Sept. 2, 1930. W. H. WHATMOUGH 1,774,910

APPARATUS FOR THE PRODUCTION OF DISPERSIONS OF SOLIDS IN LIQUIDS

Filed Oct. 4, 1928

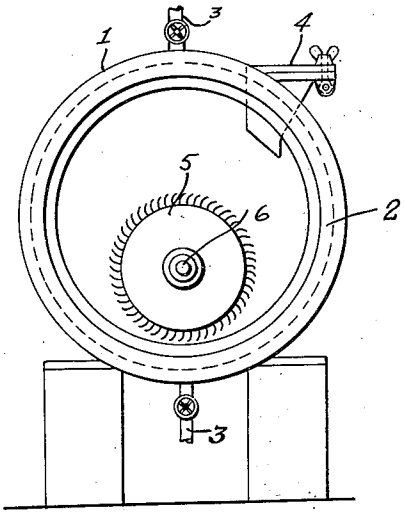


Fig. 1.

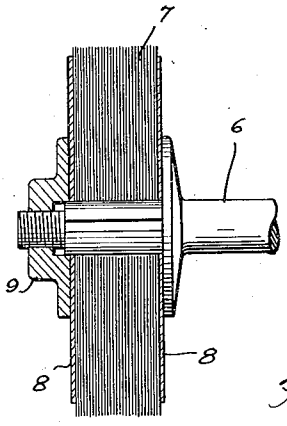


Fig. 2.

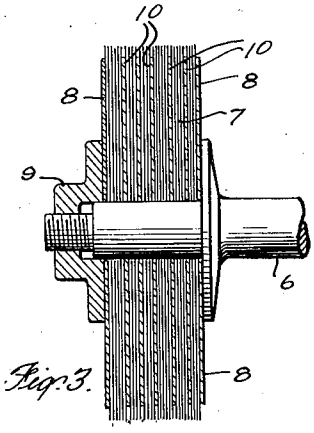


Fig. 3.

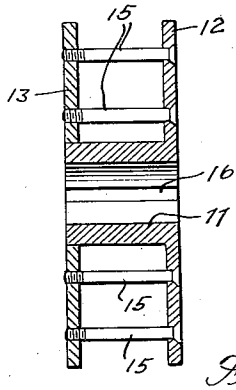


Fig. 4.

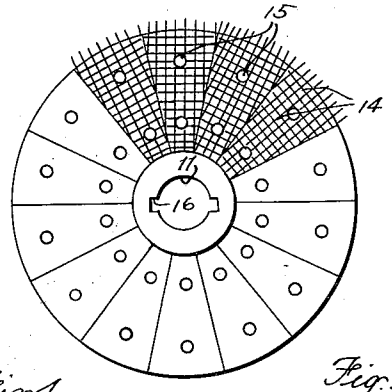


Fig. 5.

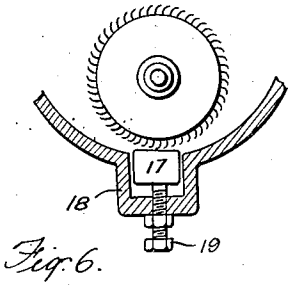


Fig. 6.

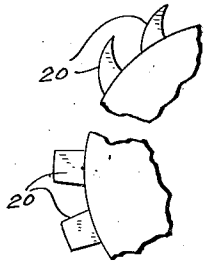


Fig. 7

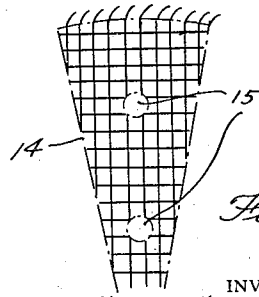


Fig. 8.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR THE PRODUCTION OF DISPERSIONS OF SOLIDS IN LIQUIDS

Application filed October 4, 1928, Serial No. 310,232, and in Great Britain October 14, 1927.

This invention relates to an improved process and apparatus for the dispersion of solids, especially amorphous aggregates in liquids. The invention is particularly suitable for the production of dispersions of colours in oil to produce highly concentrated or pasty masses suitable for printing inks and the like.

Attempts have been made to produce highly concentrated dispersions of pigments or colours in oil by the aid of high speed mills such as the Plauson mill or the Premier mill. Extensive investigations into the operation of such high speed apparatus has shown that it is not possible to reduce all the solid particles to such small size that they will remain dispersed indefinitely in the oil unless the grinding is prolonged for an excessive length of time. The mixture after treatment appears to contain a large number of globules which appear to be somewhat elastic in their properties and are not further broken down in the high speed mill, except under very prolonged and expensive treatment.

In my Patent No. 1,698,354, granted upon a co-pending application I have described a method of dispersion of amorphous aggregates while suspended in liquid by causing such aggregates to impinge upon a reticulated body. As an example of such body wire gauze was mentioned.

It has now been found that effective dispersion of amorphous aggregates in liquids can be effected by causing such aggregates, while suspended in liquid, to impact at high speed upon a body formed with a very large number of fine points or projections. Preferably there is employed a beater member adapted to be rotated at high speed and having on its surface a large number of fine points or projections which may be pointed or cut to knife edges if desired. These projections moving at high speed through the liquid appear to exert a peculiar disruptive action upon the aggregates of fine particles which are thereby broken down to form substantially stable suspensions of the solid in liquid.

The process of dispersing amorphous aggregates in liquids according to the present invention consists in causing such aggregates while suspended in liquid to impact at high speed upon a body formed with a very large number of fine points or projections. Thus a beater mounted in a liquid-tight casing and having on its surface a large number of fine points or projections may be rotated at high speed in the liquid.

The invention also includes the apparatus for carrying out the process.

In constructing apparatus suitable for the present invention it is necessary to insure that the projections have adequate support and mechanical strength to effect an adequate beating action upon the liquid. It has been found that a suitable beating member for the present invention can be formed from wire gauze. If one or two strands are removed from one side of a piece of gauze the wires in the other direction will project as a series of points.

Such a piece of gauze may be rotated edgewise in the liquid, but it is preferred to employ a plurality of such pieces of gauze so as to form a laminated body provided on its periphery with a large number of pointed projections. These projections may be cut to a point or knife-edge if desired.

The preferred apparatus according to the present invention comprises a liquid tight casing having a rotor adapted to be rotated within the casing and preferably eccentrically mounted in the casing. The rotor is formed as a laminated structure from a plurality of pieces of wire gauze so that the periphery is provided with many hundreds of small projections and resembles in appearance a teazle brush. Suitable baffles may be provided on the interior face of the casing so as to guide the material to be treated on to the face of the rotor.

Various suitable forms of apparatus are illustrated in the accompanying drawings in which:—

Figure 1 is an elevation of mill with the front removed showing the rotor in position.

Figures 2 and 3 are side sectional elevations of two forms of rotor.

Figure 4 is a side sectional elevation of a suitable bush on which may be assembled segments of wire gauze to form a beater.

Figure 5 is a front elevation of a beater assembled on the bush shown in Figure 4.

Figure 6 is a detail view of the lower part of a mill showing an adjustable baffle.

Figure 7 is an elevation showing two forms of saw-blade rotor.

Figure 8 is a detail view of one of the segments in the rotor shown in Figure 5 modified by inclining the projections.

In the drawings 1 is the casing of the mill provided with a cooling or heating jacket 2 provided with inlets or outlets 3 for cooling or heating fluid. The amorphous solid suspended in liquid is fed in at 4 and the finished material may be removed through an outlet (not shown) in the back of the casing.

A rotor 5 provided with a large number of fine projecting points is mounted on a shaft 6 and is adapted to be rotated at high speed.

This rotor 5 may be formed as shown in Figure 2 by superimposing a large number of layers of wire gauze 7 between plates 8 and securing them on the shaft 6 by means of a nut 9. A few transverse strands of wire from the edge of each sheet are removed so that the outwardly directed strands project as points from between the plates 8. In the form shown in Figure 3 further reinforcing plates 10 are provided.

In another form of rotor a bush 11 shown in Figure 4 is provided with a back plate 12 and a detachable front plate 13. The wire gauze is cut in segments 14 and these are superimposed and secured between the plates 12 and 13 by bolts 15 as shown in Figure 5. The bush 11 is then mounted on the shaft 6 by means of the keyways 16 and nut 9. The wire strands project from the periphery of the rotor substantially radially as shown.

A small baffle 17 may be mounted in a recess 18 at the bottom of the casing 1 adjustable by the set screw 19, but otherwise the casing is substantially free from projections which intercept the flow, i. e., its walls are substantially smooth as clearly shown in Figures 1 and 6.

Figure 7 shows two forms of saw blade of very thin metal having fine teeth 20 which may be employed in place of wire mesh to form the rotor.

Figure 8 shows the manner in which the projecting strands of wire may be bent forwardly in the direction of rotation of the rotor.

Two or more rotors may be mounted in one casing if desired and one or more baffles, water-cooled or not may be provided.

The wire gauze employed may be from 5 mesh to 60 mesh as desired and different meshes may be combined in one rotor. The front and back plates of the rotor may be of $\frac{3}{16}$ inch steel. In the case of stout gauze such as 5 mesh the steel plates can be of smaller diameter and the wire strands may project up to 1″ from the periphery of the plates. Where finer gauze such as 50 mesh is employed owing to its greater weakness the projection can only be up to about ¼″.

It is found that when the strands are inclined so that the points meet the liquid with a hooking motion a higher degree of dispersion is obtained with the development of a higher temperature.

In dispersing bronze blue in oil the following mixture was taken:—1 lb. canauba wax, 1 lb. petroleum jelly, 1 lb. mineral oil, 3 lbs. colour.

The test for undispersed unground colour consisted in keeping this 6 lbs. of ground mixture melted at a constant temperature of 110 degrees centigrade. This was done in an oil bath protected from draughts, and the mixture was allowed to settle undisturbed for two hours. The supernatant liquid was then poured off, and the residues washed and settled hot 3 times with paraffin oil, and a final time with petrol. The weight of the dried residues with this comparative test would give the amount of undispersed colour in each 6 lb. experiment.

On treatment in a mill having a rotor formed of circular disc of wire mesh the following results were obtained after 5 minutes grinding:—At 3000 revolutions per minute 6% residue, at 4000 revolutions per minute 5% residue, at 5000 revolutions per minute 4% residue.

Employing a rotor built up of segments of gauze having the projections inclined towards the liquid the following results were obtained after 5 minutes grinding:—At 3000 revolutions per minute 3–4% residue, at 5000 revolutions per minute 2–3% residue.

It was found inadvisable in the case of bronze blue to employ speeds over 3000 revolutions per minute owing to temperature difficulties but in the case of other colours such as mineral blacks or by employing very intensive cooling higher speeds can be employed.

The invention is not limited to the above described preferred forms which can be modified without departing from the scope of the appended claims.

I declare that what I claim is:

1. Apparatus suitable for dispersing amorphous aggregates in liquid, comprising a liquid-tight casing, means to feed liquid thereto, means to deliver liquid therefrom, a rotor mounted therein adapted to be rotated at high speed and a large number of fine projections extending from the surface of said rotor, into a space around the rotor not intercepted by any stationary projections.

2. Apparatus suitable for dispersing amorphous aggregates in liquid, comprising a liquid-tight casing, means to feed liquid thereto,

means to deliver liquid therefrom and a rotor mounted therein adapted to be rotated at high speed and formed from superimposed layers of wire mesh having a large number of strands of wire projecting therefrom.

3. Apparatus suitable for dispersing amorphous aggregates in liquid, comprising a liquid-tight casing, means to feed liquid thereto, means to deliver liquid therefrom, a rotor mounted therein adapted to be rotated at high speed and a large number of fine projections on said rotor inclined forwardly in the direction of rotation.

4. Apparatus suitable for dispersing amorphous aggregates in liquid comprising a liquid-tight casing, means to feed liquid thereto, means to deliver liquid therefrom, and a rotor mounted therein formed by a pair of end plates and superimposed layers of wire mesh secured therebetween with strands of wire projecting from the periphery.

5. Apparatus suitable for dispersing amorphous aggregates in liquid comprising a liquid-tight casing, means to feed liquid thereto, means to deliver liquid therefrom, and a rotor mounted therein formed from segments of superimposed layers of wire mesh secured between plates and having a large number of strands of wire projecting substantially radially.

6. In apparatus suitable for dispersing amorphous aggregates, a rotor adapted to be rotated at high speed comprising a spindle and a plurality of sheets of wire gauze keyed thereon and secured together into a composite element from which project a plurality of strands of wire.

7. In apparatus suitable for dispersing amorphous aggregates in liquid, a rotor adapted to be rotated at high speed comprising a spindle, a bush secured to said spindle, end plates on said bush and a plurality of sheets of wire gauze mounted on said bush and secured between said end plates with a plurality of strands of wire projecting from the edges of said sheet.

8. In apparatus suitable for dispersing amorphous aggregates in liquid, a rotor adapted to be rotated at high speed comprising a spindle, a bush secured to said spindle, end plates on said bush and a plurality of segments of superimposed sheets of wire gauze on said bush and secured between said end plates with a plurality of strands of wire projecting substantially radially of said bush.

9. In apparatus suitable for dispersing amorphous aggregates in liquid, a rotor adapted to be rotated at high speed comprising a spindle, a bush secured to said spindle, a fixed end plate and a detachable end plate on said spindle, bolting means securing said detachable end plate to said fixed end plate, a plurality of segments of superimposed sheets of wire gauze secured between said end plates and transfixed by said bolting means and a plurality of strands of wire projecting substantially radially of said bush.

10. Apparatus suitable for dispersing amorphous aggregates in liquid comprising a liquid-tight casing, means to feed liquid thereto, means to deliver liquid therefrom, a rotor mounted therein adapted to be rotated at high speed and carrying a large number of fine projections on its periphery and baffle means to guide material to be treated into the path of said beater.

11. Apparatus suitable for dispersing amorphous aggregates in liquid comprising a liquid-tight casing, means to feed liquid thereto, means to deliver liquid therefrom, a rotor mounted therein adapted to be rotated at high speed and formed from superimposed layers of wire mesh having a large number of strands of wire projecting therefrom, and baffle means to guide material to be treated into the path of said beater.

12. Apparatus suitable for dispersing amorphous aggregates in liquid comprising a liquid-tight casing, means to feed liquid thereto, means to deliver liquid therefrom, a rotor mounted therein adapted to be rotated at high speed and formed from superimposed layers of wire mesh having a large number of strands of wire projecting therefrom, and baffle means adjustable externally of said casing to guide material to be treated into the path of said beater.

13. Apparatus adapted for dispersing amorphous aggregates in a liquid which comprises means providing a channel for a stream of the liquid bearing said aggregates, a rotor adapted to rotate at high speed with at least a part of its periphery in said channel and a large number of fine projections extending from the periphery of said rotor into a part of said channel and a large number of fine projections extending from the periphery of said rotor into a part of said channel not intercepted by any stationary projections of the apparatus.

14. An apparatus as defined in claim 13, in which the rotor is not concentric with the opposite side of the channel.

15. An apparatus as defined in claim 13, in which the sides of the channel are stationary.

16. An apparatus as defined in claim 13, in which the sides of the channel are substantially smooth.

In witness whereof, I have hereunto signed my name this 21st day of September, 1928.

WILLIAM HENRY WHATMOUGH.