July 15, 1947. F. B. SCHNEIDER 2,424,122

PRESSURE RECOVERY AND GAS CLEANING DEVICE

Filed Dec. 20, 1944

Fig. 1.

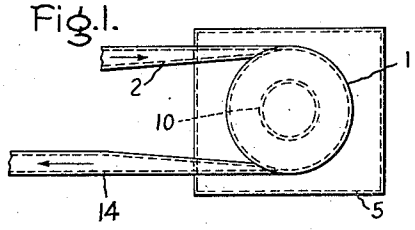


Fig. 4.

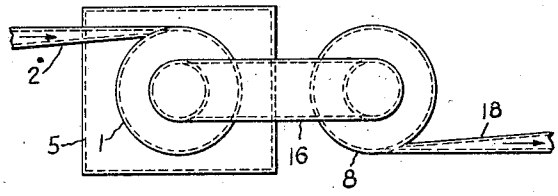


Fig. 2.

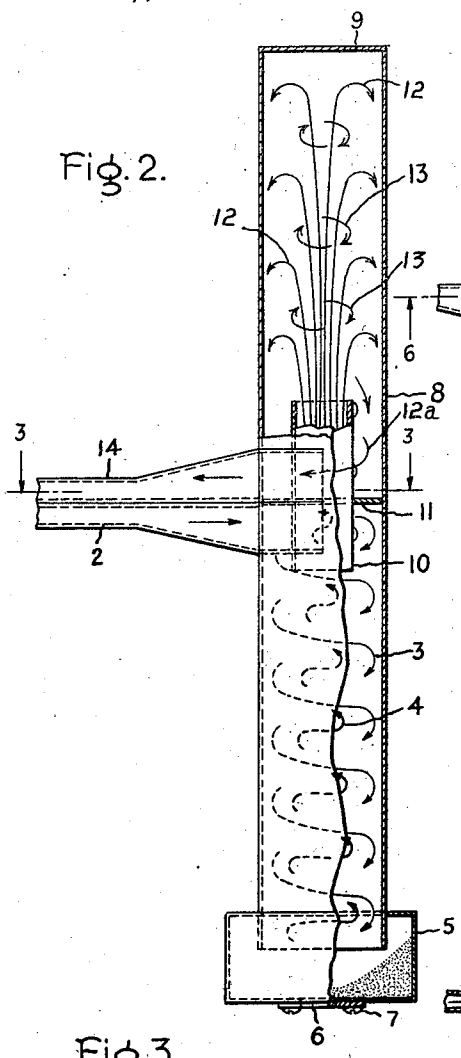


Fig. 5.

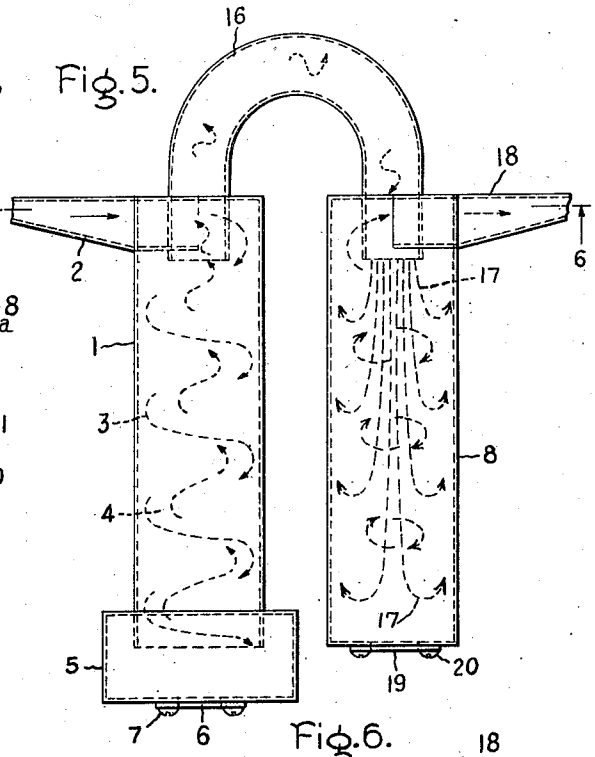


Fig. 6.

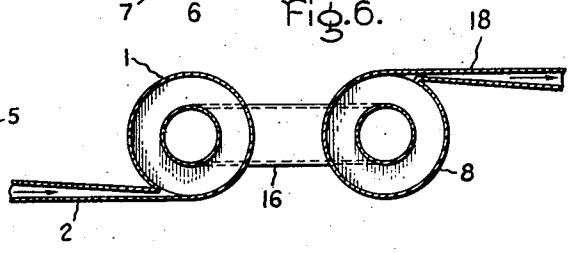
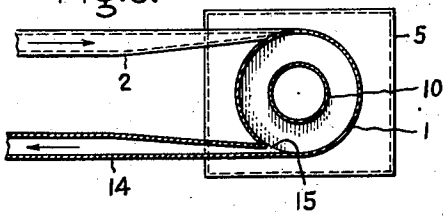


Fig. 3.



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PRESSURE RECOVERY AND GAS CLEANING DEVICE

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6 Claims. (Cl. 183—84)

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My invention relates to gas cleaning devices and more particularly to a construction for cleaning gases containing foreign material with an arrangement for recovering part of the pressure drop of the contaminated gas which is lost in passing through a cleaning device, such that the exhaust pressure of the gas is substantially the same as the intake pressure.

An object of my invention is to provide a gas cleaning device with an arrangement for recovering the pressure in the gas, such that the exhaust pressure is substantially the same as the intake pressure of the gas.

Further objects and advantages of my invention will become apparent and my invention will be better understood from the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In the drawing, Fig. 1 is a plan view of a gas cleaning device illustrating one embodiment of my invention; Fig. 2 is a side elevational view of the gas cleaning and pressure recovery device shown in Fig. 1; Fig. 3 is a sectional view taken along line 3—3 of Fig. 2; Fig. 4 is a plan view of another embodiment of my invention; Fig. 5 is a side elevational view of the gas cleaning and pressure recovery device shown in Fig. 4; and Fig. 6 is a sectional view taken along line 6—6 of Fig. 5.

Referring to the drawing, I have shown in Figs. 1, 2, and 3 an embodiment of my improved gas cleaning and pressure recovery device in connection with a vortex cleaner which comprises a cylinder 1 having a length several times the diameter thereof. The cleaner illustrated is of the type which utilizes a cylinder having a maximum diameter of substantially 15 inches and a length of 5 to 50 times the diameter of the cylinder, although the improved pressure recovery features could be applied to other types of cleaners, such as a centrifugal cleaner. In a vortex gas cleaner or dust collector, as illustrated, the inlet gas or air is blown through a tangentially arranged inlet tube 2 which introduces the gas to be cleaned substantially tangentially into the cylinder 1 adjacent the upper end thereof and adjacent the inner peripheral wall of the cylinder, as is more clearly shown in Figs. 1 and 3. This creates a vortex of the gas in the cylinder, the outer or circumferential part of which spiral downwardly, as indicated by the arrows 3, along the cylinder wall to adjacent the base of the cylinder while the center rotates upwardly around the axis of the cylinder, as indicated by the arrows 4, with the apex of the vortex adjacent the upper end of the cylinder, thereby converting a substantial part of the static pressure head of the introduced gas into velocity head. In this movement of the gas, foreign material is ejected from the gas against the sides of the cylinder and drops into a receptacle 5 arranged around the lower portion of the cylinder 1 for collection and removal of these solid particles by removal of a cleaning cover 6 secured in any suitable manner, as by screws 7, over an opening in the lower portion of the collection receptacle 5.

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In most applications of gas cleaners, such as where it is necessary that the combustion air be free from dust and grit, as where it is to be used in a gas turbine as a prime mover for a locomotive, it is desirable to recover as much as possible the high pressure losses which might occur in the air purifier or cleaner. In order to reconvert the velocity head of the gas which has been cleaned, I provide a second cylinder 8 which is arranged substantially coaxially with the first cylinder 1 to provide a gas pressure recovery arrangement. This cylinder 8 is arranged over the cylinder 1 and is formed of substantially the same size as the cleaner cylinder, being of a maximum diameter of about fifteen inches with a length of at least twice its diameter, and is closed at the upper end by a cover 9 which prevents the escape of the gas from the cylinder. The diameter of the pressure recovery cylinder 8 should, in any case, be as large or larger than the diameter of the cleaning cylinder for best results. A relatively small diameter transfer tube 10, which should not have a diameter greater than one-half the diameter of the pressure recovery cylinder 8, extends through an opening in a cover 11 and provides a communication between the cleaner cylinder 1 at the central portion and adjacent the upper end thereof and with the second cylinder 8 at the central portion and adjacent the lower end thereof, such that the gas is introduced into the pressure recovery cylinder 8 and is impelled thereinto in the form of a complementary vortex with the apex thereof adjacent the end of the transfer tube in the second cylinder. The cleaned gas emerging as a vortex from the upper end of the transfer tube 10 is rotating rapidly as shown by the arrows 13 in Fig. 2, and at the same time spiralling upwardly and outwardly as it leaves the upper end of the transfer tube 10. The path of the rotating column of gas follows the pattern

shown generally by the arrows 12. The vortex in the pressure recovery cylinder 8, therefore, resembles an expanding flared cone-shaped column of rapidly rotating gas wherein the gas expands, due to centrifugal force, to the inner surface of the cleaning cylinder 8 and is forced downwardly toward the tangential exhaust tube 14. Inasmuch as there is no escape or opening elsewhere in the recovery cylinder 8, the pressure developed in the upper end of the cylinder forces the rapidly rotating gas downwardly and into the tangential exhaust tube 14 as shown by the arrow 12a in Fig. 2. This spiral flow from the small diameter transfer tube 10 to the larger diameter of the cylinder 8 reconverts the velocity head of the gas introduced into the second cylinder by the transfer tube 10 into a pressure head which is substantially the same as the static gas pressure of the inlet gas in the supply tube 2, and an exhaust tube 14 communicates with a passage or opening 15 in the pressure recovery cylinder 8 adjacent the lower end thereof for exhausting the gas from adjacent the periphery of this cylinder. This provides a very simple arrangement for recovering the pressure of the gas as it passes through the cleaning device.

In Figs. 4, 5, and 6, I have shown another embodiment of my improved gas cleaning device in which the two cylinders are arranged side-by-side with their axes in parallel relationship. In some instances, it may be found that a relatively long cleaning device, such as that shown in Fig. 2, may not be practical, and it may be desirable, therefore, to arrange the gas cleaner cylinder and the pressure recovery cylinder in a side-by-side relationship with the axes thereof parallel to each other or in any other similar manner. This can very readily be done by using a substantially U-shaped small diameter transfer tube 16, as shown in this figure for connecting together the end of the vortex cleaner cylinder 1 adjacent the apex of the vortex with an end of the pressure recovery cylinder. In this construction, the complementary vortex in the pressure recovery cylinder is indicated by the arrows 17. The central part of this vortex spirals downwardly, while the circumference adjacent the inner periphery of the cylinder 8 rotates upwardly to the upper portion of the cylinder from which it is exhausted through an exhaust tube 18. The vortex action of the gas with the resulting centrifugal expansion and consequent pressure recovery operates in the pressure recovery cylinder 8 of Fig. 6 in a manner identical to that previously described in connection with the device shown in Fig. 2. In this construction, it is possible that a very small amount of foreign material may collect in the lower portion of the pressure recovery cylinder 8, and, therefore, a removable cover 19, secured in any suitable manner, as by screws 20, is fastened over an opening formed in the lower portion of the closed end of this cylinder in order to facilitate cleaning of the interior thereof. In most instances, it will be found that only a very minute quantity of foreign particles will be carried over into the pressure recovery cylinder and that it will not be necessary to clean out this cylinder except after periods of long use or where very fine material is being removed from the gas. The other elements illustrated in this embodiment are essentially the same and function the same as those shown in the construction illustrated in Figs. 1, 2, and 3, and corresponding numbers have been applied to these parts of this second embodiment of my invention. Obviously the position of the pressure recovery cylinder 8 can be varied in order to accommodate the device to the space available.

While I have illustrated and described particular embodiments of my invention, modifications thereof will occur to those skilled in the art. I desire it to be understood, therefore, that my invention is not to be limited to the particular arrangements disclosed, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Pressure recovery apparatus for a gas cleaning device including a vortex gas cleaner for removing entrained foreign material from said gas and having a centrally positioned tubular outlet, pressure recovery means including a cylinder communicating at one of its ends with said tubular outlet of said cleaner, said cylinder having a length at least twice the diameter thereof, said gas entering said cylinder from said tubular outlet as a vortex with the apex of said vortex adjacent said tubular outlet, and means including a tangentially disposed passage communicating with said cylinder for exhausting said gas from the periphery of said cylinder at a point adjacent the junction of said cylinder and said tubular outlet.

2. Pressure recovery apparatus for a gas cleaning device including a vortex gas cleaner for removing entrapped foreign material from said gas and having a centrally located tubular outlet, pressure recovery means including a cylinder communicating at one of its ends with said tubular outlet and having a diameter substantially greater than the diameter of said outlet, said cylinder having a length at least twice the diameter thereof, and means including a tangential exhaust passage communicating with said cylinder for exhausting said gas from said cylinder at a point adjacent the tubular outlet end of said cylinder.

3. Pressure recovery apparatus for a gas cleaning device including a vortex gas cleaner for removing entrained foreign material from said gas and having a centrally positioned tubular outlet, pressure recovery means including a cylinder positioned axially with respect to said cleaner and communicating at one of its ends with said tubular outlet of said cleaner, said cylinder having a length at least twice the diameter thereof, said gas entering said cylinder from said tubular outlet as a vortex with the apex of said vortex adjacent the end of said tubular outlet, and a tangentially disposed passage communicating with said cylinder for exhausting said gas from the periphery of said cylinder at a point adjacent the end of said cylinder in communication with said tubular outlet.

4. Pressure recovery apparatus for a gas cleaning device including a vortex gas cleaner for removing entrained foreign material from said gas and having a centrally aligned tubular outlet in the upper portion thereof, pressure recovery means including a cylinder positioned above said cleaner and enclosing at one of its ends the upper end of said tubular outlet of said cleaner, said cylinder having a length at least twice the diameter thereof and a diameter not less than twice the diameter of said tubular outlet, said gas entering said cylinder from

said tubular outlet as a vortex with the apex of said vortex adjacent the end of said tubular outlet, and means including a tangential passage communicating with said cylinder for exhausting said gas from said cylinder at a point adjacent the junction of said cylinder and said cleaner.

5. Pressure recovery apparatus for a gas cleaning device including a vortex gas cleaner for removing entrapped foreign material from said gas and having a central tubular outlet, pressure recovery means including a cylinder having a length at least twice the diameter thereof, a U-shaped tube communicating with said tubular outlet of said cleaner and with one end of said cylinder, and means including a tangential passage for exhausting gas from the periphery of said cylinder at a point adjacent the communication of said cylinder and said U-shaped tube.

6. Pressure recovery apparatus for a gas cleaning device including a vortex gas cleaner for removing entrapped foreign material from said gas and having a central tubular outlet, pressure recovery means including a cylinder having a length at least twice the diameter thereof and arranged

in side-by-side relationship with said cleaner, a U-shaped tube communicating with said tubular outlet of said cleaner and with one end of said cylinder, the diameter of said cylinder being at least twice the diameter of said U-shaped tube, and a tangential exhaust passage for withdrawing gas from the periphery of said cylinder at the end thereof adjacent the junction of said cylinder and said U-shaped tube.

FRED B. SCHNEIDER.

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