April 9, 1957 K. ENGELKE 2,788,263

TOWER-TYPE GAS PURIFIER

Filed May 29, 1952 3 Sheets-Sheet 1

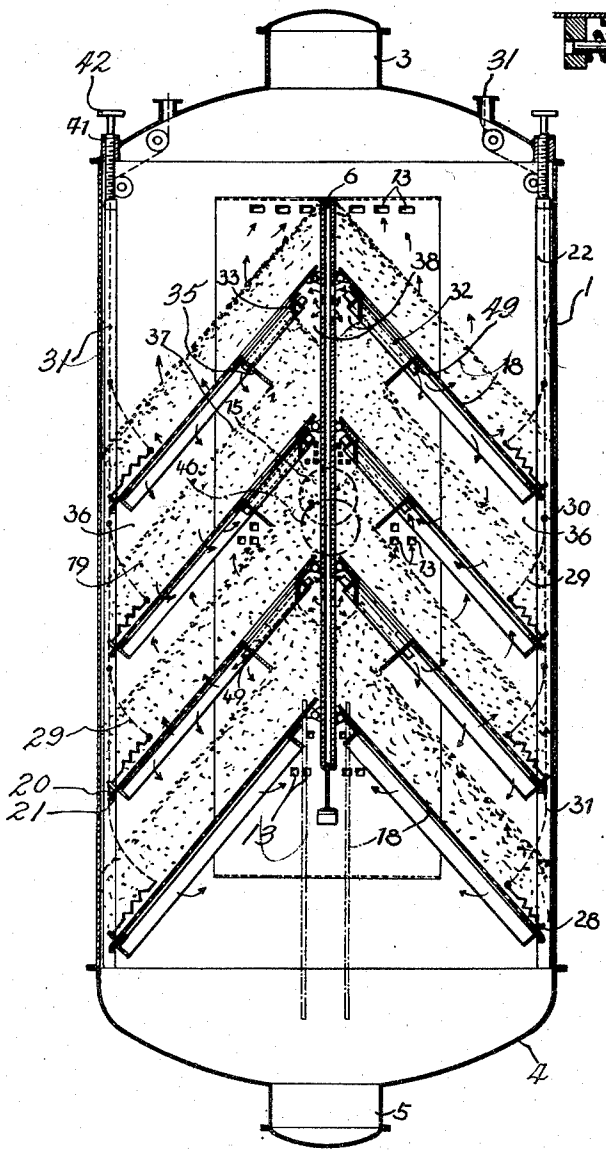


Fig. 1

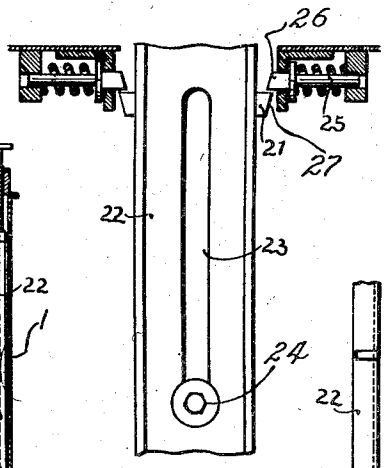


Fig. 6

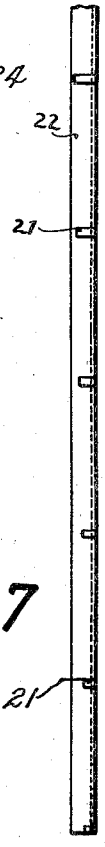


Fig. 7

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TOWER-TYPE GAS PURIFIER

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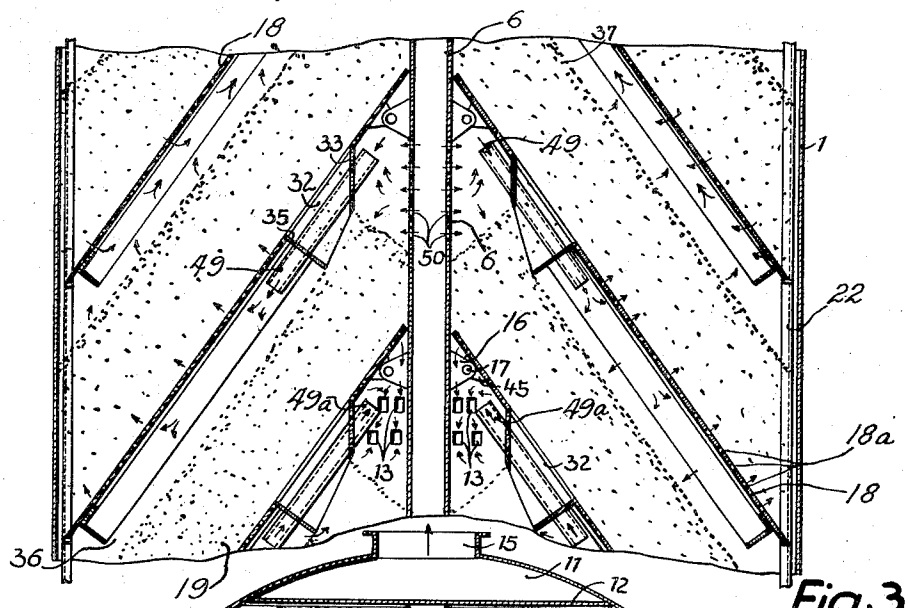


Fig.3

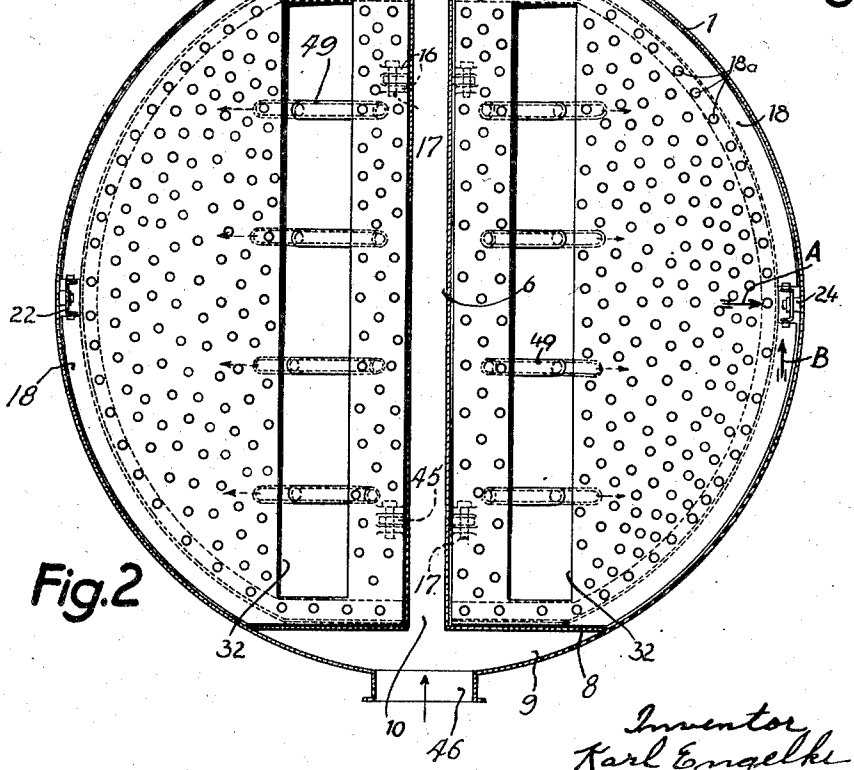


Fig.2

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TOWER-TYPE GAS PURIFIER

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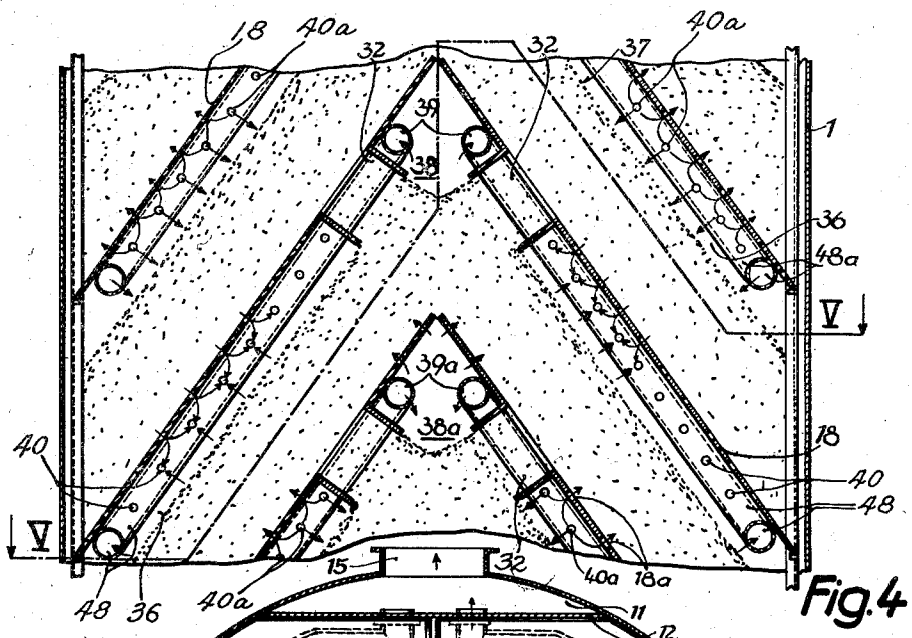


Fig.4

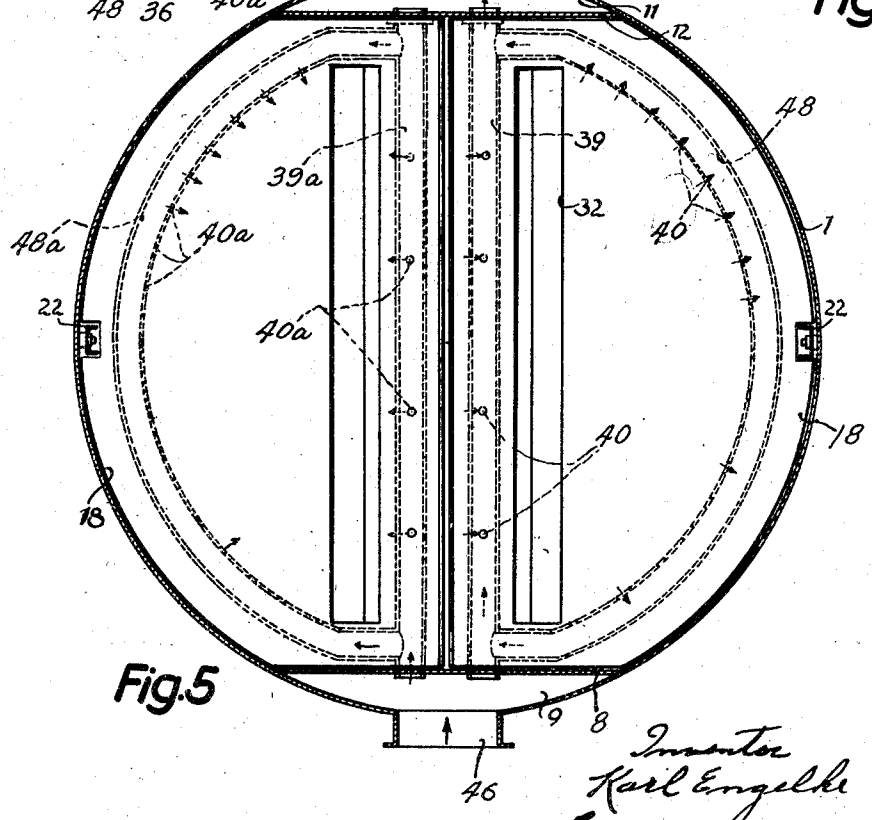


Fig.5

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TOWER-TYPE GAS PURIFIER

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Application May 29, 1952, Serial No. 290,661

8 Claims. (Cl. 23—283)

The present invention relates to a tower-type gas purifier with superimposed grate-like trays carrying the purifying material.

Charging and discharging such gas purifiers is usually done manually in a very troublesome and wearisome manner, and if the gas purifiers are equipped with horizontal intermediary trays, the purifying material must be evenly distributed over these trays in order to obtain a uniform passage of the gas to be treated through the bulk of the material.

An object of the present invention is therefore the provision of improved apparatus of that type, having superimposed trays with means for hinging one end of the superimposed, grate-like trays carrying the purifying material, and for supporting the other end in such disengageable manner that they can be swayed downwards for the purpose of discharging and then be returned again to their supports at the wall.

According to the present invention two rows of oppositely sloped superimposed trays are preferably provided, in which the lower ends of the trays are supported at the sides of the purifier by studs in combination with gas tight sealing washers, which studs are operable by means to release the same accessible from outside and extend through the casing of the purifier.

A specific object of the present invention is the provision of slidable means to support the lower ends of the trays at the wall of the purifier by way of vertical steel sections or the like which can slide along the wall of the purifier and which are provided with projecting stud parts on which bear the lower ends of the trays. The distance of these projecting parts from the center of the purifier as a single vertical plane is diminished in order from the lowest to the highest at the top tray in such a manner that, upon sliding of the supporting steel sections downwards, the trays will individually sway downwards successively in the order of the lowest first and then the others in series in the direction of the highest stud.

The provision of this arrangement and construction of the trays renders it possible to disengage them from one point e. g. from the purifier top in such a manner that they will sway down to nearly a parallel position with the vertical center line of the purifier, and drop the purifying material through the bottom hole without any additional manipulations. In this manner a complete discharge of the trays, even with a wet, sticky material is assured.

It is also an object of the present invention to rest the trays on the projections of the steel sections or stud parts by means of spring-loaded bolts cut diagonally, and to arrange these diagonally cut bolts with respect to the stud parts as diagonally cut projecting parts of the vertical steel sections so that the spring-loaded bolts can yield when swinging the trays upwards to pass by the projecting stud parts of the steel sections and come to rest on the latter.

According to the invention the trays are swung upwards by means of a chain or the like arranged within the steel section, said chain being provided with branch chains or the like suitably attached to the trays in elastic manner.

The invention offers the further advantage of charging the purifying material through a charging hole in the top in a common operation for all trays without necessitating any levelling manipulations on the individual trays. For this purpose the sloping trays are provided with slotted holes running parallel to a diametrically extending hinged axle, the slotted chord holes are given such dimensions that the purifying material charged from the top, after filling the top tray, will flow through the slotted hole of this tray on to the next tray and so forth on down to the lower trays.

A further object of the present invention is the provision, for the stated purpose, of means for supporting the trays at an angle which is in correspondence with the natural angle of repose of the purifying material.

In consequence thereof and by the arrangement of a guide plate fitted to the lower longitudinal edge of the chord slotted holes and inclined downward from each tray, it is achieved that the purifying material will lie spread out by gravity flow on each tray in an almost even layer thus leaving, out of reach of the slotted hole, a free space between the surface of the purifying material and the tray above required for the accommodating the swelling of the purifying material which occurs in use.

The inlet gas is preferably fed in the apparatus constructed according to Figures 1 to 3 of the invention, through a vertical main inlet conduit arranged in the purifier at the one end of the hinged axle of the trays, from where the gas is passed through a small vertical chamber extending over the vertical central plain of the purifier, and when having passed through the purifying material, is then conveyed to a vertical main outlet conduit of a similar construction at the other end of the axles through communicating holes provided in a division wall therefor. Individual gas pipes can be employed alternatively by which the gas will be distributed over the trays instead of by the provision of the vertical chamber. The construction, operation, and utility of the above described apparatus will be better understood by reference to the following drawings and description of the invention.

The accompanying drawings form a part of this specification and show for purposes of exemplification a preferred form of apparatus and mode of operation in which the invention may be embodied and practiced.

Fig. 1 is a vertical section through a tower-like gas purifier of preferred construction according to the invention;

Fig. 2 is a horizontal section through the gas purifier at a level above numeral 3 in Fig. 1 on an enlarged scale;

Fig. 3 shows some intermediate trays of the gas purifier, in a vertical section and on the same scale as in Fig. 2;

Fig. 4 is a vertical section through various intermediate trays but of a different type of construction on an enlarged scale;

Fig. 5 is a horizontal section taken along the line V—V of Fig. 4;

Fig. 6 is a view of the fixing device of the intermediate trays viewed in the direction of the arrow A in Fig. 2, and

Fig. 7 is a side view of the vertical steel section viewed in the direction of the arrow B in Fig. 2.

Referring now to the drawings: the gas purifying equipment consists of a cylindrical column 1, the top 2 of which is provided with a charging inlet 3, and the bot-

tom with a discharge outlet 5. In the vertical central plain of column 1, a small vertical chamber 6 is arranged extending substantially over the whole diametrical vertical cross sectional area of the column 1, and resting on a horizontal I-girder 6'. A vertical main inlet conduit 9 is formed by the arrangement of a division wall 8 at the one diametric side of this small chamber 6 communicating over its whole height by the aperture slot 10 with this conduit 9. A vertical main outlet conduit 11 of similar construction is arranged at the other diametric side of said chamber 6. In the type of construction shown in the drawings of Figs. 1 to 3, the wall 12 separating the conduit 11 from the interior of the column between walls 8 and 12 is provided at certain levels with, Figs. 1 and 3, outlet holes or apertures 13 communicating with the vertical outlet conduit 11. The gas is fed to the vertical inlet conduit 9 through a single inlet 46 and withdrawn from the vertical conduit 11 through a single outlet 15, Figs. 1 and 2.

Shoulders 16, Figs. 2 and 3, are fitted equidistantly above each other to the walls of the vertical chamber 6 by means of which the links 45 of the trays 18 are hinged by means of bolts 17. The trays 18 are sloped at an angle which corresponds to the natural angle of slope or repose of the purifying material 19 to be carried by them. The lower ends 20 of the trays 18 rest on oppositely disposed projecting parts 21 of vertical U-sections 22 (Fig. 7). The U-sections 22 as shown in Fig. 6 are provided with oblong guide slots 23 through which guide bolts 24 with nuts and washers are fitted and fixed to the purifier shell 1, so that any vertical displacement of the steel sections 22 may be effected on the guide. The trays 18 are provided with apertures or holes 18*a* as gas outlets.

In supporting the trays 18 on the projecting parts 21 of the vertical steel sections 22, use is made of the oppositely disposed spring-loaded bolts 25, Fig. 6. The ends of the bolts 25 are provided with diagonal cuts 26 which, when the trays are swung upwards, will push against the diagonal cuts 27 of the projecting parts 21. The spring-loaded bolt 25 will yield and, when the trays are swung further past the bolt surfaces 26, come to rest on the projecting part 21 under outward pressure of the spring.

As shown in Fig. 7, the space between the projecting parts 21, which are arranged at both sides of the vertical steel sections 22, and the vertical central plain of member 6 diminishes in order from the bottom to the top. It is achieved by this arrangement, when sliding the vertical steel section 22 downwards, that the trays 18 will drop in succession from the projecting parts 21, in order from the bottom to the top, and take an almost vertical position as indicated by the dash-dot line in Fig. 1. The steel sections 22 are suspended on a spindle 41 which can be moved in vertical direction by means of a handwheel 42 on top of the purifier 1.

The trays 18 are inter-connected at their lower parts 28 by chains 29 which are fixed at 30 to vertical chains 31. The individual trays can be jointly swung upwards with these chains 31 by means of a windlass, not shown in the drawing to be re-positioned in the purifier after a previous operation for releasing the individual trays from latches 21, and discharging the purifier 1.

An oblong opening 32 is arranged along the axis of the hinged joints 17 of every tray 18, with the exception of the lowest tray. A guide plate 33 is fixed to the upper longitudinal side of the opening 32, and a guide plate 35 to the lower side. Guide plate 35 extends a distance greater than plate 33 and so far partway below its tray 18 that the purifying material falling through said slot opening 32 will come to rest in even inclined layers on the trays, and at a distance from the next tray 18 above which is limited by said guide plates, in consequence of the sloped arrangement of the trays to correspond to the natural angle of slope or repose of the purifying material. The free space 36 thus formed between each tray 18 and the purifying material on the tray next below must be so large as to permit the purifying material to grow (expand, swell, fluff) into said free space 36 during the process of the gas purification without pressing against the tray above. A natural opposite angle of repose or slope 37 is formed by the upper guide plates 33 whereby a free space between the upper end of trays 18 and the vertical chamber 6 is thereby defined, thus forming by means of the plates 33, the tray portion above and the chamber 6, a pair of horizontal conduits 38 below a hinged pair of trays 18 which serve the purpose of distributing the gas in through the purifying material, whereas the next pair of conduits 38*a* is used to withdraw the gas through the apertures or holes 13 of the division wall 12. The gas to be purified passes through holes or apertures 50 in the side walls of the chamber 6 into the horizontal conduits 38 and from here by way of connecting pipes 49 through the gas purifying material in the slots 32 into the free spaces 36 above the purifying material, and flows then through the perforated tray 18 up and downwards directly through the purifying material. The purified gas passes partly directly and partly by way of pipes 49*a* through the holes 13 of the division wall 12 into the vertical main outlet conduit 11.

In the embodiment of Figs. 4 and 5, the horizontal tubes 39, 39a below each tray 18 having holes or apertures 40, 40*a* are provided, through which the gas to be processed is conveyed into and out of the purifying material 19 and which communicate directly with the vertical main outlet and inlet conduits 11, 9, as shown in Fig. 4 and Fig. 5, instead of by means of a common vertical chamber 6 as in Figs. 1–3. Tubes 39 alternate in vertical direction with tubes 39*a* which are pivoted at both ends into the side walls 8 and 12 in such a way that the trays 18 can be hinge rotated around the axis of tubes 39, 39*a* as their axis for downward swinging movement. The tubes 39, 39*a* are further connected at both ends to another distributing tube 48 arranged at the periphery of each tray 18 and provided with inlets and outlets 40 and 40*a* respectively. A baffle plate may be provided, alternatively, which forms an outer passage around the lower part of the trays and thus keeps a conduit clear of such material for the distribution of the gas, when charging the purifying material, instead of the above mentioned gas distribution tube 48, arranged at the periphery of each tray. The distributing tubes 39 as shown in Fig. 5 communicate with the vertical main outlet conduit 11 and the tube 39*a* with the main inlet conduit 9.

Spindle 41 is, in both embodiments, moved down when discharging the purifier 1 thus releasing the trays 18 successively in order from the bottom to the top, whereupon they all take a vertical position, shown by the dash and dot lines only for the lowest pair of trays. The trays 18 when swung downwardly are cleared from the purifying material which will drop through the discharging opening 5, all by gravity, onto a conveyor or belt or any other suitable conveying means not shown in the drawing. When winding up the chain 31, the trays 18 connected thereto by means of short chains 29 are swayed or swung upwards and will again come to rest on the projecting parts 21 of the steel section 22, in the method described, by a corresponding yield of the spring-loaded bolts 25.

The purifying material to be refilled into the purifier tower can now be charged through the top opening 3 in a single charging operation, and will spread out in even layers on all the trays 18, after having passed through the longitudinal slot openings 32.

I claim:

1. A tower type gas purifier, comprising a tower having oppositely disposed rows of superimposed oppositely sloping gas diffusing trays each of which are individually hinged centrally at their upper ends within the tower and

are disengageably supported in the tower at a level lower than their hinges; said trays each having a substantially continuous slotted opening longitudinally of and in proximity to its hinge for passage of purifying material charged from above the topmost tray through each tray to a tray below, for gravity spread of material onto each tray along the tops of the sloping trays in a common charging operation from above the topmost trays; and unitary movable means movable as a unit common to the superimposed trays of a row thereof, said unitary movable means having manipulating means accessible from the exterior of the tower, and projecting parts inside the tower, for supporting the trays individually against tilting at a region remote from their hinges, and with the projecting parts at different distances from the vertical plane of the hinges of the superimposed trays which distances diminish in the order of the ascent of the parts from the lower most tray, for successive tilting of all the trays seriatum from bottom to top, on operation of the manipulating means for release of the trays from outside the tower to discharge all trays by a single discharge operation; means manipulatable from the exterior of the tower and operable as a single unit common to all trays, for swinging the trays, when released, back up into sloping engagement with their disengageable projecting parts; deflector plates extending partway into the space below the trays at the lower longitudinal sides of their slotted openings, for formation of a free space between each tray and a layer of purifying material fed onto the tray next below through said slotted openings; oppositely disposed main vertical inlet and outlet conduits on diametrically opposite extremities of the tower, transversely of the ends of the hinge extremities; inlets from said inlet conduit to alternate spaces between alternate pairs of adjacent trays; and outlets to said outlet conduit from intermediate spaces between intermediate pairs of adjacent trays for serial flow of gas through layers of material on adjacent sloping trays.

2. A tower as claimed in claim 1, and in which the projecting parts comprise spring loaded bolts with tray engaging cam surfaces for retraction under pressure of trays swung back into their sloped positions; and the means for swinging the trays to their sloped position comprises a chain with individual branches to the individual trays, and the trays are supported by their hinges and projecting parts at an angle corresponding to the normal angle of repose of the purifying material for which the tower is primarily designed and particularly adapted for use with.

3. A tower as claimed in claim 1, and characterized by gas distribution pipes fixed to the alternate trays and eduction pipes fixed to the intermediate trays and both hinged in the walls of the main inlet and outlet conduits, said pipes each being connected to tubes arranged at the peripheries of their respective trays and having ports for inlet and outlet of gas therein to and from material on their trays.

4. A tower as claimed in claim 1, and in which the inlets from the vertical inlet conduit comprise a long, high, narrow channel intermediate the oppositely inclined superimposed tray rows, and open to the inlet conduit and closed to the outlet conduit, and having ports for discharge of gas into the alternate spaces above some of the superimposed trays and being devoid of ports leading to the intermediate spaces above and below said trays, and in which the outlets to the outlet vertical conduit comprises ports in the portions of the outlet conduit alongside the intermediate spaces to which the long, high, narrow channel is devoid of ports.

5. A tower type gas purifier comprising: a tower having superimposed gas diffusion trays therein for supporting purifying material thereon in layers in said tower, with each tray hinged at its uppermost part in the tower for tilting therein, and each tray disengageably supported in the tower at a region remote from its hinge for downward swinging for discharge of material on the trays, characterized by each of said trays having a substantially continuous slotted opening extending in the direction of their hinge axis at a region in proximity to their hinges at the uppermost part of the plates, and each tray being sloped downward from its uppermost part in the direction of where they are disengageably supported, for passage of purifying material charged from the top of the tower above the uppermost tray, through each tray to a tray below, whereby the material may spread in layers over each tray by gravity by passage through the slotted openings and flow along their sloping tops in a common charging operation from above; and guide plates extending partway into the space below the trays at the lower longitudinal side of the slotted opening of the trays, whereby to form a free space between each tray and a layer of purifying material fed onto a tray next below through said slotted openings, for growth in volume of purifying material on the trays in gas purifying operation thereof.

6. A gas purifier as claimed in claim 5, characterized by oppositely disposed main vertical conduits on diametrically opposite extremities of the purifier tower, transversely of the ends of the hinged extremities of the trays; and inlets from one of said conduits communicating with alternate spaces between alternate pairs of adjacent trays, and outlets to the other of said conduits communicating with intermediate spaces between intermediate pairs of adjacent trays, for gas flow in opposite directions, in through purifying material between an upper and a lower tray of alternate pairs and out by way of purifying material between upper and lower trays of intermediate pairs, during flow of gas from one conduit to the other conduit on diametrical opposite sides of the tower.

7. A gas purifier as claimed in claim 6, and further characterized by gas distribution pipes fixed to the alternate trays and eduction pipes fixed to the intermediate trays, said pipes being hinged on the walls of the main conduits.

8. A gas purifier as claimed in claim 7, and further characterized by the gas distribution and eduction pipes also comprising horizontal distribution and eduction pipes connected to tubes arranged at the peripheries of their respective trays and provided respectively with gas inlets to and outlets from material on the trays.

References Cited in the file of this patent

UNITED STATES PATENTS

57,469	Bradford	Aug. 28, 1866
272,959	Hoyt	Feb. 27, 1883
1,961,990	Sleeman	June 5, 1934
2,292,716	Pyzel	Aug. 11, 1942
2,621,112	Schmalenbach	Dec. 9, 1952

FOREIGN PATENTS

137,631	Great Britain	Jan. 22, 1950