Dec. 5, 1933. G. ECKERBOM 1,938,219

MEANS FOR DIVIDING SUBSTANCES IN LIQUID STATE INTO DROPS

Filed June 11, 1929

Fig. 1.

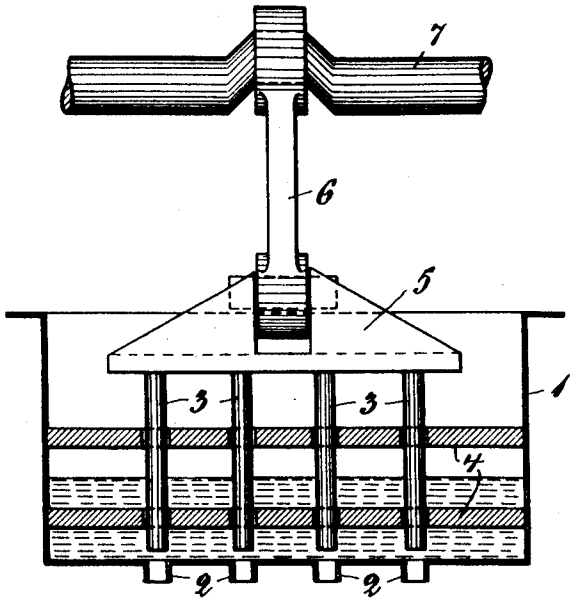
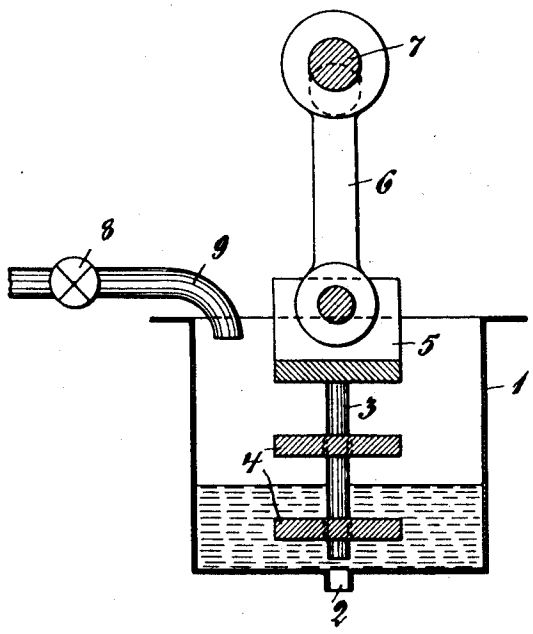


Fig. 2.



G. Eckerbom
INVENTOR

By: Marks & Clerk
ATTYS.

Patented Dec. 5, 1933

1,938,219

UNITED STATES PATENT OFFICE

1,938,219

MEANS FOR DIVIDING SUBSTANCES IN LIQUID STATE INTO DROPS

Gustaf Eckerbom, Sandvik, near Stockholm, Sweden, assignor to Stockholms Benmjolsfabriks Aktiebolag, Sandvik, Stockholm, Sweden

Application June 11, 1929, Serial No. 370,112, and in Sweden June 14, 1928

5 Claims. (Cl. 221—1)

When substances in liquid state at normal temperature are to be divided into drops it has hitherto been usual to introduce the liquid in a vessel the bottom of which has been provided with holes of a size adapted for the nature of the liquid in question. Such a disposition is in some respects inexpedient and has amongst other things the disadvantage that the formation of the drops is very irregular. In order to eliminate this disadvantage it has been proposed to insert in each hole a pin of suitable length and of a certain diameter so as to allow the liquid to pass along the pin and to gather at its lower end in the shape of a drop which, when grown to a certain size has fallen from the pin. With such an arrangement it is, however, not possible to obtain a very rapid formation of drops nor it is possible to appreciably regulate the rapidity in forming the drops as this is dependent on the size of the holes, the shape of the pin and the physical quality of the liquid, all being conditions that are constant for each apparatus and each liquid.

In industries concerned in the production of drops of uniform shape and size it is of great importance that the drops are generated with the greatest possible rapidity and also that it is possible to effectively regulate the velocity with which the drops are generated. The importance of such a regulation will be evident, when the drop generating device is to cooperate with other power driven arrangements which in its order are under the action of other sources.

The present invention relates to an improvement in the above indicated method whereby it will be possible not only to obtain a more rapid formation of drops of uniform shape and size but also to regulate the rapidity in generating the drops.

The kind of liquid to which the previously known and above mentioned method has reference is a glue solution and it is also to such a solution this invention has particular reference although, of course, other liquids of suitable kind may be treated in accordance with this invention. When a glue solution is to be divided into drops in accordance with this invention it may be prepared from glue water in any known and convenient manner. The consistency of such a solution will vary, as is well known, with variations in the quantities of glue and water used. An increase of the quantity of glue in proportion to the water will make the solution thicker at ordinary temperature but it is also well known that such solution will be less thick when subjected to a higher temperature. Any known and convenient method of raising the temperature of the liquid in the vessel and of maintaining the same at the desired temperature may be used in this connection.

A suitable liquid, for instance a glue solution, having once been prepared and suitable means provided for maintaining the same at a desired temperature in order that it may be of proper consistency, the liquid is then kept in that condition during the period the liquid is being divided into drops.

A method according to this invention consists therein that the liquid such as a glue solution of proper consistency as above indicated is allowed to enter into holes or apertures in the bottom of the vessel containing the liquid, and as soon as the desired quantity of the liquid has entered into each hole or aperture a rod adapted to said hole or aperture is introduced into the same, whereby on the one hand a further quantity of the liquid is prevented to enter into said hole or aperture during the time the rod remains in the same and on the other hand the liquid that has come into the hole or aperture will be pushed out of the same.

The invention will be better understood in connection with the accompanying drawing, in which merely for purpose of illustration has been shown a form of apparatus in which the invention may be embodied and in which the apparatus is shown diagrammatically from two different sides, Figs. 1 and 2, partly in section.

1 designates the vessel preferably made of sheet metal as shown and containing the liquid to be divided into drops. The thin bottom of the vessel is provided with a number of holes or apertures 2, from each of which extends a spout of the same interior shape and area as the hole or aperture. Centrally above each hole or aperture there is a rod 3 adapted to the same and the spout and movable in its longitudinal direction. All the rods traverse and are guided during their up- and down-motion by two cross bars 4 placed the one above the other inside the vessel. The upper ends of the rods are secured to a head 5 carried by the lower end of a connecting rod 6 the upper end of which is connected to, for instance, the crank of a crankshaft 7 or some other device that is capable of imparting the desired movement to the head and the rods 3.

The different parts of the described apparatus are so devised that at each revolution of the crankshaft the lower ends of the rods 3 once will be a certain distance above the bottom of the

vessel. The while the lower ends of the rods 3 are above the bottom is evidently dependent upon the speed of rotation of the crankshaft, while the quantity of liquid that during this time may enter into each hole or aperture is on the one hand dependent upon the consistency of the liquid and on the other hand up the height of the level of the fluid above the bottom of the vessel, provided that the lower ends of rods then are at a certain distance from the bottom. The speed of rotation of the crankshaft as well as the height of the level of the liquid having once been so determined in respect of a liquid of a certain consistency that the quantity of liquid required for each drop then is entering into each hole or aperture and spout, it is only necessary to continually keep the level of the liquid in the vessel at the same height which may suitably be done by adjusting a valve 8 in the pipe 9 through which the liquid is admitted to the vessel.

As long as the determined speed of rotation of the crankshaft is maintained and the liquid is kept at the same level in the vessel and the consistency of the liquid incessantly is the same the drops will evidently be produced at a certain rapidity, in as much as each rod 3 during each revolution of the crankshaft will eject from the spout the quantity of liquid in the same which is forming a drop of desired size.

The rapidity with which the drops are produced may evidently be increased by increasing the speed of rotation of the crankshaft, in which case the level of the liquid in the vessel must be raised in such a degree that the requisite quantity of liquid may, in consequence of the increased pressure of the liquid at the bottom of the vessel, be able to enter into the spout during the reduced period the end of the rod is above the bottom of the vessel, and at the same time it is evidently also necessary that a proportionally larger quantity of the liquid is admitted to the vessel.

Of the above it will be easily seen that the rapidity with which the drops are produced may be decreased by decreasing the speed of rotation of the crankshaft and decreasing the height of the level of the liquid in the vessel and also decreasing the quantity of liquid admitted to the vessel.

The quantity of liquid admitted to the vessel may suitably be adjusted by hand as a change in that respect is not to be reckoned with as long as the drops are produced at the same rapidity and the rapidity once established generally remains unaltered during comparatively long time. When an alteration of said rapidity more frequently has to take place the quantity of liquid admitted to the vessel may be adjusted with the aid of any convenient mechanical device (not shown), for instance, a centrifugal regulator acting upon the valve in the pipe 9.

In the drawing are shown only four drop producing elements diagrammatically. The apertures 2 and the small tubes arranged in connection with the same are in reality of a comparatively small diameter, but have, for the sake of clearness been drawn to a larger scale, in consequence whereof also the rods 3 are in the same degree enlarged. Obviously the size of the apertures 2 must in the first place be adapted to suit the consistency of the liquid to be dealt with, so that just that quantity of the liquid which enters into the aperture while the corresponding rod is in the elevated position is the quantity requisite to form a drop when the rod descends in the aperture and ejects the liquid therein out of the same. The size of each aperture is thus rather small and the corresponding rod consists only of a comparatively slender wire. At the moment when the quantity, requisite for the drop, is in the aperture 2 and the tube associated therewith, the end of the rod 3 enters into the aperture and while moving downwards the end of the rod will push the liquid in the tube downwards. In order that the drop may not fall from the end of the tube the rod continues in its downward movement until its end reaches or preferably somewhat surpasses the end of the tube. The rod, which, as mentioned above, is of a very small diameter maintains the divided off portion of the liquid in a state of suspension, said portion adhering only to the end of the rod. On account of the very small sectional area of the rod compared with the weight of the ejected drop the latter will invariably fall at the moment the rod changes its direction of movement and again moves upwards.

The ejected drops are preferably allowed to fall on a movable path upon which is applied a layer of some suitable powder or into a suitable liquid of suitable temperature and thereafter brought together as set forth in the U. S. Patent No. 1,759,737.

When an apparatus is to be built for use in the industry a great number of said elements are arranged together. Apparatus according to this invention and of such a character have been built and provided with such elements up to a number of 1008 with which 1008 drops simultaneously have been obtained. At a normal speed this apparatus delivers no less than 151,200 drops a minute. These drops are of exactly the same size and fall at predetermined uniform intervals. Apparatus of this kind, which have been found useful in the manufacture of glue in small pieces in the shape of granules or drops, may be used wherever a liquid has to be divided into drops on an industrial scale, for instance in the chemical and pharmaceutical industry, in factories for the manufacture of lozenges and the like.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. Apparatus for dividing a substance liquid at normal temperature into drops, comprising a sheet metal vessel provided with a plurality of apertures in the bottom thereof, and corresponding spouts extending below the bottom of the vessel and having unrestricted apertures therethrough, a plurality of parallel rods mounted for vertical movement in the vessel in line with the apertures, and means for imparting reciprocating movement to said rods whereby during their upward movement they rise above the bottom of the vessel and during their descent they pass through said apertures and spouts.

2. Apparatus for dividing a substance liquid at normal temperature into drops, comprising a sheet metal vessel provided with a plurality of apertures in the bottom thereof, a plurality of parallel rods mounted for vertical movement in the vessel in line with the apertures, and means for imparting reciprocating movement to said rods whereby during their upward movement they rise above the bottom of the vessel and during their descent they pass through said apertures, and tubular members carried by the bottom of the vessel having unrestricted orifices therein communicating with the apertures.

3. Apparatus for dividing a substance liquid at normal temperature into drops, comprising a sheet metal vessel provided with a plurality of un-

restricted apertures in the bottom thereof, a plurality of parallel rods mounted for vertical movement in the vessel in line with the apertures, and means for imparting reciprocating movement to said rods whereby during their upward movement they rise above the bottom of the vessel and during their descent they pass through said apertures, said apertures being arranged in a line along the bottom of the vessel.

4. Apparatus for dividing a substance liquid at normal temperature into drops, comprising a sheet metal vessel provided with a plurality of unrestricted apertures in the bottom thereof, a plurality of parallel rods mounted for vertical movement in the vessel in line with the apertures, and means for imparting reciprocating movement to said rods whereby during their upward movement they rise above the bottom of the vessel and during their descent they pass through said apertures, said apertures being arranged in a line along the bottom of the vessel, and means arranged in the tank to guide the movement of said rod.

5. Apparatus for dividing a substance liquid at normal temperature and of suitable consistency into drops, comprising a thin-walled vessel adapted to contain the liquid substance and provided with a plurality of apertures with spouts on the bottom thereof, a plurality of parallel rods mounted for vertical movement in the vessel in line with the apertures and movable through the spouts, guide members in the vessel for said rods, means for imparting reciprocating movement to the rods at a velocity sufficient to cause the release through said spouts of a drop of the liquid substance collected on the end of each rod at the change of direction of movement of said rod, and a device adapted to continually supply such liquid substance to the vessel in quantities equal to the amount drained off through the spouts.

GUSTAF ECKERBOM.