Jan. 6, 1942. F. C. MERICOLA 2,268,888

MANUFACTURE OF FUSED CHEMICAL PELLETS

Filed March 28, 1939

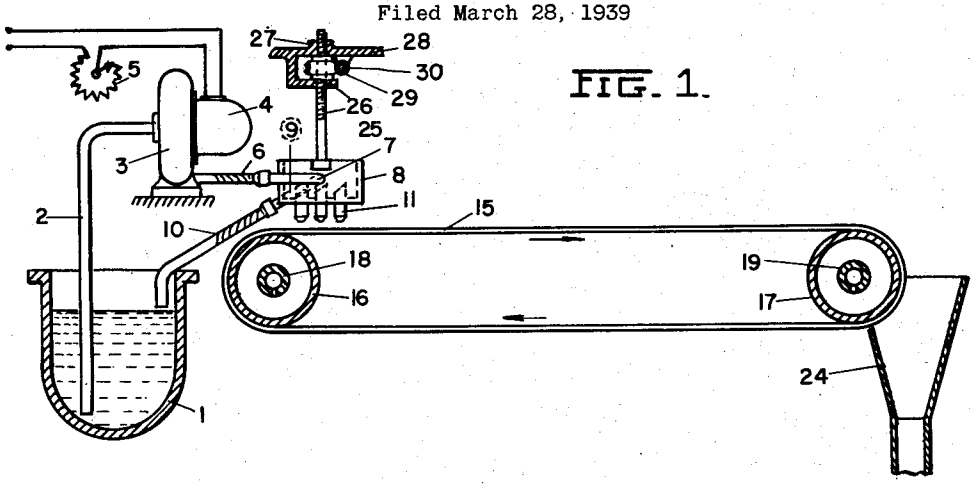


FIG. 1.

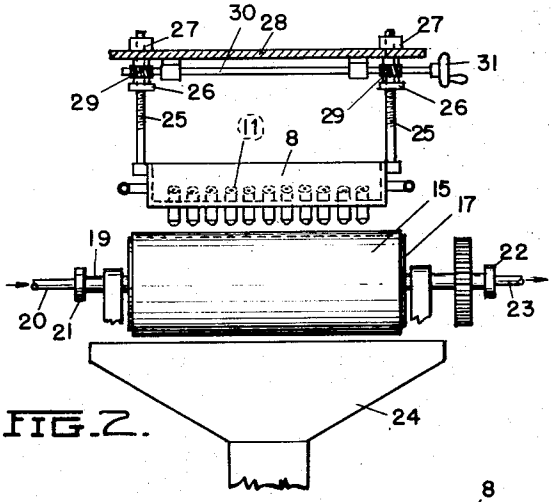


FIG. 2.

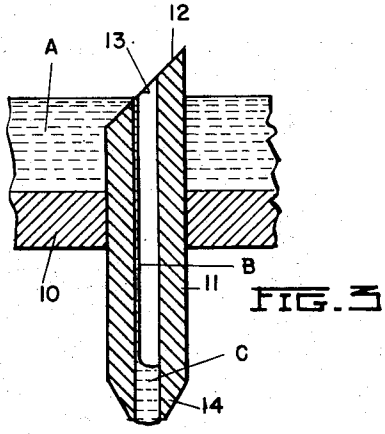


FIG. 3.

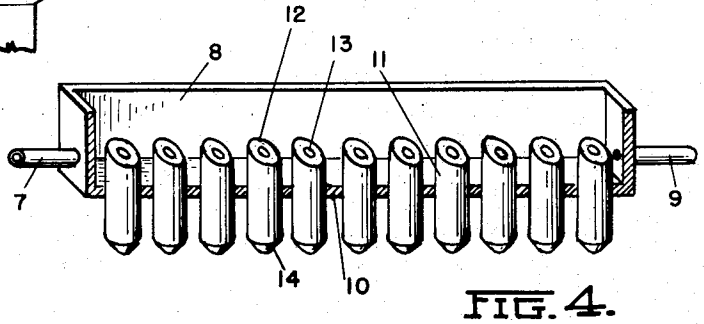


FIG. 4.



FIG. 5.



FIG. 6.



FIG. 7.

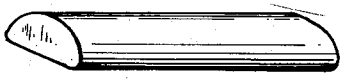


FIG. 8.

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MANUFACTURE OF FUSED CHEMICAL PELLETS

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7 Claims. (Cl. 83—91)

The present invention relates to a method and apparatus for forming or fabricating fused, i. e., molten chemical materials, such as caustic soda, calcium chloride and the like into solidified droplets or pellets.

Heretofore it has been known that such chemical materials could be produced in pellet form generally by the process of forming the molten, fluid material into drops and solidifying such drops upon a cold or cooling surface. My present invention constitutes an improvement in this previously known procedure and has for its general object the production of particles of uniform size and shape with a regular contour, viz., with the absence of "tails" or "teats" on the droplets or pellets. The process of manufacture embodied in my invention provides for accurate and reliable control in the shape of the pellets, in the rate of formation thereof, and also in the temperature of the fused or molten material which is to be formed into drops, before being deposited upon the cooling surface. The control of the temperature of the material incidentally involves such factors as surface tension and viscosity, which in turn have a bearing upon the drop forming and shaping step of the process. My invention possesses the further advantage in that it eliminates the necessity for separate and additional apparatus for heating the material in the dropping box, and at the same time insures the maintenance of uniform temperature, surface tension and viscosity throughout the body of the material present in the dropping boxes.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawing and the following description setting forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing:

Fig. 1 is an elevational, assembly view illustrating apparatus embodying my invention and adapted to perform the process thereof; Fig. 2 is a right hand end view of Fig. 1; Fig. 3 is a vertical sectional view taken through one of the dropping tubes; Fig. 4 is a sectional view taken through the dropping box; and Figs. 5 to 8 inclusive are perspective views illustrating the various forms of pellets capable of being produced by my method and apparatus.

Now referring more particularly to the drawing, the apparatus shown therein includes a melting pot 1 for the reception of a chemical material such as caustic soda, calcium chloride or the like, and for heating such material to a fused or liquid molten condition. A conduit 2 leads from near the bottom of the melting pot 1 to the hydraulic pump 3 which is in turn driven by the variable speed electric motor 4. The motor 4 is shown connected to the adjustable rheostat 5 whereby its speed and of course the rate of delivery of the pump 3 can be adjustably regulated. The flexible outlet conduit 6 leads from the discharge side of the pump 3 to the inlet pipe 7 into the interior of the dropping box 8. The outlet pipe 9 leads from the end of the dropping box 8 opposite to that of the inlet pipe 7, and through the flexible conduit 10 back to the melting pot 1.

A series of dropping tubes 11 are mounted in the botom wall 10 of the dropping box 8. The upper ends of the dropping tubes 11 are cut off at an angle of about 45° to the horizontal, thus presenting an inlet opening or orifice 13 for the interior of the tubes whose marginal edges are disposed in a plane intersecting or non-parallel to the liquid level of the material A in the dropping box 8. Thus, the open end or orifice 13 of the dropping tubes 11 functions as a weir or dam over which the material must pour or spill in a sheet-like form, as indicated at B. As the material reaches the lower end of the tube 11, it builds up into a solid body filling the interior of the tube as indicated at C. As soon as the weight of the body of material C overcomes the capillary attraction to the walls of the tube, it then forms into a cylindrical drop which drops out of the lower end of the tube.

The lower ends of the tubes 11 are cone shaped or beveled on the outside as indicated at 14. The presence of this cone shaped tip 14 prevents the fluid material from "creeping" sideways along a horizontal surface to form drops of non-uniform and irregular sizes.

An endless belt 15, composed of flexible, sheet steel, for example, is mounted on the cylindrical drums 16 and 17 and adapted to have a direction of travel as indicated by the arrows in Fig. 1. The drums 16 and 17 are mounted upon the hollow shafts 18 and 19 respectively and through which a cooling medium such as water is supplied to the interior of the drums by means of the inlet pipe 20 and packing gland 21 and withdrawn through the packing gland 22 and outlet pipe 23. A hopper or receiver 24 is located ad-

jacent the drum 17 and the right hand or discharge end of the endless belt 15.

The dropping box 8 is adjustable as to height with respect to the endless belt 15 by means of the threaded spindles 25 rotatably mounted upon each end of the box. The spindles 25 are threadably engaged in the brackets 26 and fixed nuts 27 which in turn are mounted upon a supporting beam or plate 28. Worm and gear drive connections 29 connect the threaded spindles 25 to the horizontal shaft 30. The latter is operated or rotated by means of a hand wheel 31. In this manner the pouring box 8 and the dropping tubes 11 can be moved to any desired position with respect to the cooling surface or endless belt 15, and serves as means for conveniently effecting the control of the contour or shape of the solidified pellets. Thus, a semi-spherical pellet, such as illustrated in Fig. 5, will be formed when the dropping box 8 is in a relatively low position with respect to the belt 15. A disc-like or discoid form of pellet, as shown in Fig. 7, will be formed when the dropping box is in a relatively high position with respect to the belt 15. Fig. 6 illustrates an intermediate semi-ellipsoidal shape pellet, corresponding to an intermediate height location of the dropping box 8.

The operation of the above described apparatus should now be fairly apparent. The molten, fused material is pumped from the melting pot 1 to the dropping box 8 where it rises to a predetermined liquid level dependent upon the delivery speed of the pump 3 and the rate of flow return through the return conduit 10. The molten, fused material is thus circulated through the dropping box 8 and a portion of it enters the openings or orifices 13 in the top of the dropping tubes 11, whence it is formed into drops as previously described and deposited upon the cooling surface of the endless belt 15. The drops then become solidified into droplets or pellets which are discharged by gravity from the end of the belt 15 into the hopper 24. By increasing the speed of the pump 3, the liquid level of the body A of molten material in the dropping box 8 may be raised to increase the rate of formation of the drops, as well as to serve as a very accurate means of controlling the temperature, within limits of the material in the box. This temperature control arises from the fact that there is bound to be a heat loss, and therefore a temperature drop in the material as it is removed from the melting pot 1 to the dropping box 8. The greater the rate of flow of material through the dropping box 8, the lower the proportionate amount of heat loss and temperature drop. Thus, at a relatively low rate of circulation of the material through the box 8, the temperature of the material A therein will be relatively low, and by the same token a relatively higher temperature will result with a relatively greater rate of flow.

The surface tension and viscosity of the material in the box 8 and of course that passing into the dropping tubes 11, is a function of the temperature. Since the size of the drops, as represented by the body of material C, is in turn a function of surface tension and viscosity, it will thus be seen that the sizes of the drops formed can in turn be controlled by the pumping rate or rate of circulation of the material through the box 8.

Furthermore the circulation of the excess material through the dropping box 8 prevents the dropping tubes 11 from "making up" or the material therein from "freezing out." If the rate of circulation of the material through the dropping box 8 is increased to such a point that the liquid level of the material A rises above and completely covers the orifice 13, a solid stream of material will be deposited upon the endless belt 15, resulting in the formation of a ribbon of solidified material which uopn discharge over the right hand end of the belt 15 will be broken up into smaller pieces such as indicated in Fig. 8.

It will thus be seen that the above described method and apparatus is capable of producing fused, and subsequently solidified chemical materials in pellet form with a convenient, flexible and relatively simple control over the size, shape and contour of the pellets. Due to the fact that the drops which are formed by the tubes 11, drop off cleanly from the lower ends thereof, not only is the previously indicated objection of "creeping" and formation of non-uniform sized drops eliminated, but also the tendency to form "tails" or "teats" on the pellets is substantially decreased.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A method of forming fused chemical material into pellets comprising the steps of circulating the molten material into, through, and out of, a drop forming chamber, withdrawing a lesser portion of such material than that circulated in the form of droplets from said chamber and dropping them on a cooling surface to form solidified pellets, and controlling the temperature and fluidity of that portion of material instantaneously in said chamber by varying the rate of such circulation.

2. Apparatus for forming a fused chemical material into pellets comprising a chamber for the reception of a body of said material, and a plurality of tubes extending through the bottom of said chamber, the lower ends of said tubes being externally cone shaped, and the upper ends thereof being disposed at an angle to the horizontal.

3. Apparatus for forming a fused chemical material into pellets comprising a chamber for the reception of a body of said material, a plurality of tubes extending through the bottom of said chamber, the upper ends of said tubes extending above said bottom and into the interior of said chamber, said upper ends being disposed at a horizontally inclined angle whereby the opening to the interior of said tubes is disposed in a plane intersecting and non-parallel to the liquid level of said material and said chamber.

4. Apparatus for forming a fused chemical material into pellets comprising a chamber for the reception of a body of said material, a plurality of tubes extending through the bottom of said chamber, the lower ends of said tubes being externally cone shaped, the upper ends of said tubes extending above said bottom and into the interior of said chamber, said upper ends being disposed at a horizontally inclined angle whereby the opening to the interior of said tubes is disposed in a plane intersecting and non-parallel

to the liquid level of said material and said chamber.

5. Apparatus for forming a fused chemical material into pellets comprising a melting pot for said material, a separate drop forming chamber, means for circulating said material from said melting pot into and through said chamber and thence to return to said melting pot, a cooling surface located below said chamber, and a plurality of tubes extending through the bottom of said chamber having their upper ends disposed at an angle to the horizontal.

6. Apparatus for forming a fused chemical material into pellets comprising a melting pot for said material, a separate drop forming chamber, means for circulating said material from said melting pot into and through said chamber and thence to return to said melting pot, a cooling surface located below said chamber, a pump for withdrawing material from said melting pot, a conduit leading from said pump to said chamber, a return conduit from said chamber to said melting pot, a cooling surface located below said chamber, and a plurality of tubes extending though the bottom of said chamber having their upper ends disposed at an angle to the horizontal.

7. Apparatus for forming a fused chemical material into pellets comprising a melting pot for said material, a separate chamber, a plurality of tubes extending through the bottom of said chamber, the lower ends of said tubes being externally cone shaped, the upper ends of said tubes extending above said bottom and into the interior of said chamber, said upper ends being disposed at a horizontally inclined angle whereby the opening to the interior of said tubes is disposed in a plane intersecting and non-parallel to the liquid level of said material in said chamber, a pump for withdrawing material from said melting pot, a conduit leading from said pump to one end of said chamber, a return conduit leading from the opposite end of said chamber to said melting pot, an endless belt having one end located underneath said lower ends of said tubes, and means for moving and cooling said endless belt.

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