July 2, 1963 F. E. KASBAUM 3,096,180

METHOD OF GRINDING SPICES

Filed Sept. 28, 1961

Fig. 1.

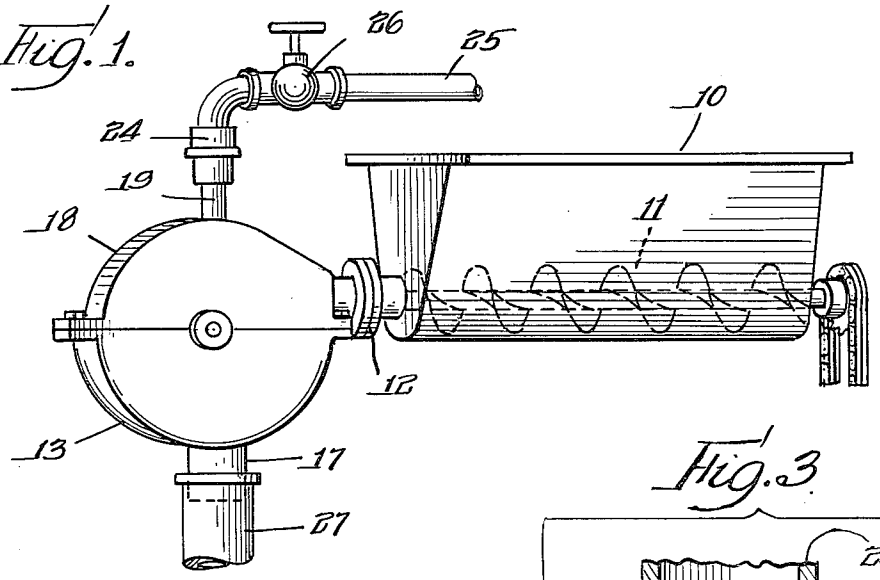


Fig. 2.

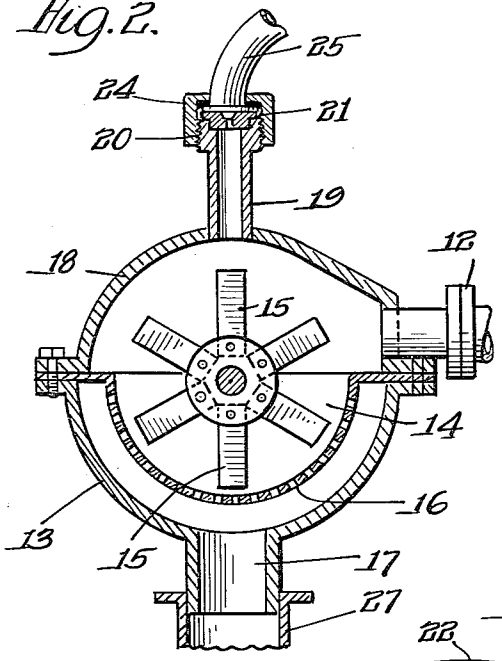


Fig. 3.

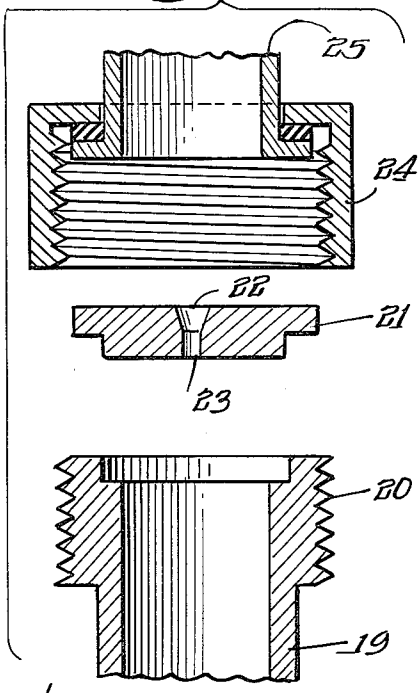
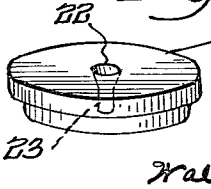


Fig. 4.



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METHOD OF GRINDING SPICES

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This invention relates to a method of grinding spices. In particular, this invention relates to a method of grinding or comminuting dry natural spices with substantially no detectable loss in the flavoring, aromatic and color characteristics of the spices.

All spices are aromatic or odoriferous, and many are taste or feeling stimuli. The most satisfying flavors of spices are chemically complex, stimulating taste, mouth-feel and odor. The preservation of this degree of complexity of flavoring is necessary for fullness or richness of effect. However, the essential oils, delicate esters and other agents responsible for this effect are highly sensitive to destruction by heat and oxidation.

The loss of these valued and desired elements is particularly acute during the grinding of the spices, resulting not only in a substantial weight reduction in the comminuted product but also in a lowering in quality due, among other factors, to changes in flavor, aromatic and color properties. Conventional methods of grinding spices have attempted to alleviate these problems by performing the grinding operation in substantially enclosed chambers which are not necessarily air-tight but which reduce the degree of oxidation of the desired flavoring and aromatic components of spices. The extent of the destruction or loss of these components may be somewhat further reduced in accordance with standard practices by employing a water-jacketed grinding chamber. The constant circulation of water about the periphery of the chamber removes to a degree the heat generated during the grinding operation and tends to reduce volatilization of desired components.

These measures, however, by no means have provided an adequately satisfactory solution to the problems encountered in spice grinding operations. This is evidenced by the fact that conventional grinding apparatus must be operated at reduced speeds to prevent the development of excessive heat within the chamber. Even with such precautionary measures, burning or scorching of the spices occurs, resulting in clogging of the screens through which the ground spices must pass, necessitating a cessation of operations to remove the obstructing material. The reduced operating speeds coupled with the inevitable work stoppages have obvious economic disadvantages not only from the standpoint of substantially reduced production rates but from the fact that quality of the final product can be and is adversely affected.

As an outgrowth of reduced operating speeds, employed in conventional methods of grinding spices, there exists still another important shortcoming in such methods centering around the matter of obtaining desirable particle size in the ground spices. In this connection, present methods of grinding spices commonly employ "grinding aids" to achieve proper particle size. Such aids in themselves possess none of the characteristics of spices and serve only the function of an adulterant, increasing the volume of product passing through the grinding apparatus but decreasing the concentration of the desired spice in the end product. A truly high quality spice is thus unattainable with conventional methods of grinding wherein such agents are utilized.

In accordance with the preferred practice of this invention, I introduce a spice into a grinding chamber where it is commingled with a non-oxidizing gas having good heat exchange properties whereby to attain a desired temperature within the chamber, and then grind the spice in the chamber while substantially maintaining that temperature by controlling the discharge of the ground spice from the chamber.

My method may be utilized in connection with the grinding of any spice, or combination thereof, with equally effective results. Examples of spices that may be subjected to size reduction in accordance with this invention are black and white pepper, nutmeg, sage, marjoram, allspice, clove, cinnamon, thyme, celery, anise, savory, wintergreen, parsley, rue, sweet basil, tarragon, mustard, caraway, tonka beans, angostura, cassia, ginger, garlic, onion, turmeric, paprika, rosemary, wormwood, jasmine, slippery elm, wild-cherry bark, witchhazel, getian root, cardamon seed, cumin, coriander, and the like.

In carrying out my method any grinding apparatus capable of being enclosed at the point of size reduction may be utilized. Examples of apparatus suitable for the purposes of this invention are stone mills, hammer mills, ball mills, roller mills, abrasion mills, and the like. The modifications to such equipment to adapt it to my method are not extensive and present no burdens from the standpoint of economic considerations, or otherwise.

In order to illustrate the above referred to modifications, and to simplify understanding of my invention, I have, on the attached sheet of drawings, shown a typical embodiment of apparatus having utility for the purposes of carrying out my method. Referring now to the drawings:

FIG. 1 is a perspective view of a hammer mill with associated equipment for introducing spices and liquified gas thereinto.

FIG. 2 is a vertical sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is an enlarged exploded view showing details of the gas inlet.

FIG. 4 is a perspective view of an expansion plug.

In accordance with the preferred practice of this invention, unground spice is placed in a hopper 10 provided with suitable drive feed means such as auger or worm screw 11. The screw 11 at one end is connected to a source of power, not shown, and at its other extremity is suitably journalled at the coupling 12 between the hopper 10 and a mill or grinder 13. The spice from the hopper 10 is conveyed at a desired rate by the screw 11 into a chamber 14 of the grinder 13. Positioned within the chamber 14 are a plurality of hammers 15 which serve to comminute the spice to proper size. The mill 13 is provided with a screen 16 through which the ground spice passes to a discharge outlet 17.

The chamber 14 is formed in part by a cover 18 which is provided with an inlet 19 for introducing a non-oxidizing gas having good heat exchange properties into the chamber 14. In the preferred embodiment illustrated, the inlet 19 is approximately 1 inch in diameter and is provided with external threads 20. The inlet 19 is adapted to receive an expansion plug 21 provided with a conical inlet portion 22 and a cylindrical outlet portion 23. The plug 21 is securely held in aligned position with respect to the inlet 19 by means of a suitably internally threaded connector 24 which in turn is connected to a conduit 25 leading from a source, not shown, of liquefied gas having utility for the purposes of this invention. A valve such as needle valve 26 may be provided between the source of the gas and the inlet 19 to control the rate of flow of gas into the inlet 19.

The line pressure desirably utilized in the conduit 25 will be dependent, in part, on the type of gas being employed as the coolant. In the case of liquid carbon dioxide, I have found that especially desirable results are obtained with a line pressure in the conduit 25 of approximately 300 p.s.i.

The gas employed in connection with my process is especially desirably in a liquified state as it enters inlet

portion 22 of the plug 21. As the liquid gas passes through outlet portion 23 of the plug 21 it is diffused and expanded in the inlet 19 from where it passes in a gaseous state into the chamber 14. There it is commingled with spices being ground by the hammers 15 of the mill 13. The diffusion and expansion of the gas are critically influenced by the size of the orifice in inlet portion 22 of the plug 21 and this dimension will vary according to the type of gas used, spice being ground, and the rate at which it is ground. If liquid carbon dioxide is utilized as the coolant, the orifice of the inlet portion 22 preferably ranges from 0.030 inch to 0.050 inch in diameter, and may vary by intervals of 0.005 inch depending on the spice being ground and on the rate at which it is ground.

The liquid gases having utility for the purposes of my inventio have been referred to herein as those that are non-oxidizing and have good heat exchanging properties. The heat exchanging characteristics of the gas will be determined by the temperature at which the gas passes from the liquid to the gaseous state. For example, if a gas has a temperature in the range of about —20° F. immediately following the transformation, it has good heat exchanging properties for the purposes of this invention. Examples of liquid gases which give good results are carbon dioxide, nitrogen, ammonium, chlorinated-fluorinated hydrocarbons such as the Freons, and the like. Certain of the gases that may be employed give off objectionable and noxious odors at the point of discharge of the ground spices and, therefore, desirably involve the utilization of equipment to remove, and protect against, such odors.

The temperature of the chamber 14 during the grinding operation advantageously should range from about —69° F. to about 30° F. The temperature may be appropriately regulated by controlling the rate of discharge of the ground spices through the outlet 17 of the mill 13. The temperature at the discharge outlet 17 most desirably ranges from about —30° F. to about 60° F. The objects of this invention are effectively achieved at a discharge temperature in the range of from about 40° F. to about 60° F. with optimum results being obtained at a discharge temperature of from about 50° F. to about 55°F. Under normal operating conditions, the temperature of the chamber 14 will be approximately 30° F. lower than the discharge temperature at outlet 17. The chamber 14 need not be pre-cooled prior to the introduction of the spices and gas.

The spices introduced into the chamber 14 remain therein only for a time sufficient to enable the hammers 15 to grind them to the desired particle size. In the particularly desirable embodiments of the practice of my invention the time interval from the point of introduction of the spices into the chamber 14 to their discharge through the outlet 17 is very rapid, generally only a fraction of a second of the order of 0.5 second, but may range to 4 seconds, and thus for all practical purposes is almost instantaneous.

At the operating temperatures specified, the frangibility of the spice particles is materially enhanced, enabling them to be comminuted with far greater facility. This greater ease in grinding, moreover, can be accomplished without the use of "grinding aids."

In addition to rendering the spice particles more susceptible to grinding, the temperatures at which my method is carried out permit the grinding apparatus to operate at substantially higher rates than is possible in conventional methods. For example, employing liquified carbon dioxide as the coolant and utilizing apparatus such as is illustrated in the accompanying drawings equipped with a 7½ horsepower, 200 volt motor, the hammer mill head may be operated at 1,750 revolutions per minute resulting in a production rate of from 200 to 500 pounds per hour. This rate of production is approximately 10 times that obtained in a conventional method employing the same grinding equipment. Furthermore, this heretofore unattainable production rate can be maintained for extended periods without burning or scorching the spices being ground. This has the very desirable concomitant effect of eliminating screen clogging and the resultant shutdowns to free the screen of adhering burned or scorched material.

The screen 16 illustrated in FIG. 2 of the drawings is of conventional design and construction, and the mesh size thereof may vary from ¾ inch to 0.01 inch. As the ground product passes through the screen it is discharged through outlet 17 into a suitable container. It is especially desirable to provide at the point of discharge some insulation of the product from the atmosphere. This may be effectively accomplished by fitting the outlet 17 with a "skirt" 27 of sufficient length to form an enclosed discharge passage from the outlet 17 to a container, not shown.

Spices ground in accordance with the method of this invention are of extremely high quality. There is no detectable loss in weight, due largely to the preservation of the volatile components of the spices, and the normal approximately 10% color loss experienced in conventional methods of grinding spices is eliminated. The absence of grinding aids gives a highly concentrated end product. The texture of the product, moreover, is in no way affected by the temperatures employed in my method.

Any increased costs, and these are relatively slight, in the use of the method of this invention are fully offset not only by the substantially greater production rates the method makes possible but by the greater value of the high quality product obtained in accordance with the method.

The foregoing detailed description has been given for purposes of explanation only and no unnecessary limitation should be understood therefrom, it being understood that numerous changes may be made in the manner of carrying out the invention, all within the spirit of the guiding principles and teachings provided herein.

What I claim is:

1. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber, commingling with the spices in the chamber a non-oxidizing gas having good heat exchanging properties whereby to obtain a temperature within the chamber of from about —69° F. to about 30° F., and grinding the spices in the chamber while maintaining the temperature by controlling the rate of discharge of the ground spices from the chamber.

2. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber, commingling with the spices in the chamber a non-oxidizing gas having good heat exchanging properties whereby to obtain a temperature within the chamber of from about —69° F. to about 30° F., grinding the spices in the chamber while maintaining the temperature in the aforesaid range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about —30° F. to about 60° F.

3. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber, commingling with the spices in the chamber a non-oxidizing gas having good heat exchanging properties whereby to obtain a temperature within the chamber of from about —69° F. to about 30° F., grinding the spices in the chamber while maintaining the temperature in the aforesaid temperature range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about 40° F. to about 60° F.

4. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber, commingling with the spices in the chamber a non-oxidizing gas having good heat exchanging properties whereby to obtain a temperature within the chamber of

from about −69° F. to about 30° F., grinding the spices in the chamber for a period of from about 0.5 second to about 4 seconds while maintaining the temperature in the aforesaid temperature range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about −30° F. to about 60° F.

5. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber, commingling with the spices in the chamber carbon dioxide gas at a temperature whereby to obtain a temperature within the chamber of from about −69° F. to about 30° F., grinding the spices in the chamber while maintaining the temperature in the aforesaid temperature range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about −30° F. to about 60° F.

6. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber, commingling with the spices in the chamber nitrogen gas at a temperature whereby to attain a temperature within the chamber of from about −69° F. to about 30° F., grinding the spices in the chamber while maintaining the temperature in the aforesaid temperature range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about −30° F. to about 60° F.

7. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber through one inlet thereof, injecting into the chamber through another inlet thereof a non-oxidizing gas having good heat exchanging properties whereby to obtain a temperature within the chamber of from about −69° F. to about 30° F., grinding the spices in the chamber while maintaining the temperature in the aforesaid range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about −30° F. to about 60° F. while shielding the spices from the atmosphere.

8. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber through one inlet thereof, spraying into the chamber through another inlet thereof a non-oxidizing gas having good heat exchanging properties whereby to obtain a temperature within the chamber of from about −69° F. to about 30° F., grinding the spices in the chamber while maintaining the temperature in the aforesaid range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about 40° F. to about 60° F. while shielding the spices from the atmosphere.

9. An improved method of grinding spices which comprises introducing the spices to be ground into a chamber through one inlet thereof, injecting into the chamber through another inlet thereof a non-oxidizing gas in a diffused and expanded state having good heat exchanging properties whereby to obtain a temperature within the chamber of from about −69° F. to about 30° F., grinding the spices in the chamber while maintaining the temperature in the aforesaid range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about 50° F. to about 55° F. while shielding the spices from the atmosphere.

10. An improved method of grinding spices which comprises introducing the spices to be ground into a hammer mill, commingling with the spices in the chamber a non-oxidizing gas having good heat exchanging properties whereby to obtain a temperature within the mill of from about −69° F. to about 30° F., holding the spices in the mill for a period of from about 0.5 second to about 4 seconds while maintaining the temperature in the aforesaid range by controlling the rate of discharge of the ground spices from the chamber, and discharging the ground spices from the chamber at a temperature of from about −30° F. to about 60° F. while shielding the ground spices from the atmosphere.

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