

No. 764,671.

PATENTED JULY 12, 1904.

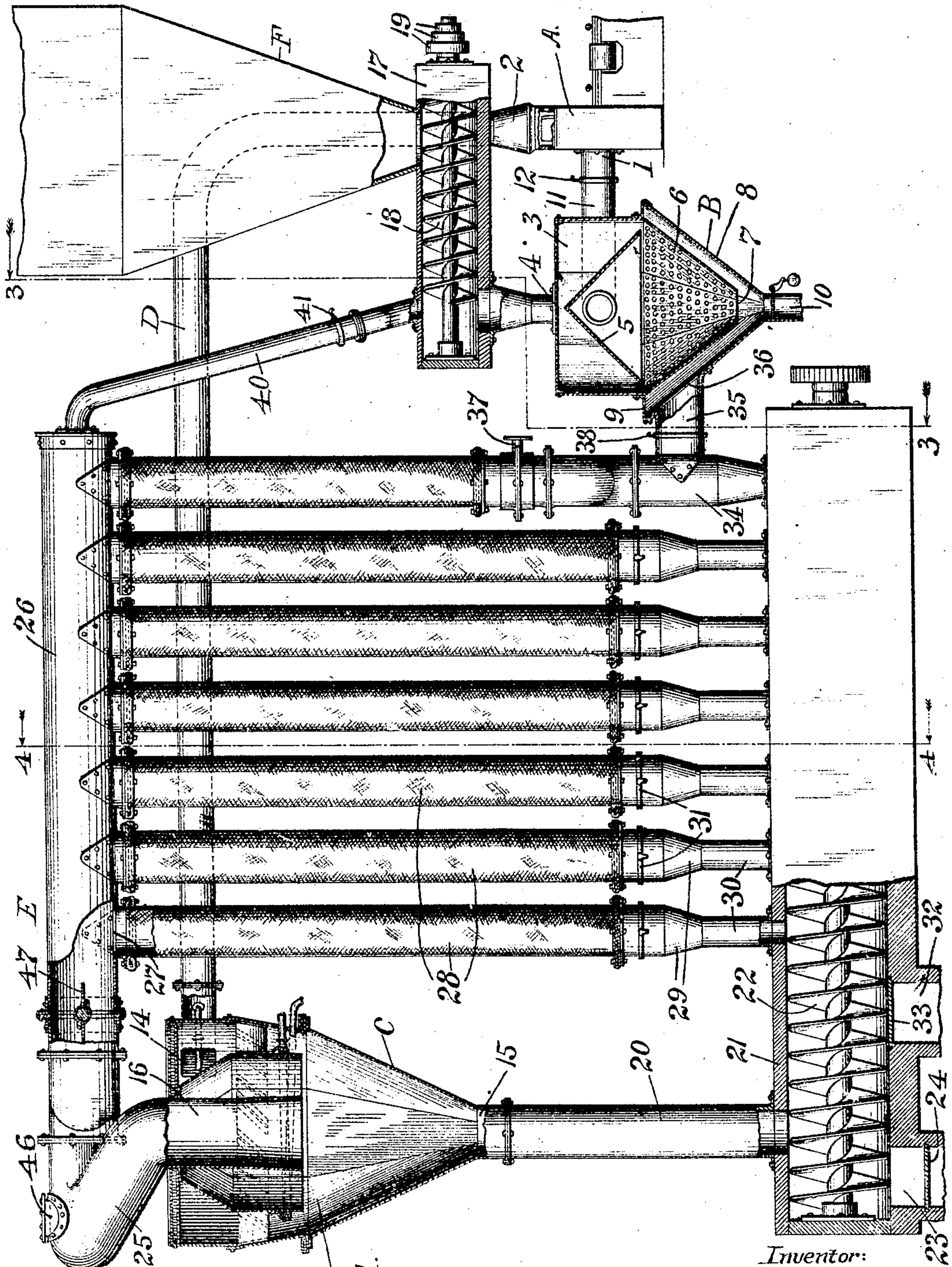
W. S. OSBORNE.

PNEUMATIC GRADING OR SEPARATING SYSTEM.

APPLICATION FILED NOV. 7, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses:
G. H. Kishner
G. A. Moore

Fig. 1.

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William S. Osborne.
by *Bakewell Cornwall*
Att'y's

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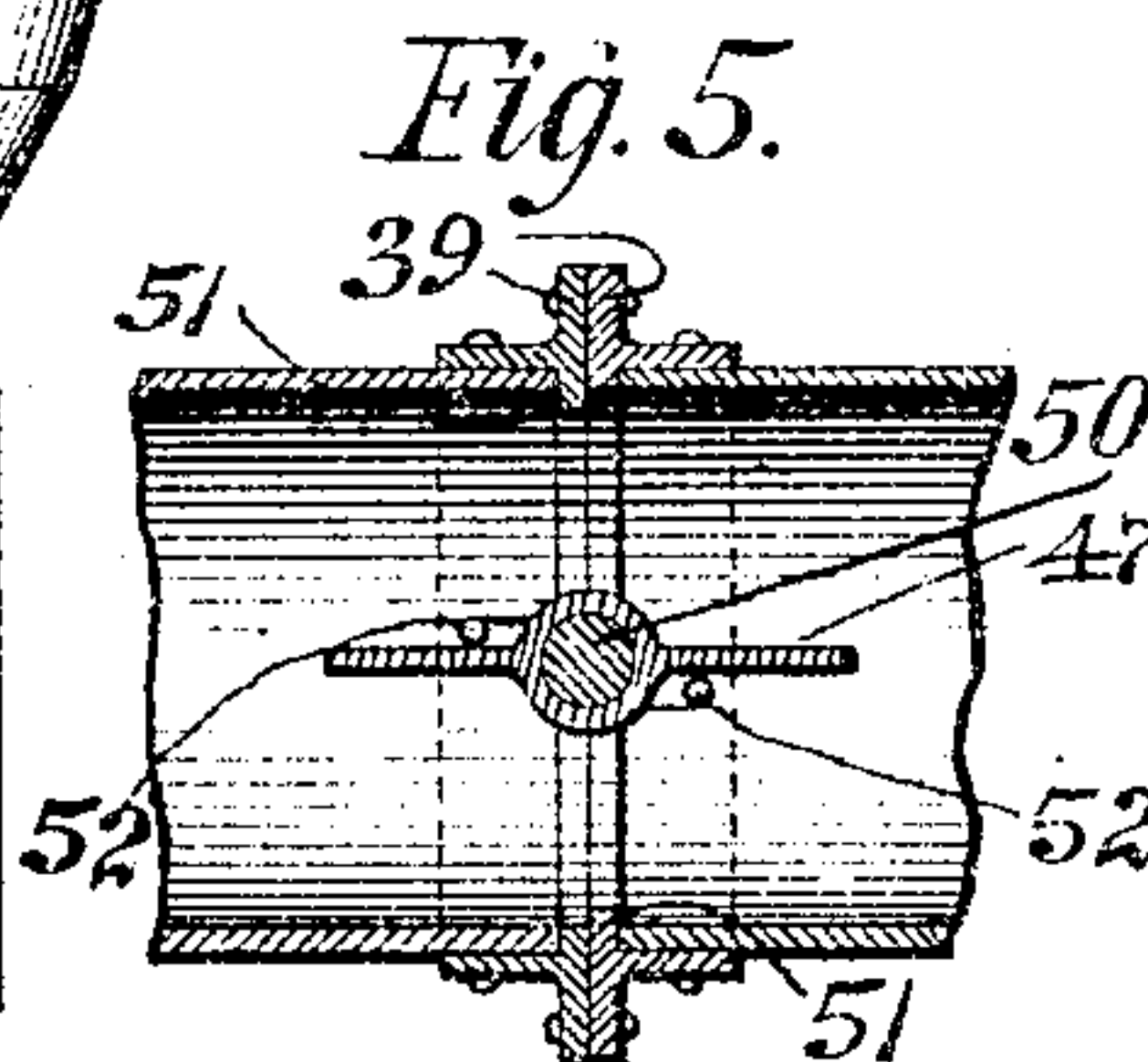
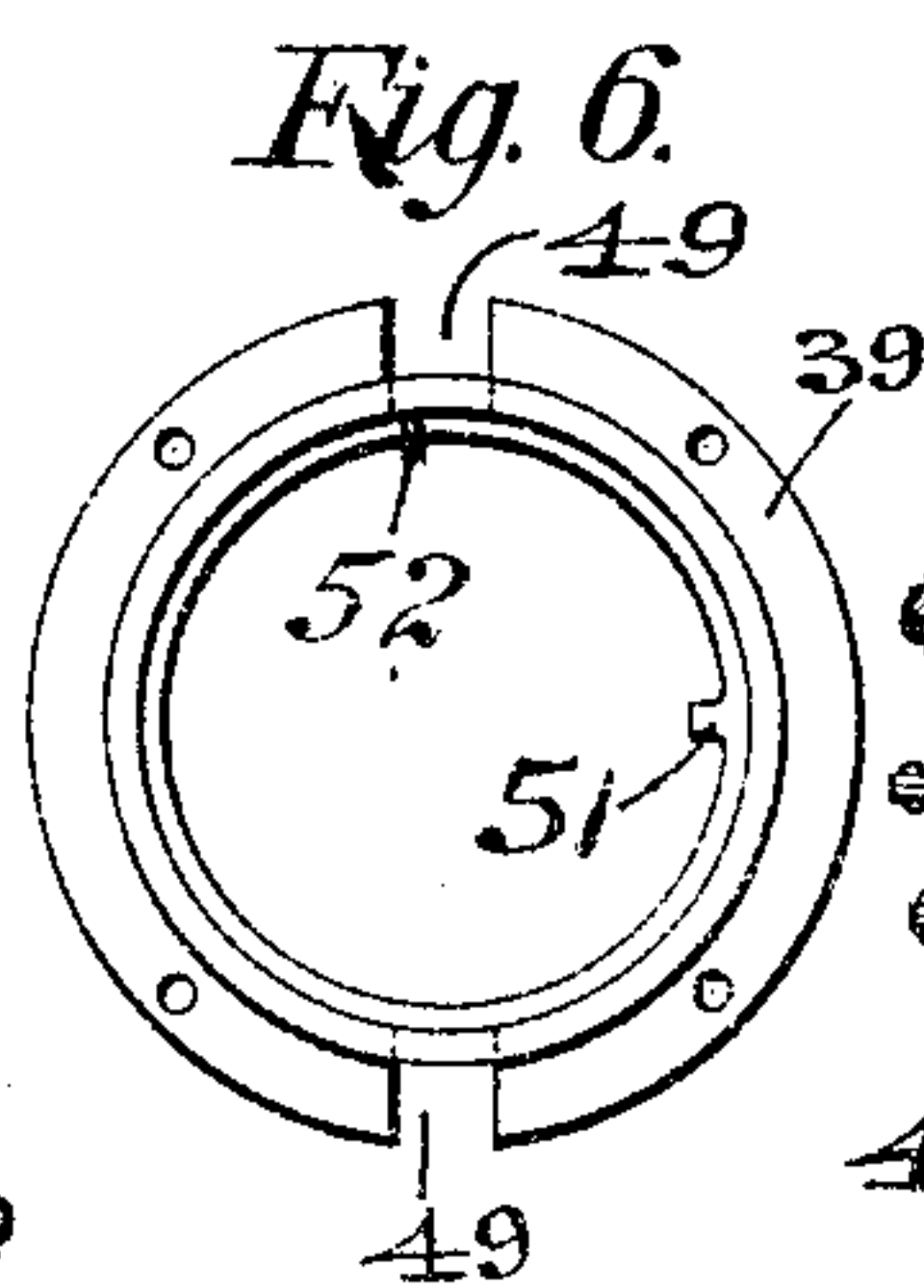
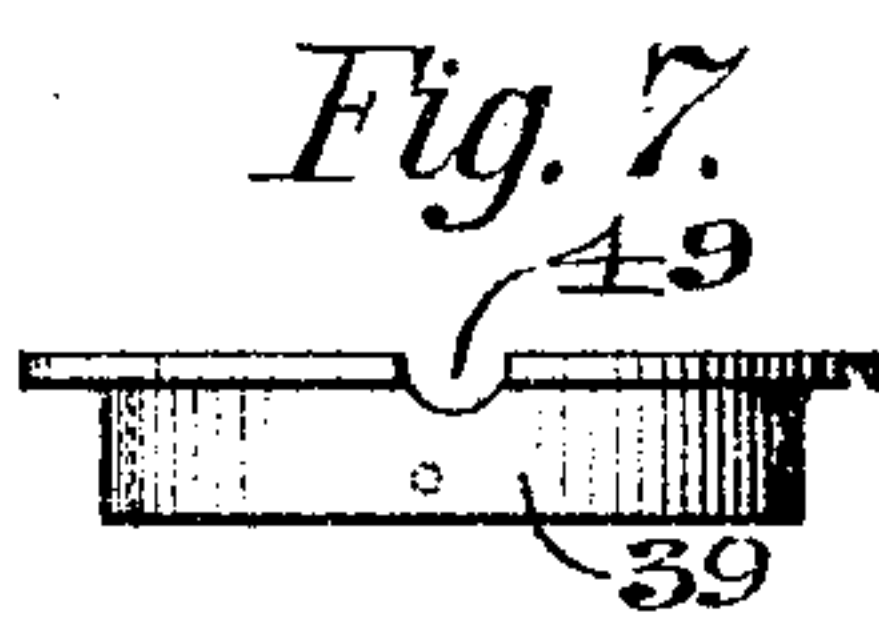
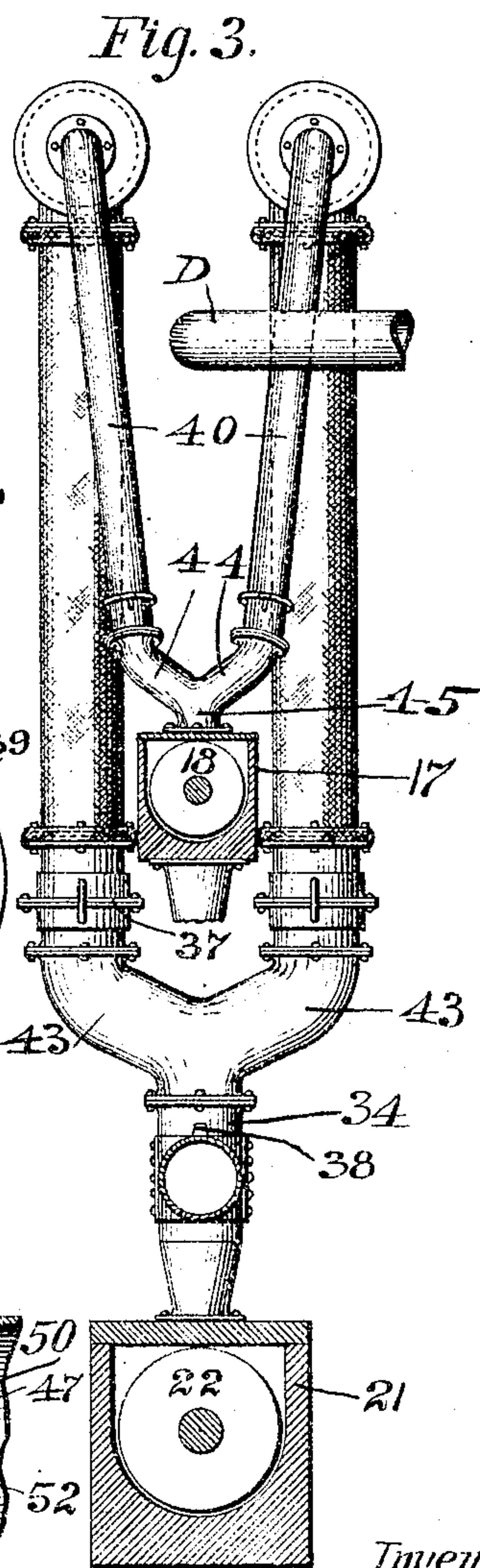
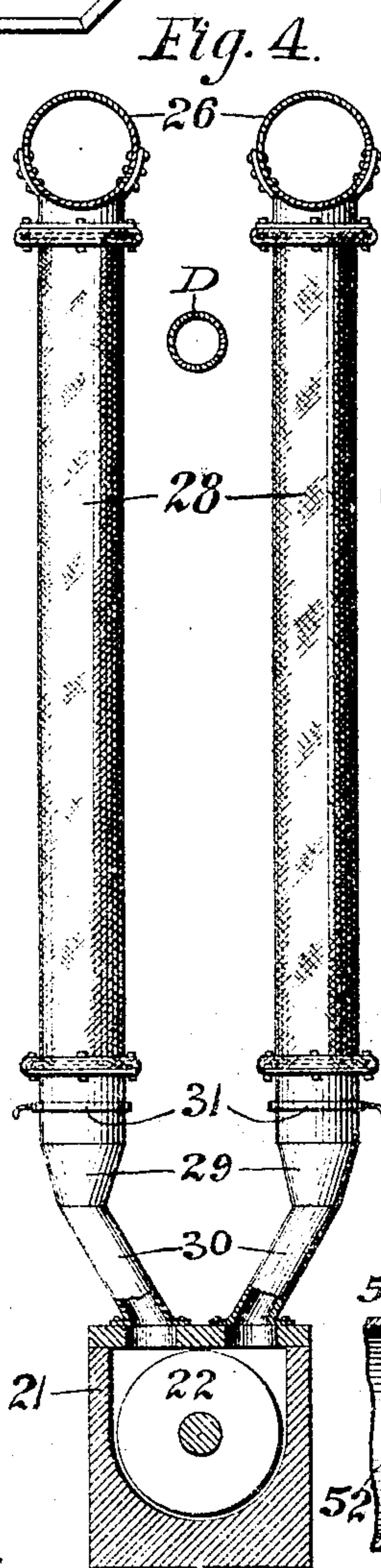
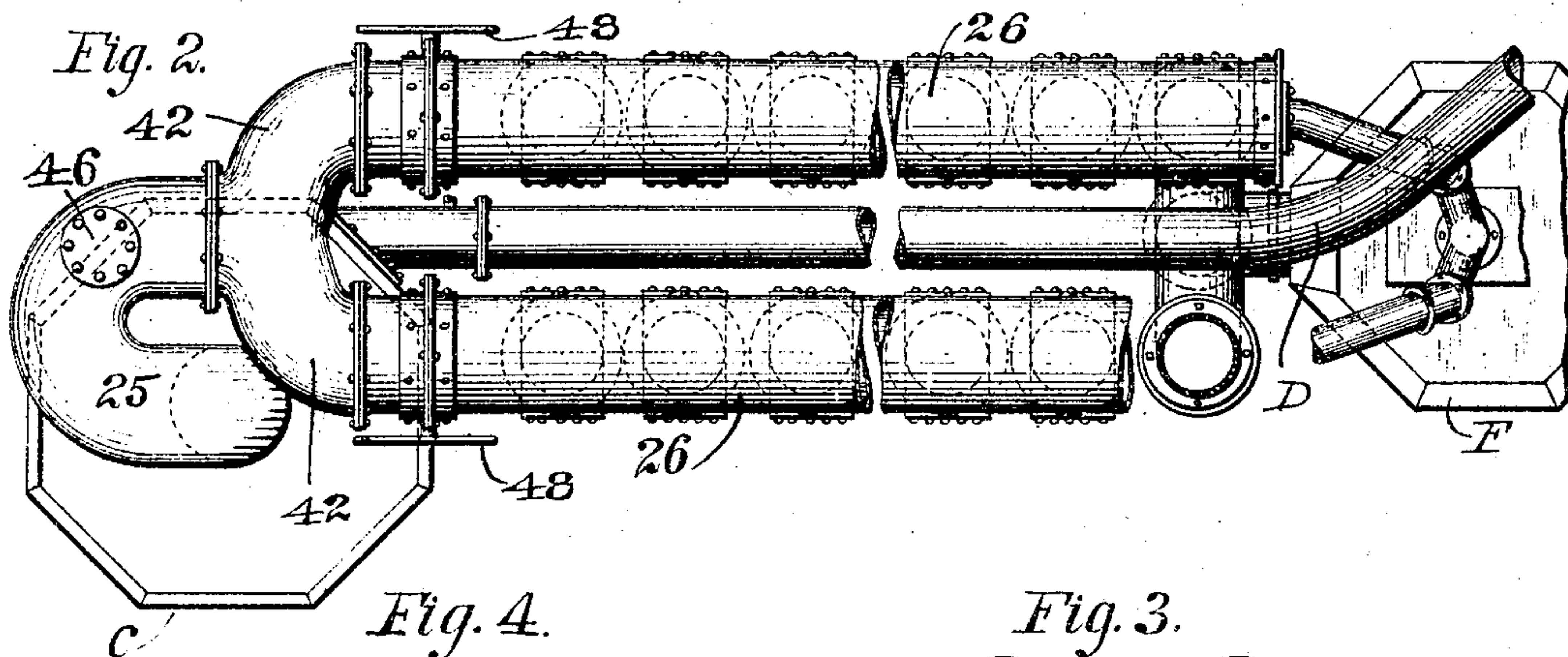
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2 SHEETS—SHEET 2.



Witnesses:
J. H. Kistner.
G. L. Moore.

Inventor:
William S. Osborne
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UNITED STATES PATENT OFFICE.

WILLIAM S. OSBORNE, OF ST. LOUIS, MISSOURI.

PNEUMATIC GRADING OR SEPARATING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 764,671, dated July 12, 1904.

Application filed November 7, 1903. Serial No. 180,174. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM S. OSBORNE, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Pneumatic Grading or Separating Systems, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is an elevation, partly in section, illustrating the system. Fig. 2 is a top plan view, partly in section, certain of the parts being broken away in order to economize space. Fig. 3 is an elevation, partly in section, on about the line 3 3 of Fig. 1. Fig. 4 is an elevation, partly in section, on about the line 4 4 of Fig. 1. Fig. 5 is a detail sectional elevation. Fig. 6 is a rear elevation of one of the coupling-sections, and Fig. 7 is a side elevation thereof.

This invention relates to improvements in pneumatic grading or separating systems, such as employed for the purpose of separating or grading pulverized material, and relates more particularly to what are known as "closed" systems of the character indicated—i. e., those systems in which the air travels in a closed circuit—and the same air can thus be employed over and over again.

Heretofore systems of the character indicated have included a separator whose purpose is to separate the finely-pulverized material from the coarser material, a fan, and a dust-collector whose purpose is to free the finely-pulverized material from the air and permit the substantially dust-freed air to escape from such dust-collector, the separator being connected to the eye or receiving side of the fan, the inlet to the dust-collector being connected to the delivery side of the fan, and the air-outlet from the dust-collector being connected to the air-inlet side of the separator, whereby a circulating system for the air is produced. While theoretically the fan or blower in such a system should exhaust from the system as much air as it delivered thereinto and would thus be able to handle the air in the system in such a manner

as to prevent back pressure, as a matter of fact in the practical operation of such systems the fan or blower does not exhaust from the system as much air as enters such system, whereby back pressure soon arises which renders the system practically inoperative. This back pressure operates against the current of dust-laden air being fed to the dust-collector, and thus serves to prevent the dust-laden air from reaching the dust-collector, the air on its way to the dust-collector being thus checked and some or all of the dust being permitted to deposit upon the interior of the feed-pipe, and thus clog the same. Furthermore, the back pressure of air blows too forcibly into the separator below its distributing-cone, thus preventing proper separation and tending to forcibly blow out through the tailings-opening the finely-pulverized material which should be delivered to the dust-collector, as well as the coarser tailings. Furthermore, the back pressure tends to objectionably forcibly blow the material from the material-outlet of the dust-collector.

In systems of the character indicated it is customary to make the pipe leading from the air-outlet of the dust-collector to the air-inlet of the separator larger in area than the pipe leading from the fan or blower to the inlet of the dust-collector, this being done with the intention of relieving the pressure in the dust-collector, and thus preventing the collected dust from being forcibly blown from the material-outlet of said dust-collector, and these large pipes leading from the dust-collector to the separator are adapted to contain a large amount of air which when it becomes packed or backed up in said pipes forms a cushion exerting an immense back pressure against the delivery side of the fan or blower and blows with great force into the separator against the material delivered from the spreader. That this objectionable back pressure exists has been fully demonstrated by the operation of large numbers of systems of the character indicated. Facts contributing to this back pressure are, first, that in addition to the air forced into the system by the fan or blower certain air enters with the material to be operated upon; and, secondly, as

the dust-laden air is forced through the pipes friction is created which serves to heat the air and to thus expand it. The result is that in these closed systems of the character indicated the blower or fan has not properly handled the air—*i. e.*, it has not taken from the system as much air as has been forced into it—so that enormous back pressures have arisen and the systems have thus been rendered impracticable and unsatisfactory.

The primary object of the present invention is to overcome the difficulties above indicated and to relieve this objectionable back pressure without loss of material and without interruption of the action of the system. To this end and also to improve generally upon systems of the character indicated the invention consists in the various matters hereinafter described and claimed.

Referring now more particularly to the drawings, A represents the fan or blower of well-known construction, air being received into the fan at its eye 1 and being delivered therefrom through a suitable outlet-pipe 2, all as is well understood.

B indicates the separator.

C is the dust-collector.

D is the pipe through which the dust-laden air is delivered from the blower to the dust-collector, and E indicates generally the pipe connections between the air-outlet from the dust-collector and the air-inlet to the separator.

F indicates the hopper, into which the ground or pulverized material is delivered and from which the material is fed to the separator.

The separator herein illustrated is practically identical with that forming the subject-matter of and fully described in Patent No. 744,390, issued to Elwin C. Bryant and myself, November 17, 1903, to which said patent reference is made for a more detailed description of said separator than is herein given.

For the purposes of the present invention it is only necessary to say that said separator comprises a casing 3, having a material-inlet 4 in its top over the apex of the conical spreader 5, an inverted pyramidal reticulated casing portion 6, extending downwardly from the open bottom of said casing 3 and having a tailings-outlet 7 at its lower end. An outer casing 8, connected at its top to said casing 3, as by the plate 9, surrounds said reticulated inverted pyramidal portion 6 and has a tailings-outlet 10 in line with and below said tailings-outlet 7, air being delivered to said separator in the space between the said reticulated casing portion 6 and the outer casing 8. From an outlet-opening leading from the interior of said conical spreader 5 and below the apex of said spreader is a pipe 11 for delivering to the eye of the fan A the air which carries the finer dust which has been separated from the heavier material, such dust-laden air

being drawn into the eye of the fan by suction, as is readily apparent and is also fully disclosed in the before-mentioned patent. Material delivered to the spreader 5 is spread thereby and falls in a thin sheet along said reticulated casing portion 6, the air drawn into the eye of the fan A passing through this spread material and passing from the separator through the said pipe 11. Said pipe is preferably provided with a valve 12 for regulating the intensity of the draft.

The dust-collector herein illustrated forms the subject-matter of and is fully disclosed in Patent No. 710,605, granted to the said Bryant and myself October 7, 1902, to which said patent reference is made for a more explicit explanation of said dust-collector than is herein given. For the purposes of the present invention it is sufficient to say that said dust-collector comprises a casing which produces a collecting-chamber 13, said casing having inlet 14, a material-outlet 15, and an outlet 16 for the substantially dust-freed air, it being of course understood that the air delivered from a dust-collector always contains some fine particles of dust.

In the system herein illustrated the material is delivered from the hopper F to a conveyer-box 17, which contains a screw conveyer 18 of well-known construction and preferably provided with means, such as the different sized pulleys 19, for driving the conveyer at different speeds, and this conveyer-box has its outlet delivering into the inlet 4 of the separator. The pipe D connects the delivery side of the fan or blower A with the inlet 14 of the dust-collector, as previously indicated, and the pipe 20 connects the material-outlet 15 of the dust-collector with the interior of a second conveyer-box 21, provided with a screw conveyer 22 and having an outlet 23, from which material can be delivered to any suitable point, this outlet being preferably controlled by a valve 24.

The pipe 25, leading from the air-outlet of the dust-collector, communicates with a horizontal pipe 26, provided upon its under side with a series of openings 27, and dust-tubes 28 extend downwardly from said pipe 26 and have the said openings 27 leading into them. These dust-tubes are tubes of bagging or a fine wire fabric having a fine mesh, so that they present porous walls through which air can escape, the meshes or pores being too fine to permit the escape of the dust carried by such air. These dust-tubes are at their lower ends connected to hoppers 29, into which they deliver, and the hoppers are connected by pipes 30 with the before-mentioned conveyer-box 21, each hopper being preferably provided with a valve 31. Thus material collected in the dust-tubes (which will be the finest material in the entire system) is delivered to the conveyer-box 21, and as said box is provided with a supplemental discharge-

opening 32, which is intermediate the points at which the said pipes 30 discharge into the said conveyer-box and the point at which the said pipe 20 discharges into said box as well as the point at which the outlet 23 is located, the material deposited in said dust-tubes can be discharged from the system as a separate product should it be so desired. Preferably this supplemental outlet 32 is provided with a valve 33, whereby said outlet can be closed, and the material from the dust-tubes can thus be carried to the main outlet 23, said main outlet 23 and the point at which the pipe 20 discharges into the conveyer-box being in what may be termed the "rear" of said outlet 32—*i. e.*, being so related to said outlet 32 that material carried along by the screw conveyer must pass said outlet 32 before reaching said outlet 23. The hopper or pipe 34 into which the dust-tube adjacent the separator delivers is connected by a pipe 35 with the air-inlet 36 of the separator, so that the closed circulating system for the air is thus completed. Preferably the pipe into which said last-mentioned flume delivers is provided with a valve 37, and the pipe 35 is provided with a valve 38, the purposes of which valves will be readily apparent.

From the foregoing it will be seen that the present system includes the dust-tubes, which present porous or finely-apertured walls through which air can escape between the dust-collector and the separator. In this manner the objectionable back pressure hereinbefore referred to is wholly obviated, although the system still retains the character of a closed one, none of the material being lost. The porous walls catch the fine dust carried by the air from the dust-collector, although they permit a sufficient quantity of this air to escape to prevent the objectionable back pressure. Furthermore, the present system not only obviates the back pressure, but it also provides in a simple manner for catching the very fine dust which escapes from the dust-collector with the so-called "dust-freed" air and for delivering such very fine dust from the system as a separate product.

Preferably a pipe 40 of reduced diameter extends from what may be termed the "outer" end of the pipe 26—*i. e.*, the end removed from the dust-collector—and this pipe 40 empties into the conveyer-box 17 above the material-inlet 4 to the separator, said pipe 40 thus being a blast-pipe which discharges against the incoming material above the apex of the conical spreader 5, and the blast from said pipe assisting in the spreading of such incoming material. Preferably said pipe 40 is provided with a valve 41 for well-understood purposes.

In a system constructed as thus far described some of the dust caught by the porous walls of the dust-tubes will by reason of the air-pressure in such dust-tubes be forced against

such walls and will thus in time clog the pores or fine apertures of said walls. The instant that such clogging results the system becomes substantially similar to those heretofore in use, and the objectionable back pressure would be created. In order to prevent such difficulty, a double set of dust-tubes is preferably provided, and provision is made whereby the air from the dust-collector can be delivered to either set of dust-tubes, so that before the pores of the walls of one set become clogged the air from the dust-collector can be turned into the second set, cut off from the first set, and said first set can be cleaned. With dust-tubes of the character of those herein described—*i. e.*, composed of bagging or fine wire—the cleaning is readily effected by merely shaking the dust-tubes, the fine dust readily falling from the pores or apertures when there is no air-pressure in the dust-tubes. For the purpose of providing this double set of dust-tubes the pipe 25 from the dust-collector has diverging arms 42, whereby a Y is produced, a pipe 26 being connected to each of these arms, each pipe 26 having depending therefrom the dust-tubes 28, heretofore described. The pipe 34, into which the dust-tubes adjacent the separator deliver, is also provided with diverging arms 43, whereby a second Y is produced, the dust-tubes at the outer ends of the respective horizontal pipes 26 emptying into and being connected directly upon the respective arms of the said Y. Furthermore, the pipes 40 connect into the diverging arms 44 of a third Y, the third arm 45 of said last-mentioned Y being connected to the conveyer-box 17. As herein illustrated, the pipe D is shown intermediate the sets of dust-tubes; but of course such arrangement is utterly immaterial, as both sets of dust-tubes could, if desired, be upon the same side of said pipe D. Preferably the pipe 25 is provided with a hand-hole 46 in order to permit cleaning, &c.

Each pipe 26 is provided with a valve 47, each valve having an operating-lever 48. Preferably the adjacent ends of a pipe 26 and its Y-arm 42 are connected to coupling-flanges 39, each of these flanges being cut away, as shown at 49, upon its face adjacent its cooperating flange, so that when the flanges are connected the recesses 49 form openings for receiving the valve-rod 50. Each flange has a teat or projection 51, which extends inwardly beyond the inner surface of the pipe, so that these teats or projections form abutments which limit the throw of the valve, and thus determine its closed position, said teats being upon opposite sides of the pipe. Preferably lugs 52 project from the interior of the pipes to act as stops for determining the open position of a valve.

In operating the present system one of the valves 47 is open and the corresponding valve 47 is closed. The valve 37 in the arm of the

Y directly connected with the pipe 26, having the open valve 47, is also opened, and the other valve, 37, is closed, and the valve 41, which controls the pipe 40, directly connected to the pipe 26, having the open valve 47, is also open, if so desired, the other valve, 41, being closed. The system then operates as hereinbefore described, and when it is deemed desirable to clean the dust-tubes which have thus been in use the said valves 47, 37, and 41 which have heretofore been closed are opened and the said valves which have heretofore been opened are closed. This transfers the air from the dust-collector to the second set of dust-tubes, and the set which has been in operation can then be readily cleaned. Thus the present system wholly obviates the objectionable back pressure which has heretofore existed, thereby making it possible to operate the fan or blower with extremely small power, provides for rapidly and satisfactorily handling the material to be acted upon, the operation of the system being continuous, and also provides for saving the very fine dust escaping from the dust-collector with the air delivered therefrom and for delivering this very fine dust as the separate product, if so desired.

It will of course be apparent that the system hereinbefore described can be employed without the separator, the pipe 35 being closed in such event and the material to be acted upon by the blower being delivered in any suitable manner to the air-current generated by said blower.

The present apparatus is adapted to handle materials of many kinds—*e. g.*, pulverized stone and grain.

I am aware that minor changes in the construction, arrangement, and combination of the several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. In a separating system, the combination of a current-creating device, a casing constituting an endless air-trunk returning the current to said device, means for feeding the material through the air-current to separate the dust therefrom, an air-filter open to atmosphere, and a passage tapping the air-trunk and leading to the filter, whereby a part of the dust-laden air is conducted into the filter; substantially as described.

2. In a separating system, the combination of a current-creating device, an endless air-trunk returning the current to said device and including a substantially vertical pipe having a porous wall opening to atmosphere and also having a material-discharge opening at its lower end, said pipe having at its upper end a material-receiving opening communicating

with another pipe of said trunk and being tapped near its lower end by another pipe included in said trunk, and means for feeding the material through the air-current to separate the dust therefrom, whereby said pipe provided with said porous wall receives the unfiltered dust-laden air and affords an air-filter open to atmosphere, and the unfiltered, dust-laden air received in said pipe and not passing through said porous wall is returned to said current-creating device; substantially as described.

3. In a system of the character indicated, a blower, a dust-collector provided with a material-outlet, pipe connection between the delivery side of said blower and the receiving side of said dust-collector, a pipe leading from the delivery side of said dust-collector, and provided with a dust-tube whose walls are porous to produce a filter, pipe connection between said pipe and the receiving side of said blower, whereby an endless air-trunk is produced, a separator in said trunk and upon the side of said filter opposite that upon which said dust-collector is located, said separator having a material-outlet, and a material-outlet from said filter and separate from the material-outlets from said dust-collector and said separator; substantially as described.

4. In a system of the character indicated, a blower, a dust-collector having a material-outlet, pipe connection between the delivery side of said blower and the receiving side of said dust-collector, pipe connection between the delivery side of said dust-collector and the receiving side of said blower, dust-tubes having porous walls and in communication with said connection between said delivery side of said dust-collector and said receiving side of said blower, a material-receiving receptacle into which both said dust-collector and said flumes deliver material, an outlet from said receptacle, and a second, valve-controlled material-outlet from said receptacle; substantially as described.

5. In a system of the character indicated, a blower, a dust-collector, a separator having a material-receiving opening and a spreader, pipe connection between said blower, the delivery side of said separator and the receiving side of said dust-collector, and pipe connection from the delivery side of said dust-collector and delivering to said material-receiving opening of said separator and upon the material-receiving surface of said spreader, whereby air from said dust-collector serves to spread the incoming material upon said spreader; substantially as described.

6. In a system of the character indicated, a blower, a dust-collector, a separator having a material-receiving opening and a spreader, pipe connection between the delivery side of said separator and the receiving side of said blower, pipe connection between the delivery side of said blower and the receiving side of

said dust-collector, pipe connection between the delivery side of said dust-collector and the receiving side of said separator, said last-mentioned connection including a porous wall 5 through which air can escape from the circulating system, and a branch pipe leading from said connection between said delivery side of said dust-collector and said receiving side of said separator and delivering into said material-receiving opening of said separator and upon the material-receiving surface of said spreader; substantially as described.

7. In a system of the character indicated, a blower, a dust-collector, pipe connection between the delivery side of said blower and the receiving side of said dust-collector, two pipes 15 between the delivery side of said dust-collector and the receiving side of said blower, each of said pipes being in communication with the delivery side of said dust-collector and with the receiving side of said blower, dust-tubes having walls of porous material and in communication with each of said last two mentioned pipes, and valves in each of said 20 last two mentioned pipes between said dust-collector and said dust-tubes; substantially as described.

8. The combination with a blower, a dust-collector, and pipe connection between the delivery side of said blower and the receiving

side of said dust-collector, of a plurality of receptacles having porous walls, pipe connection between each of said receptacles and the delivery side of said dust-collector, and means 35 for controlling the inlet to each of said receptacles, whereby the receiving end of one of said receptacles can be closed while the receiving end of another of said receptacles is open; substantially as described.

9. In a system of the character indicated, the combination with a blower, a separator, 40 and means for introducing the material from said separator into the air-current generated by said blower, of two receptacles having porous walls, pipe connection between the delivery side of said blower and each of said receptacles, and means for controlling the passage 45 between each of said receptacles and said blower, whereby the receiving end of one of said receptacles can be closed while the receiving end of the other thereof is open; substantially as described. 50

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 2d day of November, 1903.

WILLIAM S. OSBORNE.

Witnesses:

GALES P. MOORE,
GEORGE BAKEWELL.