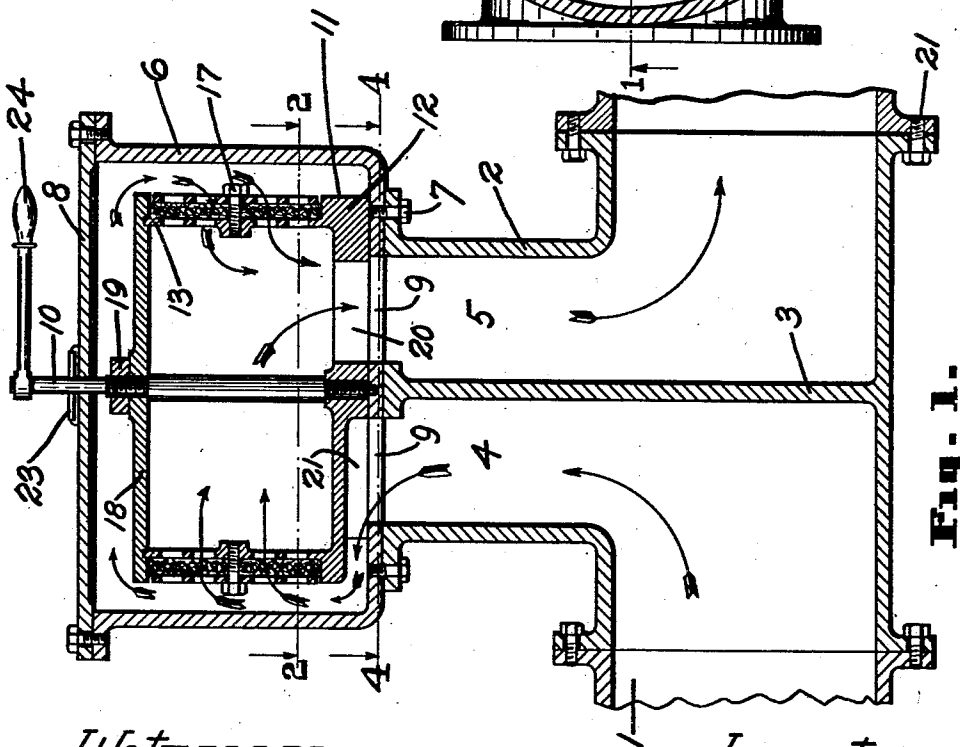
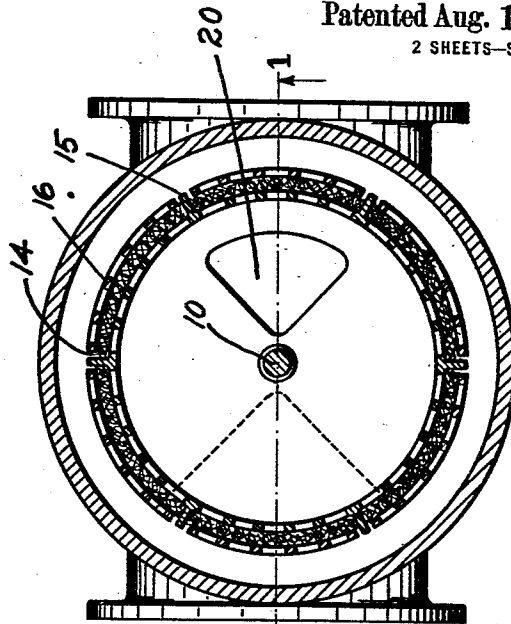
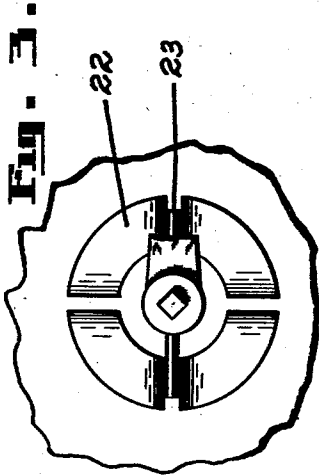


H. F. SMITH.
 APPARATUS FOR PURIFYING GASES.
 APPLICATION FILED JULY 5, 1918.

1,348,966.

Patented Aug. 10, 1920.
 2 SHEETS—SHEET 1.



Witnesses.
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 Walter R. Ridd.

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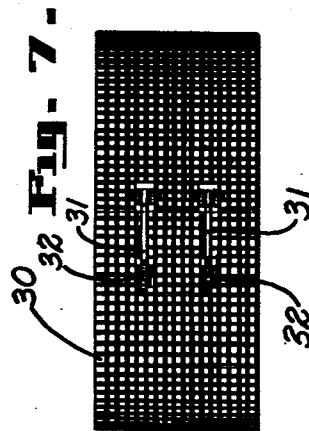
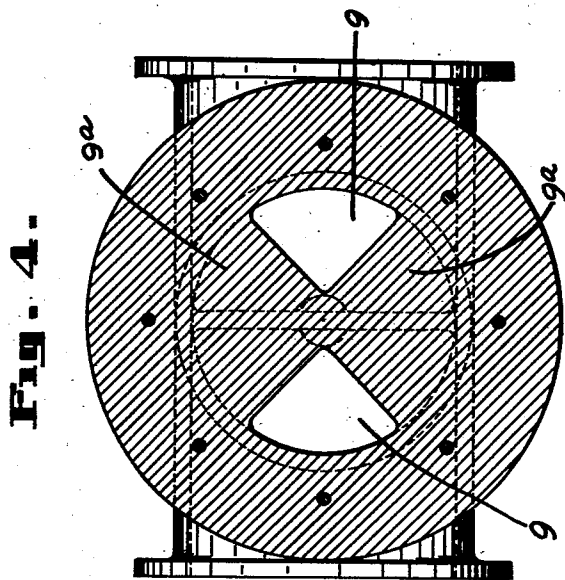
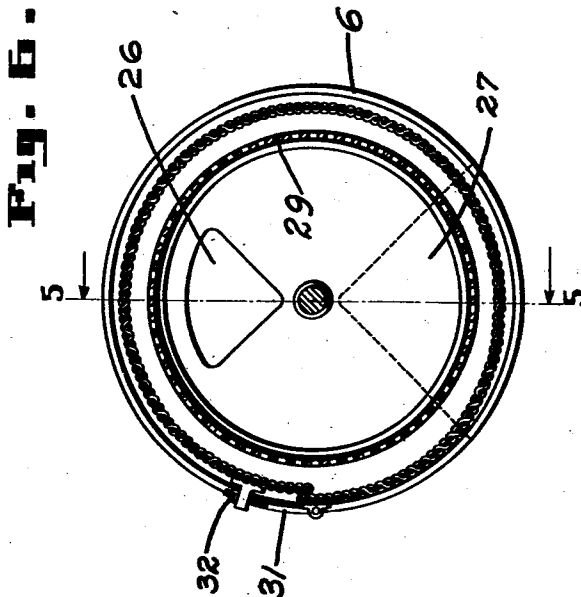
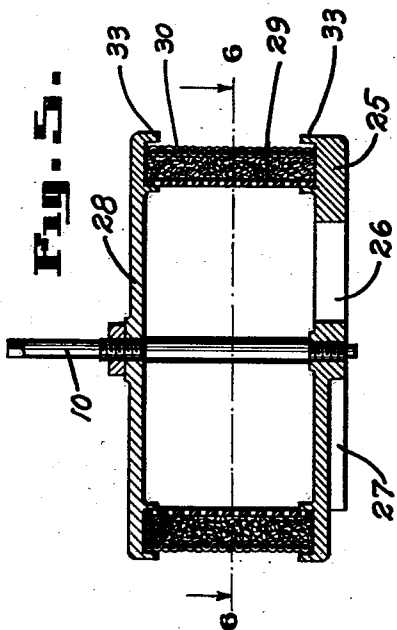
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

HARRY F. SMITH, OF DAYTON, OHIO, ASSIGNOR TO THE SMITH GAS ENGINEERING COMPANY, A CORPORATION OF OHIO.

APPARATUS FOR PURIFYING GASES.

1,348,966.

Specification of Letters Patent. Patented Aug. 10, 1920.

Application filed July 5, 1918. Serial No. 243,385.

To all whom it may concern:

Be it known that I, HARRY FORD SMITH, a citizen of the United States of America, residing at Dayton, in the county of Montgomery, State of Ohio, have invented certain new and useful Improvements in Apparatus for Purifying Gases, of which the following is a full, clear, and exact description.

10 This invention relates to gas purification and more particularly to an improved form of apparatus for removing impurities, such as tar, from gases.

15 In my Patents, Nos. 1,140,198, dated May 19, 1915, and 1,099,773, dated June 9, 1914, are described a method of removing impurities from gases and a form of apparatus for carrying that method into effect. One object of the present invention is to provide another form of apparatus for carrying out the method of gas purification described in my above referred to patents. Other objects and advantages will be apparent from the following description.

25 In carrying this invention into effect I provide a separating apparatus consisting of a housing drum having rotatably mounted therein a cylindrical frame carrying a pad of fibrous material, such for example, as finely spun-glass wool, the material constituting this pad being of the same character as that described in my above referred to patents. The housing is so positioned with relation to the gas main that, when in operation, impure gas passes therethrough, and the fibrous pad is so positioned in the housing that any gas passing through this housing must also pass through the pad. This pad is so arranged that its relative positioning may be changed to reverse the direction of flow of gas therethrough. And the frame carrying the pad is so constructed that by properly positioning it in the housing the flow of gas therethrough may be entirely cut off.

35 In the drawing in which like characters of reference designate like parts throughout the several views thereof,

40 Figure 1 is a sectional view through a form of apparatus constructed in accordance with my invention, which view is along the line 1—1 of Fig. 2;

Fig. 2 is a sectional view along the line 2—2 of Fig. 1;

Fig. 3 is a detail view of the frame raising mechanism;

Fig. 4 is a sectional view along the line 4—4 of Fig. 1;

Fig. 5 is a sectional view through a modified form of the cylindrical frame along the line 5—5 of Fig. 6;

Fig. 6 is a sectional view along line 6—6 of Fig. 5; and

Fig. 7 is an elevational view of the pad-clamping member shown in Figs. 5 and 6.

In the drawing, 1 designates a gas delivery main adapted to lead gas from any desired place of supply to a place of use. Situated in the main 1 is a T 2 having a transverse partition wall 3 therein dividing said T into two passages 4 and 5.

Mounted upon the open ended branch of the T 2 is a cup-shaped drum or housing 6 rigidly connected to the T by means of bolts 7 or any other conventional and desired means. Closing the free end of the housing 6 is a removable cap 8 which is also normally held in place by means of bolts or other desired attaching devices. The closed end of the cup-shaped housing 6 has therein two substantially quadrant shaped ports 9.

These ports are located diametrically opposite each other and are so positioned that when the housing 6 and T 2 are properly assembled one of these ports will register with the passage 4 while the other port will register with the passage 5. Any gas flowing through the main 1 must pass upwardly through the passage 4 and cooperating port 9, through the housing 6 and then downwardly through the other port 9 and passage 5.

Mounted in the housing 6 is a rotatable shaft 10 the lower end of which carries thereon a cup-shaped frame or cage 11 having a flat bottom 12 and a cylindrical upstanding portion 13. This cylindrical portion 13 has therein a plurality of pockets 14 separated by means of partitions 15. The wall of the upstanding portion 13 between the partitions 15 is perforated to permit the ready passage of gas therethrough. Cooperating with each of the pockets 14 is a previous cover-plate 16 adapted to be held in

spaced relation to the bottom of the pockets 14 by means of bolts 17. Each of the pockets 14 is adapted to contain therein a pad of fibrous material, such as finely spun glass, wool, or similar material which is held in place by means of the cover-plate 16 and is compressed to the desired density by means of the cover-plates and the cooperating bolts 17. The fibrous material contained in these pockets is identical in character with the fibrous material described in my above referred to patents. In actual practice a pad of very finely spun-glass wool is used, inasmuch as this particular material has been found to give more satisfactory results. Other forms of material, however, such as those named in my other patents, may be used if desired. By using a plurality of pockets for holding the fibrous material the necessity of replacing the entire pad in case of rupture or other defect is obviated, for if a defect develops in the material in one of the pockets it is only necessary to replace that particular material and not the entire pad. There is the slight disadvantage, however, when compared to a continuous pad, of cutting down somewhat the effective area of fibrous material for any given size of cage or frame and housing. Adjustably carried by the shaft 10 is a plate 18 adapted to fit upon the top of the up-standing portion 13 and to extend over the pockets 14 and cooperate with the cover plates 16 therefor to make each pocket in effect an inclosed chamber. As shown the plate 18 is threaded upon the shaft 10 and is held in adjusted position by means of the lock-nut 19, but it is obvious, that any other desired means for attaching it in position could be used.

The flat portion 12 constituting the bottom of the cup-shaped frame 11 has therein a port 20 similar in shape and size to the quadrant shaped ports 9 and so located that it may be brought into register with either of these ports. The flat portion 12 also carries in the lower face thereof a groove or cut-out passage 21 also so positioned that it may be brought into register with either of the ports 9. The port 20 and passage 21 are so positioned and so proportioned that when the port registers with one of the ports 9 the passage registers with the other port 9. The ports 9 are so proportioned that the blank spaces 9^a, each of which blank spaces is of greater area than either the port 20 or passage 21, lie intermediate these ports 9. By this arrangement of ports and blank space the frame 11 may be so positioned that there may be a free passage of gas through the housing, and by a 90° rotation of the pad-carrying frame from such operative position the passage of gas therethrough will be entirely cut off.

Carried by the top 8 are four quick acting

cams 22 arranged around the shaft 10 and closely adjacent thereto. Carried by the shaft 10 is a pin 23 adapted to cooperate with the cams 22, upon rotation of such shaft and the frame 11 carried thereby, to move the shaft axially and thus raise the frame 11 from its seat, so that turning thereof may be more easily accomplished. The cams 22 are so positioned that when the frame 11 is in working position, the pin 23 is so closely adjacent to one of the cams that turning movement of the shaft 10 will immediately cause the pin to ride up the inclined face of the cam to lift the frame 11 from its seat. These cams and cooperating pins may be dispensed with if desired, or other means may be used tending to easier rotation of the cage and pad. The free end of the shaft 10 has attached thereto an operating handle 24 whereby rotation of the cage 11 may be brought about.

The operation of the device herein described for removing tar and similar impurities from the gas is identical with the operation described in my above referred to patents. The gas, containing impurities, is passed through one of the passageways 4—5 and cooperating ports into the interior of the drum or housing, through the fibrous pad, and then through the other port and cooperating passageway 4—5 back into the main 1, such gas being under sufficient pressure to give it considerable velocity as it passes through the fibrous pad. It has been found that to secure a proper cleansing action by the use of a device of this character, the velocity of flow of the gas through the fibrous pad may not fall below a certain definite minimum. The desired velocity of flow is secured by maintaining a definite drop in pressure across the pad. This drop in pressure is maintained by regulating the density of the fibrous material, and this in turn is accomplished by varying the adjustment of the cover-plate 16 as described above. The apparatus being adjusted to secure the desired velocity of flow of the gas through the fibrous pads, and with the ports of the apparatus in the positions shown in the drawing, any gas admitted into the housing through the passage-way 4 and passage 21 will pass into the housing outside the cage and fibrous pad carried thereby, thence through the fibrous pad to the inside of the cage and, through the port 20, into the passageway 5. As the gas passes through the pad, the tar or other impurities therein will be caused to coalesce or agglomerate thus giving rise to drops of impurity which are of substantial size. These drops of impurity will be carried out of the fibrous pad by the rapidly flowing gas and will be carried along with such gas so long as the velocity of flow thereof is maintained. After the gas leaves the passage-way 5 it

passes into a trap, (not shown but illustrated and described in my above referred to patents) which is located in the main 1 and immediately adjacent the T 2, where 5 the velocity of flow of the gas is so decreased that the large drops of impurity will separate therefrom under the action of gravity. The operation of a gas purifier of this general character is clearly set forth in 10 by patents above referred to, and it is thought that a more detailed description is not necessary here.

Normally the impurities in the gas will not collect in the fibrous pads in sufficient 15 quantities to interfere with the passage of the gas therethrough. It sometimes happens, however, that a sufficient quantity of impurity will thus collect. It has been found that reversing the direction of flow of 20 the gas through the pads will remove therefrom a sufficient quantity of such entrapped impurities to cause a return to normal conditions. It is to provide means for reversing the flow of gas that the frame 11 is made ro- 25 tatable. When it is desired to reverse the flow of gas, it is merely necessary to turn the handle 24 through 180°. This will cause such a rotation of the pad-carrying frame as will cause the port 20 to register with the 30 passage-way 4—5 theretofore in register with the passage 21, and cause the passage 21 to register with the passage-way theretofore in register with the port 20. A reversal of the flow of the gas through the pad, itself, 35 results.

It is sometimes found quite difficult to rotate the pad-carrying frame unless means is provided for raising that frame from its seat before such rotation takes place. To 40 insure raising of the frame from its seat the cams 22 and cooperating pin 23 have been provided. The structure of the cams and the relative positioning of the pin 23 is such that immediately upon attempted ro- 45 tation of the handle 24, the pin 23 will ride along the inclined surface of the cooperating cam 22 until the frame is raised from its seat. The structure of the cam is such that the frame 11 will be held from its seat during a quarter revolution when it will again 50 be seated. This is necessary so that, if desired, the flow of gas through the drum may be completely cut off. If the frame is in such position that the port 20 and passage 55 21 register with the ports 9, a quarter revolution of the frame will bring the port 20 and passage 21 opposite the blank spaces intermediate the ports. If the frame is allowed to seat when in this particular position, it is obvious that the flow of gas into 60 the drum will be completely shut off. Any other desired mechanism for raising the pad-carrying frame from its seat before rotation may be used in place of the cam 65 mechanism disclosed.

In Figs. 5, 6 and 7 a modified form of this invention is shown. In this modification a slightly different rotatable pad-carrying frame or cage is used within the drum 6. This consists of a lower portion 25 having 70 a port 26 therethrough and a groove or passage 27 in the lower side thereof, which port and passage are identical with the port 20 and passage 21 of the modification shown in Fig. 1, and of a top 28 substantially 75 identical with the top 18 of the modification shown in Fig. 1. The members 25 and 28 are carried on the rotatable shaft 10 in definitely spaced relation, with the cylindrical perforated member 29 held between them. 80 Adapted to surround the cylindrical member 29 and spaced therefrom, when in assembled position, is a clamping sleeve 30 of wire netting, or of flexible perforated sheet metal. This clamping sleeve 30 when assembled in 85 position is spaced a substantial distance from the cylindrical member 29, the space between the two being filled with finely spun glass or some analogous fibrous material. The clamping sleeve 30 is provided with 90 bolts 31 which have adjustable nuts 32 upon the ends thereof for varying the clamping action of this sleeve and thus varying the density of the pad of fibrous material located between the sleeve and the pervious 95 member 29. Both the member 29 and the clamping sleeve 30, when assembled in position, are held between the member 25 and the top 28 and are prevented from slipping out of place by means of the flanges 33 100 carried by each of these plates. The operation of this pad-carrying frame is the same as in the case of the modification shown in Fig. 1.

From the above description it is obvious 105 that I have devised a form of apparatus for carrying out the method described in my above referred to Patent, No. 1,140,198, which is not only thoroughly effective and practicable, but which is furthermore simple 110 in structure and not liable to get out of repair. While the forms of mechanisms herein shown and described constitute preferred forms of embodiments of the invention, it is to be understood that other forms 115 might be adopted, all coming within the scope of the claims which follow.

What I claim is as follows:

1. In an apparatus for purifying gases, a housing having inlet and outlet openings, a 120 hollow pad rotatably mounted therein and so positioned that the inlet and outlet openings are adapted to communicate one with the space inside the pad and the other with the space outside thereof. 125

2. In an apparatus for purifying gases, a housing having inlet and outlet openings, and a substantially cylindrical pad rotatably mounted therein and so positioned that the inlet and outlet openings are adapted to 130

communicate one with the space inside the pad and the other with the space outside thereof.

3. In an apparatus for purifying gases, a housing having inlet and outlet openings; a rotatable hollow cage mounted therein, a fibrous pad carried by said cage, ports in the cage adapted to communicate one with the space inside and the other with the space outside the fibrous pad, said ports being also adapted to register each with either the inlet opening or the outlet opening, and so arranged that when in operative position said openings communicate one with the space inside the fibrous pad and the other with the space outside thereof.

4. In an apparatus for purifying gases, a housing having inlet and outlet openings, a rotatable cage mounted therein, a fibrous pad carried by said cage, said openings being so arranged that when one communicates with the space inside the pad the other communicates with the space outside thereof, and means cooperating with the cage for moving said cage axially upon rotation thereof.

5. In an apparatus for purifying gases, a housing having inlet and outlet openings, a rotatable hollow cage mounted therein, a fibrous pad carried by said cage and means cooperating with said pad for varying the density thereof.

6. In an apparatus for purifying gases, a housing having inlet and outlet openings, a hollow pervious frame, pockets within said frame for receiving fibrous material, adjustable pervious cover plates for said pockets, the frame being so positioned that the inlet and outlet openings are adapted to communicate one with the space inside the frame and the other with space outside thereof.

7. In an apparatus for purifying gases, a housing having inlet and outlet openings, a rotatable cage mounted therein and having two ports adapted for registration with the said openings, said openings and ports being so arranged that when one opening communicates with the space inside the cage the other communicates with the space outside thereof, a fibrous pad carried by the cage and positioned between the two ports thereof, and means to rotate the cage to reverse the relative positioning of the openings and ports.

8. In an apparatus for purifying gases, a housing having inlet and outlet openings, blank spaces between said openings, a rotatable cage mounted within the housing and having two ports, said openings and ports being so positioned that when in one position of the cage the two ports register

with the openings and in another position the two ports register with the blank spaces between the openings.

9. In an apparatus for purifying gases, a housing having an inlet opening and an outlet opening; a hollow pervious diaphragm rotatably mounted within the housing; said housing and pervious diaphragm being so constructed that during operation one of said openings communicates with the space inside the diaphragm and the other with the space outside the diaphragm; each opening being adapted for connection to either the space inside the diaphragm or the space outside thereof.

10. In an apparatus for purifying gases, the combination with a housing having an inlet opening and an outlet opening; of a hollow frame rotatably mounted in the housing; a pervious diaphragm carried by said frame; said frame having ports therein and being adapted when in one position to bring the inlet opening into communication, through one of the ports, with the space inside the diaphragm and the outlet opening into communication through the other port, with the space outside the diaphragm; when in another position to bring the inlet opening into communication, through one of the ports, with the space outside the diaphragm and the outlet opening, through the other port, into communication with the space inside the diaphragm; and when in another position to cut off each opening from communication with each port and each space.

11. In an apparatus for purifying gases, a housing having an inlet opening and an outlet opening; a hollow frame rotatably mounted within the housing; a pervious diaphragm carried by the frame; and ports in the frame one adapted to connect either the inlet or the outlet opening to the space inside the diaphragm, and the other to connect either of these openings to the space outside the diaphragm.

12. In an apparatus for purifying gases, a housing having an inlet opening and an outlet opening; a hollow pad rotatably mounted within the housing; and means associated with said pad and said openings adapted in one position of the pad to connect the inlet opening with the space inside and the outlet opening with the space outside the pad, and in another position to connect the outlet opening to the space inside the pad and the inlet opening to the space outside the pad.

In testimony whereof I affix my signature.
HARRY F. SMITH.

Witnesses:

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L. C. HOPKINS.