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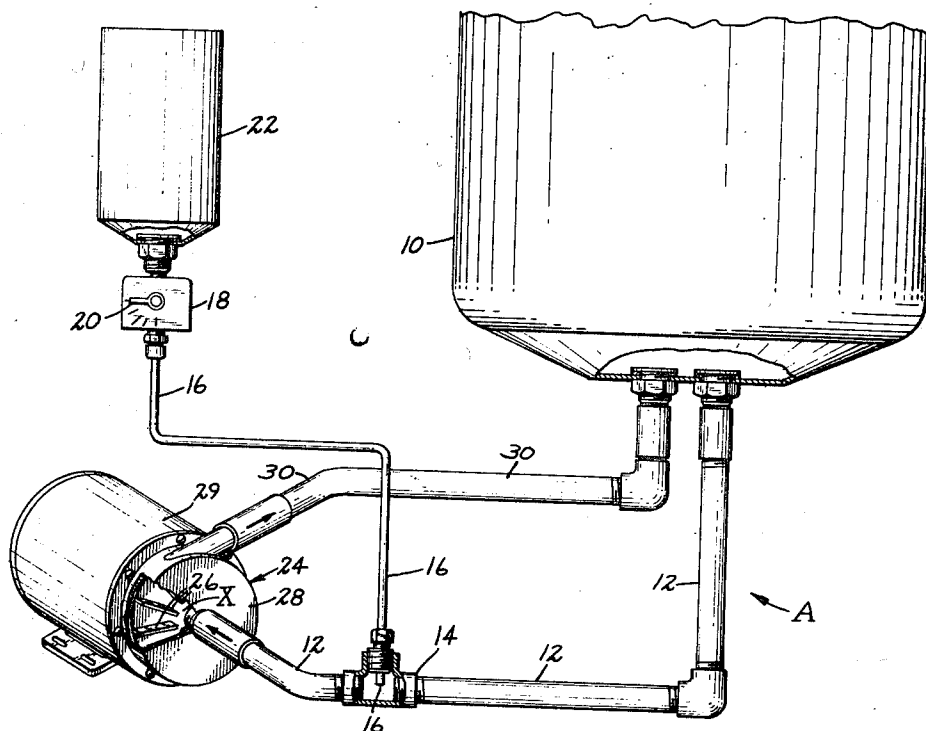
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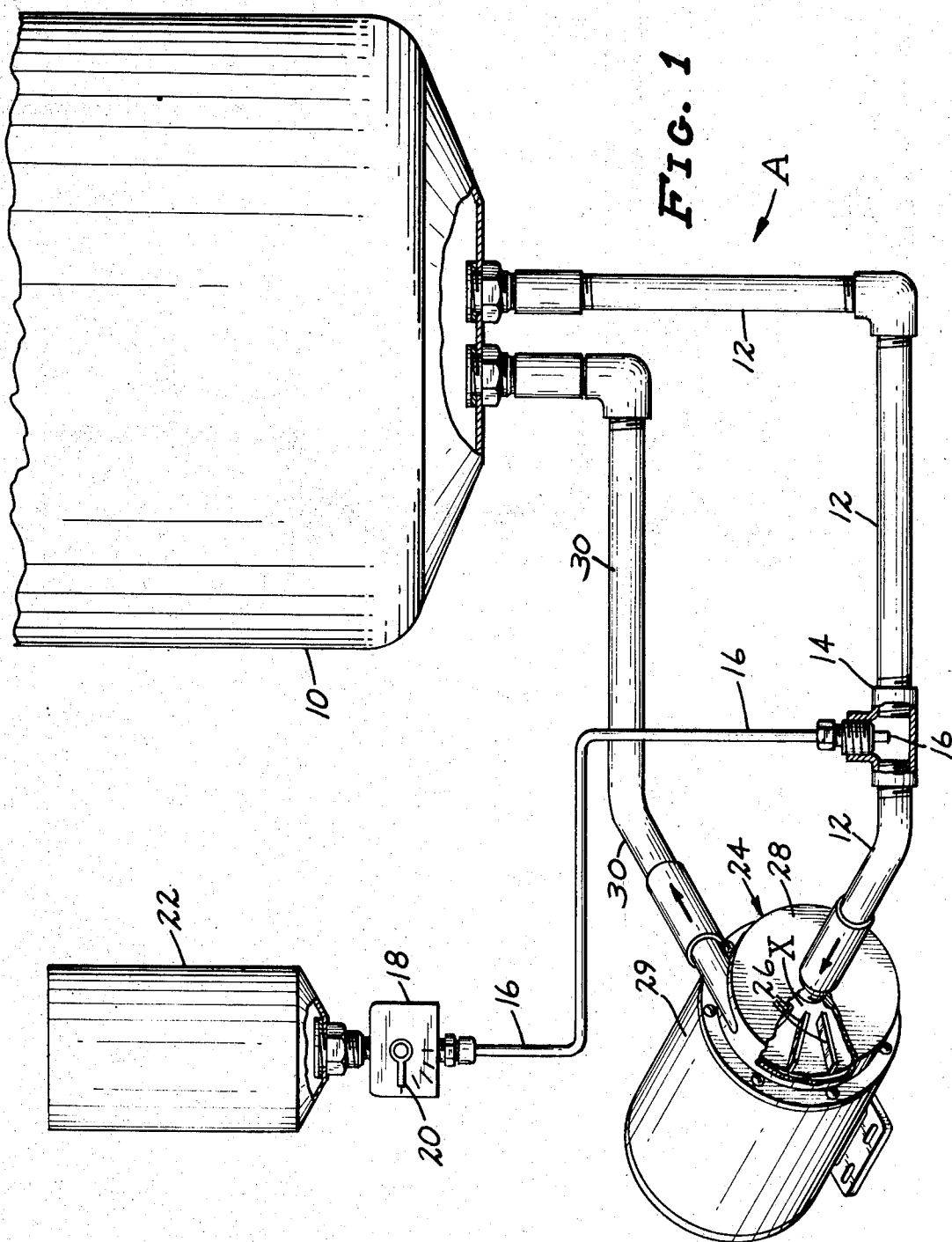
[54] **DEVICE FOR MIXING FLUIDS**
2 Claims, 3 Drawing Figs.

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 [50] Field of Search 259/95, 96,
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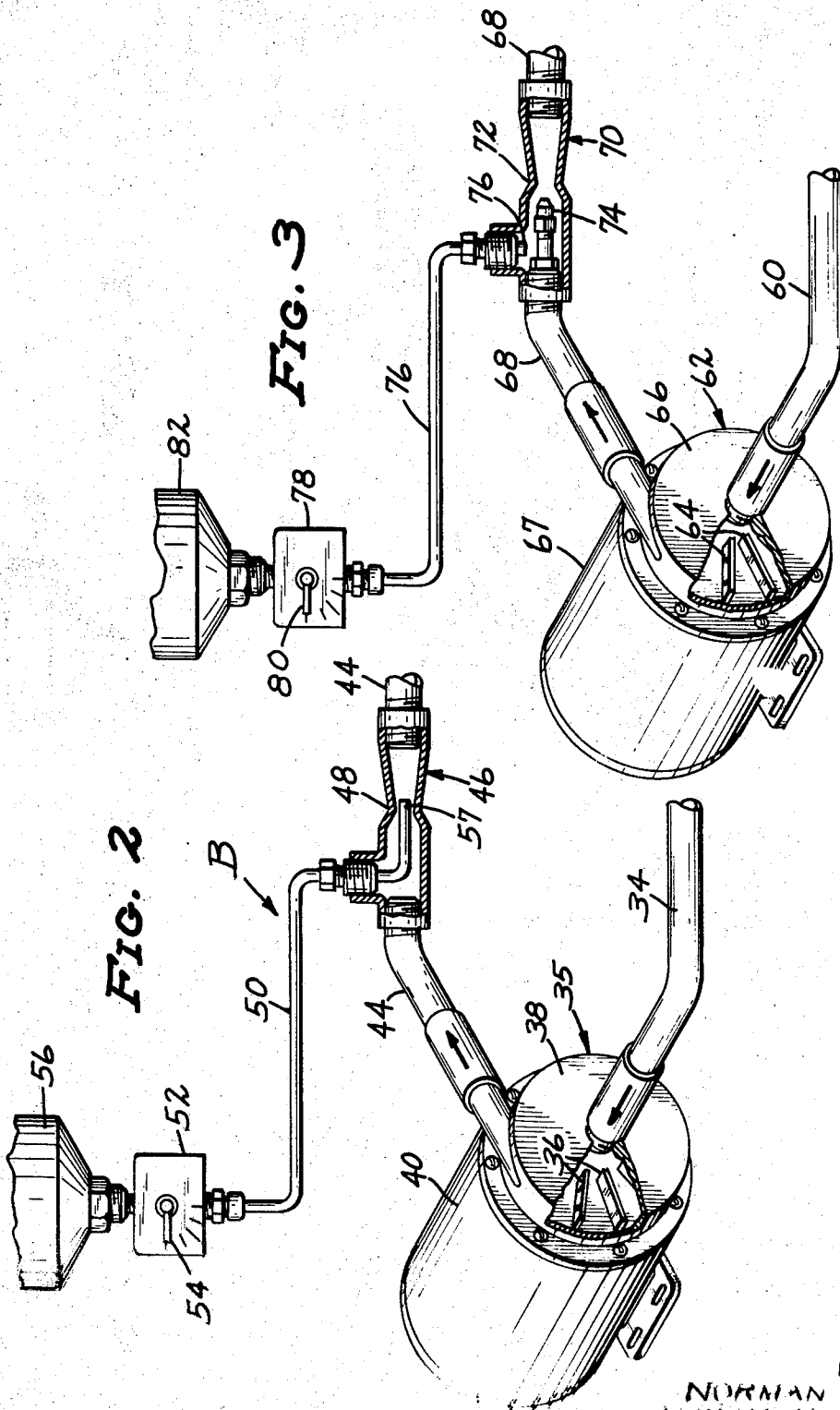
ABSTRACT: A container for containing a first fluid having conduit means leading from and to said container in a loop with the container together with a pump interposed in the conduit means for moving a fluid through the container means and the conduit means and means for creating an increase in the fluid velocity of the fluid moved through the conduit means with a resultant lower pressure area thereby creating an inducement area followed by an area of high turbulence further including means for subjecting a second fluid to the inducement area to introduce the second fluid into the first fluid and subject the mixture to the area of high turbulence.





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DEVICE FOR MIXING FLUIDS

SUMMARY OF THE INVENTION

The invention relates to devices for mixing and dissolving one fluid with another. As an example of the problem of mixing, it is difficult to dissolve a fluid such as benzyl alcohol with photographic solutions.

Liquid concentrates vary in viscosity and density. Some concentrates actually float on water in a mix tank with little tendency to sink to the bottom where the stirring action is carried on with conventional propeller blades on a shaft. A drawback of the propeller blade type of stirring is that the blades create a vortex or whirlpool in which air may be mixed into the solution which causes developer oxidation in photographic solutions.

It is therefore an object of the invention to provide a device with which is produced an area of increased fluid velocity and resulting lower pressure in which area a second fluid is introduced into a first fluid. At this area a resulting turbulence is set up which breaks up the second fluid into microdroplets which result in quick and thorough mixing of the first and second fluids.

FIG. 1 is an elevational view of a device for mixing liquids embodying the invention, portions of which are broken away other portions being in section.

FIG. 2 is an elevational view of a further embodiment of the invention portions of which are broken away and in section.

FIG. 3 is an elevational view of a still further embodiment of the invention, portions thereof being in section.

Referring to the drawings in detail, the device A includes the mix tank 10 and leading from the bottom of the tank 10 is the hollow output or suction line 12. Extended into the suction line 12 by the conventional union 14 is the lower end of the supply line 16. The line 16 at its upper end is connected to a conventional flow rate shutoff valve 18 or the like equipped with the control handle 20 for controlling the flow of concentrate or other fluid from the reservoir 22 to which the valve 18 is connected. The reservoir 22 is provided to contain a concentrate or fluid of marginal solubility and the valve 18 is adjusted to control the rate of flow from the reservoir so that the rate at which the liquid is being added to the first fluid from tank 10 does not exceed the rate at which it is able to dissolve in the fluid from tank 10.

The outer end of the suction line 12 is connected to the axial center or input of the conventional centrifugal pump 24 having the radially disposed impeller vanes 26 in the housing 28, the vanes rotated by the motor 29 of the pump 24. Leading from the periphery of the vane housing 28 is the pressure line 30 which connects to the bottom of the mix tank 10.

In the use and operation of the device A the first fluid to be mixed with a second fluid is placed in the tank 10. The concentrate or second fluid to be mixed with the fluid of tank 10 is placed in the reservoir 22. The pump 24 is then operated by a source of electrical power which draws the fluid from the tank 10 through the suction line 12 to the pump, and the fluid is ejected from the pump into the pressure line 30 by means of which the fluid is returned to the tank 10. The valve 18 is set to allow a flow of fluid from the reservoir 22 through supply line 16 to the union 14 and into the tank suction line 12.

As the first liquid is drawn from the tank through the suction line 12 as at area X the second fluid is drawn from the line 16 into the line 12, and the first and second fluids are moved to the vanes of the impeller of the pump 24. The vanes 26 of the centrifugal pump increase the radial velocity of the combined liquids and eject the same out the line 30 thereby causing reduced pressure on the center inlet or input port where the suction line 12 connects with the vane housing 28 thereby drawing in fresh solution from line 12 that in turn is set in rapid radial motion by the vanes 26 of the impeller. The "suction" created at the pump inlet port draws as much of the second fluid as the restricting valve 18 will permit. The mixture of the fluid from tank 10 and the liquid from reservoir 22 is forced into tank 10 through pressure line 30 and out the suc-

tion line 12 thus producing a circulation from tank to pump to tank. The mixture is recirculated until all the second fluid is mixed with the first fluid.

There is a positive mixing action of the first and second fluids which is caused by the violent rolling and turbulence of the mixture against the vanes 26 of the impeller and the inside surfaces of the impeller housing 28. Such an action increases the fluid velocity and reduces pressure at and near the inlet port resulting in a turbulence condition of high "shear" that disperses the second liquid into micro droplets. This vastly increases the surface area of the second liquid exposed to the first liquid from tank 10 which results in instant mixing or emulsifying of the second liquid with the first liquid. Further mixing when necessary is accomplished by recirculating the mixture from tank to pump and pump to tank. The extent of recirculation depends on the materials being mixed. The flow rate valve 18 may be closed after the desired amount of the second liquid is combined with the first liquid from tank 10. This prevents air from being drawn into the solution that frequently results in developer oxidation in the photographic industry. It will be seen that with the reduced pressure at the area of the inlet port of the pump as at X the reservoir 22 can be mounted at a point below the level of the mix tank containing the liquid with which the second fluid concentrate of the reservoir is to be mixed. This is due to the fact that the second fluid is sucked from the reservoir and it makes it highly desirable in some types of installations of mixing devices and particularly due to the increase in size and weight of the container of the second fluid. With the device described, the supply of second fluid may be drawn from a container without extended handling of the container due to the fact that the position of the second fluid supply is not critical.

A further embodiment B of the invention is illustrated in FIG. 2 in which is found the suction or output line 34 which leads from a mix tank such as 10 in FIG. 1. The suction line 34 is connected to the axial center or input of the conventional centrifugal pump 35 having the radially disposed impeller vanes 36 in the housing 38, the vanes rotated by the motor 40 of the pump 35. Leading from the periphery of the vanes housing 38 is the pressure line 44 which connects to the bottom of a mix tank such as 10 in FIG. 1.

Interposed in the pressure line 44 is the connector member 46 which has the reduced diameter or venturi formation 48. The numeral 50 designates a supply line the upper end of which is connected to the conventional flow rate and shut off valve 52 or the like equipped with the control handle 54 for controlling the flow of a second fluid from the reservoir 56 to which the valve 52 is connected. The lower end of the line 50 is connected to the connector 46, and the inner end 57 is positioned at the area of the venturi 48. The reservoir 56 is provided to contain a concentrate or fluid of marginal solubility and the valve 52 is adjusted to control the rate of flow from the reservoir so that the second fluid being added to the first fluid from tank 10 does not exceed the rate at which it is able to dissolve in the liquid from the tank 10. The line 44 is connected to a mix tank such as tank 10 in FIG. 1.

In the operation of the device B a flow of a fluid from a mix tank through lines 34 and 44 and to the mix tank is due to the pump 35 interposed between suction line 34 and pressure line 44. At the venturi 48 restriction in connector 46 there is created a reduced pressure area due to the increased velocity of the fluid through the venturi. The reduced pressure area creates an inducement area followed by a turbulence area where the second liquid from line 50 is introduced, and the submission of the second liquid to the turbulence breaks up the second fluid from line 50 into microdroplets which substantially instantly results in a complete mixing of the two liquids. The inducement area draws the second liquid from the reservoir. Further mixing when necessary is accomplished by recirculating the mixture from tank to pump and pump to tank.

A still further embodiment C of the invention is illustrated in FIG. 3 in which is found the suction line 60 which leads

from a mix tank such as 10 in FIG. 1. The suction line 60 is connected to the axial center or input of the conventional centrifugal pump 62 having the radially disposed impeller vanes 64 in the housing 66, the vanes rotated by the motor 67 of the pump 62. Leading from the periphery of the vane housing 66 is the pressure line 68 which connects to the bottom of a mix tank such as 10 in FIG. 1.

Interposed in the pressure line 68 is the connector member 70 which is formed with the reduced diameter or venturi formation 72. Connected to the pressure line 68 and extending within the connector 70 is the high velocity jet nozzle 74 the tip of which is substantially at the venturi throat 72. The numeral 76 designates a supply line the upper end of which is connected to the conventional flow rate and shutoff valve 78 or the like equipped with the control handle 80 for controlling the flow of a second fluid from the reservoir 82 to which the valve 78 is connected. The lower end of the line 76 is connected to the connector 70 and extends to a point within the connector adjacent the jet nozzle 74.

In the operation of the device C a flow of a first fluid is drawn from suction line 60 through pump 62 and ejected out through nozzle 74 where it mixes with a second liquid coming from the end of the supply line 76. The liquid coming out of the nozzle 74 is at high fluid velocity, and the venturi 72 increases the fluid velocity. The venturi creates a reduced pressure which creates an inducement area followed by a turbulence set up in the area of the venturi and nozzle which breaks up the second liquid into microdroplets which substantially instantly results in a complete mixing of the two fluids. The reservoir 82 is provided to contain a second fluid of marginal solubility and the valve 78 is adjusted to control the rate of flow from the reservoir so that the concentrate being added to the liquid from line 60 does not exceed the rate at which it is able to dissolve in the fluid from line 60. Additional mixing is accomplished by recirculating the fluids from tank to pump and pump to tank. The inducement area draws the second fluid from the reservoir through the supply line for mixture with the first fluid.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having

now therefore fully illustrated and described our invention.

We claim:

1. A device for mixing one fluid with another fluid in a manner to prevent the introduction of air into the mixture, comprising:
 - a. a first tank for containing the first fluid;
 - b. an impeller pump having an input for accepting fluid to be pumped and an output for providing fluid under pressure;
 - c. a first conduit having a first end connected to the bottom of the first tank and a second end connected to the input to the impeller pump;
 - d. a second conduit having a first end connected to the output of the impeller pump and a second end connected to the first tank;
 - e. a second tank for containing a second fluid to be mixed with the first fluid outside the first tank without the introduction of air into the mixture;
 - f. valve means connected to the second tank to control the flow of fluid out of the second tank; and
 - g. a third conduit having a first end connected to the valve means and having a second end connected to the first conduit in a manner that the second end of the third conduit is immersed in any stream of fluid flowing in the first conduit to allow the mixing of the first fluid and the second fluid outside of the first and second tanks, and without the introduction of air into the mixture, at a position before the first fluid flowing from the first tank reaches the input to the impeller pump, the suction of the impeller pump drawing as much of the second fluid as the valve means will permit, and the turbulent condition within the impeller pump dispersing the second liquid into microdroplets with an increased surface area such that the second liquid is rapidly mixed with the first liquid within the impeller pump.
2. The device of claim 1, wherein the first conduit includes a union, and the second end of the third conduit connects with the union to allow a mixing of the first and second fluids outside of the first and second tanks without the introduction of air into the mixture.

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