Nov. 13, 1945. A. R. TRIST 2,389,012

MEANS FOR THE COLLOIDAL DISPERSION OF MATERIALS

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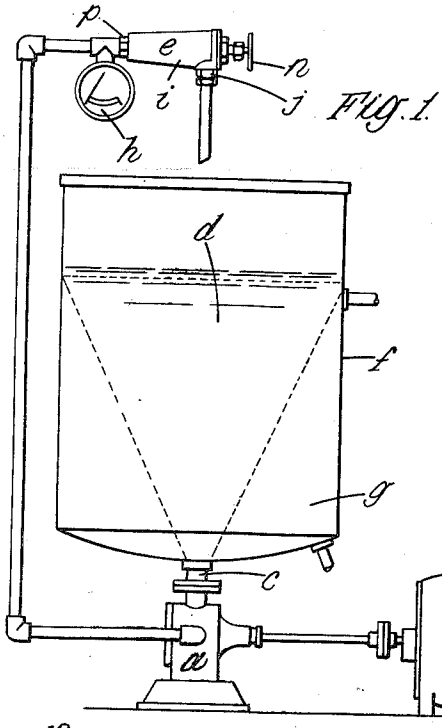


Fig. 1.

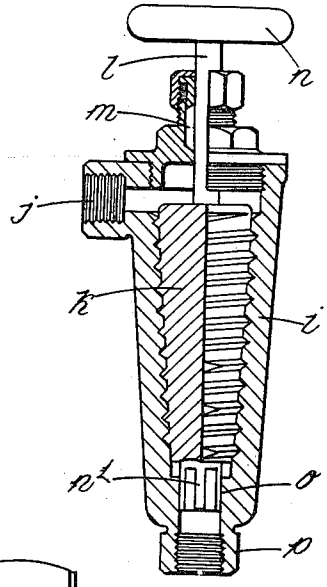


Fig. 3.

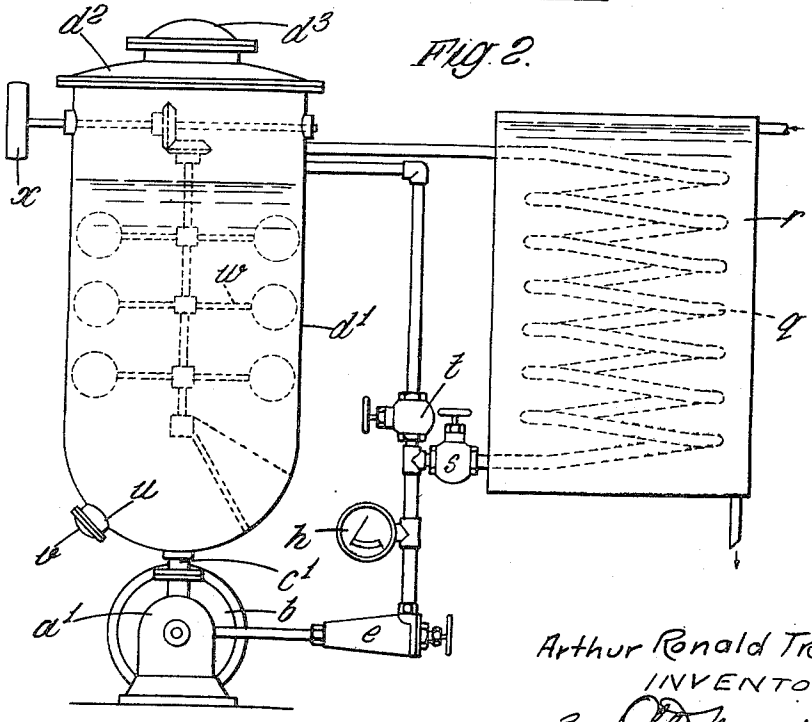


Fig. 2.

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MEANS FOR THE COLLOIDAL DISPERSION OF MATERIALS

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Application December 30, 1942, Serial No. 470,704
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4 Claims. (Cl. 252—359)

This invention relates to a new and improved process for the colloidal dispersion of materials and has for its object to produce a very large variety of oil or water phase emulsions of great stability, in an efficient, practical and economical manner.

The invention contemplates the production of oil or water phase emulsions in which the particle size can be less (when required) than that which occurs in nature made latex emulsions.

The invention also contemplates the use of novel, simple and comparatively inexpensive devices of a character suited to industrial use and which with the elements or units of the complete installation, form a novel combination, the constituent parts of which co-operate to apply the novel process in a practical way.

The invention further contemplates treatment in two stages, both of which comply with the same theoretical basis, although the products are dissimilar in some respects.

Generically the invention is characterised in that colloidal dispersion of a high order is obtained in a liquid mixture, by applying kinetic energy under controlled pressure to create very active molecular turbulence accompanied by a controlled rise in temperature of the associated materials, said materials being circulated through the kinetic energiser and the turbulence producing means until the particle size is sufficiently reduced and the excess of heat is more or less abstracted.

When implemented, the circuit comprises a power operated pump, a flow impediment or resistance, a heat interchanger and canalisation, but does not necessarily involve a sealed circuit; the only limitations being that the parts selected will produce the defined result.

To control performance a pressure gauge is located in the canalisation between the pump delivery and the flow impedance and in a general way, it may be assumed that the value of the impediment is such that no difference of pressure exists in the heat exchanger.

As already stated, the process usually includes two stages, each of which produces a different result, the second stage producing an emulsion, whilst the first stage produces a favorable predispersion of certain of the constituents of the emulsion.

The invention can be carried into practice by many different mechanical constructions and therefore the arrangement described and shown in the accompanying drawing must be regarded as by way of example only, and in order that the description may be understood reference will be had to the several figures of the drawing and to the letters marked thereon, like letters referring to like or similar parts in the different figures in which—

Figure 1 shows schematically an arrangement for carrying out the first stage;

Figure 2 shows schematically an arrangement for carrying out the second stage; and

Figure 3 is a sectional elevation of one kind of flow impediment or resistance suited to the improved process.

As shown in Figure 1 the arrangement of the predispersing means consists of a pump *a* of any kind having a delivery pressure of about three hundred pounds per square inch and capable of imparting the required kinetic energy to the liquid being pumped, that is to say, the pump *a* may have a rotor or plungers but preferably should be a rotary impeller type of pump (turbo) inasmuch as such a pump has no valves or other loose parts likely to introduce difficulties.

The pump *a* is operated by the motor *b*, such for example as an electromotor or a steam turbine, has its suction *c* connected to the tank *d* and delivers through the homogenising valve *e*.

The contents of the tank *d* usually have to be cooled and to that end it has been shown in the form of a cone disposed within a cylindrical casing *f* to which it is attached to form the water jacket *g*, but obviously any other form of heat exchanger of appropriate kind can be used. The tank *d* is not provided with a cover and receives the discharge from the valve *e*, the pipe connecting the pump *a* to the valve *e* having a pressure gauge *h* so that the valve *e* can be adjusted to give the required impediment.

The valve *e* as shown by way of example in Figure 3 consists of a body *i* having a discharge branch *j* and an internally threaded taper bore in which is located an externally threaded taper plug *k*. The plug *k* is provided with a stem *l* at its upper part, passing through a stuffing box *m* in the upper part of the body *i* adjacent to the discharge branch *j* and having an externally disposed hand wheel *n* thereon so that the plug *k* can be rotated in the body *i* to increase or decrease the impediment by adjustment of the width of the helical passage between the threads and to steady the lower end of the plug *k*, such end is provided with a grooved prolongation n^1 which co-operates with the cylindrical bore *o* in the inlet branch *p* of the said body *i*.

As shown in Figure 2 the homogeniser or emulsifier consists of a pump a^1 (having similar char-

acteristics to those of the pump a), a motor b and a closed chamber d^1 connected to the suction c^1 of the pump a^1.

The delivery of the pump a^1 is connected to a homogenising valve e the discharge j of which is connected, on the one hand, to a heat interchanger coil q immersed in a suitable liquid contained in the tank r, and on the other hand, to the upper part of the chamber d^1.

The discharge end of the coil q is connected to the upper part of the chamber d^1, valves s and t controlling the volume of the flows directly to the chamber d^1 by the valve t and indirectly to the chamber d^1 by the valve s through the coil q so that the temperature of the liquid in the chamber d^1 can be maintained at any desired level.

The chamber d^1 has a closely fitting cover d^2 which may be removed for charging purposes, or in a large installation a door such as d^3 may be provided and further the chamber d^1 is provided usually at its lower part, with a discharge spout u and cover v.

To ensure that the sequentially treated liquid supplied to the chamber d^1 is properly intermingled a stirring apparatus, such as w, may be housed in said chamber and operated for example by the pulley x.

As in the case of the predispersing means a pressure gauge h is included in the pipe carrying the discharge from the valve e in order that the valve e may be adjusted to give the particular impediment required.

It will be understood that the valve e may be modified in a variety of ways; for example, the thread on the plug k may be mutilated, that is to say, be interrupted locally here and there, perhaps on alternate threads; or the shape of the thread in the bore may be slightly different to the shape of the thread on the plug, and it will be self-evident that the thread may be angular, circular, square, or of buttress shape so that materials of different kinds and viscosity can be handled in a proper manner.

By way of example it may be assumed that a pigmented petroleum emulsion is to be produced.

In the first place, the petroleum, pigment, catalyst, polymer, resin and so on, are placed in the tank d and forced through the valve e by the pump a back into the tank d, which by virtue of the waterjacket g acts as a heat exchanger, the degree of generated heat and the zone of activity of the molecular turbulence due to the dissipation of kinetic energy being judged by the pressure generated whilst the reactions of the ingredients is provided for by the volume of the heat interchanger, which determines the length of the period of time during which the temperature of the ingredients is being decreased or increased; usually the desired result is obtained with a pump discharge pressure of about two to three hundred pounds per square inch, a delivery pressure as shown by the gauge h of about one hundred pounds per square inch, a delivery temperature from the valve e of about one hundred to one hundred and twenty Fahrenheit degrees, and a delivery temperature from the tank d of about sixty-five to seventy Fahrenheit degrees.

Sometimes improved results can be obtained by predispersing two or three ingredients together, and predispersing such mixture with other ingredients, it being understood quite clearly that ultimately a predispersed mixture is obtained in which the maxima of chemical, physical and electronic reactions have taken place, all the particles are predispersed colloidally and the size of the particles is as small as desired at this stage.

Such a predispersed mixture is ready for actual emulsification with water, and for that purpose is introduced into the chamber d^1 which is then closed by the cover d^2, and the stirring apparatus w is set in motion.

As already explained, the circuit in this stage of operation comprises the power operated pump a^1, the homogenizing valve e, the heat exchanger q, the chamber d^1, and valves s and t, by which the flow from the valve e can be led directly to the chamber d^1, or to the heat exchanger coil q, from whence it passes to the chamber d^1, the periods of time during which the mixture is in the chamber d^1 (being beaten or not) and in the heat exchanger coil q (being heated or cooled) being determined by the volume of the several units, and as before, neither the heat exchanger coil q nor the chamber d^1 are under any appreciable rise in pressure.

By this arrangement of parts kinetic energy is applied to the mixture and water under controlled pressure, as indicated by the gauge h, to create very active molecular turbulence. accompanied by a controlled rise in temperature of the associated materials whilst said materials are circulating in a closed circuit which sometimes comprises: pump a, homogenizing valve e, tank d, pump a and so on, and sometimes comprises: pump a^1, homogenizing valve e, heat exchanger coil q, chamber d^1, pump a^1 and so on, the valves s and t controlling the dual flow directly and the thermal interchange indirectly.

This process of kinetic colloidalisation enables a very wide choice of materials and the proportions thereof to be made, the polarity of the charges on the particles to be controlled, and the particle size to be reduced with great ease; the implementation being of such a simple kind that it can be arranged without any difficulty to avoid loss of volatiles, thereby constituting a new method which can be practised by means of greater adaptability, and of simpler construction than known contrivances such as hydraulic homogenisers, colloid mills and such like.

I claim:

1. Improved means for the colloidal dispersion of materials comprising a heat exchanger, a high speed pump receiving liquid from said exchanger and delivering said liquid to a homogenising valve consisting of a taper plug having a spiral thread, a threaded taper body co-operating with said threaded plug, means for rotating said plug to vary the width of the helical passage of constant breadth between the confines of the thread and means for conveying the discharge from said passage to said exchanger.

2. Improved means for the colloidal dispersion of materials comprising a heat exchanger, a high speed pump receiving liquid from said exchanger and delivering said liquid to a homogenising valve consisting of a taper plug having an interrupted spiral thread thereon, a threaded taper body co-operating with said plug, means for rotating said plug to vary the width of the helical passage of constant breadth between the confines of the thread and means for conveying the discharge from said passage to said exchanger.

3. Improved means for the colloidal dispersion of materials comprising a high speed delivery pump for imparting kinetic energy to said delivery, a threaded taper body co-operating adjustably with a taper plug having a spiral thread receiving said delivery and converting said kinetic

energy into heat, a heat abstractor, a closed treatment chamber, liquid flow controlling means between said threaded taper body and said heat abstractor, liquid flow controlling means between said threaded taper body and said chamber to bye-pass said heat abstractor and canalisation to form a sealed circuit.

4. Improved means for the colloidal dispersion of materials comprising means for imparting kinetic energy to a fluent mixture, a threaded taper body co-operating adjustably with a taper plug having a spiral thread for receiving said energised fluent mixture for converting said kinetic energy into heat and for delivering a heated fluent mixture without appreciable positive pressure, means for abstracting heat to cool the fluent mixture and means for feeding said cooled fluent mixture to said kinetic energy imparting means to maintain a closed cycle of repeated treatment.

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