April 26, 1938. R. H. RUSSELL 2,115,123

APPARATUS FOR MAKING EMULSIFIED COMPOUNDS AND COLLOIDAL COMPOUNDS

Filed July 20, 1937 2 Sheets-Sheet 1

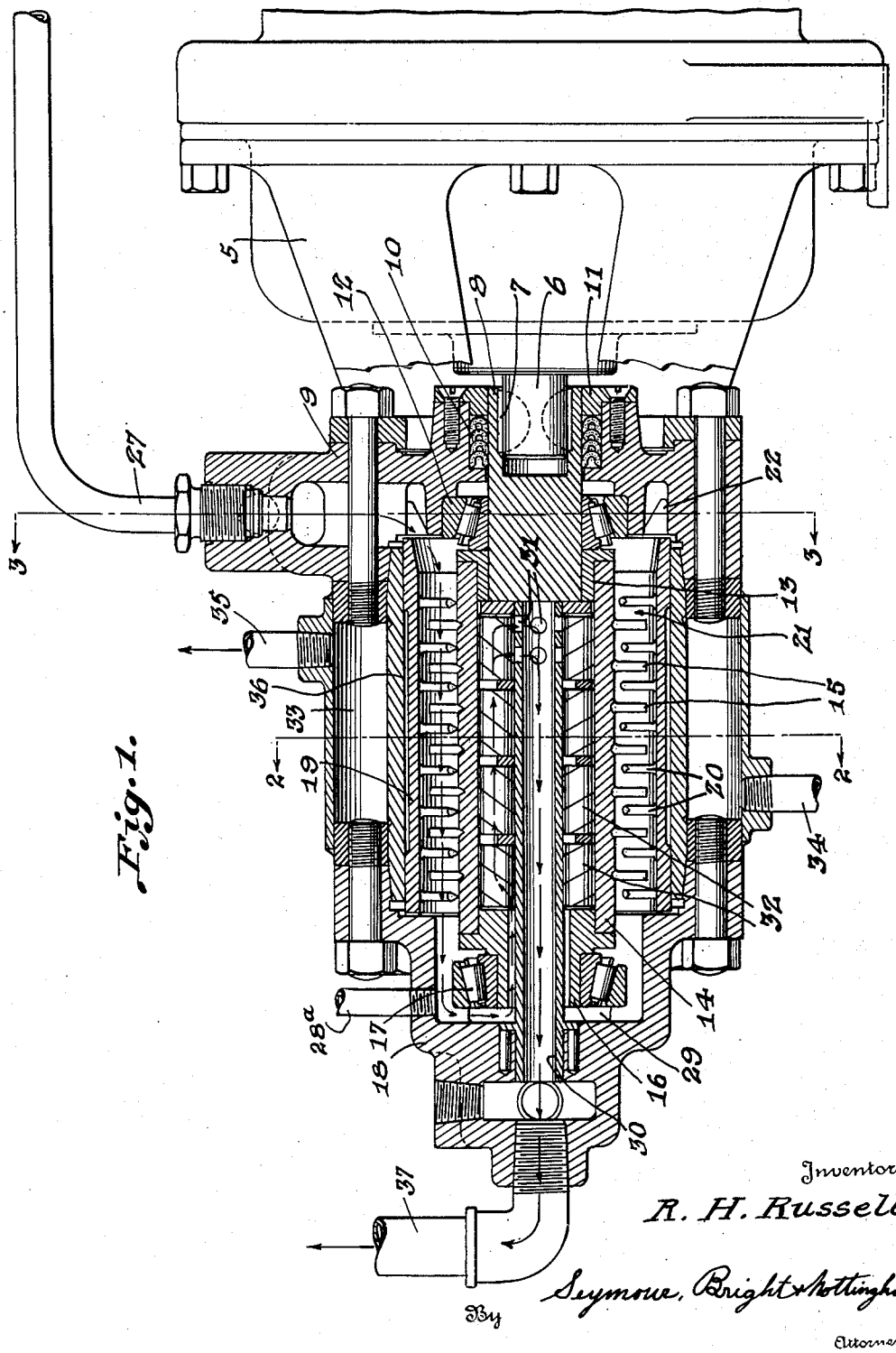


Fig. 1.

Inventor
R. H. Russell
By Seymour, Bright & Nottingham
Attorneys

April 26, 1938. R. H. RUSSELL 2,115,123

APPARATUS FOR MAKING EMULSIFIED COMPOUNDS AND COLLOIDAL COMPOUNDS

Filed July 20, 1937 2 Sheets-Sheet 2

Fig. 4.

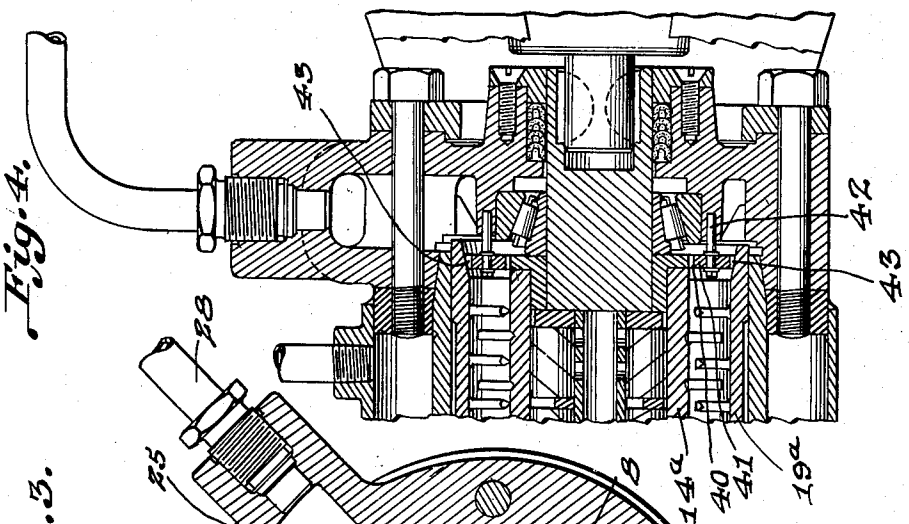


Fig. 3.

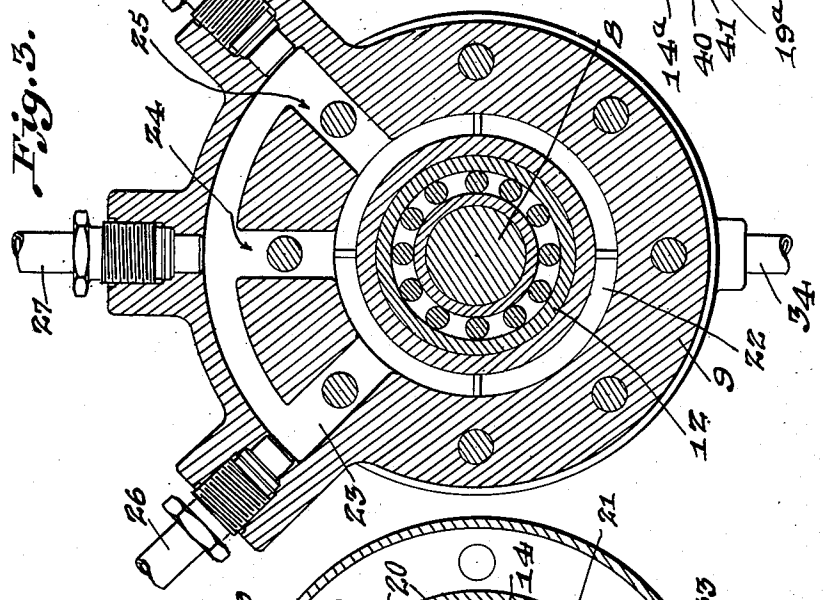
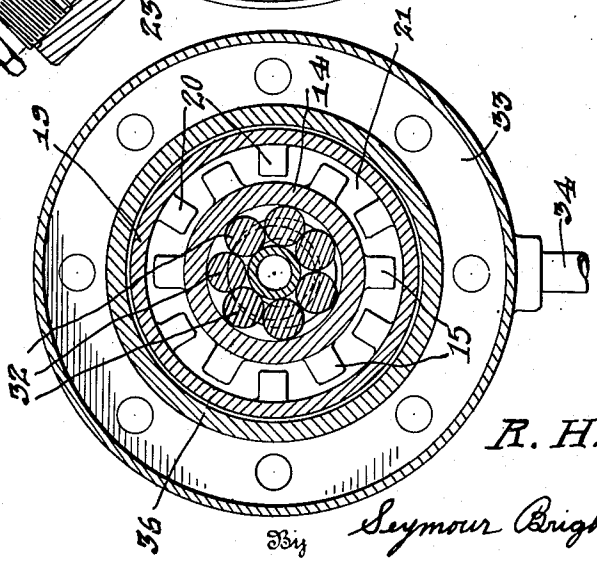


Fig. 2.



Inventor

R. H. Russell

Seymour Bright & Nottingham

Biz

Attorneys

Patented Apr. 26, 1938 2,115,123

UNITED STATES PATENT OFFICE

2,115,123

APPARATUS FOR MAKING EMULSIFIED COMPOUNDS AND COLLOIDAL COMPOUNDS

Robert H. Russell, Cleveland, Ohio, assignor to Gas Fuel Corporation, a corporation of Delaware

Application July 20, 1937, Serial No. 154,652

8 Claims. (Cl. 259—9)

This invention relates to improvements in mixing mills and more particularly to an improved mechanical agitator and compressor of the type disclosed in my application Serial No. 630,151 filed August 25, 1932, patented Jan. 4, 1938, No. 2,104,311.

One of the objects of the invention is to provide a mill adapted for use in various industries for the production of colloids and colloidal mixtures, such as paint, lacquers, emulsions, as well as the manufacture of prepared fuel oil compounds. The improved mill may also be employed for homogenizing, emulsifying, dispersing, blending, pulverizing, and disintegrating various substances to the end that they become stabilized emulsions and colloidal compounds.

The new mill eliminates one moving shaft, that is, the free running shaft shown in the drawings of my above-mentioned application. This is accomplished by attaching the pulverizing arms that were on the idling shaft, as integral elements of the lining cylinder and having them positioned intermediate the arms mounted on the spinning shaft. These projecting arms are distributed around the inner wall in a staggered arrangement to give a dividing and dispersing action to the materials being treated while the latter are being forced through the mill.

A further object of the present invention is to furnish a mill of the general type disclosed in my prior above-mentioned application, but provided with a hollow cylinder having inwardly extending blades and driven in opposite direction to the blades on the spinning shaft.

With the foregoing objects outlined and with other objects in view, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a longitudinal vertical sectional view of one form of the mill and with the motor shown in elevation.

Figs. 2 and 3 are vertical sectional views taken respectively on the lines 2—2 and 3—3 of Fig. 1.

Fig. 4 is a fragmentary longitudinal sectional view showing a structure in which the hollow blade cylinder is driven by the main shaft in a direction opposite to that of the blades on said shaft.

Referring to the drawings, 5 designates means for driving the mill and this means is preferably an electric motor. Its shaft 6 is splined at 7 to a stub shaft 8 that is rotatably mounted in one end portion 9 of the mill, and is sealed by suitable gaskets 10 held in place by a packing gland 11. The stub shaft is preferably journaled in an anti-friction bearing 12, and it is rigidly secured by a ring 13 to one end of an inner hollow shaft or cylinder 14; the latter being provided with external or peripheral blades 15.

The opposite end of the hollow shaft is fixed to a collar 16 rotatable in an anti-friction bearing 17 mounted in the opposite end portion 18 of the casing.

An outer sleeve 19 is fixedly mounted in the casing and is provided with inwardly extending blades 20 which are staggered relatively to the blades 15; the sleeve being spaced from the hollow shaft 14 to provide an annular passageway 21 through which the materials pass while being violently beaten or agitated by the blades.

The end 9 of the casing is provided with an annular groove 22 which communicates with the inlet end of the passageway 21 and receives the materials to be treated, through ducts 23, 24, and 25 (see Fig. 3) respectively, from pipes 26, 27, and 28.

The materials after passing through the beater or passageway 21, travel inwardly along one end of the bearing 17 as indicated at 29, and the mixture then enters the collar 16 and passes into the bore of the hollow shaft 14.

A stationary tube 30 extends from the end 18 of the casing into close proximity to the inner end of the shaft 8 and it is provided at its inner end with apertures 31 to receive the mixture from the bore of the hollow shaft.

The hollow shaft functions to rotate crushing or grinding rollers 32 which roll on the outer surface of the tube 30 and function to compress the mixture as it travels from the beater to the entrance 31 of the stationary tube. Any disintegrating action that is not completed in the beating or cutting portion of the machine is completed in the roller section.

While the mixture is undergoing agitation it can be maintained in heated condition by means of a suitable heating medium which enters an annular jacket 33 through a pipe 34 and is discharged through a pipe 35. Of course, this annular jacket surrounds the stationary cylindrical medial portion 36 of the casing.

The finished mixture is finally discharged through a pipe 37.

In some cases, it is desirable to incorporate a suitable gas or liquid in a vapor phase in the mixture. The amount of gas or vapor introduced and the type or kind of gas or vapor in-

troduced will depend on the characteristics desired in the finished mixture and the purpose for which it is to be used. In making water-oil compounds, such gas may be atmospheric air, CO_2, hydrocarbon gases of the kind utilized and/or produced in the petroleum industry, hydrogen, hydrocyanic acid gas, hydrofluoric acid gas and the like, or mixtures of any such gases. The gaseous agent may be introduced into the inlet end of the chamber 21 but is preferably introduced into the oil-water mixture at some intermediate point in the mill. It may be introduced under pressure, for example through a pipe 28a leading into the end portion 18 of the mill, so that it will be commingled with the water-oil mixture after the latter has passed through the agitating chamber 21 and before it enters the rolling or squeezing portion of the apparatus. The use of gases and vapors is of value in the treatment of metal, where it is desired to subject the heated metal to the action of various gases or vapor in predetermined quantities.

The number of pipes (26, 27, 28, 28a) used for introducing substances into the mill will depend upon the number to be treated, and of course, these pipes will be properly spaced to insure introduction of the materials at the correct points, and in operation some of these substances will be forced under pressure into the inlet end of the annular beating chamber 21 and as they pass along this chamber, they will be violently beaten or cut by the blades which will act to thoroughly agitate the substances and incorporate them into a homogeneous mixture or to disperse them depending on the particular use to which the mill is put. After passing through the beating portion of the mill, the mixture may be admixed or not with a suitable gas, such as air or other gases, and then enters the roller chamber and is tightly squeezed or compressed by the rollers 32 before it is discharged through the stationary tube 30. By means of the jacket 33 the mixture during treatment may be heated and may leave the rollers at any suitable temperature.

In treating hydrocarbon oils and water, either with or without the addition of atmospheric air or other gases, to make liquid-oil compounds, my experiments have shown that the emulsion made by the machine may vary from about 70% oil and 30% water to about 24% oil and 76% water, with varying amounts of air or other gases. Mixtures containing 10% or more of water and less than 90% of hydrocarbon liquid apparently make better fuels.

If the machine is employed for making fuels, the mixture or emulsion of oil and water (with or without the addition of a suitable gas) heated to about 150° F. to 175° F., which is discharged through the pipe 37, may be atomized at high superatmospheric pressure, say from about 300 to 2000 pounds per square inch, into a retort of the kind disclosed in my above-mentioned prior application, where it is burned to create extremely high temperatures.

Instead of using a stationary outer cylinder 19, as shown in Figs. 1 to 3 inclusive, said outer cylinder 19a may be rotated, as illustrated in Fig. 4, in a direction opposite to that of the inner cylinder or hollow shaft 14a. In this embodiment, the inner cylinder is provided with external gear teeth 40 which function to drive toothed pinions 41 mounted on stub shafts 42 and engaging internal teeth 43 in the outer cylinder 19a. Obviously the rotation of the inner cylinder will cause the pinions to rotate the outer cylinder in a direction opposite to that of the inner cylinder, and in this embodiment the blades on one cylinder will be moved in a clockwise direction, while the blades on the other will be moved in the opposite direction.

It is the intention and purpose that these mills be used for the incorporation of pigments or pulverized solids into fluids, chemical vehicles and carriers; emulsification of petroleum oils, fats, resins, vegetable and animal oils; mixing and emulsifying of dye-stuffs, polishers, oil and water colors; pharmaceutical products, cutting and grinding oils; emulsion for the waterproofing of paper and cardboard, and to hasten chemical reactions; increase solubilities; decrease particle size and the dispersion of liquids and solids into substantially permanent compounds; also soaps, rayon cellulose and paper pulps, etc. The machine is especially useful for colloidal work and reactions.

While I have disclosed what I now consider to be preferred embodiments of the mill and enumerated various uses of the same, it will be apparent to those skilled in the art that changes may be made in the details disclosed and the machine may be employed for various purposes without departing from the spirit of the invention as expressed in the claims.

What I claim and desire to secure by Letters Patent is:

1. In an apparatus of the character described an inner hollow cylinder provided with external blades, an outer hollow cylinder surrounding the first cylinder and provided with internal blades arranged in staggered relation in reference to the first mentioned blades, said cylinders being spaced apart to form an annular passageway, means for introducing materials to be treated into one end of said passageway, means for rotating one of said cylinders and its blades, a second annular passageway, means for leading materials from the opposite end of the first passageway to the inlet of the second passageway, circular series of rollers arranged in the second passageway, a hollow tube extending into the second passageway and having ports communicating with the outlet end of the second passageway, said rollers being adapted to roll on said tube, and means for causing said rollers to rotate in synchronism with the rotatable one of the cylinders.

2. In an apparatus of the character described an inner hollow cylinder provided with external blades, an outer hollow cylinder surrounding the first cylinder and provided with internal blades arranged in staggered relation in reference to the first mentioned blades, said cylinders being spaced apart to form an annular passageway, means for introducing materials to be treated into one end of said passageway, means for rotating one of said cylinders and its blades, a second annular passageway, means for leading materials from the opposite end of the first passageway to the inlet of the second passageway, circular series of rollers arranged in the second passageway, a hollow tube extending into the second passageway and having ports communicating with the outlet end of the second passageway, said rollers being adapted to roll on said tube, means for causing said rollers to rotate in synchronism with the rotatable one of the cylinders, and means for rotating the other one of said cylinders in a direction opposite to that of the first-mentioned rotatable one.

3. In an apparatus of the character described

an inner hollow cylinder provided with external blades, an outer hollow cylinder surrounding the first cylinder and provided with internal blades arranged in staggered relation in reference to the first mentioned blades, said cylinders being spaced apart to form an annular passageway, means for introducing materials to be treated into one end of said passageway, means for rotating one of said cylinders and its blades, a second annular passageway, means for leading materials from the opposite end of the first passageway to the inlet of the second passageway, circular series of rollers arranged in the second passageway, a hollow tube extending into the second passageway and having ports communicating with the outlet end of the second passageway, said rollers being adapted to roll on said tube, and means for causing said rollers to rotate in synchronism with the rotatable one of the cylinders, said second passageway being surrounded by the first passageway.

4. In an apparatus of the character described an inner hollow cylinder provided with external blades, an outer hollow cylinder surrounding the first cylinder and provided with internal blades arranged in staggered relation in reference to the first mentioned blades, said cylinders being spaced apart to form an annular passageway, means for introducing materials to be treated into one end of said passageway, means for rotating one of said cylinders and its blades, a second annular passageway, means for leading materials from the opposite end of the first passageway to the inlet of the second passageway, circular series of rollers arranged in the second passageway, a hollow tube extending into the second passageway and having ports communicating with the outlet end of the second passageway, said rollers being adapted to roll on said tube, and means for causing said rollers to rotate in synchronism with the rotatable one of the cylinders, said rollers being arranged within the inner cylinder.

5. In a mill of the character described a casing provided with an internal hollow tube, a rotatable hollow shaft surrounding said tube and having an inner cylinder portion spaced from the tube to provide an inner passageway, rollers arranged in said passageway and contacting with the inner cylinder and tube whereby said rollers are rotated by rotation of the inner cylinder, an outer hollow cylinder surrounding the inner cylinder and spaced from the latter to provide an annular outer passageway, oppositely extending blades fixed respectively to the inner and outer cylinders and projecting into the outer passageway, means for introducing materials to be treated into the inlet end of the outer passageway, means for leading materials from the outlet end of the outer passageway to the inlet end of the inner passageway, and means for leading materials from the outlet end of the inner passageway to said hollow tube.

6. In a mill of the character described a casing provided with an internal hollow tube, a rotatable hollow shaft surrounding said tube and having an inner cylinder portion spaced from the tube to provide an inner passageway, rollers arranged in said passageway and contacting with the inner cylinder and tube whereby said rollers are rotated by rotation of the inner cylinder, an outer hollow cylinder surrounding the inner cylinder and spaced from the latter to provide an annular outer passageway, oppositely extending blades fixed respectively to the inner and outer cylinders and projecting into the outer passageway, means for introducing materials to be treated into the inlet end of the outer passageway, means for leading materials from the outlet end of the outer passageway to the inlet end of the inner passageway, means for leading materials from the outlet end of the inner passageway to said hollow tube, and means for rotating the outer cylinder in a direction opposite to that of the inner cylinder.

7. A mill of the character described comprising an inner member having a cylindrical surface, a hollow rotatable shaft surrounding said inner member and spaced from the latter to provide an inner annular passageway, rollers arranged in said passageway and contacting with said shaft and inner member whereby rotation of the shaft causes rolling of the rollers on the inner member, a hollow cylinder surrounding said shaft and spaced from the latter to provide an annular outer passageway, blades supported respectively by said outer cylinder and shaft and projecting into the outer passageway, means for introducing materials to be treated into one end of the outer passageway, means for leading the materials treated from the outer passageway to the inner passageway, and means for discharging materials from the inner passageway after they have been rolled by said rollers.

8. A mill of the character described comprising an inner member having a cylindrical surface, a hollow rotatable shaft surrounding said inner member and spaced from the latter to provide an inner annular passageway, rollers arranged in said passageway and contacting with said shaft and inner member whereby rotation of the shaft causes rolling of the rollers on the inner member, a hollow cylinder surrounding said shaft and spaced from the latter to provide an annular outer passageway, blades supported respectively by said outer cylinder and shaft and projecting into the outer passageway, means for introducing materials to be treated into one end of the outer passageway, means for leading the materials treated from the outer passageway to the inner passageway, means for discharging materials from the inner passageway after they have been rolled by said rollers, and means for rotating the outer cylinder in a direction opposite to that of the shaft.

ROBERT H. RUSSELL.