June 18, 1957 H. MILLER 2,796,240

DUAL PUMP

Filed Dec. 21, 1954 2 Sheets-Sheet 1

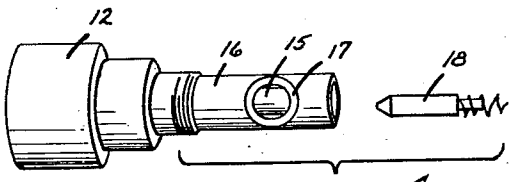


Fig. 4

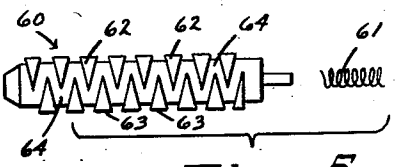


Fig. 5

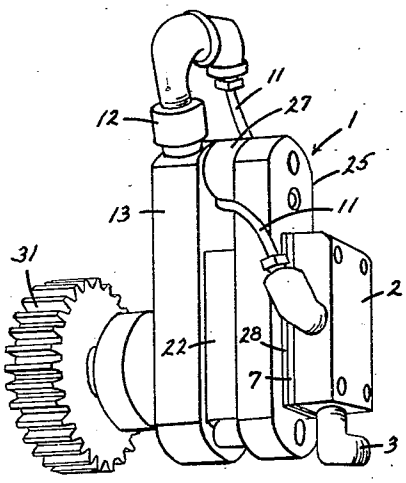


Fig. 1

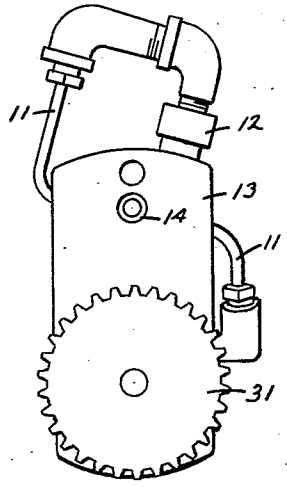


Fig. 2

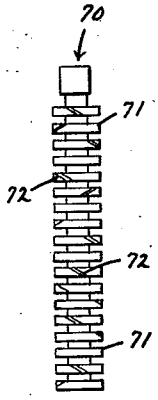


Fig. 6

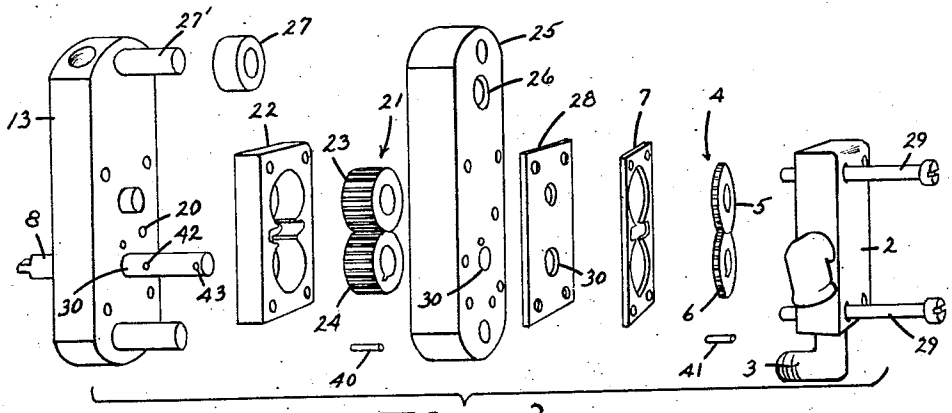


Fig. 3

June 18, 1957 H. MILLER 2,796,240

DUAL PUMP

Filed Dec. 21, 1954 2 Sheets-Sheet 2

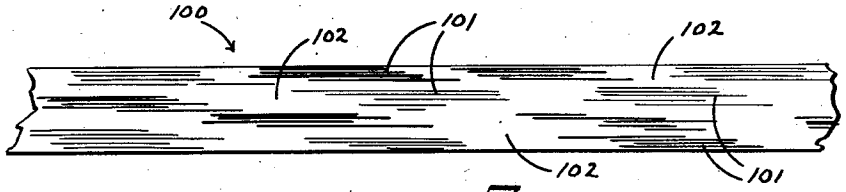


Fig. 7

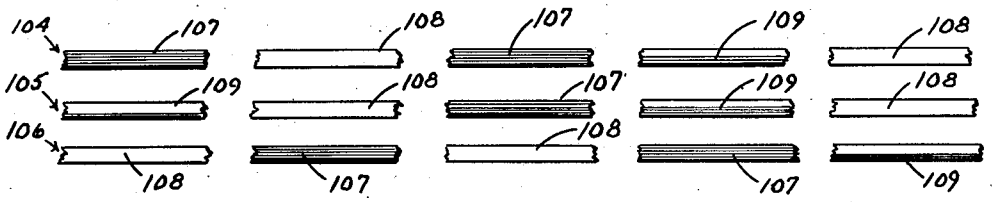


Fig. 8

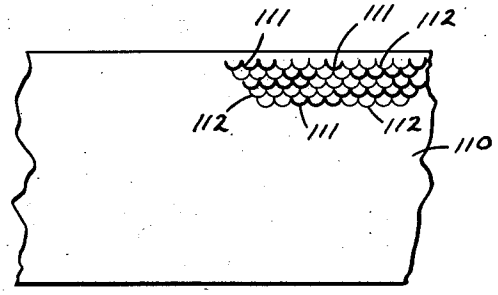


Fig. 10

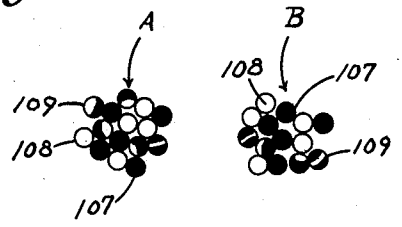


Fig. 9

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2,796,240

DUAL PUMP

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Application December 21, 1954, Serial No. 476,614

11 Claims. (Cl. 259—6)

The present invention relates to a dual pump for combining and partially intermixing, to a controlled degree, two separate liquid streams. In particular, the invention relates to a dual pump which may be used with artificial yarn spinning machines for combining and intermixing, to a controlled degree, separate streams of different composition having relatively high viscosities from which novel type yarn filaments and yarns may be produced.

My dual pump may be used in the production of yarns produced by the dry- or wet-spinning process. Examples of such yarns are the regenerated cellulose yarns such as cellulose acetate and viscose rayon yarns. In the production of cellulose acetate yarn, for example, the two streams to be combined and intermixed may be streams of cellulose acetate of different composition such as a pigmented or colored acetate stream and a clear acetate stream. Interesting and various types of novel filaments and yarns may be obtained from the combined and heterogeneously intermixed streams. My dual pump may be substituted for the usual single pumps positioned in the supply lines at a point near the yarn extrusion devices or spinnerettes. The pump may be affixed to as many of the individual supply lines leading to the extruding devices of one spinning machine as desired. It is therefore possible to spin several different novel type composite yarns on a single machine, thus eliminating the necessity of using more than one machine as is usually required when spinning different type yarns.

It is therefore an object of the present invention to provide a novel and improved dual pump for combining and intermixing, in a controlled manner, separate liquid streams of different composition.

It is another object of my invention to provide a novel and improved dual pump which first combines separate liquid streams of different composition and then intermixes or partially blends the combined streams.

Another object of the present invention is to provide a novel and improved dual pump which accurately meters, either in equal or unequal proportions, separate streams of different composition to be combined and partially blended.

Still another object of the present invention is to provide a novel and improved dual pump which has separate and distinct labyrinth intermixing units contained therein.

A final object of the invention is to provide a novel and improved dual pump wherein the degree of intermixing of the two separate streams may be varied as desired.

Other objects and advantages of the invention will become more apparent from a study of the following description and the drawings in which:

Figure 1 is a perspective of my dual pump;

Figure 2 is a view taken from the drive side of the dual pump of Figure 1;

Figure 3 is an exploded view of the dual pump showing its component parts;

Figure 4 is an enlarged view of the assembly within the dual pump for combining the separate liquid streams;

Figure 5 is an enlarged view of one of the labyrinths which may be positioned within the dual pump for intermixing the combined streams.

Figure 6 is an enlarged view of another type element which may be positioned within the dual pump assembly for further intermixing the combined streams.

Figure 7 is a representation of a variegated yarn produced from the different composition streams as combined and intermixed by the dual pump.

Figure 8 is a representation of three of the number of yarn filaments which make up the yarn of Figure 7.

Figure 9 is a view of yarn cross sections taken at different points along the length of the yarn produced by the pump of the present invention; and

Figure 10 is a fragmentary top view of a knitted fabric produced from the yarn shown in Figure 8.

The invention comprises essentially a compact two stage metering pump assembly of the gear type in which its first stage is of low capacity for metering a secondary liquid stream such as a pigment slurry into the second larger capacity stage together with a primary liquid stream with which the slurry is mingled but not completely blended. The variegated combined stream discharged from the second stage is extruded through a spinneret to fabricate a yarn of variegated structure or appearance which when incorporated into a fabric provides a fabric of interesting structure or appearance. The gears of each stage are keyed to a common shaft extending through a plate which serves as the housing for each stage. This construction simplifies the pump design and maintains a constant ratio at all times between the primary and secondary stream. Since the stages are operated in series, metered mixing of the streams takes place between the stages and various supplementary elements may be installed at this point to increase or decrease the effective blending.

Referring now to the drawings, the structure of the dual pump blender or mixer will be described. It should be pointed out that the dual pump blender or mixer can be used for combining and intermixing separate streams of many and varied composition, however, for the purposes of the present description the structure will be described with respect to the combining and intermixing of a clear cellulose acetate yarn spinning stream having a viscosity between 750–1500 centipoises at 25° C. as determined by the ball-fall test and a pigmented or colored cellulose acetate stream for the production of color variegated yarn comprising individual color variegated filaments.

As seen in Figure 1 the dual pump blender **1** comprises an inlet chamber **2** through which a colored spinning solution such as a pigmented cellulose acetate stream is introduced to the pump assembly. The pigmented stream is introduced into chamber **2** through conduit **3**. A metering assembly **4** comprising gears **5** and **6** and housed in centerplate **7** (see Figure 3) is positioned adjacent the inner face of the inlet chamber **2** for metering the pigmented stream fed thereinto from chamber **2** into and through conduit **11** and inlet connection **12** into the top of a second chamber or combining chamber **13** positioned opposite chamber **2**. Gear **6** of metering assembly **4** is slidingly keyed to a shaft **8** within the pump assembly which shaft abuts on chamber **2**. A clear yarn spinning solution, such as a clear cellulose acetate stream, is also introduced into the combining chamber **13** through a drilled port **14** in the outer face of chamber **13** (see Figure 2).

The pigmented stream and the clear stream are initially combined by the assembly shown in Figure 4. As seen in Figure 4, the inlet connection **12**, in the top of the combining chamber **13**, through which the pigmented stream

flows into chamber 13 terminates in a tube portion 15 of smaller diameter than the remaining portion of the connection which tube portion extends downwardly within chamber 13. A metal sleeve 16 is positioned over the tube 15 and welded, threaded or otherwise secured to the inlet spout 12 whereby an annular channel is formed between the periphery of the tube 15 and the wall of the bore of sleeve 16. A drilled port 17 in the wall of sleeve 16 lines up with the inlet port 14 in chamber 13. Through these ports the clear stream of spinning solution is fed to the channel described above to flow around the metal tube 15. A small spring loaded conical shaped valve 18 is seated within the outlet of the metal tube 15. As the pressure builds up within the pigmented stream in tube 15, the valve 18 is forced open and the pigmented stream passes from the outlet of tube 15 to be combined with the clear stream of spinning solution flowing down around the outlet of tube 15. The combined streams then pass through the drilled intake port 20 located in the lower portion of the inner face of chamber 13 (Figure 3). The manner in which the spring loaded valve 18 is supported within the chamber 13 will be described hereinafter.

Metering assembly 21 housed in centerplate 22 positioned adjacent the inner faces of chambers 13 and port 20 comprises gears 23 and 24, the latter being slidingly keyed to the shaft 8. The metering assembly 21 is of larger capacity than gear assembly 4 and meters the combined streams fed thereto into and through a discharge chamber 25 from which the combined streams are discharged from the pump assembly through the drilled opening 26 in the outer face portion of the chamber 25. The metering assembly 21, in addition to metering the combined streams, also intermixes the streams to a certain degree as it bites off and squeezes portions of the combined streams during the pumping operation. Combining chamber 13 is maintained in spaced apart relationship with discharge chamber 25 by spacing collar 27 positioned over pin 27'. Inlet chamber 2 and the pump assembly 4 adjacent therewith are spaced from the discharge chamber 25 by spacing plate 28. The whole assembly is secured together by screws 29, 29.

As mentioned above, the shaft 8 within the pump assembly drives both gear assemblies 4 and 21 at the same rate of speed. The revolutions per minute of the gears of each assembly are also the same since the gears are of the same pitch diameter. The shaft 8 is fitted within the assembly through gears 24 and 6, and through drilled holes 30, 30 through the chambers 13, 25, and spacing plate 28. The shaft 8 is driven by drive gear 31 (Figure 1) connected to the shaft 8 at a point externally of the pump assembly. Shaft pins 40 and 41 (Figure 3) inserted within the drilled holes 42 and 43 in shaft 8 slidingly key gears 6 and 24 of gear assemblies 4 and 21 to the shaft 8 through keyways in the walls of the gear bores.

Since the gears 23 and 24 of assembly 21 are of greater width than the gears 5 and 6 of assembly 4, the assembly 21, is of course, capable of metering and pumping a greater volume of spinning solution than the assembly 4. Both assemblies, of course, continuously meter definite amounts by volume of solution. A portion of the total amount of the combined streams drawn by assembly 21 consists of a definite and constant amount of the colored spinning solution, such as a pigmented acetate stream, which is continuously being metered by the smaller assembly 4 to be combined with the clear spinning solution entering chamber 13. The balance of the combined streams as demanded and drawn by the larger pump assembly 21 will, therefore, necessarily consist of a definite and constant amount of the clear stream. With such an arrangement it is seen that the ratio of the amounts of the clear stream to the colored stream in the combined streams will always be constant. To adjust or change this ratio, gears 5 and 6 of gear assembly 4 may be replaced with gears of greater or lesser width whereby the assembly 4 will meter more or less of the pigmented stream as desired.

If it is desired to intermix the combined streams to a further degree, a labyrinth plug 60 (Figure 5) may be inserted within the combining chamber 13 at a point immediately below the stream combining assembly of Figure 4. The upper end of the labyrinth 60 supports the conical valve 18 while a small spring 61 presses the labyrinth 60 into contact with the valve. The conical spring loaded valve 18, the labyrinth 60 and the spring 61 are all housed in a cylindrical chamber within the combining chamber 13. The cylindrical housing has a bore which is slightly larger than the diameter of the labyrinth 60. The spring 61 abuts against the bottom or end wall of the cylindrical chamber. The labyrinth 60 has right and left hand threads 62, 62 and 63, 63 respectively which form intercommunicating channels 64, 64 wherein the clear and pigmented streams are intermixed as they pass therethrough. The intermixed streams then pass through port 20 of chamber 13 into the metering assembly 21.

When the labyrinth 60 is omitted as mentioned hereinabove, a valve 18 is used which has either a longer barrel or stem which will extend approximately the length of the cylindrical chamber. The spring around the stem of valve 18, in this case, abuts against the bottom or end wall of the cylindrical chamber. The spring 61 is not necessary in this case and may be omitted.

If more complete or a finer degree of intermixing is desired, a second labyrinth 70 (Figure 6) of different design than the labyrinth 60 may be inserted within the discharge port 26 of discharge chamber 25 to further mix the already partially blended streams as they are discharged from the metering assembly 21. The labyrinth 70 has a series of rings 71, 71 which have notches 72, 72 therein through which the combined streams are further mixed as they are forced therethrough. With this arrangement, one end of the labyrinth 70 is inserted in the discharge port 26. The remainder or external portion of the blender is housed preferably in an enclosing sleeve (not shown) which in turn is connected with a feed conduit leading to the spinning or extruding element.

The physical appearance of the intermixed streams being discharged from the dual pump assembly is that of stone marble. Pigment streaks occur in random fashion throughout the mass of spinning solution. The spinning solution of marble pattern is fed directly to the spinnerette by which the filaments are formed which make up the final composite yarn.

To review the operation, the pigmented stream is introduced into the inlet chamber 2, through metering assembly 4, through conduit 11, and into the combining chamber 13 wherein, as described above, the pigmented stream is combined with the clear acetate stream entering chamber 13 through port 14. The combined streams then pass from chamber 13 by way of port 20 into the inlet side of metering assembly 21 which also mixes as it pumps the combined streams upwardly through discharge chamber 25 and out through discharge port 26. If desired, the streams may be further blended to a controlled degree with the use of one or both of the labyrinths 60 and 70 depending upon the degree of intermixing desired.

Although many types of composite artificial yarns are possible with my invention, as mentioned above, a variegated artifical cellulose acetate yarn which has a color pattern of alternating blue and white areas and which has been formed by the dry-spinning process will be described for purposes of illustration. As seen in Figure 7, the variegated acetate yarn 100, has an exterior appearance of a substantially uniform pattern of alternating sections of colored areas 101, 101 and clear or bright areas 102, 102. These colored and bright areas appear as streaks lengthwise of the yarn. The yarn 100 is spun or formed by extruding the combined and blended spinning solution directly through a single spinnerette plate such as is used

in spinning commercial bright acetate yarn. No further processing is required with respect to effecting the variegated appearance of the yarn after it is collected from the spinning or yarn producing machine.

Figure 8 shows three of the total number of individual filaments which make up the yarn of Figure 1. By filament, I mean the fine continuous thread which issues from one small hole of the many small holes in an ordinary spinnerette as mentioned above. The colored and non-colored sections of the individual filaments **104**, **105**, and **106** do not follow a uniform pattern, but on the contrary, assume a hodge-podge or non-uniform pattern. The individual filaments **104**, **105**, and **106** may have solid uniformly colored portions **107**, **107** extending from a few inches up to twenty-five feet or more. These solid portions may then be followed by clear or bright portions **108**, **108** of various lengths. The clear filament portions **108**, **108** may in turn be followed by filament sections **109**, **109** which are half clear and half colored longitudinally of the filament. This pattern described above is not necessarily followed throughout the filament length as the partially colored portions **109**, **109** may follow the solid, uniformly colored sections **107**, **107** instead of the pattern mentioned above. In addition, as seen in Figure 8 the three filaments **104**, **105**, and **106**, which were extruded through the same spinnerette plate, when compared with one another, do not necessarily agree in pattern. For instance, the uniformly colored section **107** of filament **104** may lie adjacent the partially colored section **109** of filament **105** which filament sections may in turn lie adjacent a clear or bright filament section **108** of filament **106**.

Figure 9 shows cross sections of the yarn **100** (Figure 7) taken at spaced apart points along the length of the yarn. When comparing yarn cross section A with yarn cross section B it is seen that the individual filaments do not appear in the same location within the two cross sections. The cross section pattern changes along the length of the yarn.

The amazing phenomenon which results from such a haphazard arrangement of the colored, partially colored and non-colored filament sections throughout the length of the yarn **100** is that the final yarn exhibits a substantially uniform variegated pattern of alternating colored and non-colored sections around the yarn circumference and lengthwise of the yarn.

The uniformity of the variegated pattern with respect to the alternating colored and non-colored portions of the yarn is a statistical phenomenon resulting from the random arrangement of clear and colored sections of the many adjacent individual filaments which make up the yarn.

The variegation pattern may be made finer or larger by controlling the twist incorporated in the final yarn. The higher the twist incorporated in the yarn the finer or smaller will be the variegation pattern.

Figure 10 shows a knitted fabric **110** composed of the variegated yarn of Figure 1. The fabric has a variegated pattern of alternating uniformly spaced areas of colored and non-colored portions **111**, **111** and **112**, **112** respectively whereby it exhibits an excellent "salt and pepper" effect. Woven fabrics may also be produced which exhibit the same effect.

If a finer variegated effect is desired, the labyrinths **60** or **70** or both are inserted within the pump assembly **1** as explained above to mix the streams to a controlled degree.

If a uniformly pigmented yarn is desired the mixed streams issuing from the pump proper with both of the labyrinths **60** and **70** in position, may be passed through additional blenders such as a gravel type blender to thoroughly and uniformly blend the streams.

It is to be understood that the present apparatus is not limited to the use of combining only clear and colored streams. The apparatus may also be used for combining and mixing to a certain degree many streams of different

composition such as two streams of viscose of different composition for producing viscose type rayon having the characteristics inherent with each type of viscose used. For instance, rayon may be produced from a mixture of aged viscose and young viscose. Yarns may be produced from acetate, viscose, or other suitable spinning solutions wherein portions of the yarn are receptive to certain dyes only while the remaining yarn portions are receptive to different dyes. Many other type combination yarns may be formed from spinning solutions of composite streams which have been metered and mixed to a certain degree with the dual pump of the present invention.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. A dual pump assembly for combining and mixing, to a controlled degree, two separate liquid streams, said pump assembly comprising an inlet chamber, means for introducing a first liquid stream to the chamber, a metering assembly positioned adjacent the inlet chamber for metering the liquid stream, a liquid combining chamber positioned opposite the inlet chamber, means for introducing a second liquid stream into the combining chamber, a conduit connecting the inlet and combining chambers for conducting the first metered liquid stream to the combining chamber, a combining unit positioned within the combining chamber which receives each stream in its separate state as the streams enter the combining chamber and combines the streams in a controlled manner, a discharge chamber positioned between the inlet and combining chambers for discharging the streams, a second metering assembly positioned between the combining and discharge chambers for partially mixing the combined streams as they are discharged from the combining chamber and for metering the combined streams into and through the discharge chamber, driving means for driving the metering assemblies, and means for securing the chambers together in cooperating relationship.

2. A dual pump assembly according to claim 1 comprising a labyrinth mixer positioned within the combining chamber for intermixing to a certain degree the streams combined by the combining means.

3. A dual pump assembly according to claim 1 comprising a port in the discharge chamber, a labyrinth mixer positioned in the port of the discharge chamber for further intermixing to a certain degree the combined streams as they are discharged from the pump assembly.

4. A dual pump assembly for combining and mixing in a controlled manner two separate liquid streams comprising an inlet chamber, means for introducing a first stream into the inlet chamber, a shaft terminating at a point adjacent the inlet chamber, a metering gear assembly secured to the shaft for metering the first stream, a combining chamber positioned opposite the inlet chamber, means for introducing a second liquid stream into the combining chamber, a conduit connecting the two chambers for conducting the first stream to the combining chamber, a combining unit positioned within the combining chamber which receives each stream in its separate state as the streams enter the combining chamber and combines the streams in a controlled manner without intermixing the streams, a labyrinth positioned within the combining chamber for intermixing, to a certain degree, the combined streams, a discharge chamber positioned between the first and combining chambers through and from which the combined and mixed streams are discharged, a second metering gear assembly of larger capacity than the first gear assembly, said second gear assembly being secured to the shaft and positioned between the combining chamber and the discharge chamber for further intermixing the combined streams being discharged from the combining chamber and for metering the combined streams into and through the discharge chamber, a port for the discharge chamber, a labyrinth

positioned in the port of the discharge chamber for further intermixing, to a controlled degree, the combined streams as they are discharged from the pump assembly, means connected with the shaft for rotating the shaft, and means for securing the plates together in cooperating relationship.

5. A dual pump according to claim 4 wherein the labyrinth mixer within the combining chamber comprises a cylinder having right and left hand threads which cooperate to form inter-connecting channels through which the combined streams pass.

6. A dual pump according to claim 4 wherein the labyrinth for the discharge chamber comprises a cylinder having raised rings therearound which rings have channels cut therethrough through which the combined streams are passed.

7. A dual pump acccording to claim 4 wherein the means for combining the two streams comprises a tube through which the first liquid stream passes, a sleeve positioned around the tube whereby an annular channel is formed between the tube periphery and the wall of the sleeve bore, a port in the sleeve wall through which the second stream is introduced whereby the second stream flows around and down the tube, a spring loaded valve in the outlet of the tube which is moved to the open position in response to the pressure build up in the tube as caused by the first stream passing through the tube whereby the first stream passes beyond the outlet of the tube to be combined with the second stream as it passes beyond the tube outlet.

8. A dual pump mixer and blender according to claim 4 wherein the first metering gear assembly comprises gears of lesser width than the gears in the second metering gear assembly.

9. A dual pump according to claim 1 wherein the combining unit comprises a tube through which the first liquid stream passes, a sleeve positioned around the tube whereby an annular channel is formed between the tube periphery and the wall of the sleeve bore, a port in the sleeve wall through which the second stream is introduced whereby the second stream flows around and down the tube to combine with the first stream being discharged from the tube mouth.

10. A dual pump according to claim 1 wherein the means for combining the two streams comprises a tube through which the first liquid stream passes, a sleeve positioned around the tube whereby an annular channel is formed between the tube periphery and the wall of the sleeve bore, a port in the sleeve wall through which the second stream is introduced whereby the second stream flows around and down the tube, a spring loaded valve in the outlet of the tube which is moved to the open position in response to the pressure build up in the tube as caused by the first stream passing through the tube whereby the first stream passes beyond the outlet of the tube to be combined with the second stream as it passes beyond the tube outlet.

11. A dual pump assembly for combining and mixing to a controlled degree two separate liquid streams, said assembly comprising an inlet chamber into which a first liquid stream is introduced, a metering assembly positioned adjacent the inlet chamber for metering the liquid stream, a liquid combining chamber positioned opposite the inlet chamber into which pass the first liquid stream and a separate second liquid stream, a combining unit positioned within the combining chamber which receives each stream in its separate state as the two streams enter the combining chamber and combines the streams in a controlled manner, a discharge chamber positioned between the inlet and combining chambers for discharging the streams, a second metering assembly positioned between the combining and discharge chambers for partially mixing the combined streams as they are discharged from the combining chamber and for metering the combined streams into and through the discharge chamber, drive means for driving the metering assemblies, and means for securing the chambers together in cooperating relationship.

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