April 4, 1950 A. F. NESBIT 2,502,474

GAS CLEANER

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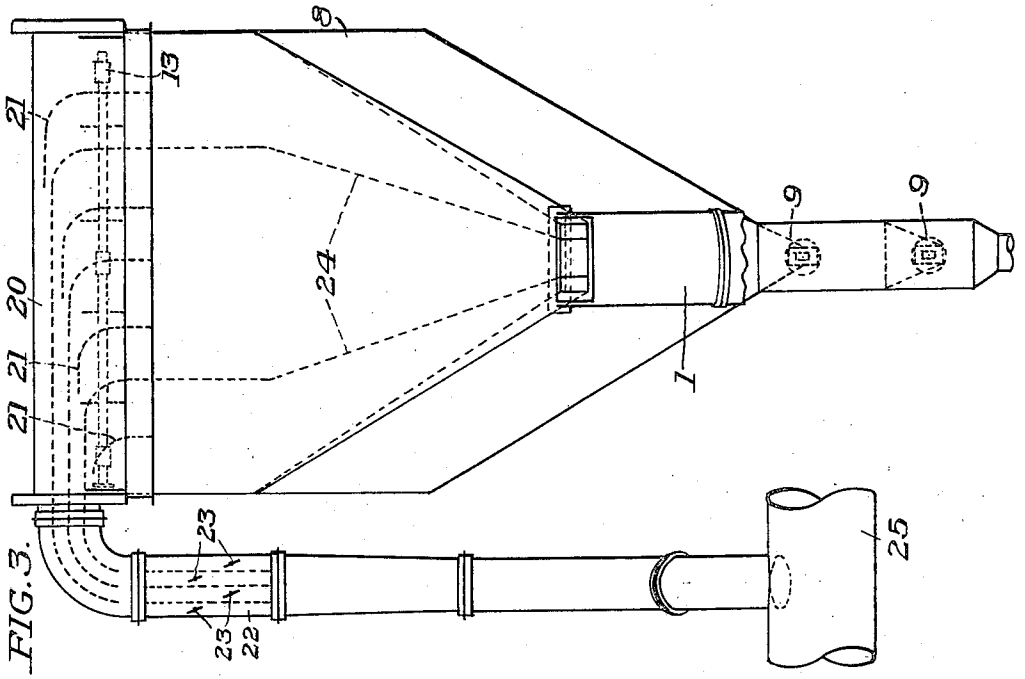

FIG. 3.

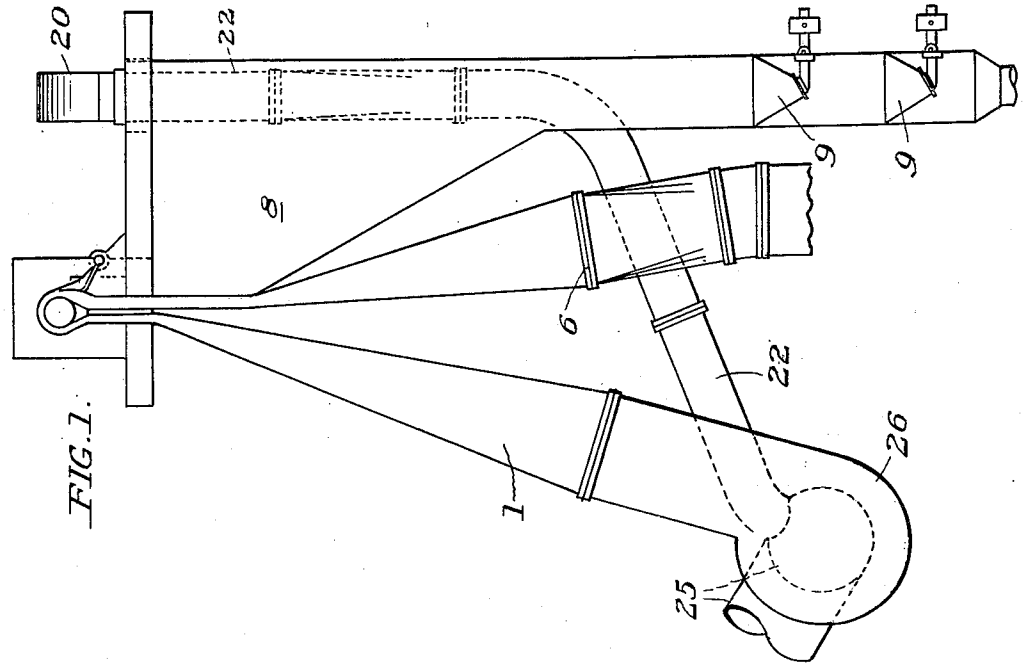

FIG. 1.

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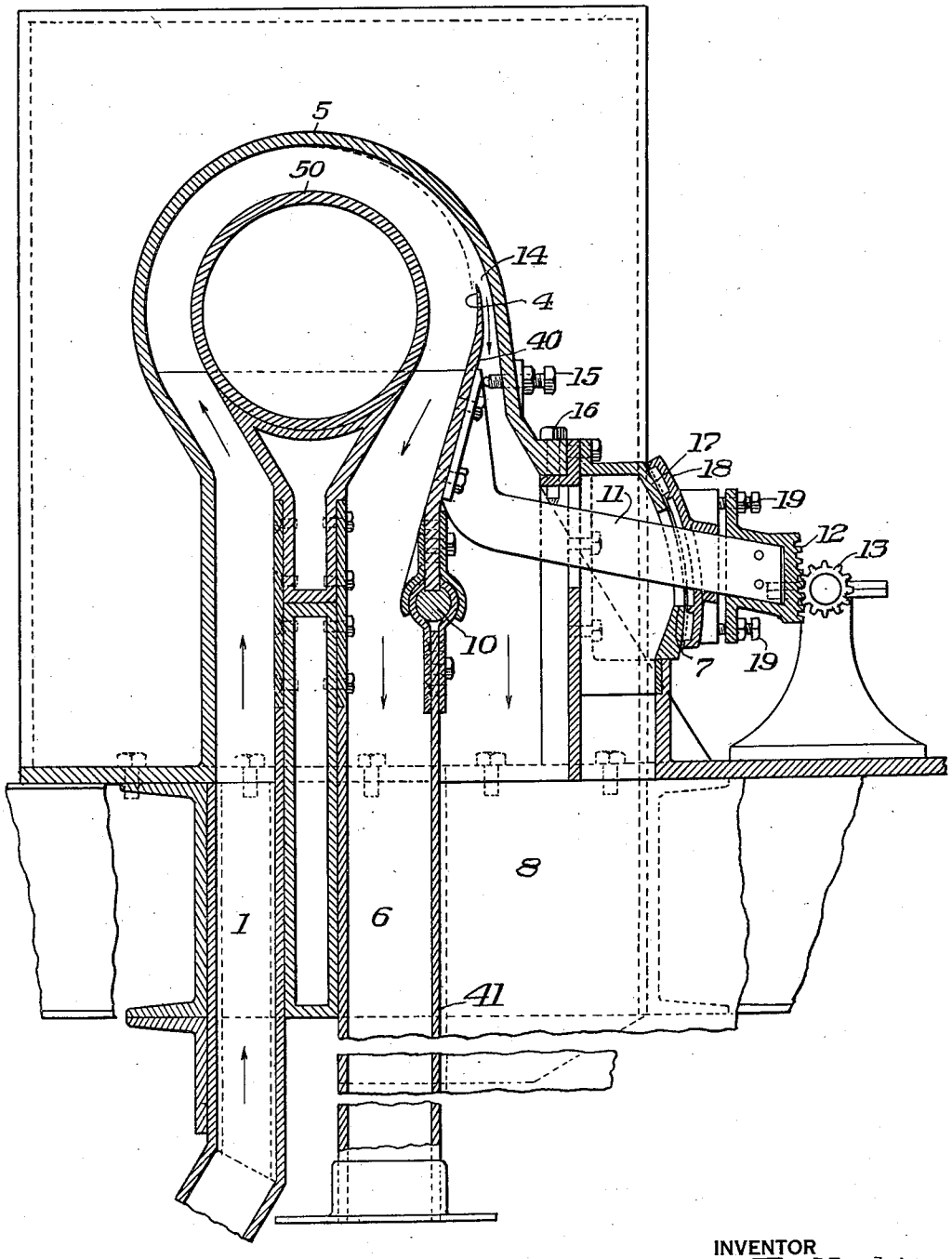
Fig. 2.



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2,502,474

GAS CLEANER

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5 Claims. (Cl. 183—79)

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This invention relates to centrifugal separation of the components of a fluid stream, and finds practical application in Dust collectors for coal houses, blast furnaces, and other particular uses. It constitutes an improvement on the structure disclosed in my United States Letters Patent No. 1,633,602 of June 28, 1927.

An object of the invention is to provide accurate means for control of the operation of a centrifugal dust collector for cleansing of a stream of dust laden air or other gas; with the further object to provide a dust collector which may, if desired, be installed in conjunction with either heating or cooling systems, since the invention may be used in a closed re-circulating path for the air when freed of its dirt particles.

The invention will be more readily understood by reference to the accompanying drawings, in which:

Fig. 1 is a view in outline in side elevation of a dust collector of my invention, designed for service in a coal house. This embodiment will serve in an exemplary way to illustrate my invention;

Fig. 2 is a view to larger scale, showing in vertical section a portion of the structure shown in Fig. 1; and

Fig. 3 is a diagrammatic view corresponding in scale to Fig. 1 and showing in elevation the same assembly. The line of view of Fig. 3 is from left to right, Fig. 1.

A stream of air or other gas, initially laden with coal dust but ultimately to be relieved of its load, or substantially so, is caused to advance from inlet 1 to outlet 6. Suitable means are provided for causing the air to flow in a stream, in through inlet 1 and out through outlet 6; for example, a blowing fan 26 may deliver to inlet 1, or a suction fan might draw from outlet 6. The dust laden air may come, for instance, from a coal-crushing room; the delivery may be to the open air. (This statement of circumstances will be understood to be exemplary merely).

At inlet and outlet the passageway is square in cross-section, to and from which portions of the passageway round conduits merge. From inlet 1 the passageway "fans out" in the direction of flow; that is to say, it narrows in one dimension and widens in the other, so that the stream advances in a broad band, whose greater transverse dimension is (Figs. 1 and 2) in the line of sight. This broad band narrows again and deepens as it approaches the outlet.

The broad band-shaped passageway is looped; the breadth of the passageway extends perpendicularly to mid-plane of the loop; the two arms of the looped passageway extend in substantial parallelism, and are vertically and adjacently arranged. The loop arches above a horizontal axis. These features are most clearly shown in Fig. 2.

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The passageway is of undiminished size from the intake end of the loop to the delivery end, but, intermediate the ends of the loop and preferably toward the down-stream end of the arch and the outer wall, there is a break 14; the outer wall 5 on the up-stream side of the break recedes on a widening spiral and overlaps the edge 4 of the wall on the down-stream side of the break. This edge 4 which tapers to a relatively thin blade, is remote from the opposite inner wall 50 of the loop a distance not less than, and preferably equal to, the normal width of the loop, before the recession of its outer wall began. Thus from this break the passageway continues in two branches; the inner branch is, from its spring, of cross-sectional area preferably not substantially less than the normal cross-sectional area of the passageway from which it springs; and both of the two branch passageways may, as Fig. 1 shows, widen somewhat as overlapped spiral passageways. The inner branch continues to outlet 6, the outer opens downward to dust-settling chamber 8. This dust-settling chamber 8 is provided at the bottom with double delivery hoppers 9 with automatically closing counterweighted closures.

The edge 4 alluded to above as the down-stream edge of the break in the outer wall of the arched passageway is the edge of a plate 40. Plate 40 is a pivotally mounted plate of some considerable radial extent standing in approximately vertical position, and is pivoted on an axle 10 arranged within chamber 8. The axle extends in parallelism to and below the horizontal axis of the circular wall element 50 about which the passageway is arched. Plate 40 conveniently forms the upper portion of a vertically extending partition wall 41 which divides chamber 8 from outlet 6.

Plate 40 is provided with arms 11 which conveniently extend at right angles from it. They extend through orifices or slots 7 formed in the wall of chamber 8. It may be understood that plate 40 is, in the structure shown, equipped with three such arms, aligned transversely across it. The orifices or slots 7 are of such extent as to allow the arms to swing and so to effect turning of plate 40 on its axle 10. Means are provided for moving the arms 11 in a vertical arc to swing and thereby adjust plate 40. Each arm at its outer end is faced with a gear segment 12 centered in axle 10, and the pinion 13 which meshes with the

gear segment may be provided with a worm drive, so that minute and accurate adjustment of the position of lip 4 of plate 40 may be attained. Means for locking the swinging plate 40 when it has been accurately positioned are found in set bolts 15 and 16 which abut perpendicularly, the one against plate 40, the other against arm 11.

The orifices 7 in the wall of chamber 8 through which the arms 11 extend are formed specifically in cylindrical plates 17 whose curvature centers in axle 10, and arms 11 carry cylindrical plates 18 which throughout all the range of swing overlap the margins of orifices 7. The meeting faces of plates 17 and 18 are suitably packed to afford a gas-tight joint. The plates 18 are telescopic upon arms 11 and are held to position by bolts 19. Thus the engagement of the plates 17 and 18 may be eased or tightened to meet the exigencies of service. It is to be remarked that all of these adjusting features, gear segment 12, and set bolts 15, 16, and 19 are external, and accessible for adjustment without disturbance of the assembly or intermission of operation.

A condition of reduced pressure is maintained within the dust-settling chamber 8, in order to cause the stream which advances through the branch passageway external to plate 40 to enter freely. To such end an exhaust box 20 is arranged in the roof of chamber 8. It extends the full width of chamber 8, and to it there is free access from chamber 8. From box 20 at one end a conduit 22 leads, and through this conduit a condition of suction may be set up by any preferred means. Figs. 1 and 3 illustrate an arrangement wherein conduit 22 may open to a conduit 25 leading to the inlet or suction side of the blower 26. Within box 20 a succession of partitions whose positions are indicated by the dotted line 21, are arranged, providing in effect a manifold passage. The partition may be prolonged as indicated, into the approach to conduit 22, and in the passageways so formed independently operable dampers 23 may be set, by which means the suction conditions across the width of chamber 8 may be adjusted and equalized. The partitions 21 may if desired be prolonged downward within chamber 8, as indicated at 24.

In operation a stream of dust laden air is by suitable means caused to flow at high velocity through the loop, from inlet 1 to outlet 6. As it flows, and because of the curved form of the passageway, the dust under centrifugal force gathers toward the outer wall. The tip 4 of plate 40 cuts from the whole volume of air which here flows in slightly widened stream, an outer dust laden stratum. The so cleaned and unburdened fraction of the stream flows on to the outlet 6; the small and heavily laden fraction is discharged into chamber 3. Because of the condition of reduced pressure within chamber 8 the stream enters easily. Because its volume is small, and because it enters a space of reduced pressure, the entering dust laden stream comes almost to rest in chamber 3, and the burden of dust which it carries settles rapidly to the bottom. From the top of chamber 8 substantially pure air is drawn off at sufficient rate to maintain the essential low-pressure condition. Regulation of this rate of withdrawal of air from chamber 8 is more easily accomplished when the conduit 22 is returned to the inlet side of the main passageway. Such preferable return connection for conduit 22 affords a closed re-circulatory system for the branch passageway 14, the collecting chamber 3 and its outlet conduit 22, whereby fine adjustment of the operating conditions in this re-circulatory system may be made in conjunction with the operating conditions that are present in the main passageways. The blade 40 projects substantially tangentially into the curved stream of gases and the gases are carried substantially tangentially out of the separator, thereby avoiding the building up of back pressure in such manner as to impair the face flow and stratification of the gases and solids.

The adjustment of plate 40 and of its edge 4 may be changed and minutely and accurately fixed without displacement of parts or interruption of operation; and when it has been adjusted to a particular optimum position it may be secured. The dampers 23, also accessible from without, may be adjusted to afford the proper conditions for withdrawing gas from the chamber 8 across the full width of the chamber. By re-circulating the gas so withdrawn, it does not matter if it carries over a slight burden of undeposited solids.

It will be understood that the specific embodiment of the invention as illustrated and described herein is only by way of illustration, and that various changes and modifications may be made within the contemplation of the invention and within the scope of the appended claims.

I claim:

1. Means for effecting centrifugal segregation and separation of the components of a flowing stream, including a curved main passageway, a collecting chamber, a branch passageway opening through the outer wall of the curved main passageway and leading to the collecting chamber, a plate pivoted on an axis parallel with the axis of curvature of said main passageway and forming a dividing partition between said main and branch passageways, the plate having a free edge projecting into the passageway and being movable in a radial direction toward and away from the center of curvature of the main passageway a portion of the wall of the collection chamber being of cylindrical curvature coaxial with the pivotal axis of said plate, and being ported in such cylindrical curved portion, an arm borne by and extending from said plate and through such port in the chamber wall for adjusting the pivoted plate, and a cylindrical closure plate for such port borne by said arm, said plate having its pivotal support downstream in reference to the gas flow of the free edge of the plate.

2. Means for effecting centrifugal segregation and separation of the components of a flowing stream which include a curved main passageway having an inlet and outlet, a branch passageway opening through the outer wall of the main passageway and leading to a collector chamber, a return manifold passageway from said collector chamber to said inlet, said collecting chamber being provided with a plurality of exit passageways opening in transverse succession from its upper portion and leading to said return manifold passageway, dampers positioned within the several passages of the manifold and adjustable transversely thereof, said manifold leading to an opening in the inlet of the curved main passageway and connected thereto.

3. A separator for cleaning gases comprising a sharply curved duct having means for supplying gas to be treated thereto and having a generally tangential discharge opening, and a separator blade projecting in a generally tangential direction into the discharge opening and serving to

separate the outflowing gases into two streams, means confining the two streams which are so formed, said blade being pivotally supported to swing in a radial direction toward and away from the center of curvature of the duct, a plurality of arms on the blade for effecting movement of the blade, adjustable stop elements engaging the arms to limit their movement, and gearing for operating the arms to adjust the blade, the gearing being out of the stream of gases, there being a slotted housing through which the arms pass with shields on the arms covering the slots in the housing, and the gearing being outside the housing.

4. A separator for cleaning gases comprising a sharply curved duct having an inlet means for supplying gas to be treated thereto and having at the outlet a generally tangential discharge opening, and a separator blade projecting in a generally tangential direction into the discharge opening and serving to separate the outflowing gases into two streams, means confining the two streams which are so formed, a dust collector chamber receiving one of said two streams, means for adjusting the blade in a radial direction toward and away from the center of curvature of the sharply curved duct, and manifold means for withdrawing gases from the dust collector and re-circulating them to the inlet side of the separator and serving to maintain a reduced pressure in the collector.

5. A separator for cleaning gases as defined in claim 4 and including means in the manifold including a plurality of exit passageways and adjustable dampers positioned within the several passages for withdrawing gases from the dust collector and recirculating them to the inlet side of the curved duct, whereby fine adjustment of the operating conditions in the recirculatory system may be made, in relation to and with the operating conditions present in the main inlet passage.

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