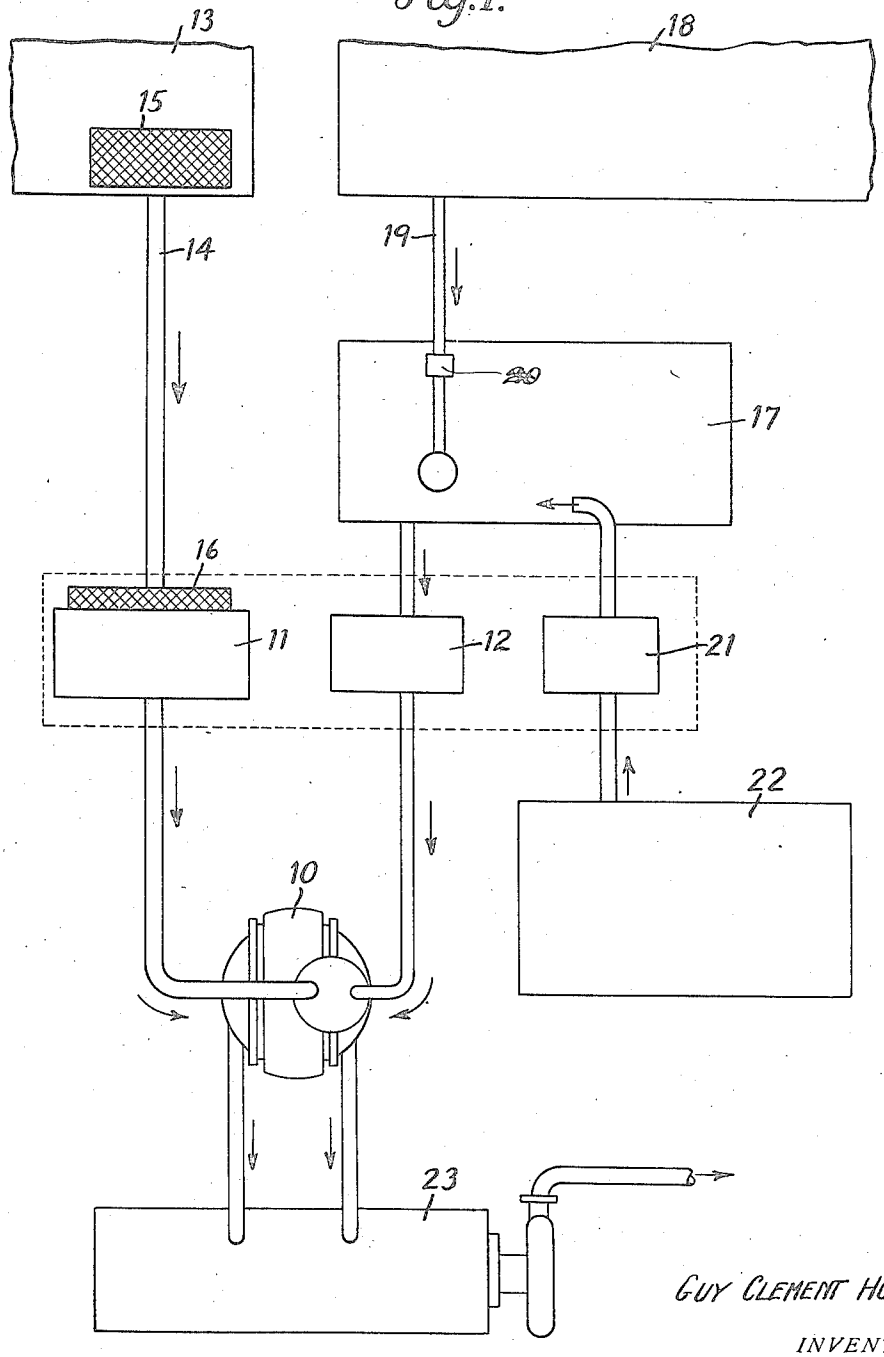
April 7, 1936. G. C. HURRELL 2,036,810

APPARATUS FOR EMULSIFICATION

Filed Aug. 9, 1930 3 Sheets-Sheet 1

Fig. 1.



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APPARATUS FOR EMULSIFICATION

Filed Aug. 9, 1930 3 Sheets-Sheet 2

Fig. 2.

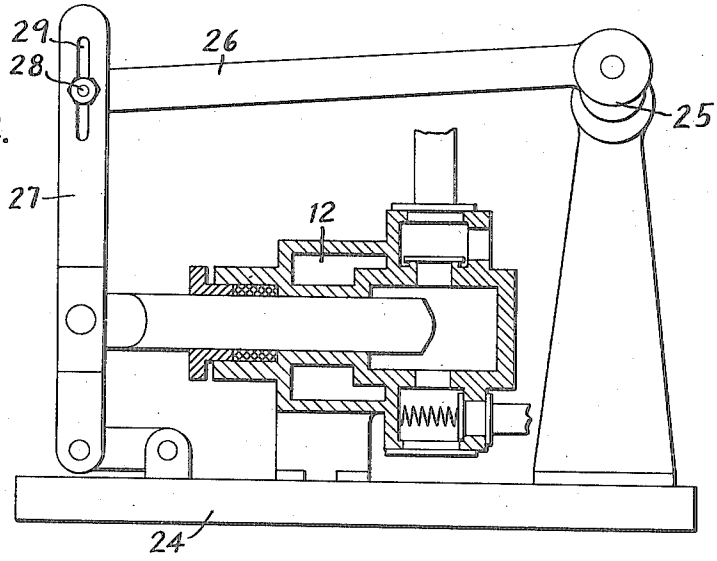
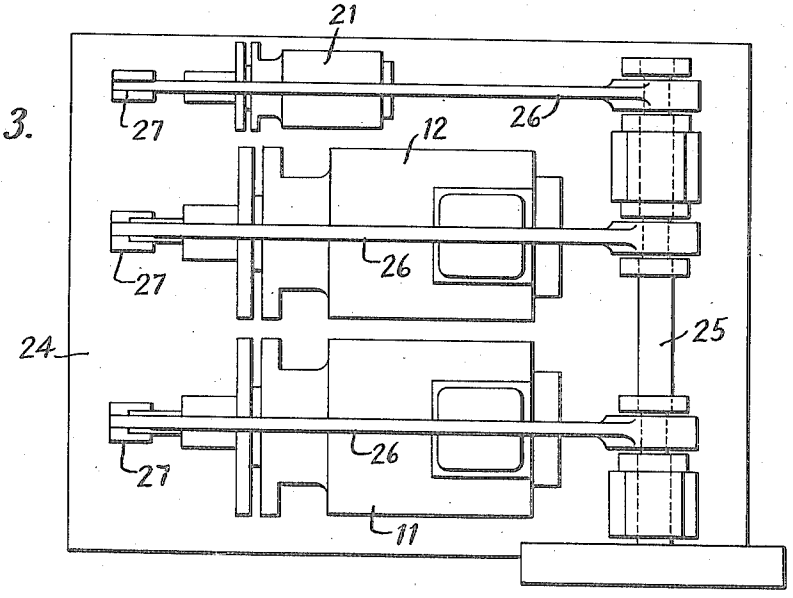


Fig. 3.



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APPARATUS FOR EMULSIFICATION

Filed Aug. 9, 1930 3 Sheets-Sheet 3

Fig. 4.

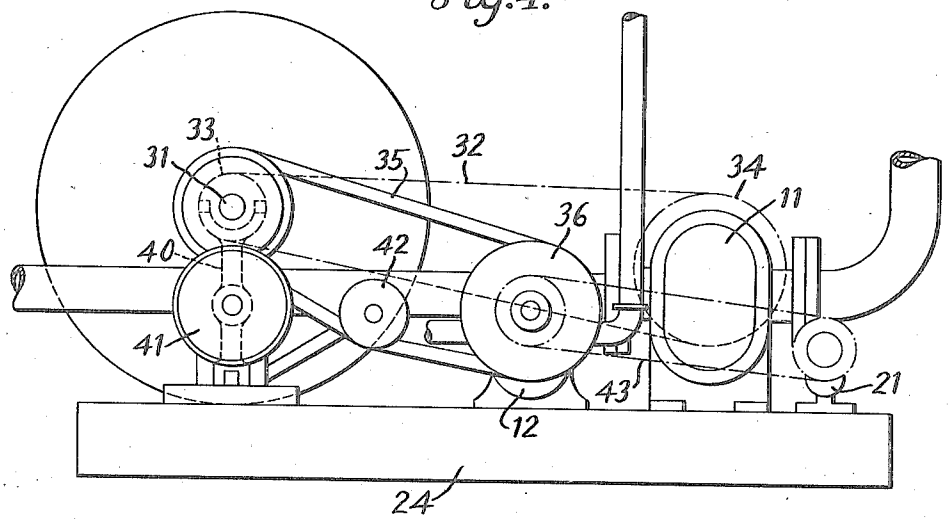
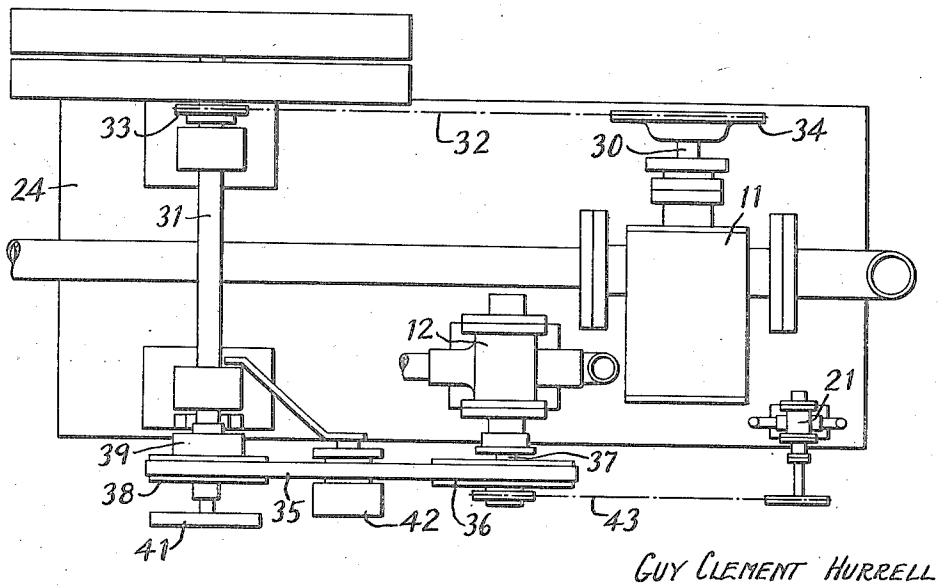


Fig. 5.



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UNITED STATES PATENT OFFICE

2,036,810

APPARATUS FOR EMULSIFICATION

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Application August 9, 1930, Serial No. 474,287
In Great Britain August 13, 1929

12 Claims. (Cl. 134—1)

This invention relates to improvements in processes of an apparatus for emulsification and is particularly concerned with processes of and apparatus for the manufacture of bituminous emulsions.

In the manufacture of bituminous emulsions, wherein a high speed emulsifying machine or colloid mill is employed, the reagents, for example molten bitumen and an aqueous solution comprising a protective colloid, are fed to the emulsifying machine from separate tanks situated above it and communicating with it by pipes (fitted with regulating valves) down which the liquid reagents are allowed to gravitate. In a plant of this kind difficulties have arisen in practice principally owing to the fact that variations occurring from time to time in the temperature of the bitumen have caused substantial changes in the viscosity of the bitumen, resulting in undesirable variations in the ratio in which the reacting ingredients are supplied to the emulsifying machine. One object of the invention is to provide means whereby this difficulty may be overcome.

This invention provides in combination with an emulsifying machine, two or more tanks to contain liquid emulsion ingredients (e. g. molten or liquid bituminous material and an aqueous solution containing a protective colloid or emulsifying agent) and two or more positive pressure pumps arranged to deliver from the tanks aforesaid to the machine.

Preferably according to this invention the pumps are coupled together so that any change in the viscosity of one or other of the ingredients of the emulsion will not affect the relative proportions in which these ingredients are supplied to the emulsifying machine.

Conveniently one of the pumps (preferably the one which is to deliver the more viscous material) is directly driven from a prime mover, and the driving shaft of this pump is coupled to the other pump or pumps by gearing which is adjustable to provide for a speed variation.

According to a feature of the invention the emulsifying machine may be directly driven from a prime mover and the pumps may be driven from the emulsifying machine so that should a stoppage occur in the latter the supply of emulsion ingredients to the machine will be automatically cut off.

In another arrangement according to the invention reciprocating plunger pumps are employed and the plungers are operated by oscillating beams coupled by connecting rods to a driving shaft, and for one or more of the pumps the coupling between the appropriate beam and connecting rod is made adjustable along the length of the beam so that the stroke of the pump may be varied at will.

In another arrangement according to the invention positive pressure rotary pumps are employed. One of the pumps is driven directly from the shaft of the emulsifying machine and the other pump is driven from the first one through a variable speed gear, for example comprising a belt drive with an adjustable pulley for varying the speed ratio between the driving and driven ends of the transmission. Any of the well known forms of variable speed gear may however be employed for this purpose.

Several embodiments of the invention for the manufacture of bituminous emulsions will now be described, reference being had to the accompanying drawings, in which

Figure 1 is a diagrammatical illustration showing the general arrangement of the plant,

Figure 2 is an elevation, partly in section, showing one arrangement of pumps,

Figure 3 is a plan of the apparatus shown in Figure 2,

Figure 4 is an elevation showing an alternative arrangement of pumps, and

Figure 5 is a plan of the apparatus shown in Figure 4.

Like reference numerals indicate like parts in the various figures of the drawings.

Referring in the first place to Figure 1, the emulsifying machine, shown at 10, is preferably of the type described in United States Patent No. 1,496,641 granted to me June 3, 1924. This machine is supplied by two main pumps 11, 12 with molten bitumen and with an aqueous solution (which is to constitute the continuous phase of the emulsion) containing a protective colloid or an emulsifying agent (e. g. soap). The molten bitumen is drawn off by the pump 11 from a heating tank 13 through a pipe conduit 14, a filter such as 15 or 16 being arranged at either end of this conduit. The solution is drawn off by the pump 12 from a mixing tank 17 which is supplied with water from a water-heating tank 18. The water enters the tank 17 by a pipe conduit 19 in which is a valve controlled by a float 20. The emulsifier, stabilizer, protective colloid or the like (in the form of a concentrated soap solution) is delivered to the mixing tank 17 by a third pump 21 which draws off from a solution-

supply tank 22. For example in the manufacture of an emulsion in which 1% of soap is required in the aqueous phase, one part of a 10% liquid soap would be pumped into the mixing tank, while 9 parts of water would be added thereto, and 10 parts of the dilute solution delivered by the pump 12 to the colloid mill 16. The emulsion formed in the mill 16 is delivered to a tank 23, from which it may be pumped to the storage tanks.

Instead of employing a water-heating tank such as 18, cold water—for instance from the public mains—may be delivered directly to the mixing tank 17, and at the same time exhaust or pressure steam may be injected into the water, the quantity admitted being preferably controlled by a thermostat. Alternatively the mixing tank may be provided with a steam heating coil.

Referring now to Figures 2 and 3, the apparatus shown therein comprises two reciprocating plunger pumps 11, 12 for delivering respectively the molten bitumen and diluted soap solution to the mill 16, and a third reciprocating plunger pump 21 for delivering the concentrated solution from the supply tank 22 to the mixing tank 17. All three pumps are mounted on a base plate 24 and are driven from a main power shaft 25 by connecting rods 26 and oscillating beams 27. For one or more of the pumps the connection between the connecting rod 26 and the beam 27 may be made adjustable along the beam, by means of a pin and slot connection 28, 29 as shown in Figure 2. By varying the position of the pin along the slot, the stroke of the pump may be varied and consequently the output per stroke may be varied. An adjusting device of this kind may be provided for the dilute solution pump or for the bitumen pump or for each of these pumps. A similar adjustment may be provided for the small pump 21 so that the ratio of the concentrated solution to the water may be varied at will.

In the above arrangement it will be appreciated that as all the pumps are coupled together any predetermined ratio in which the reacting ingredients are supplied to the emulsifying machine is maintained constant, and any change in the viscosity of one or other of the ingredients of the emulsion will not affect the relative proportions in which the ingredients are supplied to the emulsifying machine.

In the alternative arrangement shown in Figures 4 and 5, the pumps 11, 12 and 21 are of the rotary type. The pump 11 is driven by a shaft 30 to which power is transmitted from a main driving shaft 31 by means of a chain 32 and sprockets 33, 34. The dilute solution pump 12 is driven by a belt 35 from the shaft 31. The belt 35 passes over a pulley 36 on the shaft 37 of the pump 12, and also over a pulley 38 on the driving shaft 31. The pulley 38 is of the known adjustable type comprising for example two truncated cones which are arranged to form between them a V-shaped recess to take a belt or similar form and which are movable towards and away from one another to vary the ratio of the transmission. In the apparatus illustrated one portion of the adjustable pulley 38 is actuated towards the other by means of a thrust bearing 39, a fork 40 and a hand-manipulating screw 41. A jockey pulley 42 is also provided in order to maintain the proper tension on the belt 35. The concentrated-solution pump 21 is driven by a chain 43 from the shaft 37 of the dilute-solution pump 12. The pump 21 will thus vary in speed and output pro rata with any variation in the speed of the dilute-solution pump 12, and thus the relationship between the total solution and the concentrated emulsifier is maintained constant throughout any variation in the rate of delivery of the solution. If it is desired to change the proportion of concentrated emulsifier to solution, the sprocket wheels with which the chain 43 co-operates may be changed, or alternatively an adjustable drive, similar to that employed for the dilute-solution pump 12, may be used for transmitting power from the shaft 37 to the small pump 21. Conveniently the shaft 31 is belt-driven from the main shaft of the emulsifying machine.

It will be understood that the apparatus described herein is not limited in its application to the manufacture of bituminous emulsions but may be used for emulsifying oils and other liquids.

Having thus described my invention it will be apparent to those skilled in the art that numerous variations and changes may be made therein without departing from the spirit of the invention as set forth in the appended claims.

I claim as my invention:

1. The combination comprising emulsifying means, a supply means for molten bitumen, positive pump feed means located between said supply means and said emulsifying means, an emulsifying agent supply means, positive pump feed means located between said latter supply means and said emulsifying means, and said pumps being coupled together to automatically maintain the relative feeds of said materials to said emulsifying means constant.

2. Apparatus according to claim 1 wherein one of said pumps is directly driven from a source of power, and the driving shaft of this pump is coupled to the other pump by gearing adjustable to provide for a speed variation.

3. Apparatus according to claim 1 wherein reciprocating plunger pumps are employed and the plungers are operated by oscillating beams coupled by connecting rods to a driving shaft, characterized in that for one or more of the pumps the coupling between the appropriate beam and connecting rod is adjustable along the length of the beam, for the purpose specified.

4. Apparatus according to claim 1 wherein rotary pumps are employed, one of said pumps being driven from the other by a variable speed gear comprising a belt drive with an adjustable pulley for varying the speed ratio between the driving and driven ends of the transmission.

5. Apparatus according to claim 1 wherein one of said pumps is driven directly from the shaft of the emulsifying machine, and the second pump is driven from the first through a variable speed gear.

6. Apparatus according to claim 1, including a solution-mixing tank, separate means for supplying water and a concentrated solution of the emulsifying agent to said mixing tank, and a pump for withdrawing the dilute solution from the tank and supplying it to the emulsifying machine.

7. In an apparatus for the production of bituminous dispersions, the combination of a supply tank for heat liquefied bitumen, a supply tank for an aqueous suspension of dispersing agent, an emulsifier, positive displacement pumps directly connected between each of said supply tanks and said emulsifier, and a common drive for both of said pumps arranged to actuate said

pumps to deliver material from said tanks to said emulsifier in volumes of constant ratio.

8. In apparatus of the character described the combination comprising a colloid mill, a supply means for molten bitumen, positive pump feed means located between said supply means and said colloid mill, a dilution tank, a supply means for a concentrated solution of emulsifying agent and means for feeding solution therefrom to said tank, feed means for delivering dilute solution of emulsifying agent from said tank to said colloid mill, said feed means being coupled together for automatically diluting said concentrated solution of emulsifying agent in said tank simultaneously with the delivery of diluted solution therefrom to said colloid mill.

9. In apparatus of the character described the combination comprising a colloid mill, a supply means for molten bitumen, positive pump feed means located between said supply means and said colloid mill, a dilution tank, a supply means for a concentrated solution of emulsifying agent and means for feeding solution therefrom to said tank, feed means for delivering dilute solution of emulsifying agent from said tank to said colloid mill, said feed means being coupled together for automatically diluting said concentrated solution of emulsifying agent in said tank simultaneously with the delivery of diluted solution therefrom to said colloid mill, said feed means being also coupled together to maintain a constant ratio between the relative feeds of molten bitumen and dilute emulsifying agent to the colloid mill.

10. In apparatus of the character described the combination comprising a colloid mill, a supply means for molten bitumen, positive pump feed means located between said supply means and said mill, a constant level dilution tank and means for supplying water thereto, a pump for delivering a concentrated solution of emulsifying agent to said tank, a pump for delivering dilute solution of emulsifying agent from said tank to said colloid mill, said two last named pumps being coupled together to permit automatic dilution of said concentrated solution in said tank simultaneously with the delivery of dilute solution from said tank to said colloid mill.

11. In apparatus of the character described the combination comprising a colloid mill, a supply means for molten bitumen, positive pump feed means located between said supply means and said mill, a constant level dilution tank and means for supplying water thereto, a pump for delivering a concentrated solution of emulsifying agent to said tank, a pump for delivering dilute solution of emulsifying agent from said tank to said colloid mill, said pumps being coupled together to permit automatic dilution of said concentrated solution in said tank simultaneously with the delivery of dilute solution from said tank to said mill and to maintain a constant ratio between the relative feeds of molten bitumen and dilute emulsifying agent to said colloid mill.

12. The combination according to claim 1 including a diluting tank, means to supply water to said tank, pump feed means to supply a concentrated solution of emulsifying agent to said diluting tank, said last named feed means being coupled to the pump feeding the emulsifying agent from said diluting tank to said emulsifying means.

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