H. E. THEISEN.

APPARATUS FOR CLEANING, COOLING, AND MIXING GASES.

APPLICATION FILED JAN. 6, 1912.

1,039,677.

Patented Sept. 24, 1912.

3 SHEETS—SHEET 1.

Fig. 5

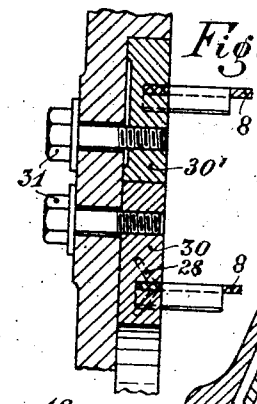
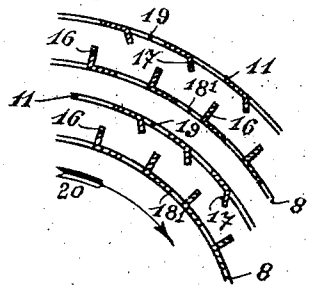


Fig. 3



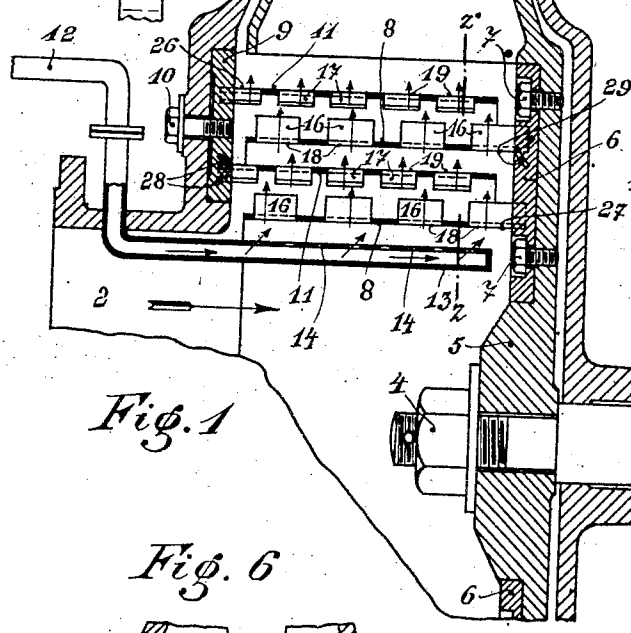


Fig. 2

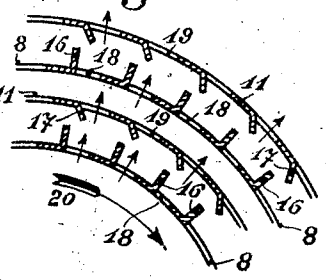


Fig. 1

Fig. 4

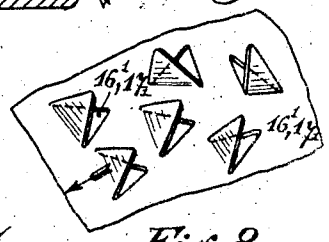


Fig. 6

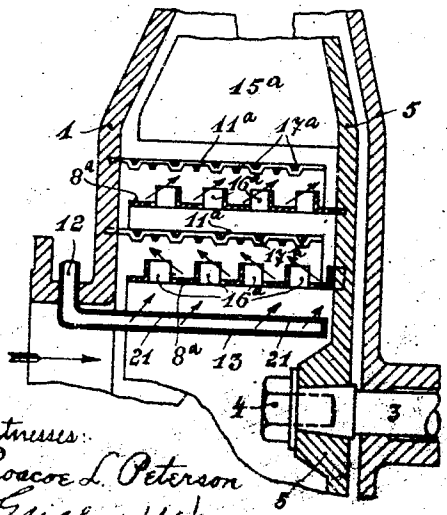


Fig. 7

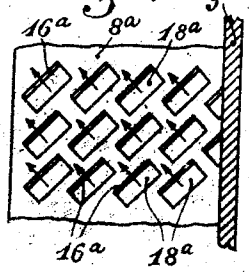
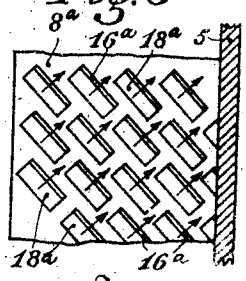


Fig. 8



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3 SHEETS—SHEET 2.

Fig. 9

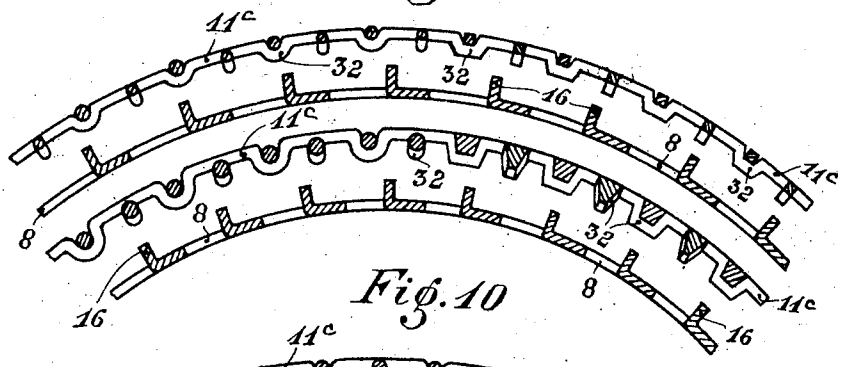


Fig. 10

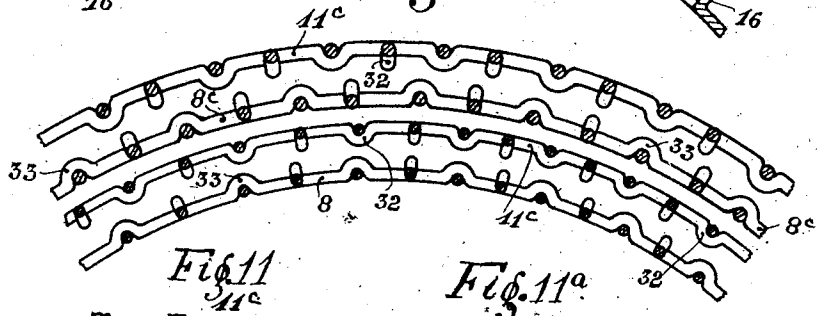


Fig. 11

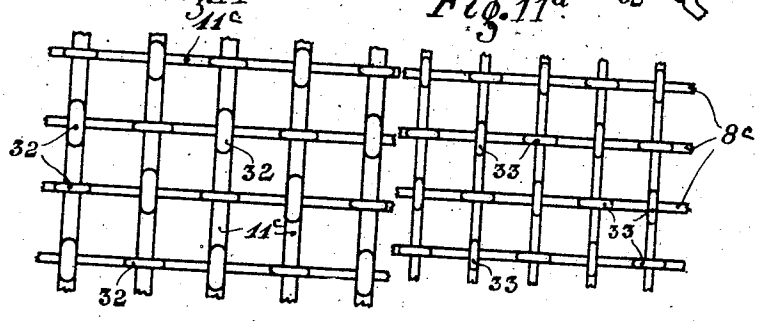


Fig. 11a

Fig. 12

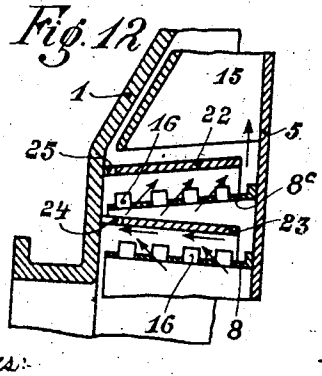
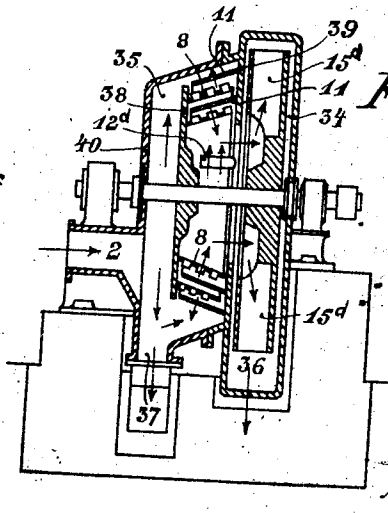


Fig. 13



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1,039,677.

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3 SHEETS—SHEET 3.

Fig. 14

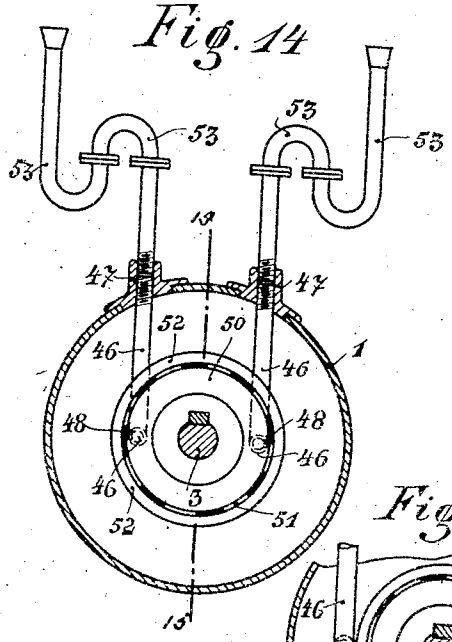


Fig. 15

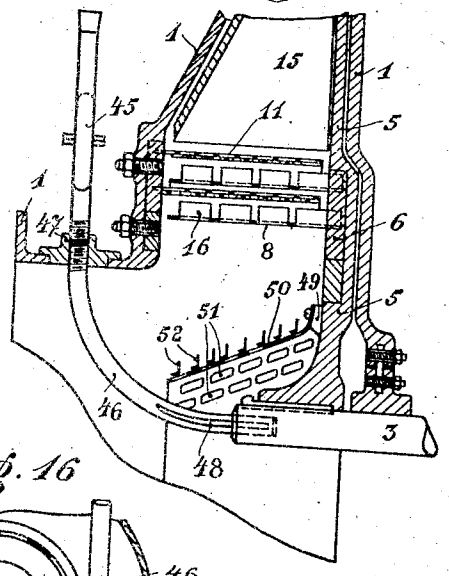


Fig. 16

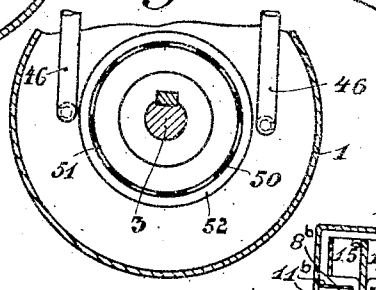


Fig. 17

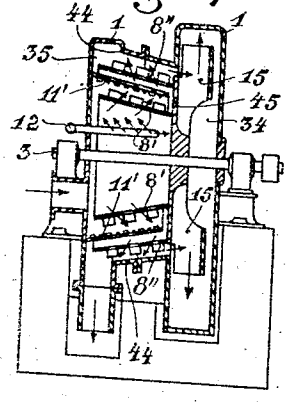


Fig. 18

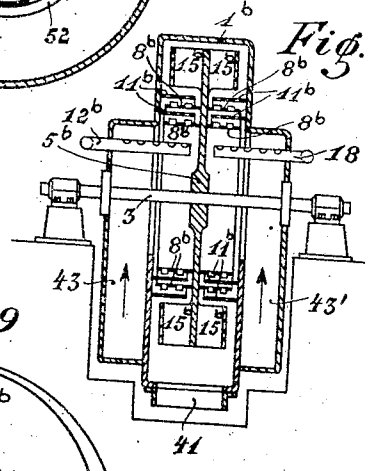
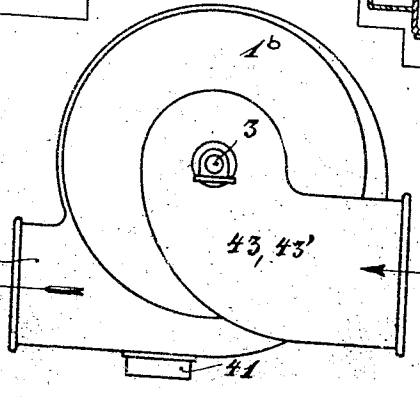


Fig. 19



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APPARATUS FOR CLEANING, COOLING, AND MIXING GASES.

1,039,677. Specification of Letters Patent. Patented Sept. 24, 1912.

Application filed January 6, 1912. Serial No. 669,827.

To all whom it may concern:

Be it known that I, HANS EDUARD THEISEN, citizen of the United States of America, residing at Munich, Bavaria, Germany, have invented certain new and useful Improvements in Apparatus for Cleaning, Cooling, and Mixing Gases; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in apparatus for cleaning, cooling and mixing gases.

The type of apparatus to which my invention more especially relates is that employing a plurality of concentric cylinders or cones arranged one within the other, and operating in the nature of disintegrators, certain of these cylinders being fixed and others revoluble. Some or all of these cylinders may be perforated or apertured, and the cleaning, cooling or mixing fluid is injected in finely comminuted form into the apparatus preferably by means of jet tubes or pipes.

One object of the invention is to generally improve the form and arrangement of the perforations in the cylinders or cones, which act in the nature of disintegrators.

Another object is to improve the construction, arrangement and installation in the apparatus of the disintegrators.

Other objects of the invention will be more fully hereinafter described.

Several forms of the invention are illustrated in the accompanying drawings, wherein like reference characters denote like parts throughout the several views, and in which drawings—

Figure 1 is a vertical sectional view through the upper part of an apparatus embodying certain features of my invention; Fig. 2 is a cross sectional view taken on the line 2—2 of Fig. 1; Figs. 3 and 4 are fragmentary views of disintegrators having modified forms of perforations or apertures therein; Fig. 5 is a fragmentary sectional view illustrating a modified means for securing the disintegrators in position; Fig. 6 is a vertical sectional view of a modified form of the apparatus shown in Fig. 1; Figs. 7 and 8 are plan views of fragments of the disintegrators used in the construction of the apparatus shown in Fig. 6; Figs. 9 and 10 are cross sectional views, and 11 and 11ª are plan views of further modified forms of disintegrators; Fig. 12 is a vertical sectional view of a modified form of apparatus wherein the disintegrators are cone shaped; Fig. 13 is a similar view of a modified form of apparatus wherein the fan or propeller is arranged laterally; Fig. 14 is a sectional elevation illustrating a modified arrangement of supplying fluid to the apparatus; Fig. 15 is a cross sectional view taken on the line 15—15 of Fig. 14; Fig. 16 is a sectional elevation of a modified form of the arrangement shown in Fig. 14; Fig. 17 is a vertical sectional view of a modified form of the entire apparatus; Fig. 18 is a similar view of a further modified form; and Fig. 19 is a schematic view of the exterior of the apparatus.

Referring by reference characters to the accompanying drawings and particularly to Fig. 1 thereof, 1 designates a two-part casing of cast metal, having the admission passage 2 through which gas flows, in the direction indicated by the arrow, into the apparatus. Secured to the shaft 3 by means of the nut 4 or in any other suitable manner is a supporting disk 5 which is arranged closely adjacent the inner face of one of the lateral walls of the casing. The disk 5 is caused to rotate at the desired rate of speed by power applied to the shaft 3 by any suitable means, such as by a belt and pulley drive (not shown). Removably secured by screws 7 to the disk 5 is an annular disk 6 which serves to support the disintegrators 8 as more fully hereinafter described. Opposite the disk 5 the casing 1 is grooved or undercut to receive a second annular disk 9 which is removably held in position by means of the screws 10. This disk 9 serves to retain the fixed disintegrators 11 which are arranged between the disintegrators 8 revoluble with the driven disk 6. Entering the casing 1 is a bent pipe 12 having a horizontal arm or branch 13 which is preferably arranged closely adjacent the inner face of the innermost disintegrator 8, this arm 13 having perforations 14 therein through

which the desired cleaning, cooling or mixing fluid under pressure is forced or jetted against the disintegrators. Secured to, or formed as an integral part of, the disk 5 are one or more fan or propeller blades 15 which project into the space in the casing above that occupied by the disintegrators. In certain forms of the invention these propeller blades may be entirely omitted, or may be arranged laterally as shown in Fig. 13, or centrally of the disintegrators, if desired. As shown in Figs. 1, 12, 13, 15, 17 and 18 the blade may be laterally closed, or as shown in Fig. 6 the blade may be substantially plane and laterally unobstructed in the direction of one of the casing walls.

The disintegrators 8 and 11 are preferably provided with suitable orifices or apertures 18 and 19, respectively, but in view of the great speed at which certain of the disintegrators rotate the function of the apertures would be rendered nugatory and the passage of gas and fluid therethrough would be practically stopped unless suitable means to overcome this defect were provided. I propose to remedy this drawback by the provision of projections 16 and 17 adjacent the orifices 18 and 19, these projections being preferably directed toward each other, that is to say, the projections of the revoluble disintegrators extending upwardly or outwardly and those of the fixed disintegrators extending downwardly or inwardly (see Figs. 2 and 3). By this construction and arrangement of parts the passage of fluid and gas through the apertures is materially facilitated during rotation of the revoluble disintegrators, the mixture being thrown centrifugally against the oppositely disposed downwardly inclined projection of the fixed disintegrators. These projections may be most simply formed by permitting the parts which result from stamping out the orifices to remain attached at one edge to the body of the disintegrator, thus forming flaps which may be bent up or down to form the desired projections.

In Figs. 1 and 2 the projections, formed as just described, are illustrated clearly; 16 are the upwardly directed projections on the revoluble disintegrators 8, extending radially and substantially at right angles to the latter; 17 are the downwardly directed, radial or inclined projections formed on the fixed disintegrators 11. In these figures the orifices 18 of the revoluble disintegrators 8 are arranged in advance of the projections 16, the direction of revolution being assumed to be that shown by the arrow 20 in Fig. 2. When the arrangement is that just described it is easy for sediment and incrustation to form in the angle at the back of the projections 16, and to prevent this it is advisable to adopt the construction of Fig. 3 wherein the openings 18^a are immediately adjacent the back of the projections 16, so that the fluid passing through these openings will wash against the rear faces of the projections keeping them clean, while the centrifugal force resulting from the revolution of the disintegrators suffices to prevent the accumulation of any solid matter on the front wall or face of the projection.

Fig. 4 shows a modified form of aperture in the disintegrators, the projections 16′, 17′, which may be formed on either the fixed or revoluble disintegrators being acute angular, so that the resulting apertures are substantially of triangular formation.

A form which has proven somewhat more effective in practice than those previously described is that illustrated in Figs. 6, 7 and 8, wherein it will be noted that the projections 16^a are preferably inclined. In this form of the invention the fixed disintegrators 11^a are preferably formed of wire grating and the revoluble disintegrators 8^a have apertures 18^a formed by stamping up the projections 16^a out of the material of the disintegrator. The projections 16^a are preferably inclined in relation to the shaft 3 so that the gas and fluid instead of being thrown radially, is caused to move in a substantially spiral path, resulting in a more effective use of the washing surfaces of the machine, a more intimate admixture of gas and fluid and thus an enhanced cleaning action on the gas. The projections of all the revoluble disintegrators may all extend in the same direction but it is preferable to so arrange the revoluble disintegrators that the projections 16^a of one of the disintegrators 8^a extend in an opposite direction to that of the projection 16^a of another disintegrator 8^a. This arrangement is shown in Figs. 6, 7 and 8. Fig. 7 illustrates the inner revoluble disintegrator and Fig. 8 the outer revoluble disintegrator. The projections 16^a in Fig. 7 incline upwardly from left to right while those in Fig. 8 incline upwardly from right to left. Seen from above, the projections 16^a on all the revoluble disintegrators cross. This construction results in producing various oppositely directed spiral currents of the gas and fluid mixture, whereby there is constant change of direction of motion, thus tending to increase the efficiency of the apparatus. The arrows in Figs. 6, 7 and 8 show the alterations or reversals in the direction of motion of the gas and fluid mixture.

Another feature of my invention consists in arranging the disintegrators so that the downwardly directed projections of the fixed disintegrators will cross the upwardly directed projections of the revoluble disintegrators, *i. e.* the projections on the revoluble disintegrators will extend or incline in a direction opposite that in which the projections of the fixed disintegrators extend or

incline. In this arrangement all the projections on all the fixed disintegrators may have the same inclination, or if desired the projections of two such disintegrators may cross if desired.

In the form of invention illustrated in Figs. 6, 7 and 8 the innermost revoluble disintegrator 16^a gives the air and gas mixture a spiral twisting movement toward the left, while the outermost revoluble disintegrator 16^a causes a like movement to the right. In connection with this form of the invention it is desirable to use the laterally open propeller blades 15^a shown in Fig. 6, to freely throw the air and gas mixture against the left casing wall. The fluid admission pipe 13 has apertures or jet openings 21, inclined toward the right in opposition to the left inclination of the openings or apertures in the innermost revoluble disintegrator. It will be understood that, if desired, the openings 21 may be straight, instead of inclined as shown. Fig. 6 also illustrates a modified form of fixed disintegrator 11^a formed of wire grating having the projections or crossing points 17^a corresponding to the projections 17 in the preceding figures of the drawing. This modified form of disintegrator will be more fully referred to hereinafter.

It will of course be understood that an apparatus embodying the invention may be double acting, *i. e.* provided with two (or more if desired) sets of disintegrators and propeller blades, such construction being shown in Fig. 18 wherein the disk 5^b is provided at each side with the disintegrator members 8^b and the screw or propeller blades 15^b which may be laterally open or closed as desired. The snail like casing 1^b (Fig. 19) incloses the apparatus and has formed therein an exhaust passage 41 through which the fluid admitted by the pipe 12^b, passes out of the apparatus. 42 is the emission passage for the cleaned gases, which pass into the apparatus in raw condition through the chambers 43, 43′ in the direction shown by the arrows.

It is to be noted that all or certain of the fixed disintegrators may be imperforate instead of being provided with apertures, so that the entire longitudinal surface of such fixed disintegrators is available against which the gas and fluid mixture is forced in a spiral path by the revoluble disintegrators. If such imperforate disintegrators are employed each thereof is then preferably provided with a recess or opening to prevent the settling of dust and tar in the corners. Fig. 12 shows a construction wherein the disintegrators are cone shaped, as distinguished from the cylindrical form of the preceding figures and the fixed cones are imperforate, except that the innermost fixed cone or disintegrator 23 is provided with an opening 24 to permit gas and fluid to pass therethrough to the next succeeding revoluble disintegrator 8^c. The outermost fixed disintegrator cone 22 is also preferably provided with an opening 25 at its point of attachment to the casing to prevent the formation of sediment or incrustation of tar and the like at this point.

The apertures and projections of the disintegrators should, when present, extend the entire cross section of the latter, and moreover the lateral walls in which the disintegrators are secured should be perfectly plane, as it is only in this way that the settling of dirt, dust, tar and the like in the corners and angles can be prevented. In accordance with the present invention the disintegrator cones or cylinders are cast into or sweated on to suitable annular disks or the like which are removably attached to the apparatus casing, and this construction results not only in providing a thoroughly rigid connection but permits of the cones or cylinders being perforated their entire length right up to the plane surfaces of the disks, whereby the settlement of tar, etc., is avoided and a larger cross sectional passage is obtained.

In Figs. 1 and 5 two methods of securing the disintegrators in position are shown. In Fig. 1 the disintegrators are cast right into the disks 6 and 9, that is, the ends 26 of the last projection 17 and the ends 27 of the last projection 16 are simply cast at the same time as and into the plane faces of the disks 9 and 6. If desired the edge of the perforated disintegrator cone or cylinder may be formed as oppositely projecting inclined flaps or tabs so as to make this edge appear notched or toothed. The teeth 28, 29 (Fig. 1) are then cast into or sweated on or otherwise secured to the disks 6 and 9. The cast metal disks 6 and 9 which are removably secured in the casing walls may also be so constructed and arranged that each perforated disintegrator is individually insertible in and removable from the apparatus, the advantage of this arrangement being that if any one cone or cylinder is damaged that one only need be removed with its supporting disk, the other remaining in position. Fig. 5 shows a form of construction wherein a separate supporting disk is apportioned to each disintegrator. 8, 8, are the fixed disintegrator cones or cylinders, each of which is cast into or sweated on to an annular disk 30, 30′, the disks being removably secured in position by means of the screws and nuts 31. It will be understood that three or more removable disintegrators may be used each being supported by a separate disk, the inner or middle disks being held in position without the use of screws, by having the edges of the disks overlapped or dovetailed. In place of using the individual cast metal disks I may employ disks of strong sheet or boiler tin on to which the perforated or

wire grating disintegrators are sweated. The disintegrators are secured to such sheet tin disks in a manner similar to either that shown in Fig. 1 or in Fig. 5.

It has been heretofore stated that in lieu of perforated or apertured disintegrator cylinders or cones, I may employ cylindrical or conical disintegrators constructed of wire grating work having a round, quadrangular, rightangular or prismatic cross section, the production of such wire disintegrators being simpler and cheaper than the other kind. In the use of such disintegrators it is possible to clean, to a certain degree of purity, great quantities of gas usable for heating and like purposes, and for cleaning gas wherein a thorough cleaning action is not necessary the perforations may be large and the projections small. This result may be much better attained by the use of wire disintegrators than by the use of the perforated tin disintegrators which lose the needed rigidity if the perforations are large and the connecting webs small. Another rather disadvantageous feature found in the projections of the tin disintegrators is that when gas rich in tar is cleaned the likelihood of this tar settling in the corners and angles is considerable, while when the wire grating disintegrators are used this settling of tar deposit is precluded because the symmetric wires having the symmetric projections or points of intersection present surfaces which are uniformly subjected to the action of the washing fluid. Moreover, when using wire disintegrators, either fixed or revoluble, having the projecting points of wire intersection, the pulverization, comminution and admixture of gas and washing fluid is more uniform because these projecting points of intersection are distributed completely uniformly over the whole surface of the disintegrator and these points of intersection are themselves symmetrical, as a result of which there are considerably more such projecting points of intersection and there is a sort of molecular pulverizing action so that the cleansing action is thus enhanced. Just as the intersecting points of the wire are symmetrical and uniformly distributed, the openings are also symmetrical and uniform, and it is thus possible to throughly clean great quantities of gas so that the latter may be used for gas engines.

Fig. 9 shows a form of invention using wire grating disintegrators; 8, 8, are the revoluble disintegrators of tin or the like having the projections 16 while 11^c 11^c are the fixed wire grating disintegrators. 32 are the downwardly, directed loops or protuberances at the points of intersection of the wires, these protuberances acting as thoroughly effective deflecting surfaces for the gas and fluid mixture. Fig. 10 shows a further modification wherein both rotating and fixed disintegrators are made of wire grating. In this figure the rotating disintegrators 8^c 8^c are provided with the upwardly directed protuberances 33 while the fixed disintegrators 11^c are provided with the downwardly directed protuberances 32. Fig. 11 is a plan view of Fig. 9 and Fig. 11^a a plan view of Fig. 10. The form of the wires of the wire grating disintegrators and the size of the mesh may be chosen to suit the needs of any particular occasion and in Figs. 9, 10 and 11 there are shown disintegrators of which the wires in cross section appear round, rectangular or prismatic. The wire of which the disintegrators are formed may be of like gage throughout or the wires may be of alternately large and small gage as desired.

In the forms of invention heretofore described the propeller or fan (which may be omitted if desired) was shown as surrounding the disintegrators. As shown in Fig. 13 the propeller 15^d may be separated from the disintegrators and arranged in a chamber 34 separate from the chamber 35 wherein the disintegrators are housed. 2 is the gas admission port, 36 the gas outlet, 12^d the fluid admission pipe and 37 the fluid emission port. In this form of the invention the washing fluid passes from the interior of the apparatus outwardly while the gas to be cleaned passes in the opposite direction, thus resulting in oppositely flowing counter currents which arrangement is adapted to intensify the cleansing or mixing action. Carried on the shaft 3 of the apparatus is a disk or plate 38 which carries on the right face thereof the perforated revoluble disintegrators 8, while the partition 39 between the chambers 34 and 35 supports the fixed disintegrators 11 which may be constructed in any of the forms heretofore described in detail. The arrangement may of course be reversed by securing to the left hand side of disk 38 the rotary disintegrators and securing to the left hand side of the casing wall 40 the fixed disintegrators.

In the form of invention shown in Fig. 17 an intimate admixture of gas and fluid is effected by the perforated rotary and fixed disintegrators 8′ and 11′, the outer rotating disintegrator 8″ throwing by centrifugal action the gas and fluid mixture against the fixed inner casing wall 44. In this action there is a spiral current to the left of the washing fluid, and a spiral counter current to the right of the gas. For this purpose the plate or wall 45 of the fan blade 15 forms the partition between the chambers 34 and 35 (Fig. 17). The construction just described is particularly advantageous in practice because of the small space it occupies and the efficacy of its action.

The use of cones such as shown in Fig. 12 has the advantage that owing to the cone

like formation of the disintegrator surfaces a small portion of the gas and fluid particles will glide outwardly in zig-zag form along these surfaces. Thus in addition to the essentially radial stream of gas and water particles, there is also a second current which to a certain extent crosses and intersects the main current. Inasmuch as this second current also encounters the several projections on the disintegrators and the gas and fluid particles are comminuted or pulverized, the use of cone shaped disintegrators results in a more effective comminution and admixture of gas and fluid particles whereby the degree to which the gas is cleaned is increased. It is to be noted that the disintegrators may either all have the same inclination and relative position, or as shown in Fig. 12 may occupy different angular positions. There may also be in the same apparatus some cylindrical and some cone formed disintegrators, the fixed cylinders or cones being partly perforated and partly imperforate, or entirely apertured or entirely imperforate.

In all these devices the uniform distribution of the washing fluid is of the greatest importance. Moreover it is necessary in order that the operation may be uniform and continuous, that the fluid admission pipes remain unobstructed, and in order to provide ready relief in a case of obstruction it is essential that this pipe be easily removable.

Heretofore an ordinary tube 12, 13 (Figs. 1 and 6) having the jet openings 14, 21, has been employed, this tube being directly connected to the source of fluid under pressure. The preferred form of water feed or supply is that illustrated in Figs. 14, 15, and 16. In this construction an ordinary open siphon tube 53 is employed to which the washing fluid flows. This siphon tube 53 which is screwed into bearings or bosses 47 in the casing 1 is provided within the apparatus with a curved terminus or end member 46 having jet openings 48 through which the fluid passes into the interior of a jet cone 50 secured to the disk 5 carried by the shaft 3 (Figs. 14 and 15). The jet cone 50 is provided with slots 51 along the cone surface and is also provided with the exterior jet or deflector plates 52. By rotation of the jet cone 50 the washing fluid is thrown out from the interior of the cone 50, in finely comminuted condition and is uniformly distributed. In addition to throwing the fluid radially, the cone 50 also causes the water to pass along the cone surface from the narrow to the wide part thereof which results in a washing action being exerted against the disk 5. To this end the jet cone 50 is secured to the disk 5 by separate, spaced brackets 49 so that the washing fluid is not impeded in its course. An equally effective distribution of fluid may be obtained by means of the arrangement shown in Fig. 16 wherein the end 46 directs the fluid against the exterior of the jet cone 50. The purpose of curving the end 46 is to facilitate the removal of the latter after the siphon tube 53 has been removed.

What I claim is:—

1. An apparatus for the purpose specified, embodying therein a casing, an annular disk removably secured to one wall of said casing, a series of concentric disintegrator members fixed to said disk, a second disk rotatably mounted within said casing adjacent and parallel to the wall of the casing opposite that carrying the fixed disintegrator members, a series of disintegrator members removably carried by said second disk and extending into said casing in alternation with the fixed disintegrator members, and a fan blade carried by said second disk and adapted to rotate in a path surrounding the series of disintegrator members.

2. An apparatus for the purpose specified, embodying therein a casing formed of walls parallel for a part of their extent and inclined to each other another part of their extent, an annular disk countersunk in one wall of said casing, disintegrator members extending transversely within the casing from said countersunk disk, a second disk rotatably mounted within said casing immediately adjacent one of said walls, said second disk being shaped to conform to the shape of the wall and having a series of disintegrator members parallel to those carried by the first named disk, and a fan blade carried by said second disk and adapted to revolve about the disintegrator members in the path formed by said inclined walls.

3. An apparatus for the purpose specified, embodying therein a casing, a disk countersunk in one wall of the casing, a series of concentric apertured disintegrator members fixed to said disk, said members having projections formed near the apertures therein, a second disk rotatably mounted within said casing adjacent and parallel to the wall of the casing opposite that carrying the fixed disintegrator members, a series of apertured disintegrator members carried by said second disk and extending into said casing in alternation with the fixed disintegrator members, the disintegrator members carried by the second disk having projections near the apertures therein, and a fan blade carried by said second disk and adapted to rotate in a path surrounding the series of disintegrator members.

4. An apparatus for the purpose specified, embodying therein a casing having a chamber with parallel walls and a second chamber with inclined walls, a disk countersunk in one of the said parallel walls, a series of fixed disintegrator members removably car-

ried by said disk, a second disk within said casing arranged at one end of the series of disintegrator members, a second series of disintegrator members carried by said second disk and a fan blade carried by said second disk and adapted to revolve about the disintegrator members in the chamber having the inclined walls.

5. An apparatus for the purpose specified, embodying therein a casing, a disk countersunk in one wall of the casing, fixed apertured disintegrators carried by said disk, an inclined projection adjacent each aperture in said disintegrator, revoluble apertured disintegrators, and an inclined projection adjacent each aperture in said revoluble disintegrators.

6. An apparatus for the purpose specified, embodying therein a casing, oppositely disposed annular disks within the casing, fixed and revoluble disintegrators carried by said disks respectively, certain of said disintegrators having apertures therein and an inclined projection adjacent each said aperture, and a fluid admission pipe extending into the casing and having jet openings therein, said jet openings being inclined in a direction opposite to that in which the projections of the innermost revoluble disintegrator are inclined.

7. An apparatus for the purpose specified, embodying therein a casing, disintegrators adapted to coöperate in said casing, and a plurality of disks adapted to removably support the disintegrators in the casing.

8. An apparatus for the purpose specified, embodying therein a casing, disintegrators adapted to coöperate in said casing, projections extending from the surface of said disintegrators, and a plurality of disks adapted to removably support said disintegrators in the casing, the end projection on each disintegrator being cast into or sweated on to the adjacent supporting disk.

9. An apparatus for the purpose specified, embodying therein a casing, a plurality of fixed and revoluble disintegrators adapted to coöperate in said casing, and an annular disk apportioned to each said disintegrator and adapted to removably support the same in the casing independently of the other disintegrators.

10. An apparatus for the purpose specified, embodying therein a casing, a plurality of disintegrators adapted to coöperate therein, an open siphon tube adapted for the introduction of fluid into said apparatus, and a bent tube removably attached to the inner end of said siphon tube, said bent tube having jet openings therein.

11. An apparatus for the purpose specified, embodying therein a casing, a plurality of coöperating disintegrators in said casing, a jet cone revoluble in said casing said jet cone having jet openings therein and jet plates adjacent said openings, and a fluid admission tube adapted to conduct fluid into the apparatus to be uniformly distributed by said jet cone.

12. An apparatus for the purpose specified, embodying therein a casing, a plurality of coöperating disintegrators in said casing, a jet cone revoluble in said casing, a siphon tube through which fluid is adapted to pass into the apparatus, and a slotted terminus to said siphon tube and adapted to direct the entering fluid against said jet cone.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

HANS ED. THEISEN.

Witnesses:
A. V. W. Cotter,
Richard Lemp.