

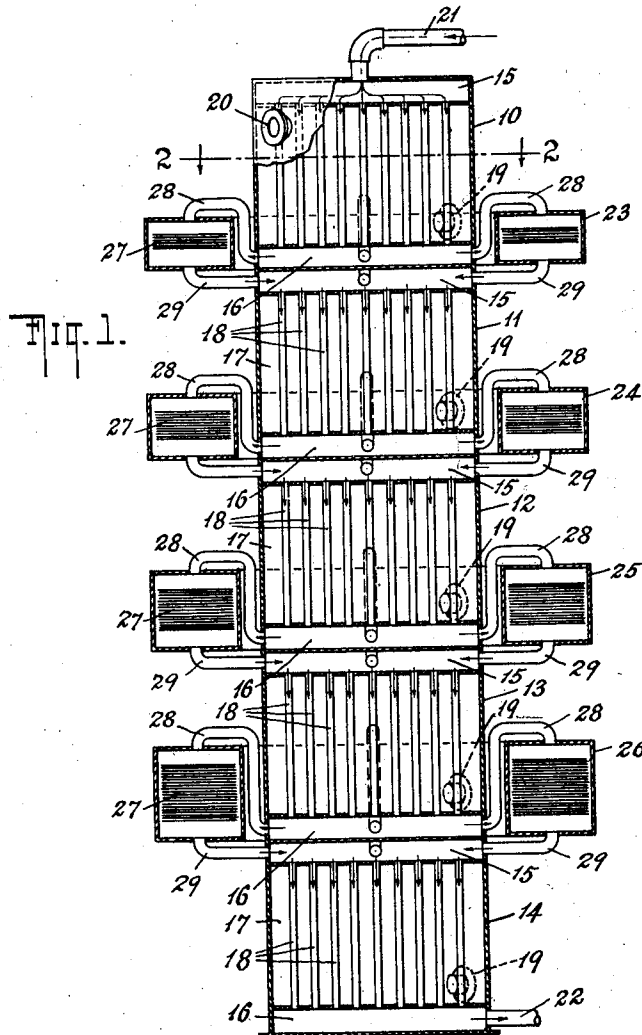
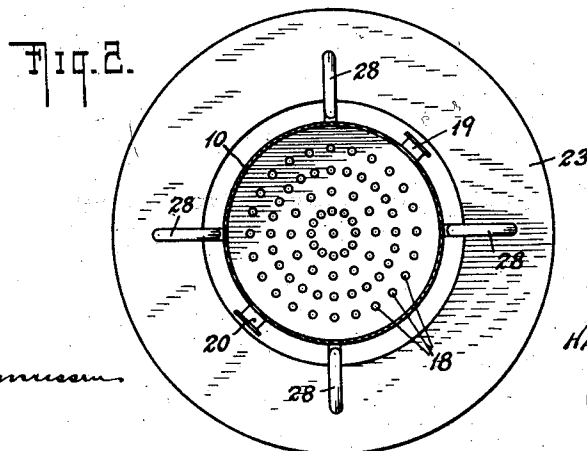
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APPARATUS FOR CHEMICALLY TRANSFORMING GASES

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WITNESS

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APPARATUS FOR CHEMICALLY TRANSFORMING GASES.

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The invention relates to apparatus for chemically transforming gases and has to do primarily with that type of apparatus commonly referred to as converters and generally utilized for converting SO_2 gas into SO_3 . The invention contemplates the provision of an improved type of multi-stage converter adapted to operate efficiently in the presence of excessive heat and in which multi-stage heat transferers are placed before, intermediate and after the converting units. Another object of the invention is to provide a compact unitary structure occupying little floor space and yet having a relatively large area of converting units, and in which the area of said converting units may be readily varied at will, by using converting units of different dimensions, without disturbing the set-up of the remainder of the apparatus. The invention proposes further to provide a novel arrangement in which the heat transferring units and the converter units may be removed for repairs or other purposes each independently of and without requiring the removal of the other from the apparatus. Other objects will appear from the description hereinafter and the features of novelty will be pointed out in the claims.

In the accompanying drawing, which shows an example of the invention without defining its limits, Fig. 1 is a sectional elevation of the apparatus and Fig. 2 is a horizontal section thereof on the line 2—2 of Fig. 1.

As shown in the illustrated example the apparatus comprises five superimposed heat transferers or cooler sections 10, 11, 12, 13 and 14 which are each provided respectively with an inlet distributing chamber 15 and an outlet distributing chamber 16 located at opposite ends of the sections 10, 11, 12, 13 and 14; in addition each of the latter sections is provided with an intermediate chamber 17 in which tubes 18 are located, said tubes establishing communication between the inlet and outlet chambers 15 and 16 of each of the heat transferers in the well known way. Each section 10, 11, 12, 13 and 14 is further provided with nozzles 19 and 20 communicating with the intermediate chambers 17 and through which a suitable cooling or heating agent may be circulated through the intermediate chambers 17. An inlet pipe 21 leads to the inlet chamber 15 of the upper section 10 and an outlet pipe 22 leads from the outlet

chamber 16 of the bottom section 14 as shown in Fig. 1.

The apparatus in its illustrated form further consists of four converter sections 23, 24, 25 and 26 which are in the form of annular chambers surrounding the cooler sections 10, 11, 12, 13 and 14, but supported independently thereof. Each converter section containing appropriate contact material 27, is preferably located approximately adjacent to the lower portion of a cooler section as shown in Fig. 1, it being understood that suitable provision is made for fixing the converter sections in place. In the illustrated example the successive converter sections contain a progressively increasing amount of contact material 27; it will be obvious that this is not an essential requirement. A plurality of reverse bend pipes 28, the illustrated example shows four, are located uniformly about the perimeters of the cooler sections 10, 11, 12, 13 and 14 and connect the outlet distributing chamber 16 of each cooler section with the contiguous converter section 23, 24, 25 or 26; in the form shown in the drawings, the pipes 28 extend upwardly from the outlet distributing chambers 16 and then horizontally over the converter sections with the top of which said pipes are connected. Each converter section, in addition, is connected by means of pipes 29 with the inlet distributing chamber 15 of the next succeeding cooler section; the pipes 29 lead from the bottom of each converter section and are uniformly distributed about the perimeters of the cooler sections in registry with, and in number corresponding to, the pipes 28. It will be understood that in practice the pipes 28 and 29 are detachably connected with either the heat exchange units 10, 11, 12, 13, and 14 or with the converter units 23, 24, 25, and 26, or with both the heat exchange units and the converter units, in any conventional manner.

In the operation of the apparatus incoming gas, such as SO_2 gas, enters the unit through the inlet pipe 21 and passes into the inlet distributing chamber 15 of the first cooler section 10. From the chamber 15 the gas passes through the tubes 18 of the section 10 into the outlet distributing chamber 16 thereof, and from the latter flows through the pipes 28 into the converter section 23; after passing in contact with the contact material 27 in the section 23, the gas flows therefrom

through the pipes 29 to the inlet distributing chamber 15 of the next adjacent cooler section 11. From the chamber 15 of the section 11 the gas flows through the tubes 18 thereof into the outlet distributing chamber 16 of the section 11 and then passes through the pipes 28 into the next converter section 24 and into contact with the contact material 27 therein; the gas then passes from the section 24, through the pipes 29, into the inlet distributing chamber 15 of the cooler section 12. The gas, in continuing its travel, passes successively through the cooler section 12 and the contiguous converter section 25 and then through the cooler section 13 and the contiguous converter section 26 into the inlet distributing chamber 15 of the bottom cooler section 14, in the same way as described above. After passing through the tubes 18 of the cooler section 14 into the outlet distributing chamber 16 thereof, the gas passes out through the outlet pipe 22. Coincidentally with the passage of the gas through the apparatus, as set forth, a cooling medium is caused to pass through the intermediate chambers 17 of the cooler sections 10, 11, 12, 13 and 14 respectively; the cooling medium may enter the chambers 17 through the nozzles 19 and pass out through the nozzles 20 so that its flow is counter to the flow of the gas or a concurrent flow of said cooling medium may be obtained by causing it to enter through the nozzles 20 and pass out through the nozzles 19. Any suitable fluid may be used as the cooling medium, which accordingly may comprise air or a gas which it is desired to preheat. It will be understood, if the nature of the process of transforming or converting the gas requires it to be heated in its passage through the apparatus, that a heating medium may be substituted for the aforesaid cooling medium. Thus the first cooler section 10 may be utilized as a heat transferer either to cool the incoming gas if it is above the conversion temperature or to preheat it up to conversion temperature if said gas is below the same; similarly any of the other sections 11, 12, 13 or 14 may be used as heating sections if this should be necessary or desirable.

With the arrangement illustrated and described, each outlet distributing chamber 16, located directly below the cooling tubes of each section 10, 11, 12, 13, and 14 and below the points at which the gas passes into the converter sections, and having a lower surface or bottom extending completely across and spaced from the lower ends of the tubes in the heat exchange sections, serves as a chamber for collecting any dirt or scale falling from the cooling tubes 18, thereby preventing the passage of such dirt and scale into the converter sections with the consequent contamination of the latter.

The area of the converting sections may be varied by substituting sections of varying

diameters, this substitution being easily accomplished without disturbing the position or arrangement of the cooler sections; this arrangement further permits the heat transferring sections to be removed for repair or other purposes without disturbing the converter sections and allows the latter to be similarly removed without interference with the cooler sections.

It will be understood that the number of cooler and converter sections included in an apparatus may be varied at will and further that any desired number of inlet and outlet pipes 28 and 29 may be provided for conducting the SO_2 or other gas from the cooler sections to the converter sections and from the latter back to the cooler sections; a uniform distribution of the gas is, in this way, secured without requiring the use of complicated baffle plate construction.

The novel arrangement provides a unitary structure of maximum compactness and occupying a minimum of floor space, in which a heat transferer or cooler section is located before and after each converter section; the features last named adapt the apparatus particularly for use in processes in which there is considerable excess heat. By locating the converting system, in which a large amount of heat is generated, externally of the heat exchange system, a greater radiation of heat is obtained than is possible in a structure including an integral tubular construction; thus in the specific form illustrated the annular converter sections 23, 24, 25, and 26 which constitute the converter system and surround the cooler sections 10, 11, 12, 13 and 14, which constitute the heat exchange system, present radiation surfaces of maximum extent, as will be apparent.

Various changes in the specific form shown and described may be made within the scope of the claims without departing from the spirit of my invention.

I claim:

1. The combination of a heat exchange unit, an annular converter unit surrounding said heat exchange unit and a connection between said two units.

2. The combination of a heat exchange unit provided with distributing chambers at its upper and lower ends, an annular converter unit surrounding said heat exchange unit at a distance therefrom and a plurality of connections from said converter unit to the lower distributing chamber of said heat exchange unit.

3. The combination of a heat exchange unit provided with distributing chambers at its upper and lower ends, a plurality of vertical heat exchange tubes within said unit connecting the two chambers thereof, an annular converter unit surrounding said heat exchange unit at a distance therefrom and a plurality of upwardly extending pipes locat-

ed uniformly at spaced intervals about said heat exchange unit and connecting the lower chamber of the latter with said converter unit.

5 4. The combination of a plurality of heat exchange units located in superimposed relation and each provided with distributing chambers at their upper and lower ends, a nest of vertical heat exchange tubes in each
10 heat exchange unit connecting the upper and lower chambers thereof, a plurality of annular converter units surrounding the heat exchange units at a distance therefrom, each converter unit extending upwardly beyond
15 the lower ends of the heat exchange tubes of a contiguous heat exchange unit, a plurality of pipes extending upwardly from the lower distributing chamber of each heat exchange unit to the top of an adjacent converter unit
20 whereby each of the latter is connected with the lower chamber of a heat exchange unit and a plurality of pipes extending from each converter unit to the upper distributing chamber of the next succeeding heat exchange unit.
25 change unit.

5. In an apparatus of the kind described, a plurality of heat exchange units, a plurality of annular converter units surrounding said heat exchange units, said heat exchange units
30 and converter units being removable inde-

pendently of each other, and connections between said units to cause the gas to flow alternately through a converter unit and a heat exchange unit.

6. In an apparatus of the kind described, 35 the combination of a heat transferring section, a converter section and a chamber located immediately below the heat transferring section and having a surface extending completely across and spaced from the heat 40 transferring section for collecting foreign material and preventing it from reaching said converter section.

7. In an apparatus of the kind described, the combination of a heat transferring section including upright heat exchange tubes, 45 a converter section, a chamber below the lower ends of said tubes and having a surface extending completely across and spaced from the lower ends of said tubes constituting 50 a trap for preventing scale falling from the heat exchange tubes from reaching said converter section, and upwardly extending pipes leading from the side of said chamber to said converter section for the passage of gas from 55 said chamber to said converter section.

In testimony whereof I have hereunto set my hand.

HANS O. C. ISENBERG.