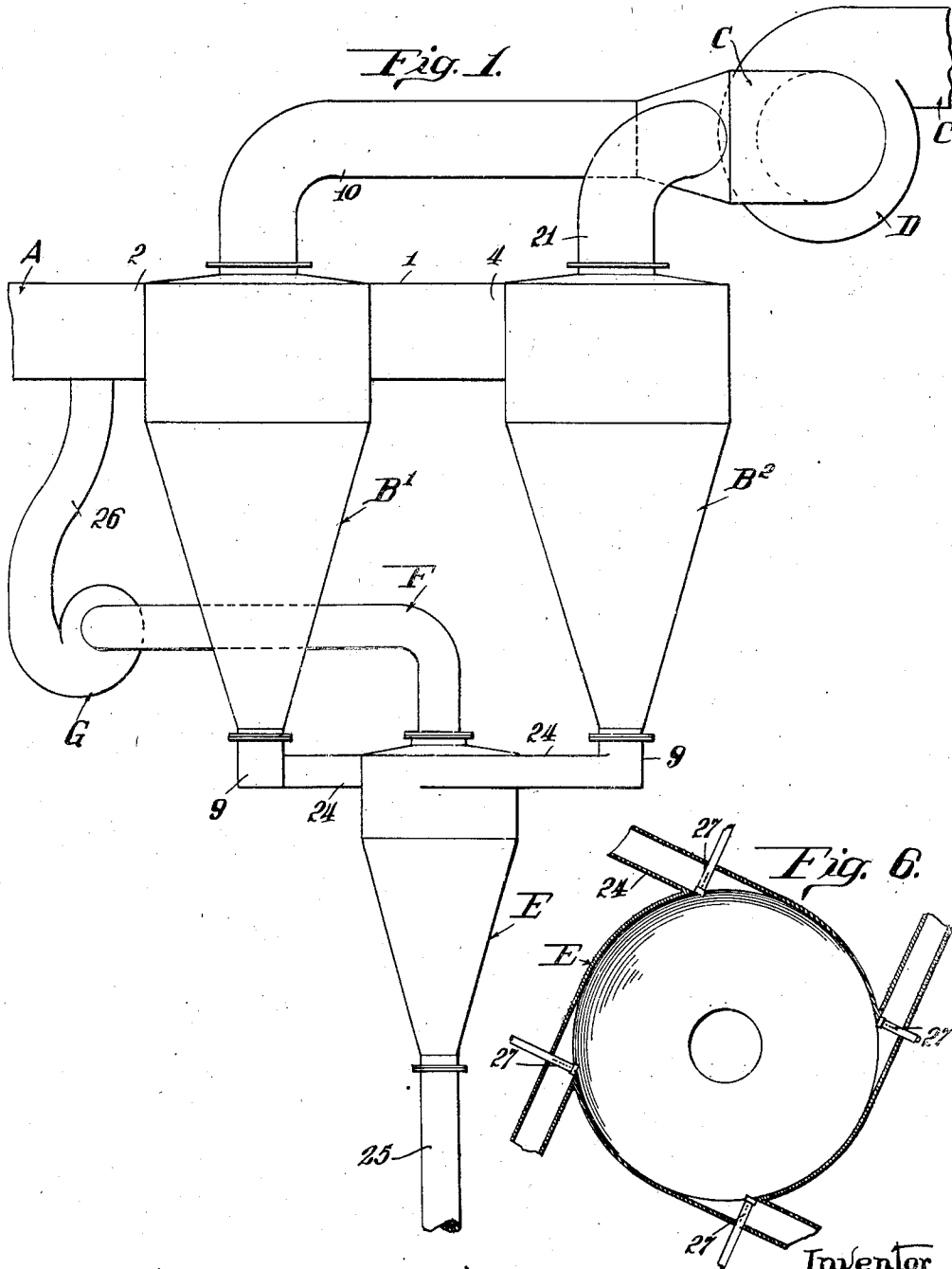
R. F. O'MARA

1,928,702

APPARATUS FOR COLLECTING DUST

Filed Aug. 7, 1931

3 Sheets-Sheet 1



Inventor

Richard F. O'Mara

Barnett & Truman
Attorneys

Oct. 3, 1933.

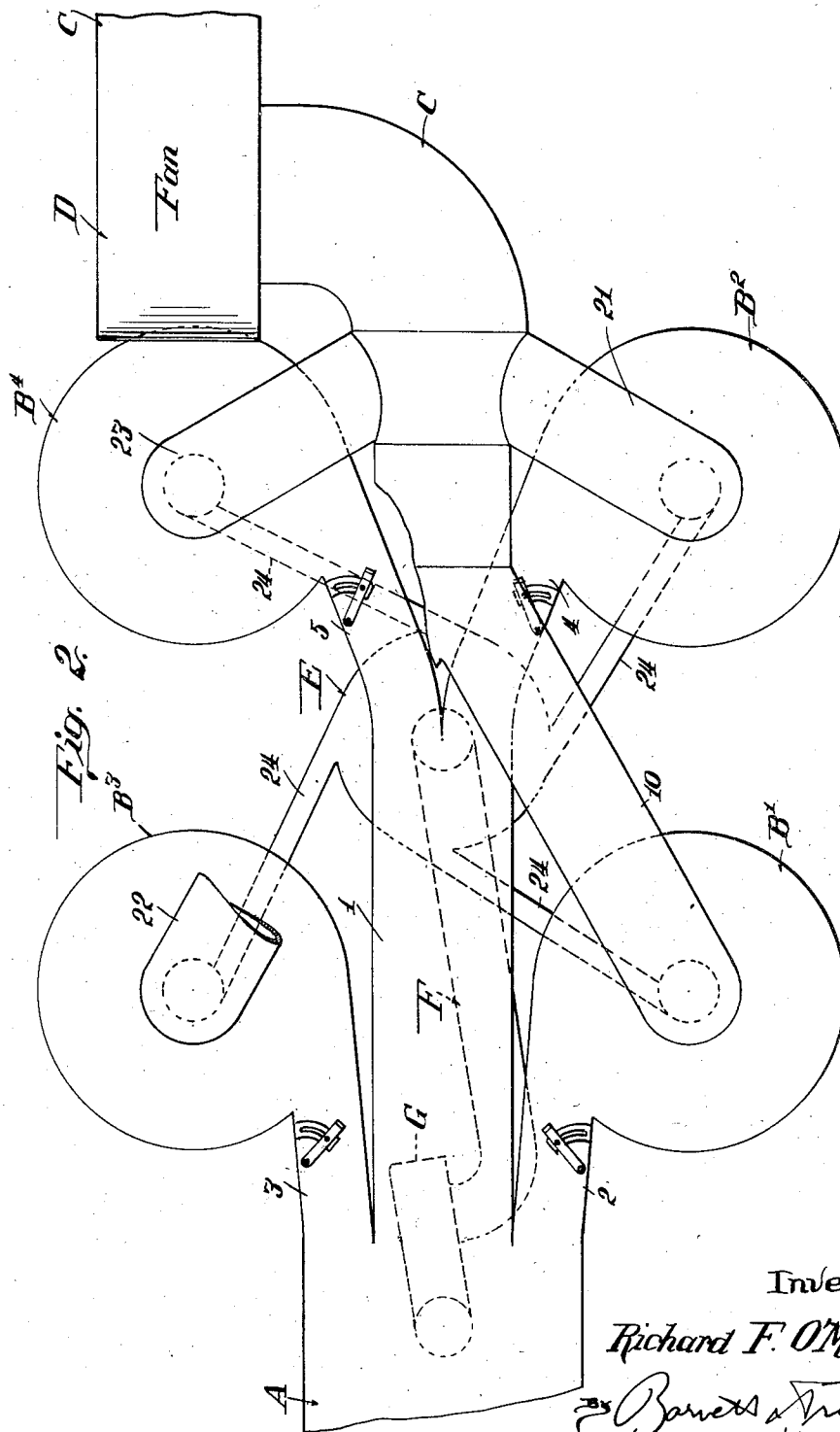
R. F. O'MARA

1,928,702

APPARATUS FOR COLLECTING DUST

Filed Aug. 7, 1931

3 Sheets-Sheet 2



Inventor
Richard F. O'Mara
By *Barnett & Truman*
Attorneys

Oct. 3, 1933.

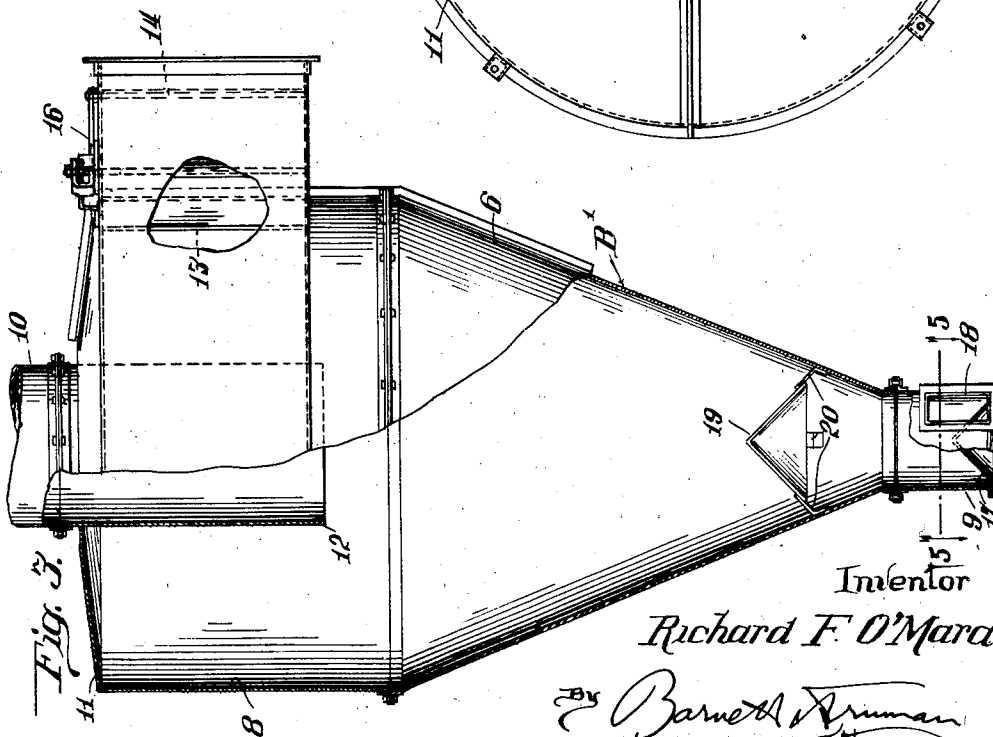
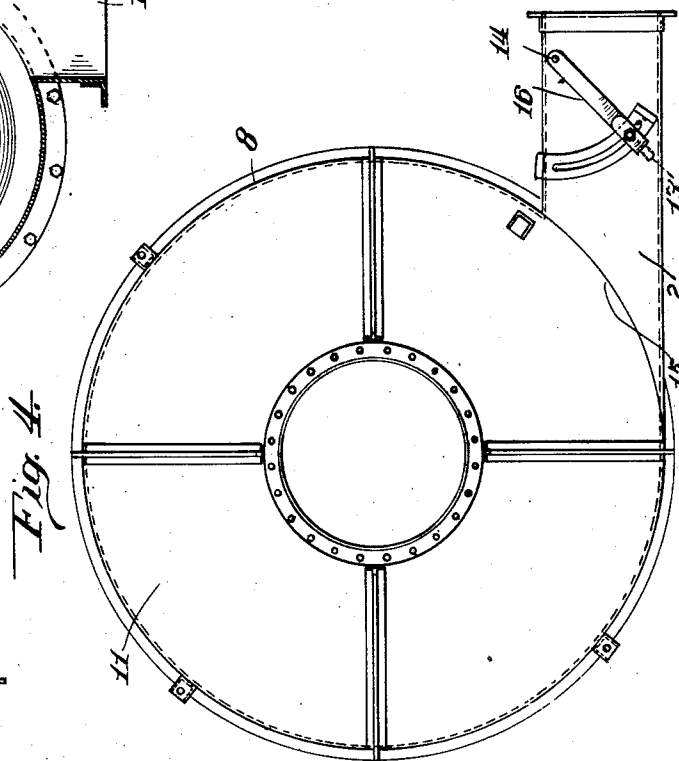
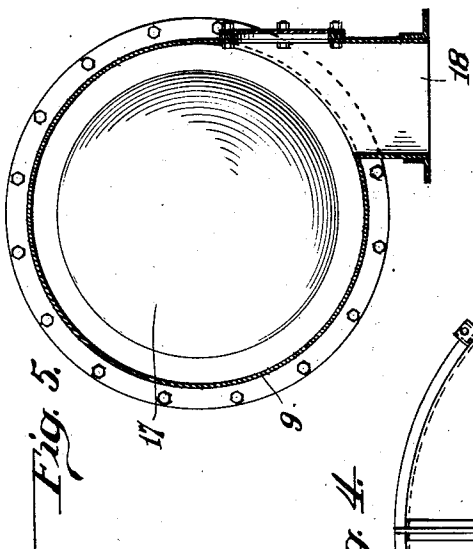
R. F. O'MARA

1,928,702

APPARATUS FOR COLLECTING DUST

Filed Aug. 7, 1931

3 Sheets-Sheet 3



Inventor

Richard F. O'Mara

By *Barnett Truman*
Attorneys

UNITED STATES PATENT OFFICE

1,928,702

APPARATUS FOR COLLECTING DUST

Richard F. O'Mara, La Fayette, Ind., assignor
to The Raymond Brothers Impact Pulver-
izer Company, Chicago, Ill., a corporation of
Illinois

Application August 7, 1931. Serial No. 555,763

7 Claims. (Cl. 183—34)

This invention relates to a certain new and im-
proved apparatus for collecting dust, and more
particularly to new and useful improvements in
an apparatus for recovering and collecting any
solid finely divided material that is carried in
suspension in a stream of air or other gases.

The usual process for recovering dust consists
in passing the air stream through a separator,
often of the cyclone type, wherein the greater
portion of the suspended material is deposited
and collected. A small proportion of very finely
divided material will still be suspended in the air-
stream flowing from the separator. It has been
proposed to pass this air-stream through a con-
centrator wherein the suspended material is con-
centrated in a relatively small portion of the air-
stream, the dust-free air being vented from the
concentrator and the dust-laden air returned to
the original air-stream.

According to the present invention the original
stream of dust-laden air is passed through a con-
centrator, or preferably a plurality of concen-
trators arranged in multiple, wherein the sus-
pended material is concentrated in a relatively
small portion of the air, and from which the
remainder of the air, substantially free from
suspended material, is vented. The material-
laden air is conducted from the concentrators
into a single cyclone separator wherein the major
portion of the material is deposited and collected.
Preferably the air stream from the separator,
which will still contain a certain small quantity
of finely divided material, is returned to the origi-
nal air stream to again pass through the process.

The general object of this invention is to pro-
vide an improved apparatus of the type briefly
described hereinabove and disclosed more in de-
tail in the specifications which follow.

Another object is to provide a new and im-
proved apparatus for separating and collecting
suspended dust from the air stream in which it is
carried.

Other objects and advantages of the invention
will be more apparent from the following detailed
disclosure of an approved example of apparatus
suitable for carrying out the principles of the
invention.

In the accompanying drawings:

Fig. 1 is a side elevation of the assembled ap-
paratus.

Fig. 2 is a plan view, on a larger scale and
partially broken away, of the apparatus shown in
Fig. 1.

Fig. 3 is an elevation, partially in central verti-

cal section, of one of the improved concentrators.

Fig. 4 is a plan view of the concentrator.

Fig. 5 is an enlarged horizontal section taken
substantially on the line 5—5 of Fig. 3.

Fig. 6 is a horizontal section through the upper
portion of the separator, showing a modification.

The apparatus comprises, in general, a main
supply conduit A, a battery of similar concen-
trators B¹, B², B³ and B⁴, a main air venting con-
duit C, a fan or blower D for maintaining the air
circulation through the concentrators, a cyclone
separator E, a return air conduit F and a blower
G in the conduit F.

The main supply conduit A splits into a central
branch conduit 1 and a pair of side branch con-
duits 2 and 3 which lead respectively to the con-
centrators B¹ and B³. In turn the conduit 1
splits into a pair of similar branch conduits 4 and
5 leading to the respective concentrators B² and
B⁴. It will be noted that the branch conduits
2, 3, 4 and 5 are all of equal size, that conduit 1
is equal in cross-section to the sum of conduits 4
and 5, and that main conduit A has a cross-sec-
tional area equal to the sum of conduits 1, 2 and 3,
so that the air stream supplied through the main
conduit will be divided substantially equally be-
tween the several concentrators.

The several concentrators B¹, B², B³ and B⁴
(of which the system may comprise one or more,
as will be hereinafter apparent) are all substan-
tially alike with the exception that concentrators
B¹ and B², in the example here shown, are so
designed that the materials therein whirl in a
clock-wise direction (Fig. 2) whereas the whirl
is in a counter-clockwise direction in concen-
trators B³ and B⁴.

This improved type of concentrator is disclosed
more in detail in Figs. 3, 4 and 5 and has previ-
ously been disclosed and claimed in my copend-
ing application Serial No. 555,762, filed August 7,
1931. This concentrator is of a modified cyclone
separator type and comprises a closed housing
having a central portion 6 of inverted conical
form, a large upper substantially cylindrical por-
tion 8 and a small lower substantially cylindrical
discharge housing 9. The inlet conduit 2 (of con-
centrator B¹, here shown by way of example),
leads substantially tangentially into the larger
upper portion 8 of the housing so that a whirling
motion will be imparted to the air content of the
concentrator, as is well understood in this art.
The outlet pipe 10, through which the greater
portion of the air is vented, leads through the
central portion of the top or closure 11 of the

housing and is provided with an extension 12, having an open lower end, leading downwardly within the concentrator below the inlet passage 2. A swinging valve or damper 13 is pivoted on a vertical axis 14 within inlet conduit 2 adjacent its discharge end 15 so as to swing toward or from the outer tangential wall of this conduit and thus vary the effective size of the inlet to the concentrator. The efficiency of the concentrator is a function of the inlet velocity of the air-stream and the fineness and character of the dust to be separated from the air, and it will be apparent that the inlet velocity can be effectively regulated by properly positioning the inlet valve 13. It will be noted that in any position of adjustment of this vertical valve or damper the entering air stream will be directed tangentially along the inner surface of the outer wall of the concentrator so that the maximum whirling or centrifugal effect will be imparted to the suspended material introduced into the concentrator. The valve or damper may be adjusted in any suitable manner from the outside of inlet conduit 2, as for example by means of the adjusting mechanism indicated generally at 16 in Figs. 3 and 4.

As is usual in a separating apparatus of this type, the suspended material will be deposited against the inner walls of the housing or concentrated in the air adjacent these walls, due to the centrifugal force imparted to the material by the whirling air, and the material will tend to settle by gravity to the lower end of the concentrator. However, unless a positive down draft is provided to carry out this material, too large a proportion of the finely divided material will be caught in the central air vortex and sucked up through the outlet conduit 10. To prevent this the smaller lower end of the conical housing is provided with the cylindrical extension 9 having the upwardly projecting conical bottom 17, and provided with the outlet 18 leading tangentially from one side of the housing in the direction in which the whirling materials are traveling. A relatively small proportion of the air stream entering the housing through inlet 15 is drawn out through outlet 18, thus producing a sufficient down draft adjacent the inner walls of the concentrator to effectively suck down the air adjacent these walls which carries the concentrated suspended material. This air, still moving with a whirling motion, will pass out through tangential outlet 18 carrying with it practically all of the suspended material. The upwardly projecting conical member 17 serves to puncture the central air vortex tending to suck material upwardly through outlet 12, thus maintaining the whirling movement of the air within the lower extension 9 and reducing the upward flow of suspended material to a minimum. If desired, a second conical member 19 may be centrally supported within the lower portion of conical housing 6, as by means of brackets 20 so as to further insure the breaking up of the inner vortex in the lower portion of the concentrator, but ordinarily this additional conical member will not be necessary. The air stream passing out through outlet 12 and conduit 10 will be substantially free from dust or other suspended material.

The outlet conduit 10, and similar air conduits 21, 22 and 23 leading respectively from concentrators B², B³ and B⁴, join together to form the main air discharge conduit C, in a portion of which is positioned the main fan or blower D which maintains the necessary air circulation in the concentrating system. This blower D might alternatively be located in the supply conduit A

or in some other portion of the circulating system. The dust-free air can be vented from conduit C to the outer air, or may be returned to a circulating system for further use thereof.

The outlets 18 of the several concentrators are connected by similar conduits 24 with the inlet end of the cyclone separator E which may be of usual and well known construction. The several conduits 24 all enter substantially tangentially, and in the same direction, the larger upper end portion of the inverted conical housing of the separator so as to cause the air and suspended materials to whirl therein. The major portion of the highly concentrated suspended dust or similar material will be thrown out centrifugally and will settle out to be collected through spout or conduit 25. The air is drawn out through the conduit F leading from the central upper portion of the separator, an auxiliary fan or blower G preferably being positioned in this conduit to positively insure the desired suction through the air outlet conduit F. A small amount of finely divided material will be carried out in the air through conduit F and to prevent loss of this material it is desirable to direct the air from conduit F back into the main inlet or supply conduit A, as indicated at 26, so that this relatively small air stream is again passed through the system to deposit its suspended materials.

Instead of the dry separation process above described, a wet separation process could be used, as indicated in Fig. 6. Suitable liquid sprays 27 are positioned in the discharge ends of conduits 24 so as to wash out the solid materials in the air and carry these materials away in solution or in suspension in the liquid through conduit 25. If the separation is sufficiently complete the air from the separator E need not be returned to conduit A but may be vented directly or into main air discharge conduit C.

In the general operation of this system the dust-laden air drawn in through conduit A by the suction of fan or blower D (and perhaps by other propulsion means in the air-circulation system), is divided among the several separators B wherein the suspended material is concentrated in a relatively small volume of the air, the dust-free air from all of the concentrators being drawn out and collected by fan D and vented through conduit C. The relatively small remaining volume of air carries the suspended dust into separator E, wherein the major part of the dust is deposited and separated out through discharge conduit 25, either dry or in a liquid stream. The small air flow through separator E is withdrawn by fan or blower G through conduit F and returned into the main supply conduit A so that any finely divided materials that may be sucked out in this air stream are not lost but are again passed through the separation process.

While four concentrators B have been used in the system here disclosed by way of example, one or more concentrators may be used depending on the relative sizes of the concentrators and the separator. It is more efficient and economical to employ a battery of concentrators B arranged in parallel or multiple, since a single separator is capable of handling the combined concentrated output from a plurality of the concentrators. The assembly is quite compact and capable of separating the suspended materials from a large volume of dust-laden gases.

It is to be understood that the term "dust" as used in the above description and in the claims which follow is intended to cover any sort of finely

divided solid material that may be carried in suspension in a stream of air or other gases. Also, the term "air" is used in a general sense to indicate any suitable gas or gases in which the solid material may be carried in suspension.

I claim:

1. A dust-collecting apparatus comprising a plurality of similar concentrators, means including a main conduit and a plurality of branch conduits leading therefrom for conducting the dust-laden air into the several concentrators, means for venting the dust-free air from each concentrator, a separator, a plurality of conduits leading from the several concentrators into the separator through which the concentrated dust is conveyed in suspension in a relatively small portion of the original air stream, means for collecting the major portion of the dust from the separator, and means for returning the air from the separator to the main conduit.

2. A dust-collecting apparatus comprising a concentrator including a housing of inverted conical form, a conduit for dust-laden air extending tangentially into the upper portion of the housing, a valve at the inlet to the concentrator for regulating the velocity of the air stream projected into the concentrator, an outlet for dust-free air leading from the central upper portion of the housing, an outlet conduit leading tangentially from the smaller end of the housing through which the dust is carried in suspension in a relatively small portion of the original air stream, a cyclone separator into the upper portion of which the last mentioned conduit leads tangentially, a conduit leading from the upper central portion of the separator for conducting the air therefrom back into the first-mentioned conduit, and blowing means for causing the air-streams to circulate through the concentrator and separator.

3. A dust-collecting apparatus comprising a plurality of similar concentrators each including a housing of inverted conical form, a main conduit for dust-laden air, a plurality of branch conduits leading from the main conduit and each leading tangentially into the upper portion of one of the concentrator housings, an outlet conduit for dust-free air leading from the upper central portion of each housing, an outlet conduit leading tangentially from the smaller lower end of each housing, a cyclone separator, the several outlet conduits all leading tangentially into the upper portion of the separator, an air outlet conduit leading from the upper central portion of the separator back into the main conduit, and a blower in the last mentioned outlet conduit.

4. A dust-collecting apparatus comprising a plurality of similar concentrators each including a housing of inverted conical form, a main conduit for dust-laden air, a plurality of branch conduits leading from the main conduit and each leading tangentially into the upper portion of one of the concentrator housings, an outlet conduit for dust-free air leading from the upper central portion of each housing, an outlet conduit leading tangentially from the smaller lower end of each housing, a cyclone separator, the several

outlet conduits all leading tangentially into the upper portion of the separator, an air outlet conduit leading from the upper central portion of the separator back into the main conduit, and blower means for causing circulation of the air streams through the concentrators and separators.

5. A dust-collecting apparatus comprising a plurality of similar concentrators each including a housing of inverted conical form, a main conduit for dust-laden air, a plurality of branch conduits leading from the main conduit and each leading tangentially into the upper portion of one of the concentrator housings, an outlet conduit for dust-free air leading from the upper central portion of each housing, a main air venting conduit into which the several outlet conduits leads, a blower in this venting conduit for causing the air circulation through the concentrators, an outlet conduit leading tangentially from the smaller lower end of each housing, a cyclone separator, the several outlet conduits all leading tangentially into the upper portion of the separator, an air outlet conduit leading from the upper central portion of the separator back into the main conduit, and a blower in the last mentioned outlet conduit.

6. A dust-collecting apparatus comprising a plurality of similar concentrators each including a housing of inverted conical form, a main conduit for dust-laden air, a plurality of branch conduits leading from the main conduit and each leading tangentially into the upper portion of one of the concentrator housings, a valve at the inlet to each concentrator for regulating the velocity of the air projected into the concentrator, an outlet conduit for dust-free air leading from the upper central portion of each housing, an outlet conduit leading tangentially from the smaller lower end of each housing, a cyclone separator, the several outlet conduits all leading tangentially into the upper portion of the separator, an air outlet conduit leading from the upper central portion of the separator back into the main conduit, and blower means for causing circulation of the air streams through the concentrators and separator.

7. A dust-collecting apparatus comprising a plurality of similar concentrators each including a housing of inverted conical form, a main conduit for dust-laden air, a plurality of branch conduits leading from the main conduit and each leading tangentially into the upper portion of one of the concentrator housings, an outlet conduit for dust-free air leading from the upper central portion of each housing, an outlet conduit leading tangentially from the smaller lower end of each housing, a cyclone separator, the several outlet conduits all leading tangentially into the upper portion of the separator, means for spraying a liquid into the air-streams adjacent the discharge end of each of these outlet conduits, means for collecting the liquid and dust carried thereby, and means for venting the air from the separator.

RICHARD F. O'MARA.