May 3, 1938. S. G. BAUER 2,116,380

EMULSIFICATION OF LIQUIDS AND APPARATUS THEREFOR

Filed July 21, 1936

Fig. 1.

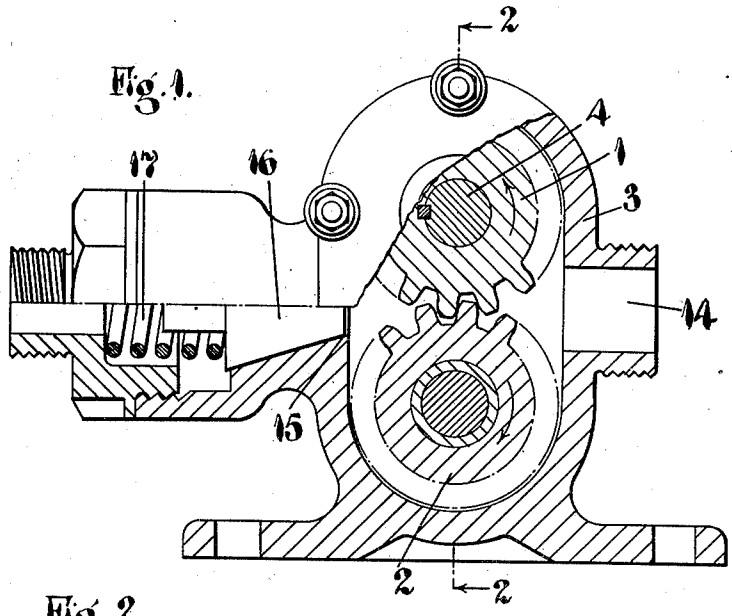


Fig. 2.

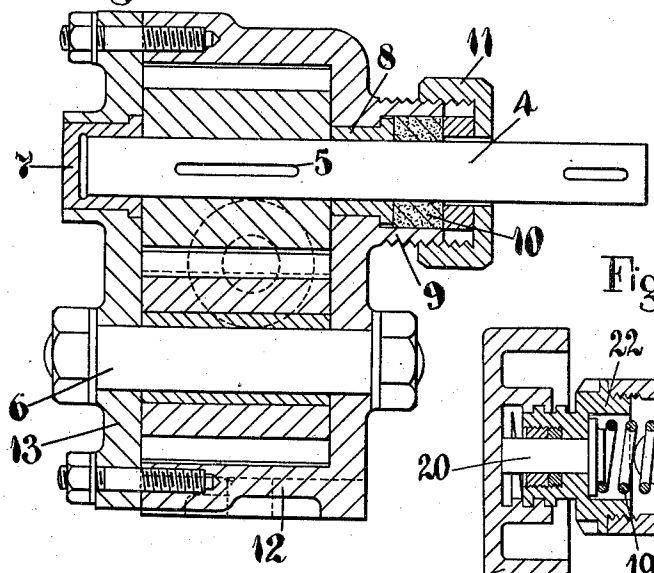
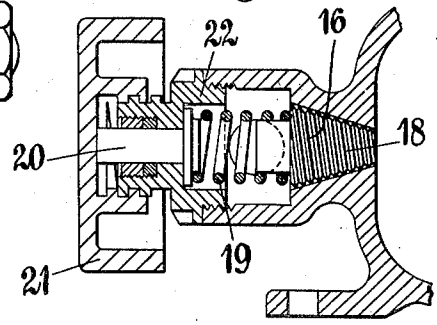


Fig. 3



Inventor:
S. G. Bauer
By Prentice & Prentice
Attorneys

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EMULSIFICATION OF LIQUIDS AND APPARATUS THEREFOR

Stefan Georg Bauer, Cambridge, England

Application July 21, 1936, Serial No. 91,792
In Great Britain August 13, 1935

1 Claim. (Cl. 259—41)

This invention is for improvements in or relating to the emulsification or intimate admixture of high viscosity semi-liquid masses by means of a gear pump.

The invention has for its object to provide an improved form of apparatus for this purpose which will enable emulsions or mixtures of high quality and stability to be very readily produced.

According to the invention, an apparatus for the emulsification or intimate admixture of high viscosity semi-liquid masses comprises a gear pump constructed with sufficient clearance between the casing and the teeth of the gears to provide a definite leakage path for the mass under treatment in the pump back from the outlet end thereof towards the inlet end of the pump (that is, in counter-course with the body of material being carried round between the teeth of the gears), and incorporating a spring-loaded outwardly opening non-return valve in the outlet of the pump for establishing and maintaining during the operation of the pump and therefore while the outlet thereof is in open pump-discharging condition, a positive pressure difference at the outlet end of the pump as compared with the pressure at the inlet end thereof, sufficient, having regard to the magnitude of the clearance referred to and to the viscosity of the mass under treatment in the pump, to ensure a constant return flow of a substantial proportion of the said mass along the leakage path.

The spring-loaded outwardly opening non-return valve in the outlet of the pump is preferably provided with means for adjusting the loading of the spring and therefore the operative opening pressure of the valve. By this means it is possible to adjust the apparatus for use with a variety of viscosities of material to be treated in the apparatus and in consequence the capacity of the apparatus in this sense is very greatly increased.

With a gear pump constructed in accordance with the present invention, with a relatively large clearance space between the teeth of the gears and the wall of the casing, so as to provide a definite leakage path for the return flow of a substantial proportion of the material undergoing treatment in the pump, and in association with such relatively large clearance space, with a spring-loaded non-return valve in the discharge outlet of the pump, there is sometimes the difficulty that owing to the magnitude of the clearance space, coupled with the normally loaded condition of the non-return valve, the body of air which initially occupies the interior of the pump at the commencement of operation thereof refuses to be displaced past the valve by the pumping action of the gears and in consequence the pump is prevented from drawing the material to be treated into it. In this way, the effectual starting of the pump is prevented.

To overcome this difficulty, the non-return valve is given an elongated tapered form, with the taper directed of course towards the interior of the pump, and is formed in its surface, whereat it seats upon the seating surface of the valve, with a spiral groove which extends continuously along the surface of the valve from the end thereof toward the interior of the pump to the end remote therefrom. With the provision of such a groove in the surface of the valve, any air that is present in the pump interior at the commencement of operation of the pump is permitted to pass out of the pump by the action of the gears thereof, while owing to the extended nature of the groove consequent upon its spiral formation and the elongated form of the valve, the material to be treated, which of course is much more highly viscous than air, is prevented from expression past the valve so as to escape the action of the gears of the pump or interfere with the establishment of the positive pressure difference referred to above as between the outlet end of the pump and the inlet end thereof. In consequence, the pump starts immediately.

In the prior use of a gear pump for emulsification purposes, a positive pressure difference at the outlet end of the pump has been maintained during the operation of the pump by reason of a pressure head of the material discharged from the pump and in course of being re-cycled back to the inlet end of the pump. It will be understood, however, that in accordance with the present invention this pressure difference is maintained of such a magnitude, in relation to the size of the clearance space between the teeth of the pump and the casing and having regard to the viscosity of the material under treatment, as to ensure a constant return flow of a substantial proportion of the material along the leakage path referred to within the pump. By this means, it is usually possible to effect even the highest desired degrees of emulsification or intimacy of interadmixture of the material under treatment in one straight-through operation in contrast to re-cycling the material a number of times through the pump. Also, a very perfect emulsion or mixture is producible at an exceedingly high rate of production.

The invention will now be further described

with reference to the accompanying drawing which illustrates one embodiment by way of example.

In this drawing,

Figure 1 is a transverse section through the improved emulsifying machine according to this invention;

Figure 2 is a longitudinal section through the machine on the section line 2—2 of Figure 1, and

Figure 3 is a fragmentary transverse section through the throttled outlet of the machine, showing a form of means for adjusting the loading of the valve.

The machine is in principle a gear pump, as already indicated herein. It comprises a pair of intermeshing toothed gears 1, 2 rotatable about parallel axes within a pump casing 3 of oval cross-section as shown in Figure 1. Gear 1 is mounted upon a driving shaft 4, to which it is keyed by a key 5. Gear 2 is mounted upon a stationary shaft 6. Shaft 4 is carried in bearings in the ends of the casing 3. One of these bearings is marked 7. The other is marked 8 (see Figure 2). Bearing 8 is at the inner end of a hollow boss 9 accommodating packing 10 maintained in position by a gland nut 11 screwed on to the exterior of the boss 9.

The casing 3 is, in the constructional form of the invention shown, in two parts, a body part 12 which includes one of the ends of the casing (see Figure 2) and a cover part 13 constituting the other end of the casing. The casing has at one side an inlet 14 for the material to be emulsified and immediately opposite this inlet at the other side of the casing an outlet 15 for the emulsion which has been formed in the machine by the action of the pump gears 1, 2 therein. These gears rotate in the directions of the arrows in Figure 1 and carry the material inflowed through the inlet 14 round with them to the opposite side of the casing, that is to say within the spaces between the teeth of the gears, the intermesh of the teeth of the respective gears at the point of tangency of the pitch circle of the gears providing in effect a fairly tight block to the flow of material across the pump directly, that is to say in by-passage in either direction of the normal path of conveyance between the gears and the wall of the casing.

According to the invention, however, a definite clearance is provided between the teeth of the gears and the wall of the casing (that is, around the upper half and the lower half respectively of the two gears 1, 2), this clearance being of sufficient magnitude, having regard to the viscosity of the material to be treated in the pump and to the loading or opening pressure of the spring-loaded non-return valve, hereinafter referred to, in the outlet thereof, to provide a return leakage path for a substantial proportion of the material back from the outlet end of the pump interior toward the inlet end thereof.

The emulsion outlet 15 is of elongated conical form, as shown in Figure 1, with the taper of the cone towards the interior of the pump and in it is a correspondingly conical non-return valve block 16 spring loaded by a compression spring 17 to result in a predetermined positive back pressure or pressure difference in the pump as between the pressure obtaining at the outlet thereof and the pressure obtaining at the inlet end, this back pressure serving to promote the return flow above referred to of the material back along said leakage path toward the inlet end of the pump.

Referring to Figure 3, the loaded valve 16 is here shown as formed, for the purpose hereinbefore described with a continuous spiral groove 18 extending along its surface from end to end of the valve also and as associated with means for adjusting the loading pressure of the valve. These means comprise a compression spring 19 interposed between the outer end of the valve and a plunger 20 in turn interposed between the spring and a knob or wheel 21 adjustable along a spigot 22 by screw-threaded engagement therewith, the spigot 22 being screwed into the body of the outlet as shown.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

Apparatus for emulsifying or intimately admixing high viscosity semi-liquid masses, comprising a toothed wheel gear pump constructed with sufficient clearance between the casing and the teeth of the gears to provide a definite leakage path for the mass under treatment in the pump back from the outlet end thereof towards the inlet end of the pump, and incorporating a spring-loaded outwardly opening non-return valve in the outlet of the pump for establishing and maintaining during the operation of the pump and therefore while the outlet thereof is in open pump-discharging condition, a positive pressure difference at the outlet end of the pump as compared with the pressure at the inlet end thereof, sufficient, having regard to the magnitude of the clearance referred to and to the viscosity of the mass under treatment in the pump, to ensure a constant return flow of a substantial proportion of the said mass along the leakage path.

STEFAN GEORG BAUER.