July 24, 1956 | G. E. EUWE | 2,755,739

PROPORTIONING PUMP

Filed July 19, 1954 | 2 Sheets-Sheet 1

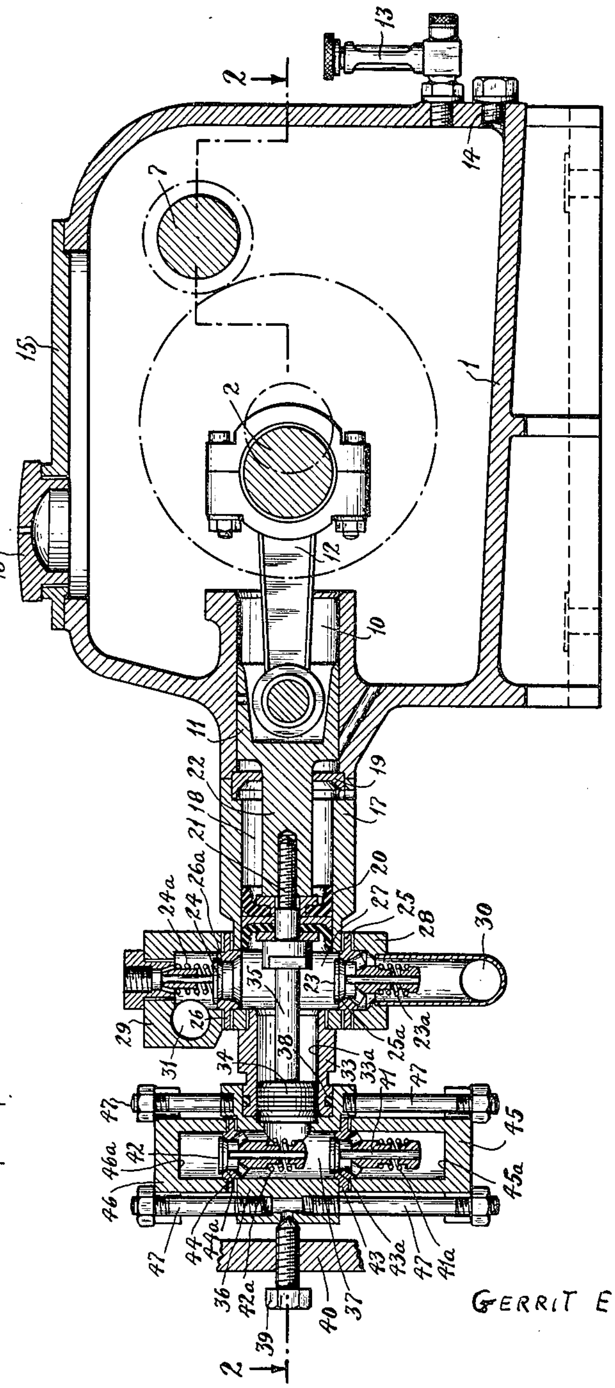

FIG. 1

GERRIT EVERT EUWE
INVENTOR.

BY Campbell, Brumbaugh, Free & Graves
Attorneys

July 24, 1956 G. E. EUWE 2,755,739

PROPORTIONING PUMP

Filed July 19, 1954 2 Sheets-Sheet 2

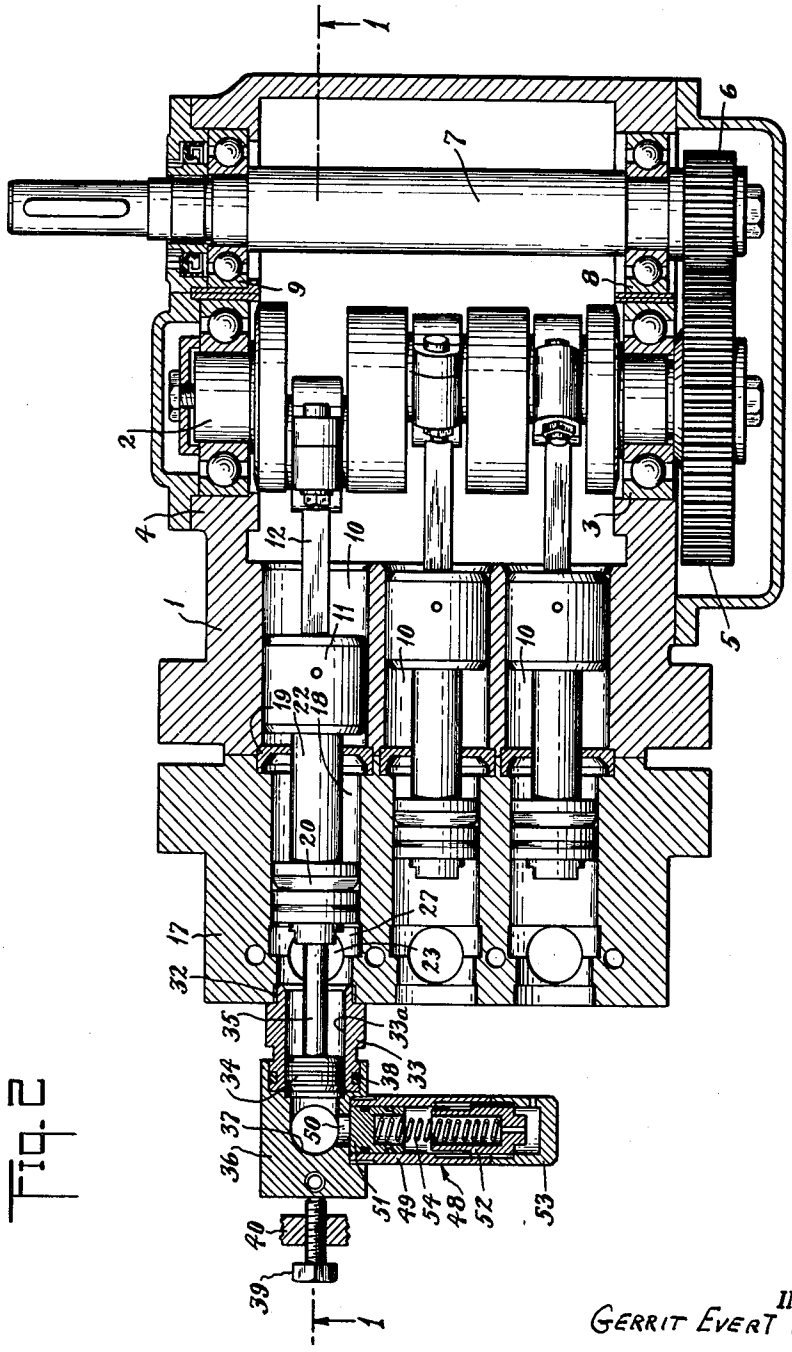

Fig. 2

INVENTOR.
GERRIT EVERT EUWE
BY
Campbell, Brumbaugh, Free & Graves
attorneys

United States Patent Office 2,755,739 Patented July 24, 1956

2,755,739

PROPORTIONING PUMP

Gerrit Evert Euwe, Brasschaat, Belgium, assignor to Lever Brothers Company, New York, N. Y., a corporation of Maine

Application July 19, 1954, Serial No. 444,260

Claims priority, application Great Britain July 20, 1953

8 Claims. (Cl. 103—9)

This invention relates to proportioning pumps for delivering at least two different substances in a fixed proportion.

Proportioning pumps having a plurality of cylinders are known. In pumps of this type, one of the cylinders delivers one liquid and the other cylinders the other liquid, the two liquids being delivered in a fixed proportion. Such pumps are used, for example, in the manufacture of margarine where a mixture of oil and water in the ratio of approximately 4:1 has to be delivered. For that purpose pumps having five cylinders of equal bore have been used, four for the oil and one for the water. The piston of the cylinder for the water-phase is sometimes provided with a variable stroke so that an adjustment can be made for differences in the volumetric weights of the liquids.

With such a pump, however, it is impossible to alter the proportion between the output of the four cylinders on the one hand and the output of the fifth cylinder on the other hand without throwing the pump seriously out of balance. Nor is it possible to obtain a ratio of say 4:1 with a three-cylinder pump of normal construction. This is a serious disadvantage as a three-cylinder pump is much simpler in construction and has only a slight larger maximum deviation from the average output than a five-cylinder pump.

It is, therefore an object of the present invention to provide a pump having a plurality of cylinders capable of being readily adapted to deliver at least two substances in any desired proportion without throwing the pump seriously out of balance.

According to the invention a pump can be provided having a plurality of main cylinders for one substance and at least one interchangeable secondary cylinder for another. The latter cylinder is joined in direct communication with one main cylinder and a common in-phase piston motion provided for the two to establish a total output which equals that of another main cylinder so that dynamic balance obtains, assuming fluids of equivalent characteristics are being pumped. A preferred embodiment of the invention from which the several advantages and features can be perceived is described below having reference to the drawing in which:

Figure 1 is a view in vertical section of the pump taken on the line 1—1 of Figure 2 looking in the direction of the arrows; and

Figure 2 is a horizontal section taken on the stepped line 2—2 of Figure 1 looking in the direction of the arrows, with the details of the second and third main cylinders having been omitted for the purpose of simplicity and clarity.

Referring to the drawings the invention is illustrated as embodied in a pump having a casing 1 in which a crank shaft 2 is journalled as by ball bearings 3 and 4. The crank shaft is driven through stepdown gears 5 and 6 by an input shaft 7, which can also be mounted in ball bearings 8 and 9, and which can be arranged to be driven

by suitable motive means such as by an electric motor, not shown. The casing 1 is provided with three guides 10 for cross-head assemblies 11, each of which is connected to the crank shaft 2 by a connecting rod 12. The casing 1 is also provided with the usual oil level gauge 13, drain plug 14, and a cover 15 having a cap 16 for lubricating purposes.

A cylinder block 17, formed with three main cylinders 18 of equal bore in register with the corresponding guides 10, is bolted to the casing 1 with three intermediate locating rings 19 disposed therebetween. Each of the cylinders 18 receives a piston 20 connected as by a bolt 21 to a piston rod 22 which can form part of the cross-head assembly 11. Each cylinder has a poppet type inlet valve 23 and an outlet valve 24. Seats 25*a* and 26*a* for these valves are arranged in two separate blocks 25 and 26 which are clamped to the cylinder block 17 at the location of the pump chamber 27 by valve blocks 28 and 29 bolted to the cylinder block 17. The valve block 28 houses the inlet valve 23 and the valve block 29 houses the outlet valve 24. The valves 23 and 24 are normally forced against their seats by compression springs 23*a* and 24*a*. The inlet valve of each cylinder is in communication with a manifold 30 and the outlet valve with a duct 31 which can be formed in the valve block 29.

The back-wall of one of the pump chambers 27 is provided with an aperture 32 in which a cylinder block 33, formed with a cylinder 33*a*, is mounted so that the cylinder 33*a* is in register with the corresponding cylinder 18. The cylinder 33*a* has a smaller bore than cylinder 18 and is provided with a piston 34 coupled in tandem with the piston 20 by a rod 35 which is integral with the bolt 21. A block 36 formed with a pump chamber 37 is fitted over the end of the cylinder 33*a*, a gasket 38 providing a seal between the blocks 33 and 36.

To hold the blocks 33 and 36 tightly in place and at the same time facilitate dismantling for cleaning, replacement or substitution, locking means in the form of a bolt 39 is provided. The bolt is screwed into a frame member 40, which can be carried by the casing 1 to bear against the outer surface of the block 36.

The cylinder 33*a* is furnished with an inlet valve 41 and an outlet valve 42 which seat respectively, under the influence of compression springs 41*a* and 42*a*, on seats 43*a* and 44*a* formed in blocks 43 and 44. The blocks 43 and 44 are clamped between the block 36 and valve blocks 45 and 46, respectively, the latter being bolted to block 36 by the bolts 47. The cavities 45*a* and 46*a* in the valve blocks 45 and 46, respectively, are connected to inlet and outlet conduits, not shown.

For accurate adjustment of the output of cylinder 33*a*, its pump chamber 37 is provided with an adjusting device 48 comprising a guide 49 screwed into the block 36. The guide is in open communication with the chamber 37 by means of an aperture 50 in that chamber. A free piston 51 is movable in the guide 49, with the stroke limited at one extremity by the block 36 and at the other by an adjustable stop 52 screwed into the guide 49. A lock-nut 53 is provided for fixing the position of the stop 52. The piston 51 is forced against the block 36 by means of a compression spring 54 situated between the piston and the stop 52.

It will be observed that the tandem pistons 20 and 34 have sides working in the same chamber 27 so that the output supply pumped into the duct 31 is equal to the difference between the displacements of the tandem pistons. The pumping action of the piston 34 in the chamber 37 is not affected.

The operation of the apparatus is as follows:

Assuming that the pump is intended to deliver a mixture of two liquids, for example oil and water, in a pro-

portion of 5:1, the three cylinders **18** will be used to supply the oil-phase and the single cylinder **33***a* to supply the water-phase. In that case the diameter of the bore of cylinder **33***a* is equal to $\frac{1}{2}\sqrt{2}\times D$, where D is the diameter of the bores of cylinders **18**. This is derived by subtracting from the output of the tandem piston **20**, the displacement of the piston **34**. As the total output supply (including two different fluids) of cylinders **33***a* and **18**, which are coupled in tandem, is always equal to the supply of each of the other cylinders **18**, which are not coupled in tandem to water-phase cylinders, it will be evident that by variation of the diameter of the bore of cylinder **33***a* any desired proportion between the oil and water delivered can be obtained without affecting the balance of the pump. For example, if a ratio of 8:1 is required the diameter of the bore of cylinder **33***a* will equal $\frac{1}{3}\sqrt{3}\times D$.

However, in order to take into account variations of the volumetric weight of the liquids, the adjusting device **48** is provided. The strength of the spring **54** is such that the piston **51** is moved against stop **52** before the pressure built up in the chamber **37** is sufficient to open valve **42**. The liquid delivered from cylinder **33***a* is consequently reduced by the volume displaced by the piston **51**. The diameter of the bore of cylinder **33***a* is calculated so that this cylinder **33***a* supplies the correct quantity if stop **52** is situated in its middle position.

It will be evident that the spring **54** must fulfill two conditions. Firstly, it must yield at a pressure in the pump chamber **37** lower than the ultimate pressure in that chamber during the delivery stroke of piston **34** and, secondly, it must bring the piston **51** again into contact with the block **36** before the minimum pressure in the pump chamber **37** is reached during the suction stroke of piston **34**.

Although a preferred embodiment of the invention has been illustrated and described herein, it is to be understood that the invention is not limited thereby, but is susceptible of changes in form and detail. Thus more than one secondary cylinder assembly can be provided in communication with other main cylinders and a common in-phase drive provided for their respective pistons. The invention should not, therefore, be regarded as limited save as defined in the following claims.

I claim:

1. A proportioning pump for providing at least two different substances in preestablished portions comprising a plurality of first cylinders each having a valve chamber, pistons in the cylinders and common drive means to reciprocate the pistons, at least one secondary cylinder having a secondary valve chamber and a piston in the cylinder, means placing the secondary cylinder on one side of its piston in communication with the valve chamber of one of said first cylinders, and means to reciprocate the secondary piston in phase with the piston of one of the first cylinders.

2. A proportioning pump for providing at least two substances in preestablished portions comprising a plurality of first cylinders each having a valve chamber, pistons in the cylinders and common drive means to reciprocate the pistons, at least one secondary cylinder, a piston in the secondary cylinder, means placing the secondary cylinder on one side of its piston in communication with the valve chamber of one of said first cylinders, a valve chamber for the secondary cylinder on the other side of its piston, and means to reciprocate the secondary piston in phase with the piston of the said one first cylinder, said secondary cylinder being smaller than the first cylinder.

3. A proportioning pump for delivering at least two substances in preestablished portions comprising wall means defining a plurality of first cylinders, pistons in the first cylinders, valve chambers in communication with the first cylinders, a common crank shaft, and operative driving connections between the crank shaft and the respective pistons, wall means defining at least one secondary cylinder substantially in alignment with one of said first cylinders, a piston in the secondary cylinder, said secondary cylinder on one side of its piston being in direct communication with the valve chamber of said one first cylinder, a secondary valve chamber on the other end of the piston of the secondary cylinder, and connecting means between the piston of said one first cylinder and the piston of the secondary cylinder whereby the two are driven in phase.

4. Apparatus as set forth in claim 3, including adjusting means comprising an auxiliary chamber in communication with the secondary valve chamber, and a spring-loaded piston in the auxiliary chamber movable in response to pressure changes in the secondary chamber.

5. Apparatus according to claim 4, including adjusting means for the piston in the auxiliary cylinder comprising a threaded member axially movable in the cylinder and spring means between the adjusting member and the piston.

6. A proportioning pump as set forth in claim 3 including a detachable block containing the secondary cylinder, a detachable block containing the secondary valve chamber, aligned openings between the blocks and between the secondary cylinder block and the wall means defining said one first cylinder, and releasable clamping mean for holding the blocks and wall means together.

7. A proportioning pump as set forth in claim 3, said first cylinders being of equal diameter, the piston in the secondary cylinder being connected in tandem to that of said one first cylinder so that the two move in unison to carry out their delivery strokes simultaneously and their suction strokes simultaneously, said operative driving connections between the crank shaft and the respective pistons comprising a plurality of cranks, one for each of said first cylinders, and said second cylinder being of a diameter smaller than said first cylinders.

8. A proportioning pump as set forth in claim 7, said one first cylinder and said secondary cylinder being in axial alignment and said connecting means connecting the piston of said one first cylinder and the piston of the secondary cylinder comprising a connecting rod in alignment with the paths of travel of said pistons.

References Cited in the file of this patent

UNITED STATES PATENTS

566,895	Dow	Sept. 1, 1896
1,322,236	Fish	Nov. 18, 1919
1,563,328	Bradbury	Dec. 1, 1925
1,943,162	Coatalen	Jan. 9, 1934
2,561,227	Reed	July 17, 1951