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B. M. CARTER

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PROCESS FOR CLEANING CONTACT MATERIAL

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Fig. 1.

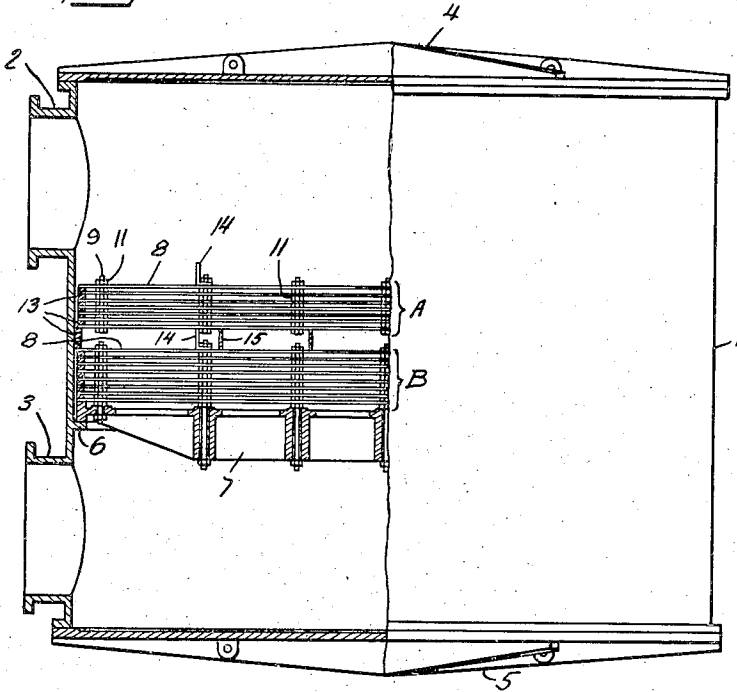


Fig. 2.

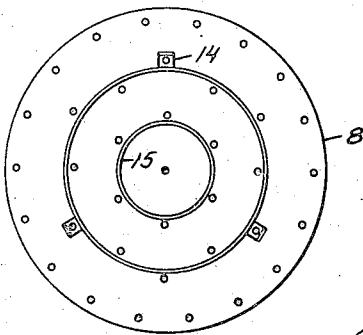


Fig. 3.

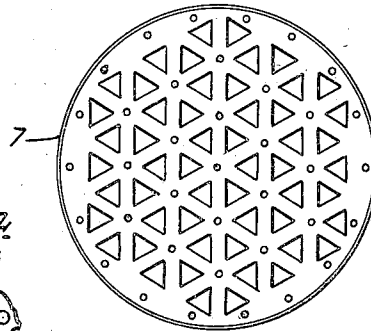
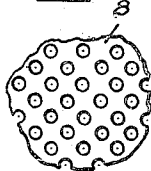


Fig. 4.



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PROCESS FOR CLEANING CONTACT MATERIAL

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9 Claims. (Cl. 23—238)

This invention relates to a method for removing foreign substances from contact material. More particularly, the invention is directed to a method for removing foreign substances which collect on platinized asbestos during the employment of the latter in the production of sulfuric anhydride, and to the accomplishment of this result without necessitating the removal of the contact material from the contact chamber, while leaving the contact material at the completion of the cleaning operation in position and condition for the continuance of the conversion process.

Several methods have been heretofore suggested for cleaning contact materials. In one of such prior methods, the contact material is removed in its entirety from the converter, and is returned to the converter after treatment. During this procedure, where platinized asbestos is being cleaned, the platinum is completely dissolved and separated from the carrier, and must then be redeposited upon fresh asbestos, while the used asbestos carrier is destroyed or rendered unfit for further use. According to another method of regeneration, in which the contact material is treated in place in the converter and the contact carrier is not destroyed, only such substances as can be converted into volatile matter are removed by volatilization by passing a gas or a mixture of gases through the contact material. Another method of cleaning contact material has been suggested which comprises washing the material in place by causing water to flow into the contact chamber from the bottom upwardly, the rate of flow into the contact chamber being so regulated as to be rapid enough to promote solution of the water soluble substances without substantial displacement or disarrangement of the contact material.

It is the primary object of the present invention to provide a process for removing foreign substances from catalytic material, and particularly from platinized asbestos after the latter has been employed in the production of sulfuric anhydride, which process is more effective, with regard to the removal of foreign substances, than any of the methods of which I am aware, and which is far more economical with respect to the time and necessary equipment than known processes.

The invention broadly comprehends the vibration of the contact material supports or shelves in the converter (by suitable mechanical means) so as to produce an appreciable agitation of the contact material, and simultaneously passing air

or other gas through the contact material at a relatively high velocity and in a direction reversed to the direction of the passage of the reactant gases through the converter during the normal conversion process.

Although the invention is applicable to the cleaning of contact material suitably maintained in position in all types of converters, a description of the invention may be facilitated by reference to specific apparatus. For convenience I have illustrated in the accompanying drawing a converter which is not my invention, and which I describe only for the purpose of presenting specifically one embodiment of the present invention.

In the accompanying drawing,

Fig. 1 is an elevation of a converter chamber partly in section;

Fig. 2 is a plan view of the catalyst container;

Fig. 3 is a plan view of a grid forming a rigid support for the catalyst container; and

Fig. 4 is a plan view of the section of one of the perforated plates used in the construction of the catalyst container.

For simplicity, the perforations in the circular plate shown in Fig. 2, which are the same as those illustrated in Fig. 4, have been omitted.

In Fig. 1, the numeral 1 indicates generally a contact chamber. This contact chamber is preferably a cylindrical iron casting, provided with an inlet 2 and an outlet 3 arranged above and below the filtering and contact materials. The contact chamber is provided with a removable top 4 and bottom 5, in order that by removing the same, the containers A and B, for the filtering and contact materials respectively, may be easily made accessible or lifted entirely out of the contact chamber. An annular rib 6 is formed on the chamber casting to provide a seat for the cast iron grid 7 supporting the containers A and B for the filtering and contact materials.

The containers illustrated comprise a plurality of spaced perforated metallic plates 8, rigidly bound together at a relatively large number of points by bolts 9 extending therethrough. The bolts 9, particularly those adjacent the circumference of the plates, are preferably threaded and provided with nuts 11 intermediate and on the outer sides of the plates which act not only as spacers but firmly bind the plates together in a rigid construction. The bolts 9, or other fastening means employed, are desirably spaced uniformly over the area of the plates to take up strains and provide a uniformly rigid structure.

To further provide a rigid structure, steel rings 13 are placed intermediate each pair of plates adjacent the periphery thereof. The rings 13 are not bound to the plates, but are held in position by being clamped between the plates by the bolts 9 and nuts 11. These rings not only act as spacers, but form a practically closed container, and thus prevent the catalytic or filtering material held between such plates from escaping around the periphery of the containers. The eyes 14 are attached to the top plates of containers A and B by the bolts 9. The provision of the eyes 14 thus facilitates the lifting of these units from the contact chamber.

The catalyst container B is rigidly fastened to the grid 7. In this instance the bolts 9 are extended through holes in the grid casting, and are secured by a nut on the end of each bolt. In this manner the plates of container B are rigidly held from warping, and maintained in the desired parallel relation. Upon the top plate of the catalyst container B a number of steel rings 15 are placed, which rings act as spacers to maintain the upper filtering unit A the desired distance from container B. A number of open rings 13, totaling the vertical dimension of rings 15, may also be placed between the two containers to support the outer edges of the container A.

Before placing the containers in the contact chamber, the filtering and contact material is packed uniformly between the plates as they are assembled. Thus the series of spaced parallel plates in each container retain in place a number of uniform beds of filtering or contact material. In the construction illustrated, container A is packed with asbestos to form a filter, and container B is packed with catalytic material in the form of platinized asbestos. It is apparent that such construction provides a filter immediately preceding the catalyst, which serves to a large extent to protect the catalyst from contamination and which filter is readily replaceable when it becomes clogged.

During the normal operation of the conversion process, the sulfur dioxide-oxygen gas mixture enters the converter through the inlet 2, passes through the filter unit A, through the catalyst unit B, conversion to sulfur trioxide taking place therein, the converted gases then leaving the converter chamber through the outlet 3. It will be understood that as the conversion process progresses, resistance to the passage of gases through the catalytic material is gradually built up because of the accumulation of sulfate, dirt and other foreign material filtered out of the gas stream by the catalyst material. The sulfate for the most part is formed by the action of sulfuric acid mist on the iron or steel of the equipment. When the resistance to the passage of the gas through the converter becomes too great for further economical operation, the flow into the converter through the inlet 2 is cut off, and the catalytic material in the converter unit B may be cleaned without removal from the converter according to the present invention by the following procedure.

It will be understood, of course, that the converter 1 illustrated in the drawing is simply one unit of a complete conversion apparatus which includes, in addition to the converters, the usual known sulfur burners, drying towers, blowers, heaters, heat transferers and absorbers, etc. After the flow of sulfur dioxide gas in the system has been cut off, a connection between the drying tower, not shown, and the atmosphere is opened

whereby, on operation of the plant blowers, air, instead of sulfur dioxide gas, is drawn into the drying tower, forced through the heater, bypassed around the heat transferers, and conducted into the bottom of the converter 1 through the outlet 3. Before the blowers are started up, the top 4 of the converter chamber is removed and the filter unit A lifted out. The blower is started up slowly, gradually increasing the volume of air circulating through the apparatus in the first few minutes to some suitable extent substantially less than the usual volume of gas forced through the system during the normal conversion process. A few minutes operation at this low gas velocity serves to blow out the residual sulfur trioxide from the converter unit. The quantity of air is then gradually increased until a maximum volume of about three times that delivered to the converter during the conversion process is attained. The blowing of the air at this volume is continued for approximately 15 to 20 minutes during which time the top plate 8 of the converter unit B is hammered moderately by workmen either by hand or by pneumatic hammers. The vibration set up in the top plate 8 of the unit is transmitted by the rings 13, rings 15, bolts 9 and the associated spaced nuts 11 to all plates of the unit, and consequently to the catalytic material interposed between and supported by the several plates. The vibration thus set up in the catalyst unit and communicated to the catalytic material therein is sufficient when acting together with the air passing through the converter at comparatively high velocity to dislodge and remove mechanically carried dust or dirt and such other foreign substances as are volatile which impurities have been deposited on the catalytic material during the conversion process.

It will be understood that there are in general use at the present time, several types of converters in which the upper layer of catalytic material is not normally covered by a perforated plate such as a top plate 8 of the catalyst unit B illustrated in the drawing. In such instances, it will be necessary to place a perforated steel plate over the top of such uncovered catalytic material, and support such plate by the lower shelves in some such manner as by members corresponding to the rings 13 shown in the drawing. When proceeding in such manner, it will usually be necessary to place a screen of suitable mesh immediately above or immediately below the perforated plate to prevent the catalytic material on the upper or top shelf from being blown out of the converter when the air pressure is turned on. When operating with such an arrangement, the hammering is done, of course, on the top of the superposed perforated steel plate, and the vibration set up in such plate is transmitted to the lower supporting shelves in the same manner as heretofore described.

After blowing and hammering, as outlined above, for approximately 15 to 20 minutes, the catalytic material in the catalyst container B will be found to be substantially cleaned of mechanically carried dust and dirt and also such other foreign substances as are volatile. The filter unit A, or a new filter unit if necessary, is lowered into position, the top 4 of the converter chamber replaced, and after the air connection between the drying tower and the atmosphere has been closed, the sulfur dioxide gases are then reintroduced into the system, and the conversion process is resumed.

It will be apparent that the foregoing process

is a marked improvement over prior methods. The contact material is not removed from the contact chamber, and the mode of operation is such that there has been no substantial disarrangement of either the contact carrier or the contact substance. During the normal operation of the conversion process, the fibrous carrier tends to mat and pack together, and numerous small fissures are formed which permit the passage of gas through the converter unit without causing the gas to come in contact with the contact catalytic material. This obviously reduces the effectiveness of the catalytic material and reduces the efficiency of the plant. In the present process, the high velocity of the cleaning air in reversed direction, and the agitation imparted to the contact carrier act together to break up the matting effect and destroy defined gas passages, and thus restore the catalytic material to its original loose, evenly distributed condition. Substantially all detrimental mechanically carried dust and dirt and volatile foreign substances are removed, and it does not appear that the contact substance or the carrier become in any way deteriorated.

Decided advantages of the process are the absence of any additional equipment, except a connection by which air instead of sulfur dioxide gas may be drawn into the drying tower, and the great saving of time. Time consumed for cleaning according to prior processes varies from several hours to several days in instances where the catalytic material is taken out of the converter, cleaned and then repacked. According to the present process the catalyst may be thoroughly cleaned, and the converter returned to operation in the system within an hour. Since the original contact substance and the original carrier remaining in place in the converter are available for further use, and since the process requires much less time than any of the processes heretofore employed, thereby eliminating the length of time that a converter must be out of use while being cleaned, the saving in time, labor and capital investment accomplished by the present invention is apparent.

It will be understood, of course, that the invention is in no way limited by the particular type of converter employed, the nature of the catalyst in the converter, or the character of the gases treated in the converter during the normal conversion process. There may be some instances where it may be desirable to conduct the hammering directly on the shell of the converter if the construction of the converter is such that by so doing the vibration set up by the hammering is efficiently communicated to the catalytic material, and suitable provision is made to prevent blowing the catalytic material out of its position on the shelves in the converter. The process is applicable to all kinds of catalytic material whether granular, as in pellet form, or when the catalytic substance is distributed on a suitable distended carrier such as asbestos. Neither does the invention depend upon the character of the cleaning gas, so long as it is gas which has no detrimental effect on the catalytic substance. For obvious reasons, of course, air is best adapted for use in the process.

I claim:

1. The process for removing foreign substances from catalytic material which comprises agitating the material without substantial disarrange-

ment of the particles thereof, and passing a gas through the material to remove foreign substances therefrom.

2. The process for removing foreign substances from catalytic material which comprises agitating the material without substantial disarrangement of the particles thereof, and simultaneously passing a gas through the material to remove foreign substances therefrom.

3. The process for removing foreign substances from catalytic material which comprises agitating the material without substantial disarrangement of the particles thereof, and passing a gas at high speed through the material to remove foreign substances therefrom.

4. The process for removing foreign substances from catalytic material maintained in position in a converter by a support which comprises causing the support to vibrate whereby the material is agitated without substantial disarrangement of the particles thereof, and then passing a gas through the material to dislodge and remove foreign substances therefrom.

5. The process for removing foreign substances from catalytic material maintained in position in a converter by a support which comprises causing the support to vibrate whereby the material is agitated without substantial disarrangement of the particles thereof, and simultaneously passing a gas at high speed through the material to dislodge and remove foreign substances therefrom.

6. In the process for removing foreign substances deposited on contact material by the passage therethrough of a reactant gas, such material being maintained in position in a converter by a support, the steps which comprise causing the support to vibrate whereby the material is agitated without substantial disarrangement of the particles thereof, and simultaneously passing an inert gas through the material at a speed greater than the speed of the passage of the said reactant gas through the material to dislodge and remove foreign substances therefrom.

7. In the process for removing foreign substances deposited on contact material by the passage therethrough of a reactant gas, the steps which comprise passing a gas through said material in a direction reverse to the flow of the reactant gas to remove foreign substances from the contact material.

8. In the process of removing foreign substances deposited on contact material by the passage therethrough of a reactant gas, the steps which comprise agitating said material, and passing a gas through said material in a direction reverse to that of the flow of the reactant gas to remove foreign substances from the contact material.

9. In the process for removing foreign substances deposited on contact material by the passage therethrough of a reactant gas, such material being maintained in position in a converter by a support, the steps which comprise causing the support to vibrate whereby the material is agitated without substantial disarrangement of the particles thereof, and simultaneously passing an inert gas through the material in a direction reverse to the flow of the reactant gas and at a speed greater than the speed of the passage of the said reactant gas through the material to dislodge and remove foreign substances therefrom.

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