

July 17, 1951

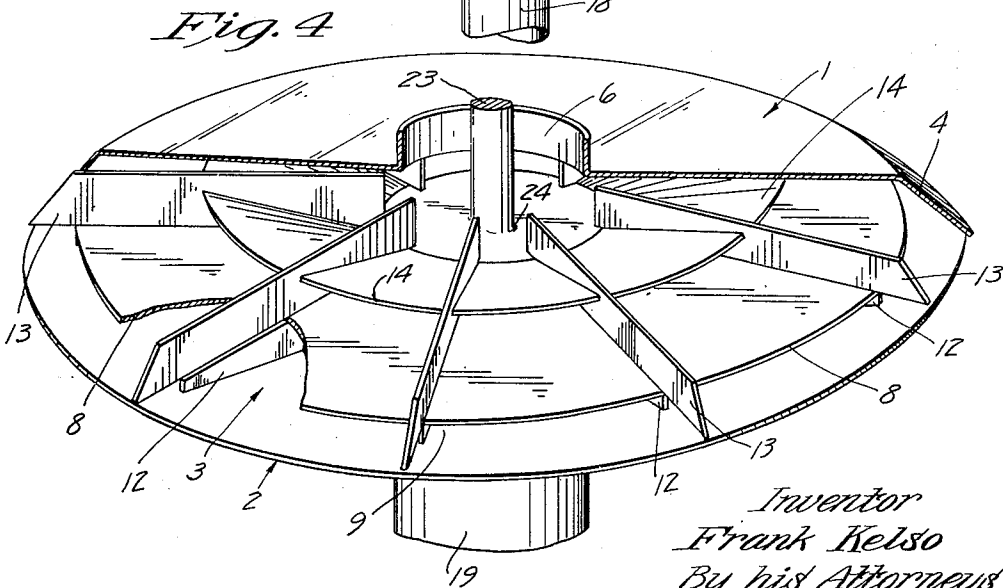
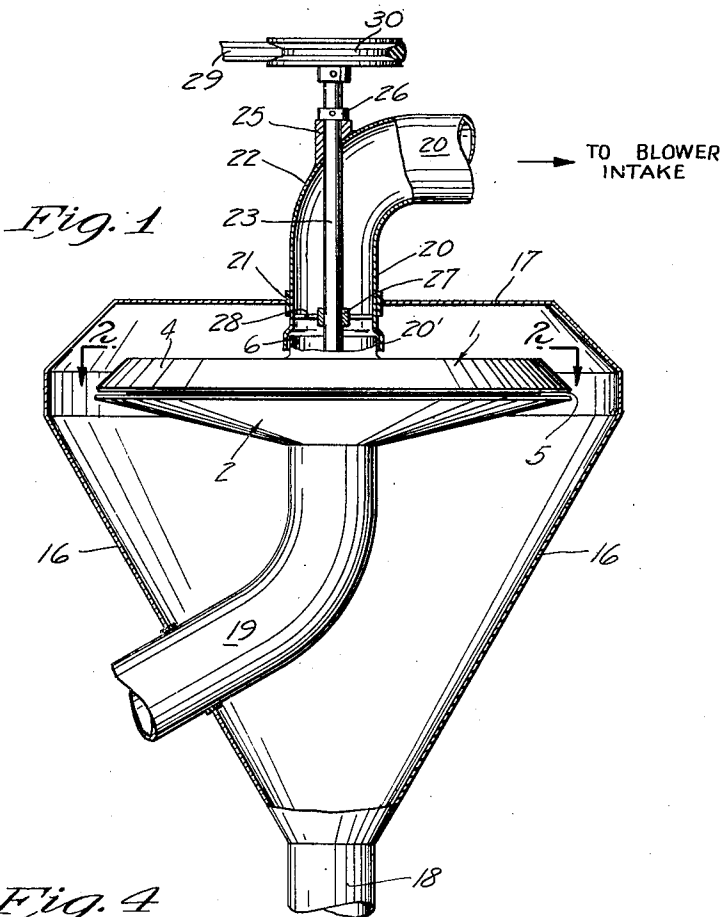
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2,560,874

CENTRIFUGAL AIR CLEANER

Filed April 6, 1950

2 Sheets-Sheet 1



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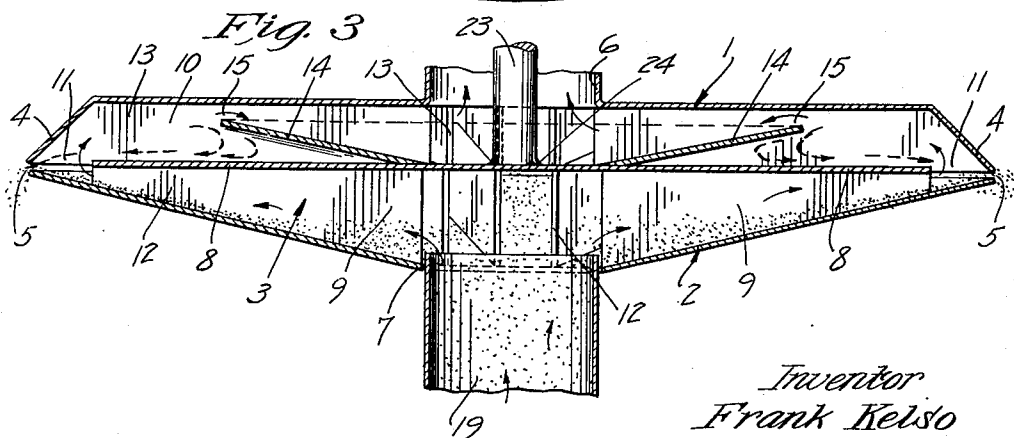
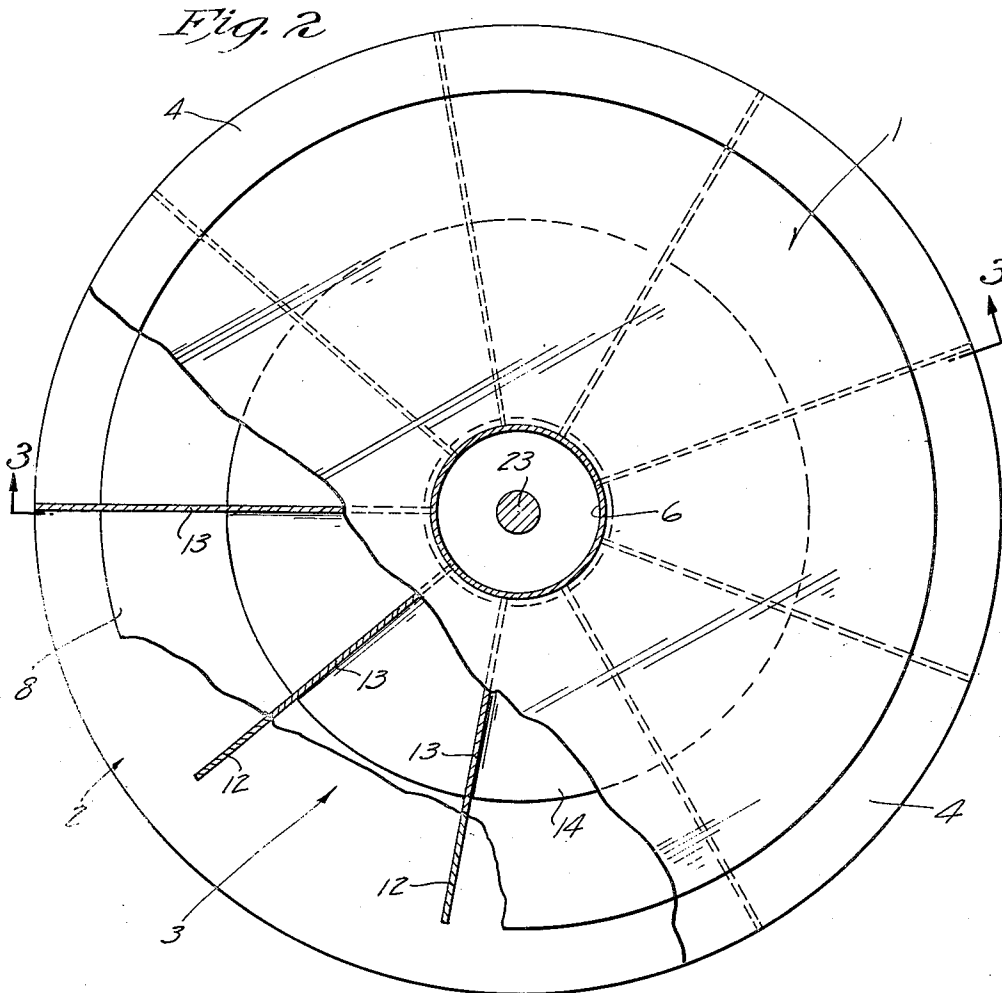
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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CENTRIFUGAL AIR CLEANER

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4 Claims. (Cl. 183-77)

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My invention relates to air cleaners and, more particularly, to air cleaners of the centrifugal type.

More specifically, my invention relates to improvements in mechanically-driven air cleaners as distinguished from the well-known cyclone type in which a swirling motion is imparted to the air in a shell by means of introducing the same into the shell tangentially and under pressure.

The primary object of my invention is to provide a structure which is of the class above-described, and which is more efficient than structures of this type heretofore produced.

A further object of my invention is the provision of a device of the class described, which is inexpensive to produce, rugged in construction, durable in use, and which requires a minimum of adjustment.

Generally stated, the invention consists of the novel devices, combinations of devices, and arrangement of parts hereafter described and defined in the claims.

In the accompanying drawings, like characters indicate like parts throughout the several views. Referring to the drawings:

Fig. 1 is a view in side elevation of my novel air cleaner, some parts being broken away and some parts being shown in section;

Fig. 2 is an enlarged view, partly in plan and partly in horizontal section, taken on the line 2-2 of Fig. 1, some parts being broken away;

Fig. 3 is a vertically axial section, taken on the line 3-3 of Fig. 2; and

Fig. 4 is a view in perspective of my novel air cleaner, some parts being broken away and some parts being shown in section.

My novel air cleaner comprises spaced upper and lower wall-forming elements 1 and 2 respectively which define an expansion chamber 3. The upper wall-forming element 1 is for the most part flat and, at its peripheral portion, is downwardly dished as indicated at 4, converging with the lower wall-forming element 2, which is preferably conical in shape. The peripheral edges of the wall-forming elements 1 and 2 are spaced apart to provide a restricted peripheral dust passage 5. A central outlet 6 in the wall-forming element 1 is axially-aligned with an inlet 7 in the wall-forming element 2. An imperforate circular baffle plate 8 divides the chamber 3 into inlet and outlet compartments 9 and 10 respectively, the former communicating with the inlet 7 and the latter communicating with the outlet 6. The baffle plate 8 lies substantially in the

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plane of the peripheral dust passage 5 and is of smaller diameter than the wall-forming plates 1 and 2, the space between the peripheral edges of the baffle plate and the peripheral edges of the wall-forming elements 1 and 2 providing an annular gas passage 11.

A plurality of circumferentially-spaced radially-projecting imperforate vanes 12 are radially disposed within the inlet compartment 9 and extend from the inlet 7 thereof to the peripheral edge of the baffle plate 8. A plurality of similarly spaced imperforate vanes 13 are radially-disposed within the outlet compartment 10 and extend outwardly from the outlet 6 to the periphery edge of the wall-forming element 1. The vanes 12 and 13 are rigidly secured at their opposite side edges to the baffle plate 8 and their respective wall-forming elements 1 and 2. With reference to Figs. 2, 3, and 4, it will be seen that the vanes 13 are equal in number to the vanes 12, one each of the vanes 13 overlying one of the vanes 12.

An annular generally conical baffle plate 14 is located within the outlet compartment 10 concentric with the outlet 6, and has its inner portion rigidly secured by welding or the like to the baffle plate 8, its outer peripheral edge being in relatively closely spaced relationship to the wall-forming element 1, whereby to provide a restricted gas or air passage 15 therebetween. It will be noted that the baffle plate 14 is of less diameter than the baffle plate 8. The vanes 13 may be slotted to receive the conical baffle plate 14, or said baffle plate 14 may be made in sections, each extending between adjacent vanes 13. In any event, the conical baffle plate 14 is rigidly secured to each of the vanes 13 by welding or the like.

My improved air cleaner is adapted to be mounted for rotation within a downwardly-tapered conical housing or the like 16, the axis of which is concentric to the axis of the cleaners. The housing 16 is provided with a relatively flat top wall 17 and a downwardly-opening dust-discharge outlet 18 at its apex portion. A conduit 19 extends through and is supported by the tapered side wall of the housing 16 and terminates within the inlet 7 of the air cleaner. The conduit 19 extends to and is adapted to conduct dust-laden air from a desired room or area, not shown. A second conduit 20 extends axially through the top wall 17 of the housing 16 and is supported thereby as indicated at 21. The conduit 20 is bent to form an elbow portion 22 and is adapted to extend to and be coupled with the intake of a

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blower not shown, whereby dust-laden air may be drawn through the conduit 19, the expansion chamber 3, and the conduit 20. The intake end of the conduit 20 is enlarged, as indicated at 20', and encompasses the outlet 6 of the wall-forming element 1 sufficiently loosely to permit free rotation of the wall-forming element 1 with respect to the conduit 20.

A rotary shaft 23 is axially aligned with the wall-forming elements 1 and 2 and has its lower end rigidly secured by welding or the like to the center of the baffle plate 8, as indicated at 24. The shaft extends axially upwardly through the outlet 6 and the lower portion of the conduit 20, and through the wall of the elbow portion 22, where it is journaled in a bearing 25. It will be noted that the air cleaner structure, including the wall-forming elements 1 and 2, depend from the shaft 23 and are supported against downward movement with respect to the conduits 19 and 20 and the housing 16 by a collar 26 pinned or otherwise rigidly secured to the upper end portion of the shaft 23 and engaging the outer end of the bearing 25. The shaft 23 is further journaled in a bearing 27 rigidly mounted in the lower end portion of the conduit 20 by means of a conventional spider mounting or the like 28. Rotary movement is applied to the shaft 23 and the air cleaner supported thereby from a motor or other rotary element not shown but adapted to be connected to the shaft 23 by a V-belt or the like 29 running over a pulley 30 rigidly secured to the upper end of the shaft 23.

When it is desired to utilize my novel air cleaner to remove dust from a particular area, the air is caused to be drawn through the conduits 19 and 20 and the expansion chamber 3 of the air cleaner by the blower, not shown. Simultaneously, the cleaner is caused to rotate on the axis of the shaft 23. As the dust-laden air enters the expansion chamber, its velocity is appreciably decreased. However, rotation of the cleaner causes the dust in the air to impinge upon the vanes 12 of the inlet compartment and be discharged radially outwardly through the restricted peripheral passage 5 by the action of centrifugal force, together with a relatively small amount of air. The bulk of the air drawn into the inlet compartment 9 is drawn upwardly through the annular gas passage 11 into the outlet compartment 10 and radially inwardly through the restricted passage 15 to the outlet 6 and upwardly through the conduit 20. The conical baffle plate 14, due to its inclination toward the wall-forming element 1, tends to set up eddy currents in the air travelling radially inwardly from the annular passages 11. Any residual dust failing to escape through the peripheral dust passage 5 and being carried upwardly through the annular passage 11 is caught in the eddy currents below the peripheral edge portion of the baffle plate 14, as shown by broken arrows in Fig. 3, and impinges against the rotating vanes 13 and is thrown radially outwardly by centrifugal force through the air stream flowing upwardly through the annular passage 11 and through the peripheral dust passage 5 into the housing 16. The eddy currents extract substantially all the remaining dust in the air flowing through the compartment 10, so that relatively dust-free air is drawn inwardly through the restricted passage 15, the outlet 6, and the conduit 20. Obviously, the suction of the blower is sufficient to maintain a continual flow

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of air upwardly through the air cleaner to overcome the tendency of the air to be blown outwardly through the peripheral dust passage 5. However, the speed of rotation of the shaft 23 and the baffles, vanes, and wall-forming elements carried thereby, is such that the dust particles are discharged radially through the peripheral dust passage 5 and the air is permitted to be drawn radially inwardly through the compartment 10 and restricted passage 15 against the action of centrifugal force.

My improved cleaner has been thoroughly tested and found to be completely satisfactory for the accomplishment of the objectives set forth; and, while I have shown and described a commercial embodiment of my rotary air cleaner, it will be understood that the same is capable of modification without departure from the spirit and scope of the invention as defined in the claims.

What I claim is:

1. In a device of the class described, upper and lower wall-forming elements defining an expansion chamber, said elements having aligned central inlet and outlet openings one in each thereof, said wall-forming elements converging toward their peripheral edges, said peripheral edges being spaced apart to provide a restricted peripheral dust passage, an imperforate baffle plate within said chamber, said baffle plate being in substantially the same plane as the restricted dust passage and dividing said chamber into inlet and outlet compartments, said baffle plate terminating radially inwardly of said restricted dust passage whereby to provide an annular gas passage between said inlet and outlet compartments, a plurality of circumferentially-spaced radially-projecting imperforate vanes in each of said compartments, an annular generally conical baffle plate in the outlet compartment, said last-mentioned baffle plate being secured at its inner portion to said first-mentioned baffle plate and terminating at its peripheral edge intermediate said first-mentioned baffle plate and the adjacent wall-forming element, the outer diameter of said last-mentioned baffle plate being less than the diameter of said first-mentioned baffle plate, and means for simultaneously rotating said wall-forming elements said baffle plates and said vanes as a unit about the axis of said inlet and outlet openings.

2. The structure defined in claim 1 in which said outlet compartment overlies said inlet compartment and in which said last-mentioned baffle plate is concentric with said inlet and outlet openings.

3. The structure defined in claim 1 in which the vanes in the inlet compartment extend from the inlet opening to the peripheral edge of the first-mentioned baffle plate and in which the vanes in the outlet compartment extend from the outlet opening to the peripheral edge of the adjacent upper wall-forming element.

4. The structure defined in claim 1 in further combination with a non-rotary housing encompassing said wall-forming elements, said housing terminating at its lower end in a dust discharge opening concentric with the inlet and outlet openings of the expansion chamber, a non-rotary elbow-shaped conduit projecting through the wall of said non-rotary housing and telescopically received within said inlet opening, a second non-rotary elbow leading from said outlet opening, and a bearing centrally mounted in said last-

mentioned elbow adjacent said outlet, said means for simultaneously rotating said wall-forming elements including a drive shaft journaled in said bearing, said drive shaft having its inner end rigidly secured to the central portion of said first-mentioned baffle plate and its outer end projecting through its cooperating elbow, and driving connections on said shaft outwardly of said elbow.

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