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(54) Circulation system and method for reducing foaming in the dampening system of a printing press.

(57) A circulation system for reducing foaming of the water or water and isopropanol wetting fluid circulating in a printing press, comprises a fountain pan (20) which drains into a vented return conduit (26). The vent exhausts air drawn into the circulation system to minimize foaming. A sump (36) is provided at a low point in the circulation system to prevent air entrainment in the system during start up. Wetting fluid is drawn from the sump (36) by a venturi tube (38) calibrated to provide a sufficient amount of suction that will drain the sump (36) but which will not draw air into the circulation system from the fountain pan (20). The venturi tube (38) has at least one, and preferably two orifices (52, 54) therein. The circulation system allows increased wetting fluid flow rates while reducing foaming, reducing the temperature increase across the fountain pan inlet and outlet by one-half of that of prior art devices.

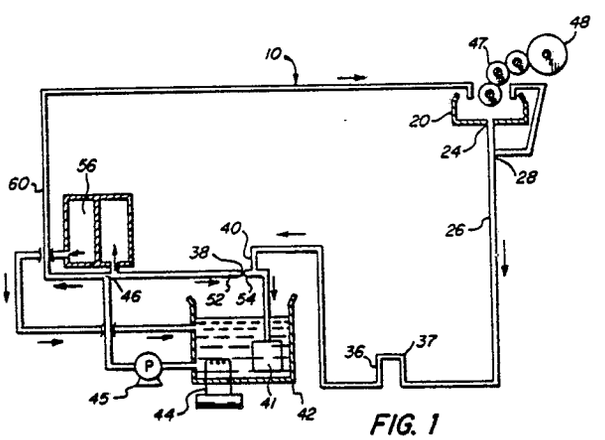

FIG. 1

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CIRCULATION SYSTEM AND METHOD FOR REDUCING FOAMING IN THE DAMPENING SYSTEM OF A PRINTING PRESS

Field of the Invention

The present invention relates to the dampening systems of printing presses.

Prior Art

In high speed printing presses, such as web offset lithographic presses, a dampening system is used to provide a thin layer of a wetting fluid to the press plates. The wetting fluid is usually water, or a water, chemical and isopropanol mixture. Isopropanol is used to reduce the surface tension of the wetting fluid, allowing it to be spread more easily and thinly on the press plate. The dampening system wets down the plate before the ink is applied to the plate to selectively prevent inking of the press plate.

Typically the dampening system will include an open fountain pan having an inlet and an outlet through which flows a stream of the wetting fluid and in which rotates a water pan roller. The water pan roller picks up a film of the wetting fluid and transfers this film to a contacting counter-rotating roller to make the film thinner; at least one more roller is usually used to further thin the wetting fluid before it is applied to a press plate.

In dampening systems known in the industry, the wetting fluid is drawn from the fountain pan through return tubing by suction which is created by a venturi in a cooling unit. The wetting fluid is passed through a filter to remove lint, dust, fibers and ink from the wetting fluid, and then cooled in a refrigerated reservoir in the cooling unit. The wetting fluid is then pumped from the reservoir to a flow divider which directs a portion of the wetting fluid back to the fountain pan, and a portion of the wetting fluid through the venturi to create suction in the return conduit. The venturi has a single orifice at its throat sized to provide the maximum amount of vacuum for the pump flow rate. A wetting fluid specific gravity measuring apparatus and isopropanol metering unit is provided between the pump outlet and the fountain pan to maintain a predetermined mixture of water and isopropanol in the wetting fluid.

It has been found with such known dampening systems that foam and bubbles will form in the circulation system. It often happens that air above the open fountain pan will be drawn into the fountain pan outlet and collect in the circulation system. This leads to two problems.

The most severe problem of air entrainment in the circulation system is that it can cause foaming of the wetting fluid as it passes through the venturi and the filters. Foam in the wetting fluid creates immediate print quality problems. Foam in the dampening system, particularly in the fountain pan, impedes the smooth dispersion of the wetting fluid on the press plate, giving unacceptably poor print quality. In addition, the foam will cause false measurements in the wetting fluid specific gravity measurement apparatus. The wetting fluid specific gravity measurement apparatus will be measuring a wetting fluid having a lower specific gravity due to the entrained bubbles in the wetting fluid, and will thus meter a lower quantity of isopropanol into the system than desired, causing a further deterioration in wetting fluid dispersion and print quality.

The other problem of air entrainment into the system is the potential for creating an air bubble within the return tubing which will impede the draining of the wetting fluid from the fountain pan, causing overflows and flooding of the press room floor.

It should be appreciated that the aforementioned foaming problems are most prevalent where there are reduced quantities of isopropanol in the wetting fluid, because the surfactant effect of isopropanol in the wetting fluid reduces foaming problems. Nevertheless, it has been found that foaming occurs even with higher isopropanol concentrations.

Several solutions to these problems have been considered. For example the fountain pan outlet size might be increased in diameter; however, this would involve expensive retrofitting of the existing press hardware. A defoaming agent might be added to the wetting fluid; however, this could negatively affect the qualities of the etch solution.

A reduction of the wetting fluid flow rate can reduce the foaming in the system. However, such a reduced flow rate causes other problems. The constant contact between the rotating rolls generates a great deal of frictional heat, which causes a substantial temperature differential in the wetting fluid between the inlet and outlet of the fountain pan. This temperature differential in the wetting fluid from one end of the pan to the other causes a viscosity change in the wetting fluid as it passes through the pan. Consequently, more wetting fluid will be picked up by the pan rollers at the inlet side than at the outlet side of the pan, causing print quality variations. The lower the flow rate of the wetting fluid through the fountain pan, the more severe this problem becomes. Furthermore, the uneven spreading associated with low wetting fluid

flow rates may induce the pressman to increase the amount of isopropanol in the wetting fluid in an attempt to achieve better spreading of the wetting fluid. However, high levels of isopropanol in the wetting fluid pose potential health problems for the pressmen, may violate emissions control standards, and increase fire and explosion hazards.

Summary of the Invention

It is an object of the present invention to provide a circulation system and method for reducing foaming in the dampening system of a printing press. It is a further object of the invention to provide such reduced foaming at higher flow rates than has hereto been possible.

These objects, and other objects which will become apparent from the description that follows, are achieved by a circulation system which comprises a fountain pan having at each end an inlet and an outlet through which flows a wetting fluid. A return conduit is attached to the fountain pan outlet; this return conduit has a vent downstream of the outlet which allows entrained air to escape from the conduit. The return conduit has preferably at least a 5/8 inch inner diameter. The vent is located between closely adjacent to up to about 24 inches downstream of the outlet, preferably in a vertical section of the conduit. A tube which leads back up to and into the fountain pan may be mounted in the vent to recycle liquid to the fountain tray outlet. A sump, which may comprise a portion of the return conduit formed into an inverted U-shaped loop, may be provided downstream of the vent at the lowest point of the return conduit. Wetting fluid is drawn from the sump and return conduit by a venturi tube, and flowed through a filter unit. The venturi tube provides a vacuum to the sump which calibrated to be sufficient to draw wetting fluid from the sump, yet which does not entrain air into the wetting fluid at the fountain pan outlet. The venturi tube has an inlet with a first orifice and a throat with a second orifice. The return conduit is connected to the venturi downstream of the second orifice, and the vacuum created in the return conduit pulls the wetting fluid from the sump and return conduit. The ratio of the inner diameter of the first orifice to the inner diameter of the second orifice is about 0.5 to 1.25.

A reservoir having a cooling means within it receives the wetting fluid from the filter. A pump then flows the wetting fluid from the reservoir to a flow divider which sends a portion of the pumped fluid to the venturi to induce the vacuum in the return conduit, and a portion of the fluid back to the fountain tray inlet for application to the press plate.

Brief Description of the Accompanying Drawings

FIG. 1 is a schematic of the circulating system embodying the invention.

FIG. 2 is a perspective view of the circulating system embodying the invention.

FIG. 3 is a cross sectional view of the venturi tube embodying the invention.

FIG. 4 is a cross sectional view of an embodiment of the vent of the present invention.

Detailed Description of the Drawings

The invention will now be illustrated further with respect to the drawings.

With reference to FIGS. 1 and 2, the circulation system 10 comprises a standard fountain pan 20 having an inlet 22 and an outlet 24 at opposite ends of the fountain pan 20. Wetting fluid in the fountain pan is drained through outlet 24 into return conduit 26, which is typically a flexible tubing which preferably has an inner diameter of at least 5/8 inch to allow a downward fluid flow as well as a upward flow of any trapped air bubbles.

Vent 28 is located in return conduit 26. Vent 28 serves to vent air which is drawn into conduit 26 through the outlet 24, preventing air bubbles from becoming trapped in the conduit 26 and blocking the flow of the wetting fluid, and eliminating these bubbles from the circulation system before they are passed through a venturi tube 38 where they would create foam in the wetting fluid. Preferably, vent 28 is provided in a vertical section of the return conduit 26, at a location adjacent to or up to 24 inches downstream of the outlet 24. However, the vent may also be located in a horizontal or angled section of the return conduit on the upper surface of the conduit.

Vent 28 may be take any number of embodiments, although it has been found that the easiest vent 28 to install and remove is one such as that shown in FIG. 4, namely a sleeve 30 having an outwardly directed vent stem 32. Sleeve 30 is sized such that conduit 26 may be pushed onto each end of the sleeve 30 and clamped. Vent tubing 34 leading to and feeding into fountain tray 20 from vent stem 32 allows any liquid or foam which is vented to be recirculated in the circulation system.

Return conduit 26 will typically continue from the vent 28 downward to floor level. A closed sump 36 such as the inverted U-shaped loop 37 in return conduit 26 is provided at this low point in the return conduit. Sump 36 promotes the exhaustion of air in the circulating system during initial start up, as will

be described later in this section.

Return conduit 26 leads from sump 36 to venturi tube 38, which is shown in detail in FIG. 3. Venturi tube 38 is typically mounted at an elevation above the sump 36. The suction provided by venturi tube 38 at return inlet 40 draws the wetting fluid from the sump 36 through the return conduit 26. The venturi 38 then propels the wetting fluid through a filter means 41 such as a foam rubber filter to remove fibers, lint, dust and other debris collected in the wetting fluid. The filter 41 may be submerged in a cooling reservoir 42, as shown in FIG. 1. Reservoir 42 may be provided with refrigeration coils 44 and a refrigeration system to cool the wetting fluid. Wetting fluid is withdrawn from the reservoir 42 by pump 45, which is typically a constant pressure pump such as a centrifugal pump. The wetting fluid is flowed to flow divider 46, which directs a portion of the pump output to the venturi tube 38 and a portion of the pump output to feed line 60 leading to the inlet 22 of fountain pan 20. A film of wetting fluid is collected by rollers 47 from fountain pan 20 and applied to press plate roller 48.

In contrast to prior art circulating systems in which the venturi tube was designed to give a maximum vacuum effect, the present invention uses a venturi tube calibrated to provide a vacuum sufficient to draw the wetting fluid from its lowest point in the return line, without entraining air into the circulating system from the fountain pan. A venturi tube using a single orifice can be so designed and calibrated, and is regarded as part of the present invention. However, a venturi tube having two orifices allows a greater ability to calibrate the amount of vacuum to the particular layout of the return conduit.

In the preferred embodiment, venturi tube 38, as shown in FIG. 3, has a fluid inlet 50 with a first aperture 52 mounted therein. The second aperture may comprise the throat 54 of venturi tube 38. The ratio of the inner diameter of the first orifice to the inner diamenter of the second orifice is about 0.5 to 1.25, allowing for a wide range of calibration of vaccum. In a typical installation, the first aperture has a inner diameter which is between .15 to .25 inches, and the throat 54 of the venturi has an orifice size which is between .20 to .30 inches. The preferred orifice sizes are respectively .20 inches for the first orifice and .25 inches for the throat orifice. It has been found that these orifices in combination provide a balanced amount of suction at the return inlet 40 so that the wetting fluid can be flowed through the system from the sump 36 without drawing air into the circulation system.

A wetting fluid specific gravity measuring apparatus and isopropanol metering system 56 such as the Balcontrol manufactured and sold by the Baldwin Technology Corporation, Stamford, Connecticut may be mounted at the flow divider 46.

In operation, the circulating system of the present invention has been found to eliminate problems of foaming found in the prior art systems, since the vent 28 allows entrained air to escape from the system before it is turbulently agitated in the the venturi, filter and pump. The double orifice venturi tube provides a reduced suction in the return line over prior art venturi tubes having a single orifice designed for maximum suction; this reduced suction provides sufficient suction to draw the wetting fluid through the sump and return conduit, yet is not so powerful as to entrain air into the wetting fluid in the system. The circulating system 10 has allowed fountain pan flow rates to be increased from the about 0.25 to 0.3 gallons per minute (GPM) flow rates achieved by the prior art systems to about 0.5 to 0.7 GPM, without the problems of foaming and flooding which would otherwise have occurred at such higher flow rates in the prior art devices. As a consequence of the higher flow rates of wetting fluid attained by the present invention, the temperature increase from the inlet to the outlet of the fountain pan is decreased to about one half of the temperature increase of the prior art systems.

The sump 36 minimizes problems of foaming during start-up of the circulating system 10. The sump 36 provides a pooling point for the wetting fluid and an additional pressure drop in the return conduit line during start-up so that the system can begin flowing wetting fluid to the fountain pan 20 without having an immediate intake of air to the circulation system 10 from the fountain pan outlet 24.

Claims

1. A dampening system for a printing press, said dampening system comprising: an open fountain pan having an inlet and an outlet at each end thereof for a wetting fluid; means for conducting the wetting fluid to a printing plate from said fountain pan; a return conduit connected to said outlet; means for filtering said wetting fluid located downstream of said fountain pan and connected to said return conduit; means for flowing said wetting fluid from said fountain pan and through said filtering means; and

a vent located downstream of said outlet in said return conduit; said flowing means being calibrated to provide a vacuum sufficient to draw said wetting fluid from said return conduit without entraining air into said return conduit from said fountain pan outlet.

2. A circulation system for the dampening system of a printing press, comprising:
a fountain pan having an inlet and an outlet at each end thereof for a wetting fluid;
a return conduit connected to said fountain pan outlet;
a vent located in said return conduit downstream of said outlet, said vent including a tube leading to and feeding into said fountain pan;
a sump located downstream of said vent and connected to said return conduit;
a venturi tube connected to said sump, said venturi tube having an inlet having a first orifice therein, and a throat having a second orifice therein, said return conduit being connected to said venturi downstream of said second orifice, whereby a vacuum sufficient to draw said wetting fluid from said sump to said venturi tube is created in said sump and return conduit, said vacuum being insufficient to entrain air into said wetting fluid at said fountain pan outlet;
means for filtering said wetting fluid;
a reservoir for receiving said filtered wetting fluid;
a pump for flowing said wetting fluid out of said reservoir; and
a flow divider for receiving the output of said pump, a portion of said wetting fluid from said flow divider being directed to the inlet of said venturi tube, the other portion of said wetting fluid being directed to said fountain pan inlet.

3. A circulation system for the wetting fluid of a printing press, comprising:
a fountain pan for a wetting fluid, having an inlet and an outlet at each end thereof;
a return conduit connected to said fountain pan outlet;
a vent located downstream of said outlet in said return conduit;
means for flowing said wetting fluid through said circulation system and for providing a vacuum sufficient to draw said wetting fluid from said return conduit without entraining air into said return conduit from said fountain pan outlet.

4. A system in accordance with claim 1 or 3, wherein said means for flowing comprises:
a reservoir for containing said wetting fluid;
a pump for flowing said wetting fluid from said reservoir;
a flow divider for receiving the output of said pump; and
a venturi tube for receiving a portion of said wetting fluid from said flow divider, the other portion of said wetting fluid being directed from said flow divider to said fountain pan inlet, said venturi tube having at least one orifice therein calibrated to provide a sufficient vacuum in said return conduit to drain said wetting fluid from said conduit without entraining air into said return conduit, said return conduit being connected to said venturi downstream of said at least one orifice.

5. A system in accordance with claim 1, 3 or 4, wherein said venturi tube has two orifices, the first said orifice being located in an inlet of said venturi tube, and the second said orifice comprising the throat of said venturi tube.

6. A system in accordance with claim 2 or 5, wherein the ratio of the inner diameter of said first orifice to the inner diameter of said second orifice is between about 0.5 to 1.25.

7. A system in accordance with claim 6, wherein the ratio of the inner diameter of said first orifice to the inner diameter of said second orifice is about 0.8.

8. A system in accordance with any of claims 2, 5, 6 or 7, wherein said first orifice of said venturi tube has an inner diameter of about, or between, 0.15 to 0.25 inches, and said second orifice has an inner diameter of about, or between, 0.20 to 0.30 inches.

9. A system in accordance with claim 8, wherein said first orifice of said venturi tube has an inner diameter of about 0.20 inches, and said second orifice has an inner diameter of about 0.25 inches.

10. A system in accordance with any preceding claim, wherein said vent is located up to about 24 inches downstream of said outlet.

11. A system in accordance with any preceding claim, wherein said return conduit has an inner diameter of at least 5/8 inch.

12. A system in accordance with any preceding claim, wherein said vent is located in a substantially vertical section of said return conduit.

13. A system in accordance with any preceding claim, wherein said vent further comprises a tube leading to and feeding into said fountain pan.

14. A system in accordance with any preceding claim, wherein a sump is provided downstream of said vent.

15. A system in accordance with claim 14, wherein said sump comprises an inverted U-shaped loop formed in said return conduit.

16. A method of reducing foaming in the dampening system for a printing press comprising an open fountain pan having an inlet and an outlet at each end thereof for a wetting fluid; means for conducting the wetting fluid to a printing plate from said fountain pan; a return conduit connected to said outlet; means for filtering said wetting fluid located downstream of said fountain pan and connected to said return conduit; and means for flowing said wetting fluid from said fountain pan and through said filtering means; said method comprising the steps of:
venting said return conduit from a point down-

stream of said outlet;
providing a vacuum in said return conduit calibrated to draw said wetting fluid from said return conduit without entraining air into said fountain pan outlet.

17. A method in accordance with claim 16, wherein said vacuum is provided by a venturi tube having at least one orifice therein calibrated to provide a sufficient vacuum in said return conduit to drain said wetting fluid from said conduit without entraining air into said return conduit, said return conduit being connected to said venturi downstream of said at least one orifice and said venturi tube being connected to said flowing means.

18. A method in accordance with claim 17, wherein said venturi tube has two orifices, the first said orifice being located in an inlet of said venturi tube, and the second said orifice comprising the throat of said venturi tube.

19. A method of reducing foaming in the circulation system for the dampening system of a printing press comprising: a fountain pan having an inlet and an outlet at each end thereof for a wetting fluid; a return conduit connected to said fountain pan outlet; a sump located downstream of said vent and connected to said return conduit; a venturi tube connected to said sump; means for filtering said wetting fluid; a reservoir for receiving said filtered wetting fluid; a pump for flowing said wetting fluid out of said reservoir; and a flow divider for receiving the output of said pump, a portion of said wetting fluid from said flow divider being directed to the inlet of said venturi tube, the other portion of said wetting fluid being directed to said fountain pan inlet; said method comprising the steps of;
venting said return conduit from a point downstream of said outlet to said fountain pan; and
calibrating said venturi tube to provide in said sump and return conduit, a vacuum sufficient to draw said wetting fluid from said sump to said venturi tube, said vacuum being insufficient to entrain air into said wetting fluid at said fountain pan outlet.

20. A method in accordance with claim 19, wherein said venturi tube has an inlet having a first orifice therein, and a throat having a second orifice therein, said return conduit being connected to said venturi downstream of said second orifice.

21. A method in accordance with claim 18 or 20, wherein the ratio of the inner diameter of said first orifice to the inner diameter of said second orifice is about 0.5 to 1.25.

22. A method in accordance with claim 21, wherein the ratio of the inner diameter of said first orifice to the inner diameter of said second orifice is about 0.8.

23. A method in accordance with any of claims 17 to 22, wherein said venting point is located up to about 24 inches downstream of said outlet.

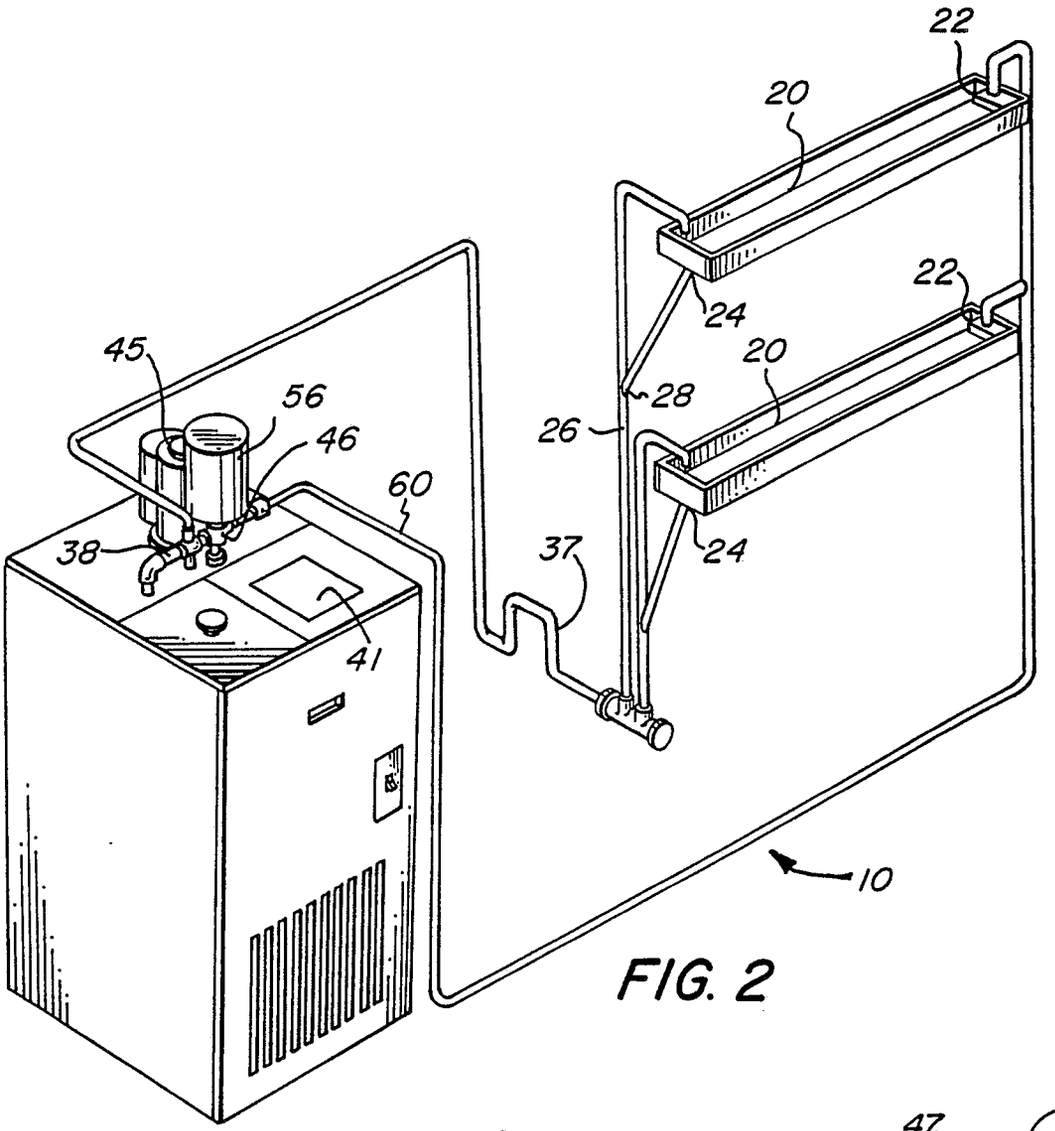
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FIG. 2

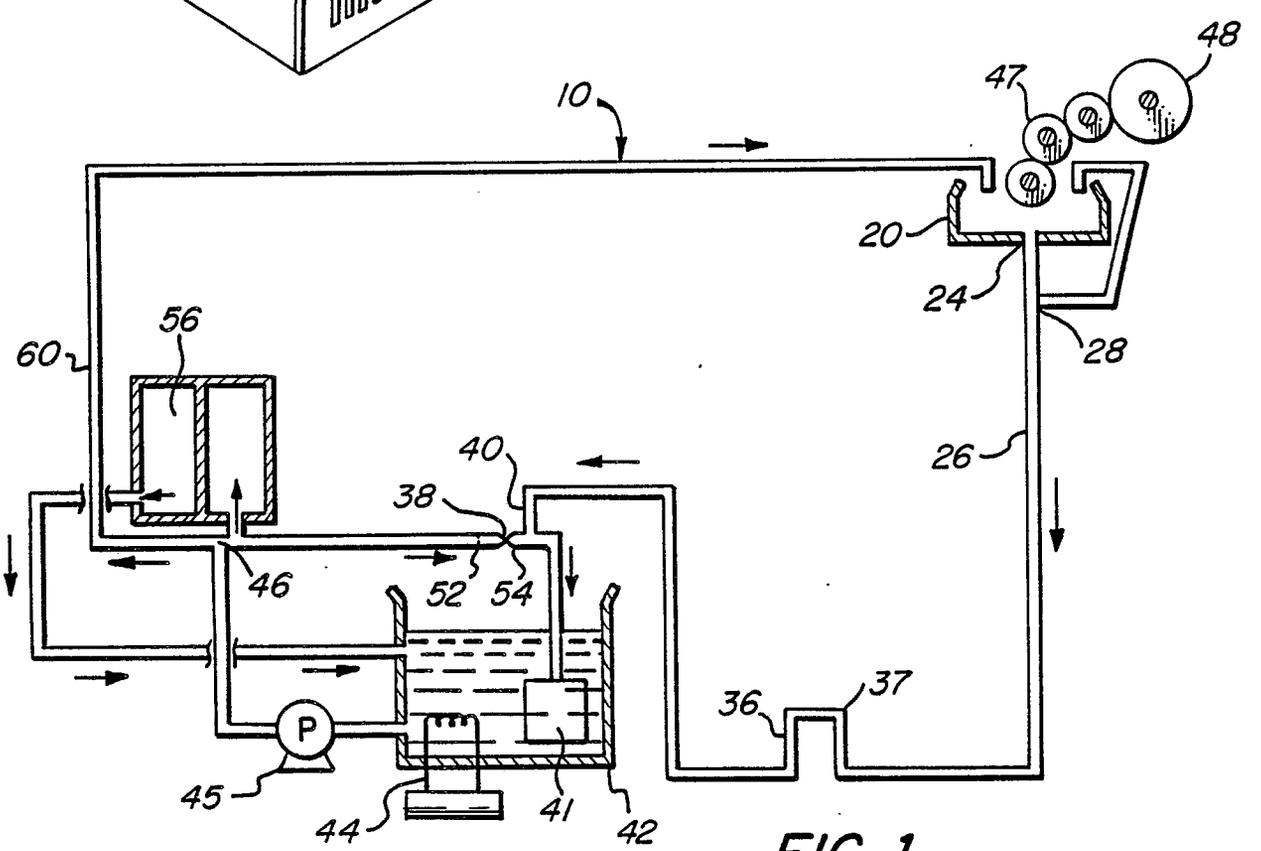
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FIG. 1

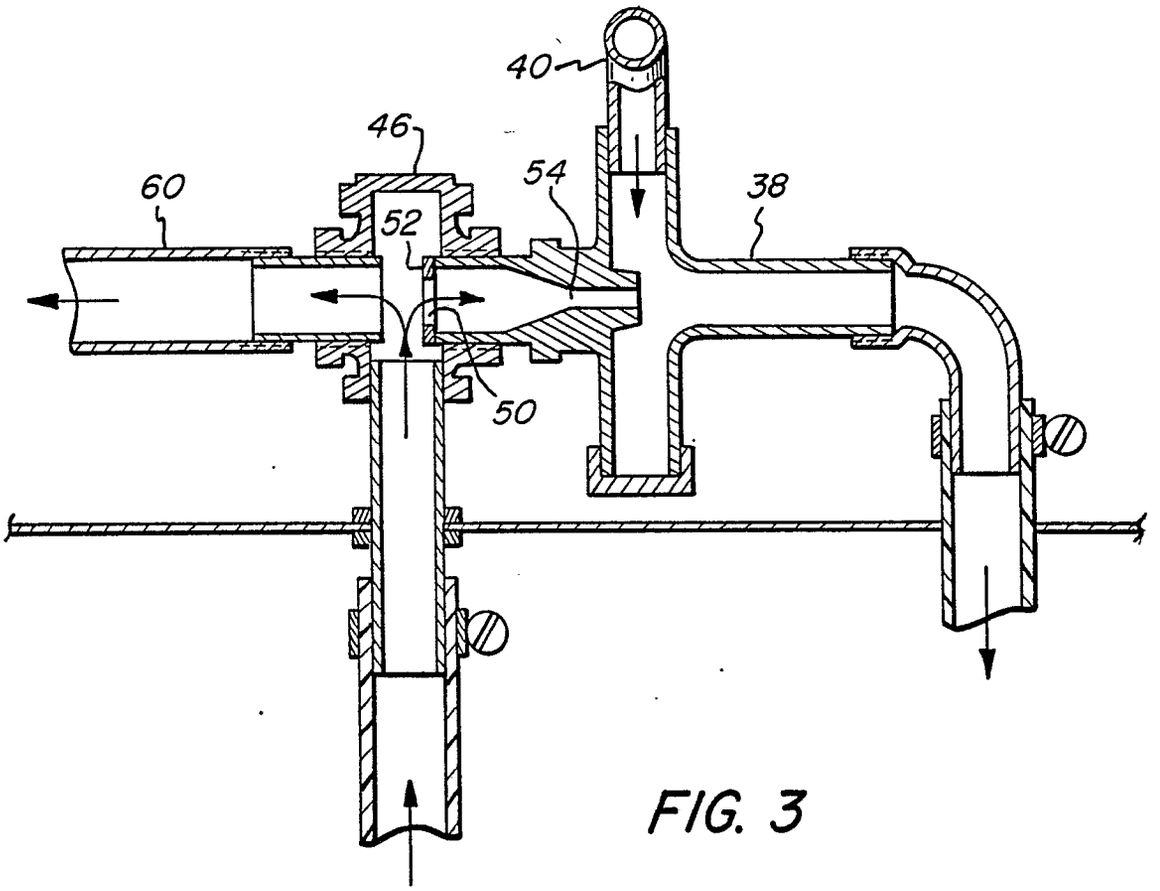

FIG. 3

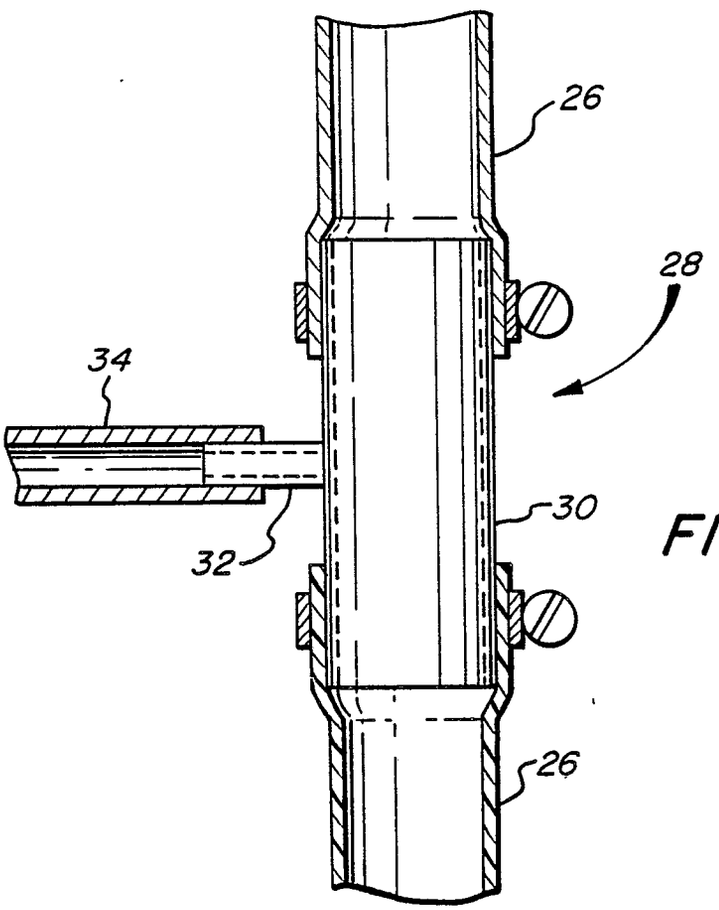

FIG. 4