United States Patent [19]

Pfefer

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[45] **June 11, 1974**

[54] **FILM WASHING APPARATUS**

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[22] Filed: **May 12, 1969**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 720,757, April 12, 1968, Pat. No. 3,581,568.

[52] **U.S. Cl.** **354/328,** 354/299

[51] **Int. Cl.** **G03d 13/04**

[58] **Field of Search** ..... 95/96, 97, 98, 89 R; 68/183

[56] **References Cited**

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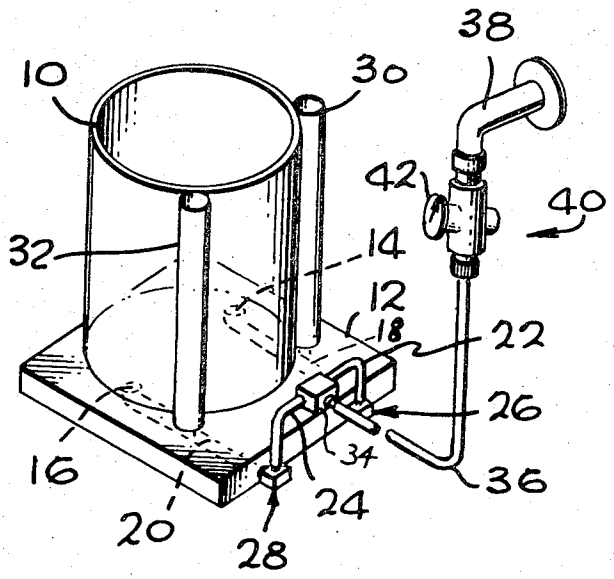
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[57] **ABSTRACT**

Apparatus for washing film comprising a round tank and a water pipe leading to holes in the base of the tank. The water pipe includes a portion with an opening constructed to draw in air to mix with the water, so that an air-water mixture enters the tank. The holes in the tank are near its perimeter and may be directed tangentially so that the air-water mixture swirls. The water pipe is adapted for connection to a water faucet through a thermometer-holding fixture, from which the thermometer can be readily removed.

1 Claim, 9 Drawing Figures



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SHEET 1 OF 2

Fig. 2

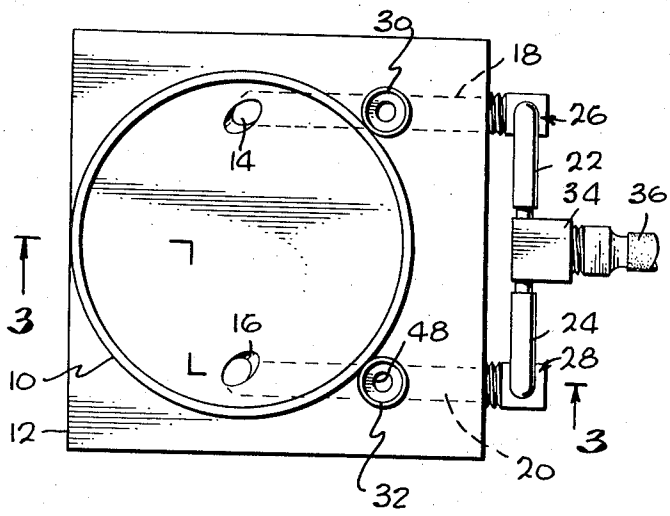


Fig. 5

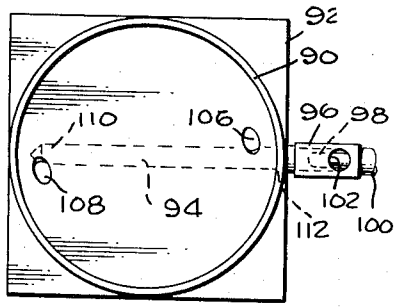


Fig. 3

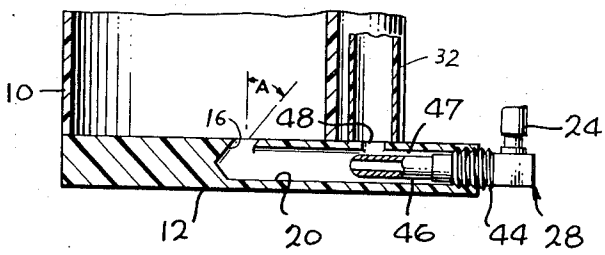


Fig. 6

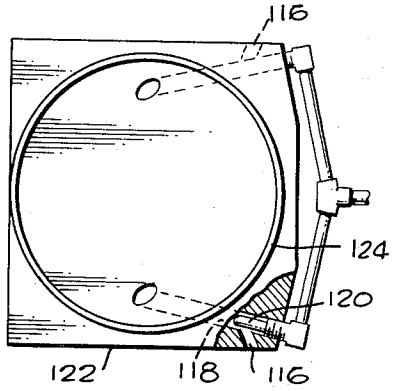


Fig. 1

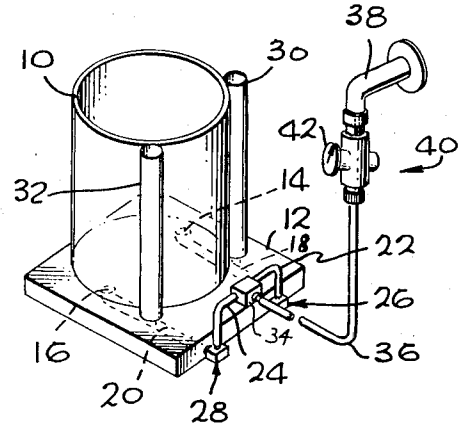
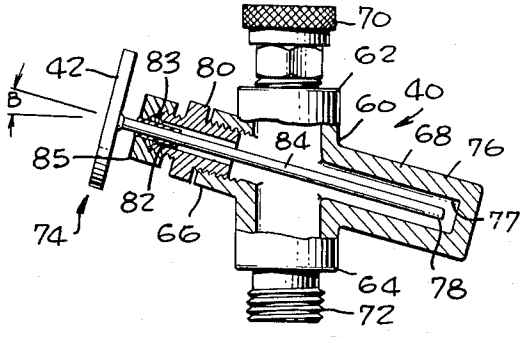


Fig. 4



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Fig. 7

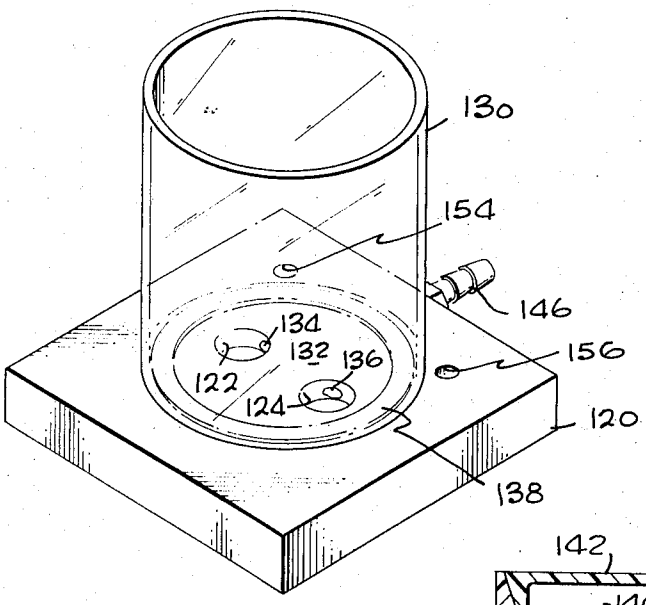
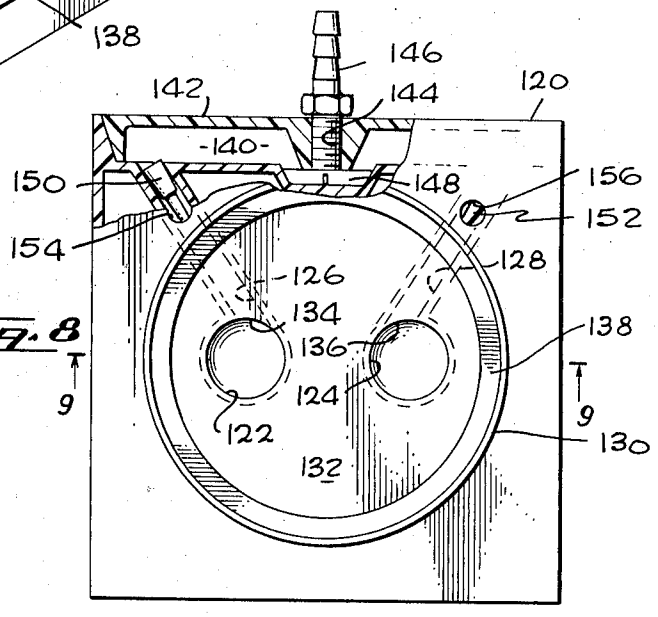


Fig. 8



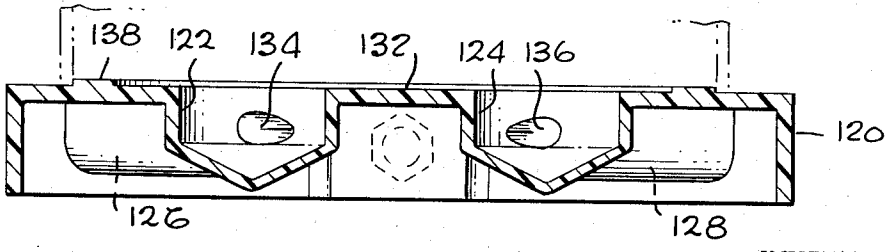


Fig. 9

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FILM WASHING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

This invention is a continuation in part of patent application Ser. No. 720,757 filed Apr. 12, 1968, now U.S. Pat. No. 3,581,568, by Irving Pfefer.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to fluid control apparatus.

2. Description of the Prior Art

The developing of photographic film generally involves steps in which the film must be thoroughly washed to remove the previous chemical processing solutions. The water in contact with the film must be agitated in order to obtain efficient washing action. Such washing action can be obtained by holding the film under a running faucet, or by holding the film in a tank filled with water and rapidly agitating the water. Both of these methods are inconvenient to apply.

One method for facilitating washing is by the use of a tank with a water pipe connected to provide a continuous flow that stirs up the water already in the tank. In order to obtain substantial agitation using water pressure available from ordinary household faucets, an appreciable flow of water must be maintained. However, after the tank is partially filled, the flow tends to be laminar instead of turbulent, and only a small degree of agitation is obtained.

OBJECTS AND SUMMARY OF THE INVENTION

An important object of the invention is to provide apparatus which creates an agitated washing stream.

Another object is to provide apparatus for the improved washing of photographic film.

Yet another object is to provide a fixture for facilitating the use of a stem thermometer.

In accordance with the present invention, film washing apparatus is provided which includes a tank with at least one hole in its base, and a conduit leading to the hole. The conduit has one end connected to a water source and a portion constructed to draw in air that mixes with the water. A substantial amount of air is drawn in with even a small flow of water. The air bubbles emanating from the hole in the tank rise and create turbulence which agitates the water and provides good washing action.

In one embodiment of the invention, the conduit leads to a pair of holes near the perimeter of the tank, the holes being directed substantially tangential to the tank perimeter. The air-water mixture emanating from the holes tends to swirl around the tank to further aid in agitation. In order to draw air into the conduit, a hole is provided which is coupled to an air passage that is directed downstream into the conduit. When water flows in the conduit, a vacuum is created by the velocity head of the flow, causing air to be drawn in to mix with the water. The flow of water for drawing in air and creating a washing action in the tank is obtained from an ordinary water faucet.

A fixture is provided between the faucet and conduit, to enable a thermometer to be held in the water stream for measuring the water temperature. The fixture has a thermometer-holding boss which enables a stem-type thermometer to be held in the flow. The aperture in the boss is directed perpendicular or downstream to the flow of water through the fitting. The thermometer can be readily removed from the fitting for use in many other applications requiring a thermometer in a film developing laboratory. Even though the thermometer removal leaves a hole in the fitting, the water faucet can still be used when the conduit leading to the washing tank is detached, without leakage of water through the thermometer-receiving hole.

The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a pictorial view of the film washing apparatus of the invention;

FIG. **2** is a plan view of the washing tank apparatus of FIG. **1**;

FIG. **3** is a partial side sectional view of the washing tank apparatus of FIG. **2**;

FIG. **4** is a sectional view of the thermometer-holding fixture of FIG. **1**;

FIG. **5** is a plan view of a washing tank apparatus constructed in accordance with a second embodiment of the invention;

FIG. **6** is a plan view of a washing tank apparatus constructed in accordance with a third embodiment of the invention;

FIG. **7** is a perspective view of a washing tank apparatus constructed in accordance with a fourth embodiment of the invention;

FIG. **8** is a plan view of the washing tank apparatus of FIG. **7**; and

FIG. **9** is a sectional view taken on the line **9—9** of FIG. **8**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** illustrates film washing apparatus comprising a cylindrical washing tank **10** into which film to be washed is placed. The side walls of the tank are supported on a base **12**, which also serves as the bottom of the tank. The base has two agitation holes **14** and **16** through which an air and water mixture emanates for filling up the tank with water and for agitating the water already in the tank. The agitation holes **14** and **16** are connected to the passageways **18** and **20** formed in the base. The ends of the passageways opposite the agitation holes are coupled to hose sections **22** and **24** through couplings **26** and **28**. The middle sections of the passageways **18** and **20** are coupled to snorkel tubes **30** and **32** through holes in the base.

The hose sections **22** and **24** are connected by a T coupling **34** to a hose **36** that leads to a water faucet **38**. A fitting **40** in series with the faucet and hose **36** enables a stem thermometer **42** to be held in the pipeline to measure the temperature of the water flowing to the tank. When the faucet is turned on, a stream of water passes through the fitting **40** and hose **36** to the two passageways **18** and **20**. The water moves past openings in the passageways where they connect to the snorkel tubes **30** and **32**. Air is drawn into the passageways through the snorkel tubes so that an air-water mixture enters the tank through the agitation holes **14** and **16**. Air bubbles rise through water already in the tank to

provide an agitating effect that helps to wash film in the tank.

FIGS. 2 and 3 illustrate the tank apparatus in greater detail. The coupling 28 has a threaded connector 44 which is engaged with threads at the end of the passageway 20. The connector 44 has a constriction tube 46 attached to its end. The constriction tube has a diameter somewhat smaller than the diameter of the passageway so there is a space 47 between the tube and the passageway 20. The space 47 serves as an air passage to carry air into the passageway. A snorkel hole 48 is formed through the base to the passageway at the space 47 where the constriction tube 46 extends. The snorkel hole 48 opens to the bottom of the snorkel tube 32. Air passing through the snorkel hole mixes with water downstream of the constriction tube, so that an air-water mixture is discharged from the agitation holes 14 and 16.

The agitation hole 16 is formed at an angle A with a normal to the bottom surface of the tank, so that the hole is directed with a substantial horizontal component. The hole is also directed substantially tangential to the perimeter of the tank. As a result, fluid emanating from the hole has a tendency to swirl about the tank. The orientation at the angle A also prevents drops of water from shooting out of the tank when it is first being filled.

When the water under a moderate pressure, such as that supplied by an ordinary household faucet, flows through the coupling 28 and out of the end of the constriction tube 46, its momentum tends to keep it flowing along the passageway towards the agitation hole 16. This flow of water creates a velocity head, which produces a partial pressure in an opening which is directed downstream. The space 47 opens in a downstream direction towards the flow emanating from the constriction tube 46. The velocity head of the water stream draws air through the snorkel tube 32 and through the snorkel hole into the passageway 20 where it mixes with the water stream. The constriction caused by the constriction tube 46 may also create a lower pressure that helps to draw in air. As a result, the fluid emanating from the agitation hole 16 contains air bubbles.

The air bubbles emanating from the agitation hole 16 swirl along with the water in the tank and also rise towards the surface of the water. These bubbles provide a turbulence which greatly facilitates the washing action on film which is in the tank. The constriction tube 46 and snorkel hole 48 can be constructed to provide large quantities of air even for a moderate water flow, for the water pressures commonly available in household water faucets. Accordingly, numerous large air bubbles can be provided to agitate the water in the tank without necessitating a large water flow.

The washing tank 10 is generally placed in a sink during use, so that water can flow into the tank for an extended period. When the tank is filled, water flows over the top of the tank into the sink. The sink may then have a layer of water in it, and the snorkel tubes 30 and 32 prevent such water from blocking the flow of air into the passageways 18 and 20. Where the tank is used for only a short time so it does not completely fill, the snorkel tubes prevent the drainage of water back through holes 48 when the faucet is turned off. This allows the tank to be placed on a table or the like where it is convenient to drain away water.

When photographic films are being washed, it is generally necessary to maintain the washing temperature within certain limits. If the film is left too long in hot water, the film base may become soft, and the film may be damaged. On the other hand, if the water is too cold, the developing solutions will not be dissolved away. Generally a temperature on the order of 20° C is desired.

In order to maintain a close control on temperature, the fitting 40 is provided which enables the stem thermometer 42 to be held in the water stream which is applied to the washing tank. The stem thermometer 42 is used in many applications in film processing, but small film laboratories often have only one or two of them because accurate thermometers are costly. In accordance with the present invention, the fitting 40 is provided which facilitates the removal of the stem thermometer 42 after washing is completed, to enable the thermoeter to be used in other applications.

As shown in FIG. 4, the fitting 40 comprises a body 60 having four hollows ends 62, 64, 66 and 68 which are connected to each other within the body. The end 62 carries an adapter 70 for connection to a faucet while the opposite end 64 carries a nipple 72 for connection to the end of a hose. The end 66 is adapted to carry a thermometer assembly 74 which includes the stem thermometer 42. The opposite end 68 has a receiving plug portion 76 which is formed with a recess 77 for receiving the outer stem end 78 of the stem thermometer. The recess generally does not support the thermometer, but merely provides a receiving area for it.

The thermometer assembly 74 comprises a sleeve 82 of thermally insulative material such as a plastic which is tightly fitted over the stem 84 of the thermometer. A compression fitting 83 is fastened around the sleeve. An adapter 80 which is threadably engaged with the end 66 of the fitting, receives the compression fitting 83. A holding nut 85 holds the compression fitting in place on the coupling 80, and prevents the leakage of water around the compression fitting. Tapered pipe threads are employed on coupling 80 to provide a water-tight seal between it and the end 66 of the fitting.

In order to install the thermometer assembly 74, the stem 84 is inserted through the coupling 80 at the fitting end 66. The nut 85 is turned until it holds the compression fitting in place. The thermometer is left in place during the washing process to enable adjustment of the hot water and cold water controls on a typical water faucet to achieve the desired washing temperature. When the washing process is over, the thermometer can be removed by simply unscrewing the nut 85, and the thermometer can then be taken to other areas where it is needed.

Often, it is desired to use the faucet 38 after the thermometer assembly has been removed from the fitting 40. This can be accomplished by removing the hose 36 which is coupled to the nipple 72 at the end of the fitting. When the faucet is then turned on, water does not leak through the opening in the end 66 of the fitting body, so long as a narrow constriction is not coupled to the nipple 72 that would create a large back pressure. To further aid in preventing leakage and to facilitate the viewing of the thermometer dial, the end 66 of the fitting body is tilted up while the opposite end 68 is tilted down. The tilting is at an angle B on the order of

15° with respect to water flow past the end **66** where it connects to the flow between ends **62** and **64** of the fitting. This results in the thermometer facing at a slightly upward tilt, so that it is easier to read, and also results in the hole in the end **66** being directed somewhat downstream. The downstream direction helps to prevent the flow of water out of the end **66** when the thermometer assembly is removed.

FIG. **5** illustrates another embodiment of the invention which employs a tank wall **90** mounted on a base **92** which has only one passageway **94** therein. A separate coupling **96** is mounted on the base, which includes a constriction tube **98** that provides a space which opens downstream into the passageway. When water enters the coupling through a hose **100,** which is connected to a water faucet or other source of water under pressure, a partial pressure is established about the constriction tube **98.** A snorkel hole **102,** formed in the coupling, connects the space about the constriction tube to the ambient atmosphere, to admit air into the coupling that mixes with the water emanating from the tube **98.**

The passageway **94** which receives an air-water mixture terminates in two agitation holes **106** and **108.** Both holes are located near the perimeter of the tank, and both are formed so as to direct the air-water mixture to circulate about the tank in a generally counterclockwise direction, (as seen from the plan view of FIG. **5**). The agitation hole **106** is coupled to the passageway **94** along its length, while the other agitation hole **108** is coupled to the end **110** of a passageway opposite the inlet **112** which receives the air and water. It is found that the hole **108** must be made smaller than the hole **106** in order to equalize the flow of water and air from them. This is due to the momentum of the water which tends to carry it past the hole **106,** at the point where the hole **106** meets the passageway substantially perpendicularly. The water tends to flow toward the outer end **110** and to leave through the agitation hole **108.** By making the hole **108** smaller, less of the water-air mixture flows out of it, and the flow out of the two holes is equalized. A more equal flow tends to provide approximately the same washing action at all areas of the tank instead of making it considerably more turbulent at one side than the other.

FIG. **6** illustrates still another embodiment of the invention. In this embodiment, the holes **116** for admitting air in the space between a passageway **118** and constriction tube **120,** lead to the sides of the base **122.** In using the tank **124,** the base should be placed where there is good drainage, so water will not block the holes **116** which admit air.

FIG. **7** illustrates yet another embodiment of the invention, which employs a base **120** with a pair of depressions **122, 124.** A pair of passageways **126, 128** that carry water and air open into the depressions, to direct the air-water fluid in a substantially horizontal direction into the depressions. The reason for employing the depressions **122, 124** is to produce an agitation action at regions close to the bottom of the tank. In the embodiments described above, the air-water stream generally does not spread out until it has risen a couple of inches above the bottom of the tank. As a result, film which is at the bottom of the tank, but at a position not in line with the openings through which air and water enter the bottom of the tank, may be subjected to very little agitation. By providing the depressions **122, 124,** the passageways **126, 128** can easily lead into and direct the fluid into the tank in an almost horizontal direction. This allows the air bubbles to spread laterally throughout the tank at even a small distance above the upper surface **132** of the base.

As also shown in FIGS. **8** and **9,** the depressions **122, 124** are circular and at least several times as large in cross-section as the passageways **126, 128.** The passageways extend in a substantially horizontal direction, and end in apertures **134, 136** at the periphery of the depressions so that fluid emanating from the passageways swirls around the depressions. The side walls **130** of the tank are formed by a cylinder that is positioned about a circular land **138** formed in the upper surface of the base. The land **138** has an outer diameter which enables a larger cylinder to be positioned thereon, and an inner diameter for receiving a smaller size tank to position it thereon. This allows the base **120** to be used with two different standard size tank side walls.

The base is designed for easy manufacture by injection molding processes. It has a slot **140** at one end which is adapted to receive a cover member **142.** The cover member **142** has a threaded aperture **144** which receives a hose coupling **146.** When the cover member is in place, the threaded hole **144** faces a dividing recess **148** in the base, where water emanating from the hole **144** is divided to direct it in equal amounts to the two passageways **126, 128.** A pair of separate constriction tube members **150, 152,** are positioned at the outer end of the passageways, the constriction tubes having narrowed portions extending past air passage apertures **154, 156** in the base through which air is received, in the manner described in the case of the above embodiments of the invention. This embodiment of the invention can be mass-produced at lost cost. In addition to providing turbulent washing action in the upper portions of the tank, it assures washing action near the bottom of the tank where film may be resting, by slowing the air-water stream entering the tank before it has risen into the tank, and by allowing it to enter in a horizontal direction. In addition, apparatus constructed in the manner shown in FIGS. **7–9** has been found to provide a very high turbulence, even higher than the levels experienced with the apparatus of the embodiments described earlier herein.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art, and consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. Photographic film washing apparatus comprising:

a tank for holding photographic film, said tank having a base surface for generally supporting items to be washed, and a depression in said base surface;

a conduit having an outlet positioned near the bottom of said tank and an inlet for connection to a liquid source, said conduit opening into said depression with an orientation to direct a water-air stream against the walls of said depression to slow the stream prior to it rising into the rest of the tank; and

means coupled to said conduit between said inlet and outlet for flowing air into said conduit to pass with said water out of said outlet into said tank.

* * * * *