June 5, 1928. 1,672,070

E. LUNGE

PUMP AND LIKE DEVICE FOR CONTROLLING THE DELIVERY RATE OF FLUIDS

Filed Nov. 13, 1925 3 Sheets-Sheet 1

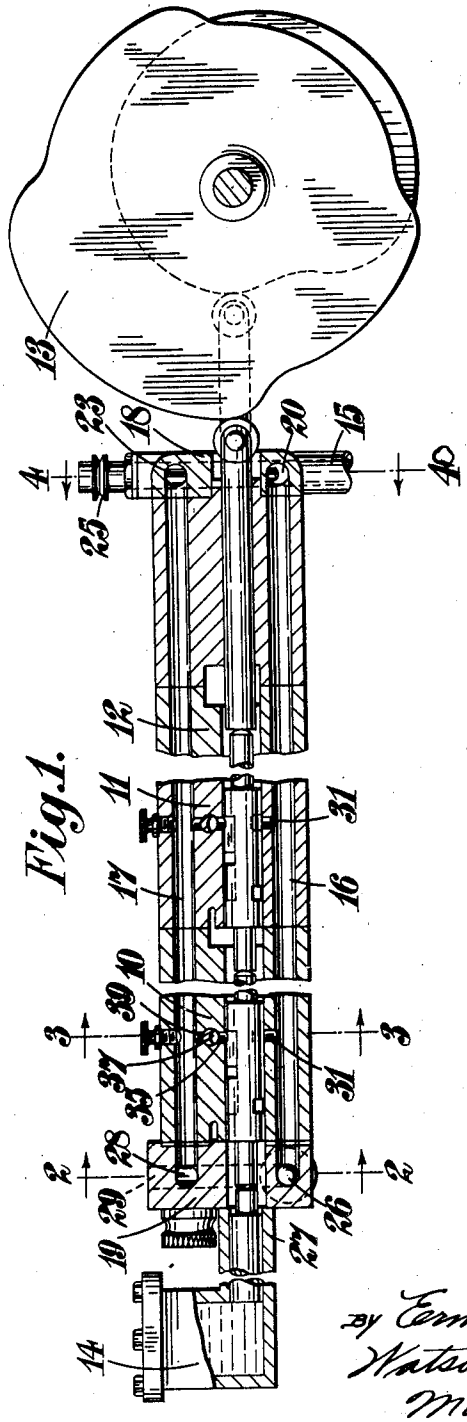

Fig. 1.

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Filed Nov. 13, 1925 3 Sheets-Sheet 2

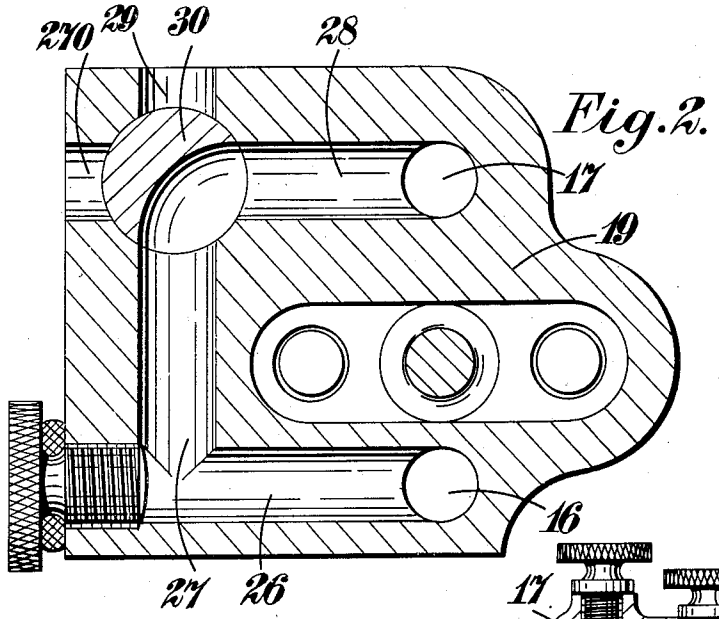

Fig. 2.

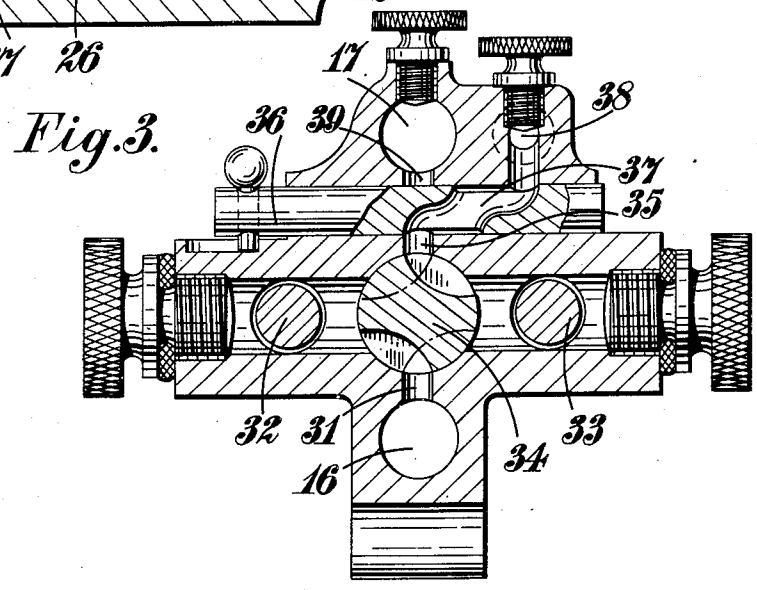

Fig. 3.

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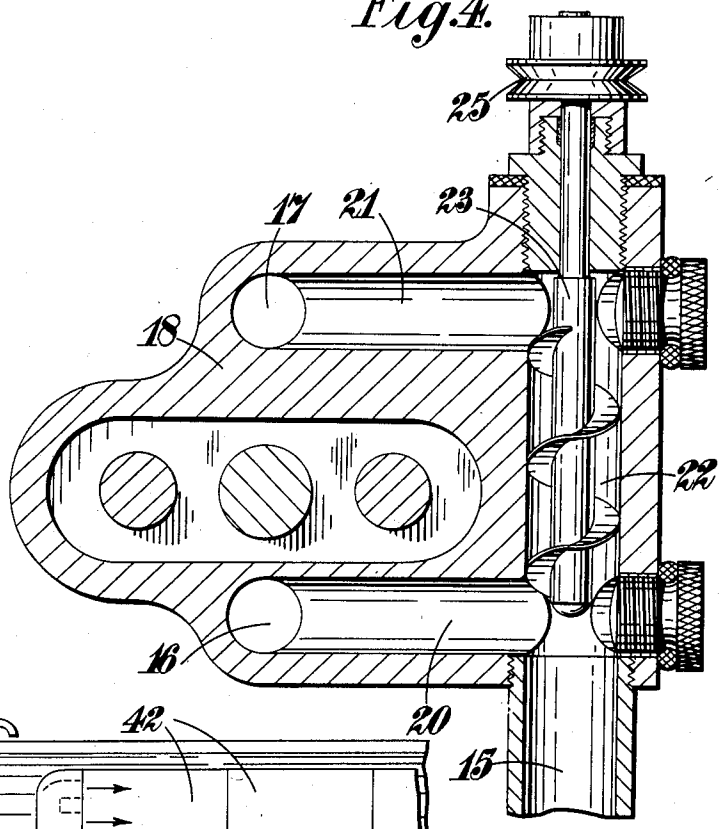
PUMP AND LIKE DEVICE FOR CONTROLLING THE DELIVERY RATE OF FLUIDS

Filed Nov. 13, 1925 3 Sheets-Sheet 3

Fig.4.



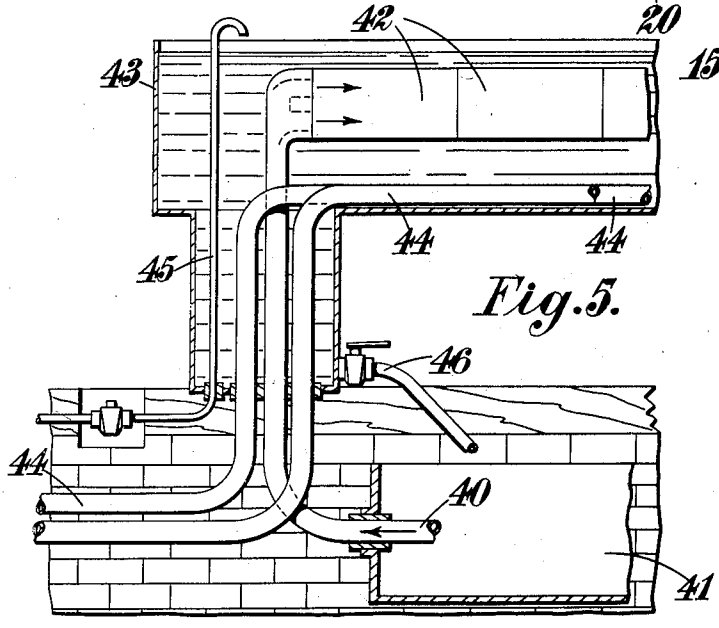


Fig.5.

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UNITED STATES PATENT OFFICE.

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PUMP AND LIKE DEVICE FOR CONTROLLING THE DELIVERY RATE OF FLUIDS.

Application filed November 13, 1925, Serial No. 68,876, and in Great Britain November 20, 1924.

This invention is for improvements relating to pumps and like devices for delivering or controlling the rate of delivery of fluids, and has for its object to provide a construction and arrangement of parts for use with fluids which may lack homogeneity when such lack of homogeneity is undesirable.

This invention accordingly comprises an apparatus for delivering from a plurality of outlets a fluid which may lack homogeneity, the combination with the supply-pipe or -pipes, of a conduit forming a continuous ring, that is fed thereby, and has the outlets all supplied through similar branches from it, and means for continuously circulating the fluid around the ring; it is not necessary that the branches should be equally spaced around the ring provided they are all similar to one another.

The circulation of the fluid around the ring may be, and preferably is, at a speed higher than would be produced merely by the flow of the fluid from the outlets, as thorough mixing of the fluid is thereby facilitated.

The invention is particularly applicable for use in the manufacture of artificial silk in which a viscose solution is squirted from spinning-nozzles. The spinning-nozzles are usually arranged in groups of a considerable number which are fed from a supply-pipe, and as the spinning-nozzles are constituted by comparatively small orifices, the rate of flow of the viscose from the supply-pipe to the nozzles is small. The nature of the viscose changes by ageing or maturing with the effluxion of time, and the result is that a nozzle which is near the supply-pipe will deliver viscose which is less matured than a nozzle which is remote from the supply-pipe, and this of course, is undesirable. The object of the present invention, when used in the manufacture of artificial silk, is to ensure that the product delivered from a series of nozzles, is substantially uniform, irrespective of the distance of any particular nozzle from the supply pipe. This uniformity may be further ensured by suitably controlling the temperature of the viscose solution and thereby controlling its rate of ageing.

The herein-described method of rapidly circulating the liquid around a closed circuit, from which the spinning-nozzles are fed, also ensures homogeneity of the product in such circumstances, for example, as when introducing a fresh supply of material, which may not be absolutely identical with the material which is being treated. By thoroughly mixing the two liquids the resulting product is rendered more uniform in quality than it would otherwise be.

According to another feature of this invention, therefore, there is provided for use in the manufacture, of artificial silk from viscose, the combination with a series of spinning-nozzles, each associated with means controlling the rate of delivery of viscose therefrom, of a supply-pipe common to all of the nozzles, a return-flow pipe forming a closed circuit with the supply-pipe, and means for causing a circulation of the viscose in the said closed circuit.

The pumping device for causing the circulation aforesaid in the closed circuit, is conveniently embodied in a separate element which constitutes the conduit connecting the supply- and return-pipes, and has the pumping device mounted or incorporated in it. Any desired form of pumping device may be used, but it is preferably such as provides a clear passage through it, being, for example, a screw-propeller.

According to another feature of this invention, the element connecting the supply- and return-flow pipes is provided with one or more openings to atmosphere, and valve-means for putting the pipes in communication therewith at will, for the purpose of permitting the easy expulsion of air from the whole of the system when filling the conduit or pipes with liquid.

The invention also comprises the constructions hereinafter described, whereby the temperature of the spinning-fluid is controlled, for the purpose of controlling its rate of ageing, and thereby more effectively ensuring the homogeneity of the final product.

In the accompanying drawings which illustrate one embodiment of the present invention—

Figure 1 is a longitudinal elevation in section of a series of pump-like devices which control the rate of flow of viscose from the nozzles of artificial silk spinning-machinery, the particular pump selected for illustration

being one of those described in the concurrent patent application No. 68,873, filed November 13, 1925. Other devices which are suitable for use in this manner are described and illustrated in the concurrent patent applications Nos. 68,874 and 68,875, both filed November 13, 1925.

Figure 2 is a sectional elevation on the line 2—2 of Figure 1, but on a larger scale;

Figure 3 is a section on the line 3—3 of Figure 1, also drawn to a larger scale;

Figure 4 is a section on the line 4—4 of Figure 1, also drawn to a larger scale; and

Figure 5 is a diagrammatic sectional elevation showing the arrangements for controlling the temperature.

Like reference characters indicate like parts throughout the drawings.

Referring to Figure 1, the references 10, 11, 12 indicate diagrammatically a series of pumps arranged end-to-end and operated by a cam 13, in conjunction with a hydraulic pressure reservoir 14. These pumps are supplied with viscose solution from a pipe 15 which supplies a conduit 16 extending throughout the length of the set of pumps. In the particular construction illustrated, this conduit is constituted by a straight bore extending lengthwise through the body of each pump and aligned with the bore of the adjacent pumps. The pump-bodies are pressed together endwise, packing material being inserted between them, if desired, in order to make tight joints and thereby provide a continuous pipe 16.

A similar pipe 17 is provided in the upper part of the pump-bodies and this constitutes a return-flow pipe, as hereinafter described.

The pipes 16, 17 are connected together at their ends in order to form a closed circuit by means of two separate members 18, 19, one at each end of the set of pumps. The member 18, as illustrated in Figure 4, consists of a suitable casting formed with a passage 20 into which the supply-pipe 15 opens and which communicates with the channel 16 aforesaid. A similar transverse passage 21 communicates with the channel 17 aforesaid and the two passages 20, 21, are connected by a vertical passage 22. Within this passage there is provided a screw-propeller or other simple device which will operate as a pump to cause the transfer of the liquid between the pipes 16 and 17. As illustrated, this device consists of a rotatable spindle 23 carrying a helical blade 24 in the passage 22, and provided with a pulley 25 conveniently situated outside the body of the part 18 for driving it.

The various passages in this part 18 are preferably formed as far as possible as straight-through bores having their ends closed by removable plugs in order to provide for easy cleansing of the whole device. Preferably, also, the propelling device is of a kind which does not of itself constitute a complete closure for the passage 22 so that liquid can pass through this passage, even when the propelling device is not in operation.

At the other end of the set of pumps 10, 11, 12, the channels 16, 17 are connected together by passages formed in the member 19. These passages are indicated at 26, 27, 28, and preferably the passage 27 is extended at 29 so as to open to atmosphere. A valve 30 is interposed at the junction of the passages 27, 28, 29, this valve being so arranged that it can permit communication between the passages 27 and 28 (whilst shutting off the passage 29), or between passages 27 and 270 (passages 29 and 28 being shut off) or between passages 29 and 28 (27 and 270 being shut off) or can open passages 27 and 28 to passage 270 (29 being shut off) or passages 27 and 28 to passage 29, the passage 270 being shut off.

In the operation of this apparatus, the viscose or other solution is admitted from the supply-pipe 15. It flows in through the passage 20 to the pipe 16 and fills it, expelling the air therefrom, and during this time the valve 30 is set so that the passage 270 is open to permit the escape of air. After the channel 16 is filled the liquid rises in the passage 27 and will be seen overflowing at 270, having driven the air before it. When the passage 27 is filled with liquid, the valve 30 is turned clockwise to connect the passages 28 and 29 and close the passages 27 and 270. The pressure of the supply will now let the liquid rise in the passage 22 and pass into the channel 17 and from there into the passage 28, driving out the air through 29. The filling of the passages 22, 21, 17 and 28 will be shown by liquid overflowing at 29. The valve is now turned further clockwise to connect passages 27 and 28 and shut off passages 27 and 270. As the opening 29 is at a higher level than any other part of the circuit 20, 16, 27, 28, 17, 21, 22, all the air will be expelled without any being entrapped in the circuit. The valve 30 being turned so as to shut off the passage 29 and provide communication only from the passage 27 to the passage 28, there is provided a complete circuit, as above set forth, and when the propelling device 24 is set in operation the liquid will be circulated around this circuit at a speed dependent upon the action of the propelling device.

If the propelling device 27 is of a kind which does not allow liquid to pass through the bore 22 when said device is not operating, then such device must be started as soon as the valve 30 has been turned as aforesaid to connect the passages 28 and 29.

It will be appreciated that the possibility of connecting and disconnecting the various

passages in the part 18 by means of the valve 30 in the manner described enables the operator to ensure that the air is completely removed from the junction of the passages 27 and 28.

The spinning-nozzles are supplied by the pumps 10, 11, 12 in a manner which need not be described in detail, the supply for each nozzle being drawn from the channel 16 through a lateral outlet 31, see Figures 1 and 3, and the rate of circulation of the liquid around the closed circuit or ring aforesaid is preferably substantially higher than would be given simply by the flow of liquid along the channel 16 to the outlet-passages 31 to supply them.

Figure 3 is a sectional view of one of the pumps described in concurrent patent application aforesaid, No. 68,873, and this view, in addition to showing the supply- and return-flow channels 16, 17, also shows two pump-pistons 32, 33 with a valve-member 34. The operation of these need not be described in detail, as it is set forth in the patent specification aforesaid, but attention is directed to the passage 35 by which the spinning solution is delivered from these pumps. This passage is controlled by a valve 36 comprising a cylindrical body provided with an aperture 37 through it, which, by longitudinal movement of the body, can provide communication from the passage 35 to the outlet 38 whereto the spinning-nozzle is attached, or, alternatively to a passage 39 communicating with the return-flow channel 17. If it is desired to stop the delivery from the nozzle of any one pump, without interfering with the delivery from the other pumps, all that is necessary is to adjust the valve 36 so that the liquid delivered from the pumps 32, 33, is sent through the passage 39 into the channel 17 where it takes part in the general circulation taking place therein.

A further feature of this invention relates to the arrangements for controlling the temperature of the spinning solution. The solution is prepared in chambers, usually in underground cellers, whereof the temperature can be accurately controlled, and it is conveyed therefrom to the spinning-nozzles by pipes such as 40, see Figure 5. These pipes are immersed in a jacket 41 which contains any suitable liquid whereof the temperature can be controlled. If it is desired to use particularly low temperatures, brine may be used; this would be suitable when it is desired to cool the solution to such an extent that the ageing process practically stops, as would be desirable, say, in closing the factory down for a week-end.

The solution is conveyed through the pipe 40 to a series of pumps or like devices as hereinbefore described and diagrammatically illustrated at 42.

These devices are mounted in a bath 43 and immersed in a liquid whereof the temperature can be controlled. Preferably a dilute alkaline solution such as 1% caustic soda or 1% sodium carbonate is used, as such solutions prevent corrosion of iron or steel, of which the pumps are conveniently made.

The temperature of the liquid in the bath 13 is controlled by providing in it pipes 44 through which a refrigerating medium or a heating medium may be circulated, according to the requirements of any particular case. The pipe indicated at 45 is used for supplying the liquid to the bath, and a drain-cock from the bath is illustrated at 46.

It will be seen that by providing a complete and positive control of the temperature of the spinning solution from the time it leaves the ageing-chamber until it reaches the devices which supply the individual spinning nozzles, that is to say, by means of the baths 41 and 43, the control of the nature of the solution is complete and can, in association with the arrangements for circulating the liquid as above described, ensure perfect homogeneity of the liquid delivered to the spinning nozzles. Moreover, any difficulties which may arise from stoppage of the plant may be obviated by arranging that the temperature of the spinning solution is reduced to such an extent that the ageing practically ceases, and the spinning operations can be recommenced after the interruption as soon as the temperature of the spinning solution has been brought back to normal.

Whilst a specific construction of pumping device has been described and illustrated, it will be appreciated that the invention is not limited to this form, nor even to forms in which the closed ring or circuit aforesaid is constituted by passages provided in the bodies of the pumps, for it can be equally well used in the form of separate piping. Also, the particular form of by-pass valve which is used for rendering one pump inoperative is not limited to the construction illustrated in Figure 3, for various other arrangements could be used, and if the pumps are of a type in which the motion of the pistons of any one pump could be stopped without interfering with the other pumps, it would not be necessary to provide this by-pass valve. The invention, therefore, covers many modifications or alternative constructions other than those already described.

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

1. In apparatus for the manufacture of artificial silk from viscose, the combination of a series of spinning-nozzles, means controlling the rate of delivery associated with each of said nozzles, a supply-pipe common to all of said nozzles, a return-flow pipe

forming a closed circuit with said supply-pipe, and means for causing a circulation of the viscose in said closed circuit.

2. In apparatus for the manufacture of artificial silk from viscose, the combination of a series of spinning nozzles, means associated with each of said nozzles for controlling the rate of delivery therefrom, a supply-pipe common to all of said nozzles, a return-flow-pipe, an element constituting a conduit connecting said supply and return-flow-pipes, and a pumping device in said conduit.

3. In apparatus for the manufacture of artificial silk from viscose, the combination of a series of spinning nozzles, means associated with each of said nozzles for controlling the rate of delivery therefrom, a supply-pipe common to all of said nozzles, a return-flow-pipe, an element constituting a conduit connecting said supply and return-flow-pipes, a screw-propeller in said conduit, and means for rotating said screw-propeller.

4. In apparatus for the manufacture of artificial silk from viscose, the combination of a series of spinning nozzles, a supply-pipe common to all of said nozzles, a return-flow-pipe forming a closed circuit with said supply-pipe, a branch pipe in said circuit opening to atmosphere, valve means controlling said branch pipe, and means for circulating the viscose in said supply and return-flow pipes.

5. In apparatus for the manufacture of artificial silk from viscose, the combination of a series of spinning-nozzles, a supply-pipe common to all of said nozzles, a return-flow-pipe, a conduit connecting said supply and return-flow-pipes, a branch from said conduit opening to atmosphere, a valve controlling said branch, and means for circulating the viscose through said supply and return-flow-pipes.

6. In apparatus for the manufacture of artificial silk from viscose, the combination of a series of spinning-nozzles, means associated with each of said nozzles for controlling the rate of delivery therefrom, a supply-pipe common to all of said nozzles, a return-flow-pipe, valve-controlled means permitting communication from each of said flow-controlling devices to said return-flow-pipe, and means for circulating the viscose around said supply and return-flow-pipes.

In testimony whereof I affix my signature.

ERNEST LUNGE.