Sept. 9, 1941. F. C. GOOD 2,255,213

APPARATUS FOR THE DISINTEGRATION OF MATERIALS

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Fig. 1.

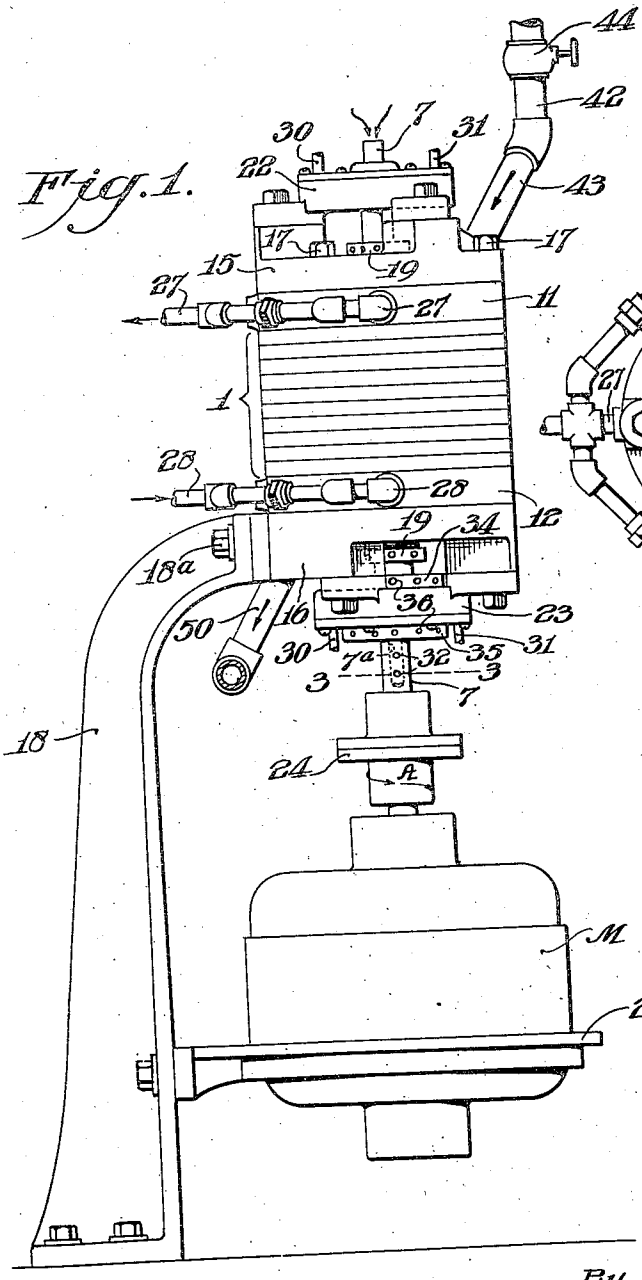


Fig. 2.

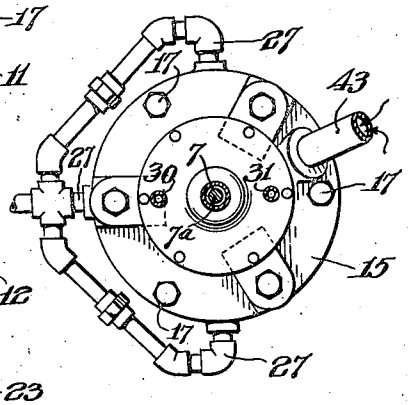
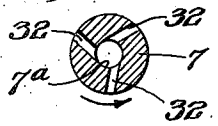


Fig. 3.



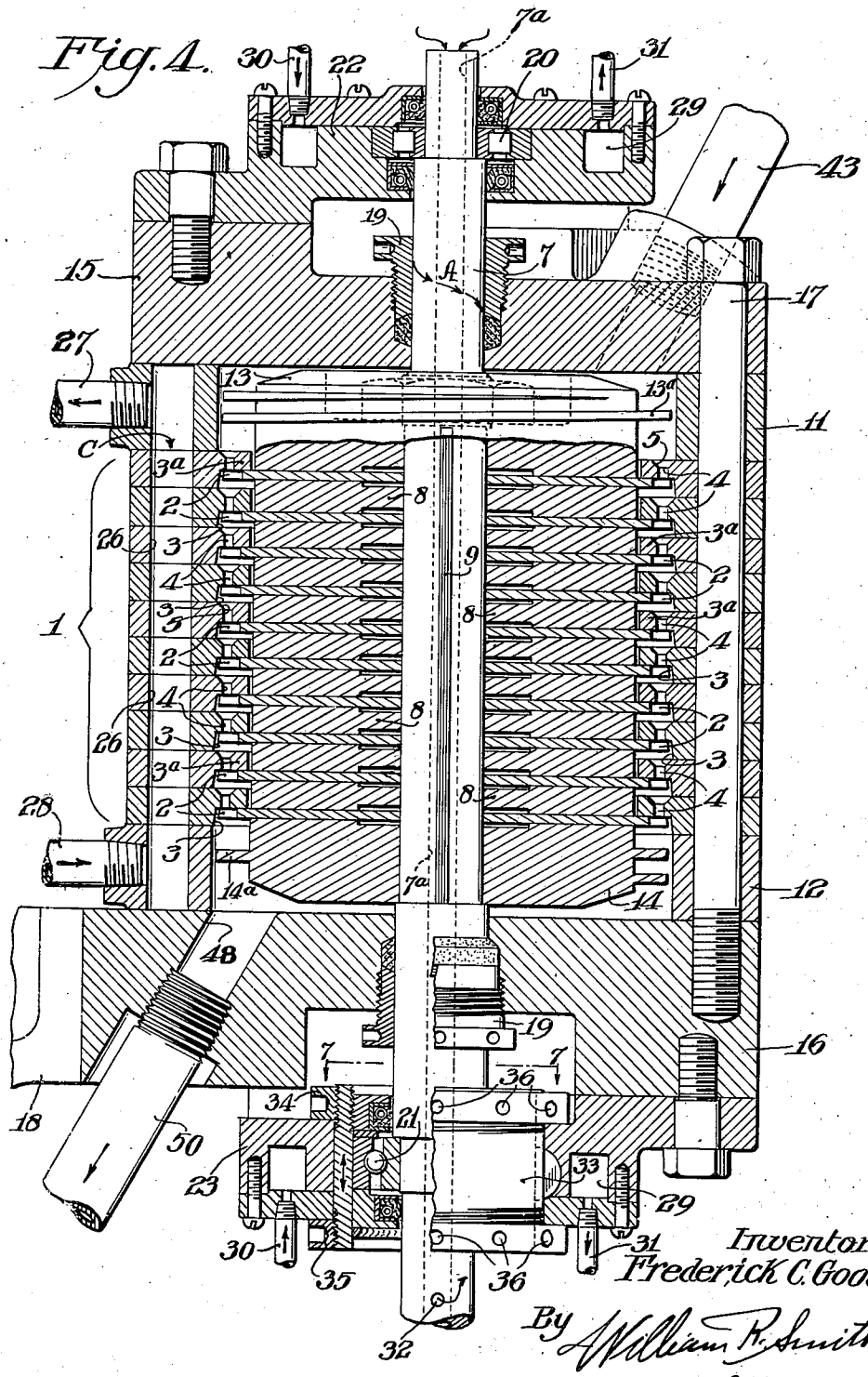
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APPARATUS FOR THE DISINTEGRATION OF MATERIALS

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Fig. 4.



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APPARATUS FOR THE DISINTEGRATION OF MATERIALS

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Fig. 5

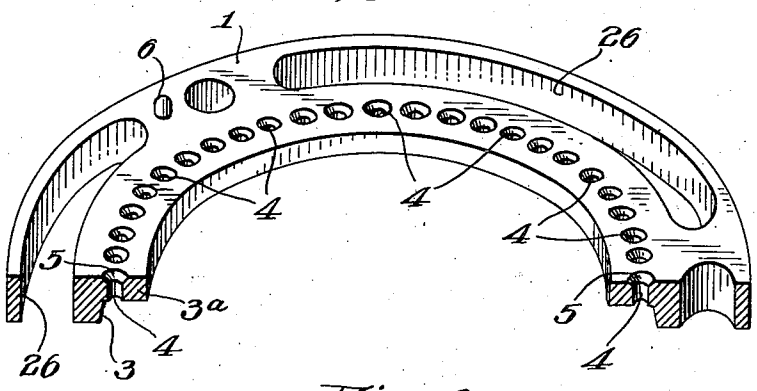


Fig. 6.

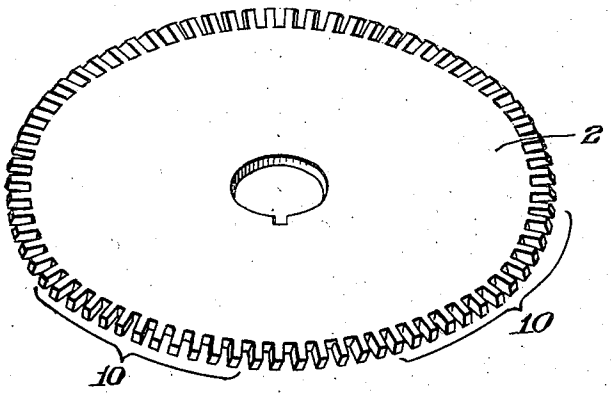
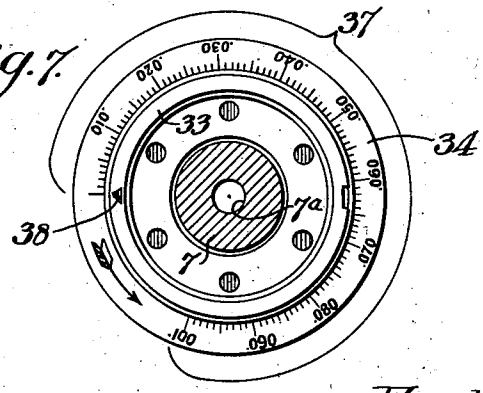


Fig. 7.



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UNITED STATES PATENT OFFICE

2,255,213

APPARATUS FOR THE DISINTEGRATION OF MATERIALS

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Application February 15, 1939, Serial No. 256,603

1 Claim. (Cl. 83—93)

The present invention relates to an apparatus for treating materials or substances, particularly insoluble or immiscible materials or substances, whereby they are disintegrated and worked upon in a novel manner to assure an adequate and effective breaking down of particles and the proper mixing and homogenization thereof.

Heretofore, two methods have been generally known, followed, and utilized in the art to treat materials and substances for the disintegration and homogenization thereof. According to one of said known methods, the materials or substances are subjected to a rubbing or grinding action which results in crushing the treated materials or substances into minute fragments or particles and more or less intermixing them into a homogeneous mass. This particular known method is realized by passing the materials or substances as a film through so-called plate mills wherein are arranged paralleling opposed plates or grinding surfaces set in close micrometer adjustment.

According to the other of said known methods, the materials or substances are subjected to a high pressure and thereby forced through mediums acting to reduce the treated materials or substances to particles which then become more or less agglomerated into a homogeneous mass. This second known method is usually realized by introducing the materials or substances into so-called hydraulic mills provided with hydraulic or like high pressure pumps adapted to force said materials or substances through valves having fine apertures.

Whereas, in theory, either or both of the methods and the apparatus used in the performance thereof should produce the desired results, it has been found, in practice, that in the treatment of a wide variety of insoluble and immiscible materials or substances, they are impractical because in plate mills where a film of material is ground between two opposed surfaces, the friction of many types of materials, by their rubbing action in passing between the plates, heats up the latter, causing expansion to such an extent that the operation of the mills becomes troublesome and inefficient, and because in hydraulic mills the material being forced through the fine apertures of the valves clogs and deforms the latter, requiring their frequent removal, regrinding, or replacement, all of which increase the cost of upkeep, operation, and labor, with the accompanying consequences of loss of time and production.

It is, therefore, the primary purpose of the invention to provide apparatus for treating materials or substances in an improved and novel manner, whereby the disintegration and homogenization of such materials or substances may be accomplished effectively and economically with a minimum of time and labor.

Another equally important object of the invention resides in the provision of an apparatus for treating materials or substances to afford maximum reduction and complete disintegration and homogenization, the apparatus being devised so that its use is not restricted to any particular substance, but may be employed to treat any substance or material that can be caused to pass or flow through the apparatus.

The invention is moreover characterized in that it provides an apparatus of the type stated which may be easily installed and operated, which is positive in action, requiring no watching or attention, and is of compact, rugged construction; an apparatus which may be put to the widest possible range of use, and capable of treating materials at both relatively high and low temperatures, without impairing its efficiency of operation; and an apparatus which may be thoroughly cleaned without dismantling or opening the same and thus capable of being put to use immediately after cleaning.

Other important objects and advantages of the invention will be in part obvious and in part pointed out hereinafter.

In accordance with the present invention, the materials or substances to be treated are fed and allowed to pass or flow continuously through a series of passageways without rubbing or grinding action, and without being subjected to any substantial pressure.

As the feeding is carried on, in the manner aforesaid, the materials or substances are repeatedly cut or shreaded or beaten up and, in that condition, flung or hurled with great force against impact walls or surfaces until the materials or substances are reduced to the desired fineness, to assure proper disintegration and homogenization. Thus it will be noted that the disintegration, according to the present invention, is obtained by means of repeated impacts which may be had by providing high speed rotors surrounded by walls, the materials or substances to be treated being flung or hurled against said walls from the periphery of said high speed rotors which, in actuality, travel at a rate of approximately five thousand peripherial feet per minute up to peripherial speeds of six miles per

minute or more, depending upon the kind of materials or substances being treated.

The invention will be better understood from the accompanying drawings and the detailed description based thereupon, wherein is set forth an apparatus particularly constructed and adaptable to accomplish the results above mentioned.

In these drawings:

Figure 1 is a view in elevation of an apparatus embodying the present invention;

Figure 2 is a plan view of the upper end of the main or body portion of the apparatus shown in Figure 1;

Figure 3 is an enlarged view in section taken on line 3—3 of Figure 1;

Figure 4 is an enlarged view in section vertically through the main or body portion of said apparatus, illustrating the details of construction and arrangement of the essential parts thereof;

Figure 5 is a fragmentary view in perspective of one of the stationary members of the apparatus.

Figure 6 is a view in perspective illustrating the construction of one of the rotor elements of the apparatus;

Figure 7 is a view in section on line 7—7 of Figure 4.

Referring more particularly to the drawings, wherein like characters of reference will designate corresponding parts throughout, the apparatus essentially comprises one or more annular stationary members 1 cooperatively associated with one or more rotor elements 2. As shown particularly in Figure 5, the annular stationary members 1 are formed to include an impact wall portion 3 and an overhanging inwardly projecting flange portion 3a which is provided with a series of openings 4 of predetermined size and shape extending substantially vertically therethrough and having their upper ends preferably countersunk as indicated at 5. These annular stationary members 1 form in effect the wall of the main or body portion of the apparatus and a plurality of them are secured against rotation in properly centered superimposed relation as shown in Figures 1 and 4 by means of one or more dowel pins 6 (Figure 5) which engage correspondingly formed recesses in the adjacent upper member 1.

The rotor elements 2 are arranged in spaced relation upon a shaft 7 by means of spacing disks 8 which, together with said rotor elements 2, are secured to said shaft 7 by means of a spline or key member 9. As shown, the rotor elements 2 are of greater diameter than the diameter of the opening in the stationary members 1 as defined by their flange portion 3a and the peripherial portions thereof, which are provided with a series of teeth 10, are disposed beneath or at the underside of said flange portions 3a and openings 4 therein between adjacent stationary members 1.

Annular housing or casing members 11 and 12 are disposed respectively immediately above and below the succession or series of stationary members 1, and material feed elements 13 and 14 having threads 13a and 14a respectively are secured upon the shaft 7 within each casing 11 and 12 by means of the aforementioned spline or key 9. At this point, attention is called to the fact that the feed elements are not for the purpose of forcing the materials or substances through the apparatus under high pressure, but are merely intended to assist said materials or substances and assure their continuous feed in passing through the apparatus. Top and bottom end or cover members 15 and 16 are similarly positioned above the casing member 11 and below the casing member 12, and the entire assembly comprising the stationary members 1, casings 11 and 12 and cover members 15 and 16, is secured together by means of bolts 17 and supported by or upon a standard 18 which is bolted or otherwise secured to the lower cover member 16, as shown at 18a.

The shaft 7 which carries the rotor elements 2, spacing disks 8 and feed elements 13 and 14, extends through sleeves 19 threaded in the end members 15 and 16 respectively and has its upper and lower end portions journalled in suitable bearings 20 and 21 respectively mounted in suitable supporting structures 22 and 23 which are secured to the outer faces of the upper and lower end members 15 and 16. The lower end of the shaft 7 is coupled as indicated at 24 to the shaft of an electric motor M which is supported in a suitable bracket 25 secured to the standard 18 and, as indicated by the arrows A, the motor is arranged to drive the rotor elements 2 in a counter-clockwise direction with respect to the drawings, and is adapted to impart to said elements 2 a peripherial speed approximating at least five thousand feet per minute.

In many instances it may be desirable to treat materials in the apparatus at relatively high or low temperatures and to this end the stationary members 1 and casings 11 and 12 are provided with elongated openings 26 which cooperate when assembled to form a channel or channels C in which a suitable heating or cooling medium may be circulated through pipes 27 and 28 and in order that the bearings 20 and 21 in which the shaft 7 is journalled may be maintained relatively cool during operation of the apparatus at high temperatures a channel 29 is formed in each supporting structure 22 and 23 through which water or other substance may be circulated by means of pipes 30 and 31. To further assist in keeping the shaft 7 and bearing assembly relatively cool, said shaft is provided with an axial bore 7a therein which extends from the upper end of the shaft to a point adjacent the lower end thereof where a plurality of angularly arranged ports 32 communicate outwardly therefrom. These ports 32 extend rearwardly with respect to the direction of rotation of the shaft 7 as shown in Figure 3 with the result that upon rotation of said shaft suction is created at said ports 32 which operates to draw cool air downwardly through the bore 7a of said shaft while the apparatus is running.

It will be clear that different substances depending upon their various physical properties will require different clearances between the flanges 3a of the stationary members 1 and the adjacent faces of the rotor elements 2 in order that most efficient results may be obtained, especially since the present invention aims to eliminate the rubbing or grinding action of the apparatus parts on the materials being treated, and to this end a particular feature of the invention consists in providing for vertical adjustment of the rotor elements 2 with respect to the stationary members. In the present instance this is accomplished by mounting the lower shaft bearing 21 in a sleeve or collar member 33 which is supported in the lower supporting structure 23 and adjustable vertically by means of two rings 34 and 35 which threadably engage said collar 33

above and below said structure 23. These rings 34 and 35 are each provided with a number of suitably located recesses 36 for the reception of a tool (not shown) by means of which said rings may be turned, for example, to first loosen the upper ring 34 and then tighten the lower ring 35 to lower the sleeve 33, its bearing 21 and the shaft 7 and its rotor elements 2; or to first loosen the lower ring 35 and then tighten the upper ring 34 to raise the shaft and rotor assembly.

Vertical adjustment of the rotor elements 2 and shaft 7 is, of course, confined to micrometer adjustments of the clearance between said rotor elements and the adjacent surface of the flange portion 3a of its associated stationary member 1 and in order to facilitate and permit accurate adjustments of such clearances, the upper adjusting ring 34 is suitably marked and graduated as indicated at 37 with respect to an arrow or pointer 38, the threads on the sleeve or collar 33 and rings 34 and 35 being formed at a predetermined pitch with respect to the scale markings 37 so that a single revolution of said ring 34 will effect adjustment of the rotor elements within normal operating limits to accurately set said rotor elements at the indicated clearance below the overhanging flange portions 3a of the corresponding stationary members 1. When either ring 34 or 35 is first loosened to permit adjustment of the rotor elements as above set forth by the other ring, the ring first loosened may be subsequently tightened to lock the rotor elements and shaft assembly securely in the position to which adjusted.

As shown in Figure 1 of the drawings, the material to be treated, which may comprise one or more different substances, is fed inwardly of the apparatus from one or more suitable tanks or receptacles connected to a pipe or tube 42 which connects or leads to an inlet port 43 provided in the top cover member 15. The pipe or tube 42 may be provided with a suitable valve 44 for controlling the feed of material into the apparatus.

In the operation of the apparatus, as the material to be treated enters through the inlet port 43 at the upper end thereof, it is fed downwardly through the openings 4 in the flange of the uppermost stationary member 1 by means of the screw thread 13a on the feed member 13, the openings 4 in the stationary member 1 acting to divide the fed material in portions. As the divided portions of said material emerge from the lower ends of said openings 4, they are engaged and cut or sheared or beaten up into fine particles by the teeth 10 at the periphery of the uppermost rotor element 2 which, because of the high speed as hereinbefore specified, also function to fling or hurl the material with substantial impact and great force against the surrounding wall portion 3 of the stationary member 1, reducing the particles to a further degree of fineness. As the particles progress through the apparatus by the continuous feeding of the material, they flow inwardly along the upper surface of the flange 3a of the next or succeeding stationary member 1 and then downwardly through the openings 4 in that flange where they are again cut or sheared or beaten and picked up and impacted against the wall portion of that member by the teeth 10 of the next or succeeding rotor element 2 resulting in further reduction of the particles of material. This operation continues until the particles of material have traversed the entire length of the tortuous path provided by the several stationary and rotating members 1 and 2 respectively and arrive at the lower end of the apparatus where the material which is reduced to particles of desired fineness is forced outwardly or discharged from the apparatus, through an outlet 48 and discharge pipe 50, by the lower feed member 14.

An apparatus made according to this invention is characterized by its high degree of selectivity and control over the material being treated. For example, the number of stationary members 1 and consequently rotor elements 2 employed in any given instance may depend upon the nature and properties of the material to be treated as well as the degree of fineness of the reduction desired and one or more sections comprising a stationary member 1 and rotor element 2 may be added to or removed from the apparatus as desired with little labor and loss of time.

Whenever it becomes desirable to wash the apparatus, it will be appreciated that this can be accomplished by merely running water or some suitable cleaning solution through the apparatus. Thus the apparatus may be thoroughly cleansed without dismantling or opening the same.

From the foregoing, it will be understood that I have provided an apparatus capable of disintegrating and homogenizing materials or substances in a characteristic manner, that is, by first cutting or shearing or beating up the fed materials or substances into particles, then hurling the latter against impact walls or surfaces, these operations being repeated in continuous sequences to produce the desired results.

Of course, it is to be understood that the particular construction of the machine herein shown and described has been given as an example of a possible embodiment of the invention, and that such a construction is capable of certain structural modifications, without departing from the gist of the invention. Accordingly, any modifications coming within the scope of the subjoined claim are to be considered within the spirit of the invention.

What I claim is:

An apparatus for the homogenization of material, comprising: a plurality of annular members rigidly locked axially together in adjoining relationship to form a unitary body, each of said members consisting of an inner cylindrical impact wall portion and a radially inwardly projecting flange portion, said wall and flange portions being relatively disposed at substantially right angles to each other; a row of longitudinally oriented openings with countersunk inlets formed in the flange portion of each of said members; a rotor within the unitary body comprising rotor plates contacting and interspersed with round spacer disks, each plate having peripherally extending teeth arranged in radial alignment with respect to the impact wall portion of the annular member and disposed to closely sweep past the row of openings in the flange portion of the annular member, the spacer disks having a diameter only slightly less than the internal diameter of the radially projecting flanges of the annular members; the spacing between the disks and annular members substantially confining the flow of material treated to paths through the openings in the flanges, the teeth of the rotor plates shearing the material passing through the openings and hurling the sheared material against the impact wall portions.

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