

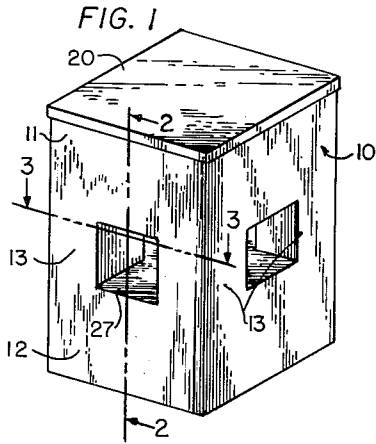
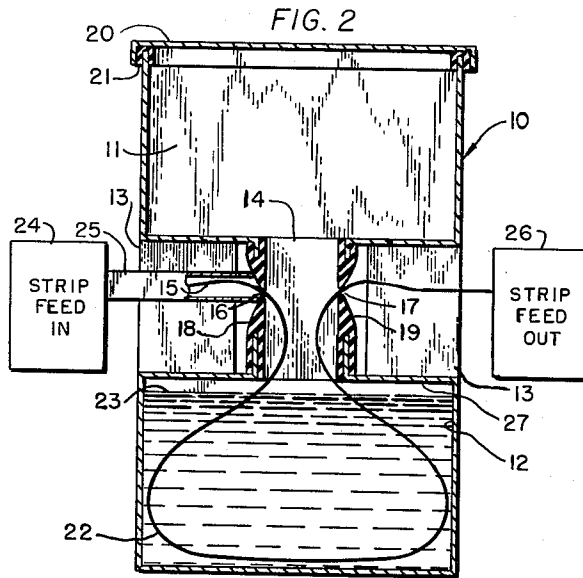
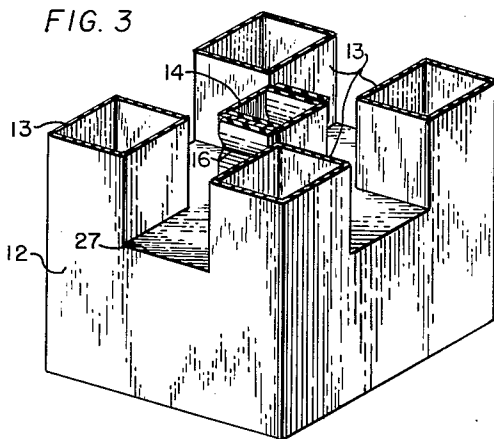
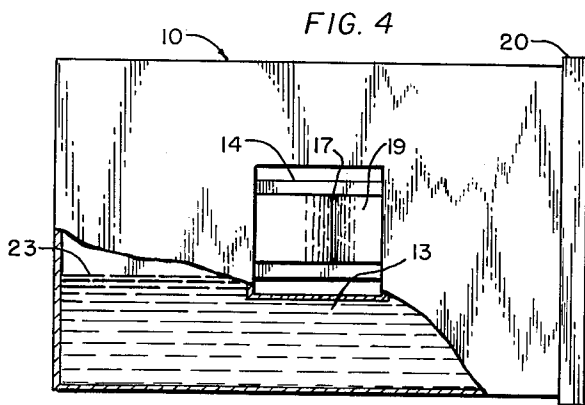
July 2, 1963

V. Q. KELLY
PROCESSING TANK

3,095,798

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2 Sheets-Sheet 1



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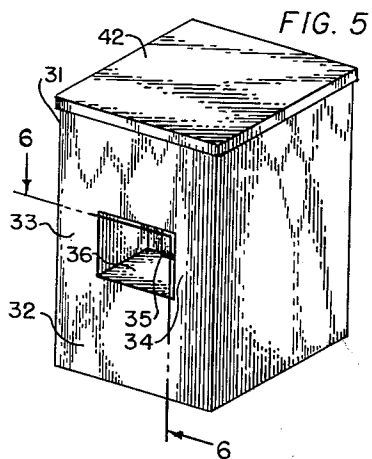
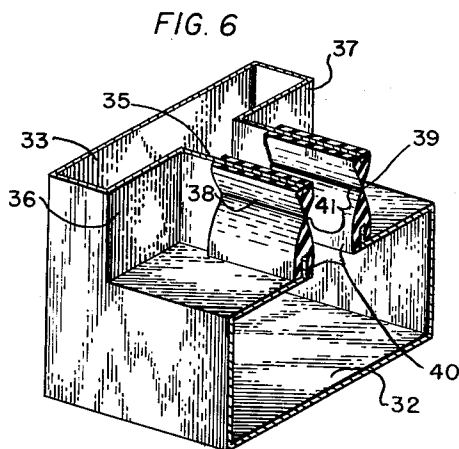
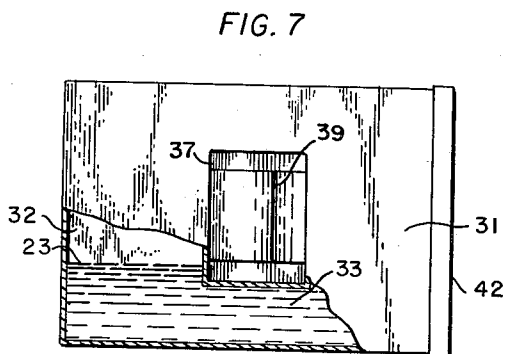
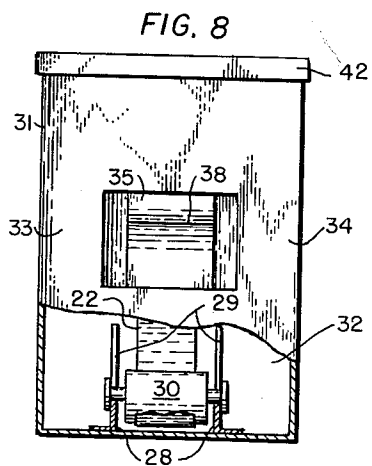
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2 Sheets-Sheet 2



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3,095,798

PROCESSING TANK

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5 Claims. (Cl. 95-94)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment of any royalty thereon.

This invention relates to a specialized tank for processing sheet materials and particularly for processing strip material under conditions imposing severe shaking and tipping of the tank such as in planes, and ground or water vehicles.

The invention supplies the need for compact lightweight equipment which may be used for a continuous processing operation upon strip type film or other photosensitive materials in an environment where the equipment is subjected to uncontrollable agitation and tipping. With conventional open tank or tray equipment processing under such conditions would be almost impossible. This invention provides a tank for processing operations using low viscosity liquid solutions such as in conventional photographic processing wherein severely agitated liquid is confined even through film entering and exit slots are provided through which the liquids tend to leak out. It is possibly true that sealing means at the film slots could be provided to partially prevent leakage of the liquid. The necessary construction of such a seal however would involve substantial wiping pressure upon the film as it is moved through the tank. Such contact with the wet film emulsion would scratch and abrade the surface thus degrading the product.

The present invention decreases the necessity for a positive liquid tight seal at the entering and exit slots and at the same time prevents spilling and leakage of the solution.

A practical concept of the invention embodies a liquid tight vessel of sufficient capacity to hold the required amount of processing liquid. The vessel is constructed to provide two compartments of substantially equal size one at the top and one at the bottom of the vessel. Between these compartments a system of liquid channels are provided at the outer wall of the vessel interconnecting the upper and lower compartments.

In addition to the liquid channels another channel interconnects the upper and lower compartments and it is located approximately in the center of the tank structure. This latter channel provides film slots through which the film strip enters and leaves the tank. The slots may be provided with light trapping means which may also provide a certain degree of sealing against liquid leakage and in addition may function as a squeegee to strip surplus liquid from the film as it emerges from the tank.

In operation when the tank is subjected to severe agitation most of the moving liquid will find its way into the outer connecting channels and flow freely therein to and from the upper compartment while only a small portion of the liquid will enter the center compartment thus only very slight or no leakage at all will occur at the film slots which are the only possible points for leakage.

An important feature of the invention prevents leakage and spilling when the tank is tipped at a substantial angle or tipped over suddenly onto its side or into a horizontal position. When this occurs the solution will rapidly flow through the outer channels into the upper compartment and not through the center channel. Thus spilling and leakage is avoided. Further details of the operation of the invention will appear hereinafter.

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It is a primary object of the invention to provide a processing tank permitting film feed through which is spill proof when agitated or tipped into angular positions.

A further object of the invention is to provide a processing tank having non-spilling characteristics which is of light weight and portable.

A further object of the invention is to provide a processing tank which may be readily adapted to function in conjunction with other units such as additional processing tanks, drying means or any pre-processing or final finishing operation.

A further object of the invention is to provide a processing tank permitting film feed through which is spill proof and which causes no disfigurement to the processed workpiece either in a wet or dry condition.

Other objects and features of the invention will more fully appear from the following description and will be particularly pointed out in the claims.

To provide a better understanding of the invention particular embodiments thereof will be described and illustrated in the accompanying drawings wherein:

FIGURE 1 is a perspective view of a selected embodiment of the invention.

FIGURE 2 is a vertical cross section on line 2-2 FIGURE 1.

FIGURE 3 is a horizontal cross section on line 3-3 FIGURE 2.

FIGURE 4 is a detail view showing the disposition of liquid in the tank shown in FIGURE 1 when it is tipped into horizontal position.

FIGURE 5 is a perspective view of a different embodiment of the invention.

FIGURE 6 is an irregular cross section on line 6-6 FIGURE 5.

FIGURE 7 is a detail view showing the disposition of liquid in the tank shown in FIGURE 5 when it is tipped into horizontal position.

FIGURE 8 is a detail view showing a structure which may be used in the lower tank section for controlling the film strip and loop to maintain the strip immersed in the liquid.

The invention as illustrated in the drawings is made in a suitable size and configuration for the treatment of strip material such as a 35 millimeter photographic film strip and is totally enclosed with the exception of film strip entering and exit slots to be described hereinafter. Larger or smaller tanks embodying the invention will function equally well. Moreover a plurality of tanks arranged in series is an ideal arrangement for practicing the invention where a plurality of steps is required to complete the treatment.

Referring to FIGURE 1, the tank body 10 is made of sheet metal which is non-corrosive such as stainless steel or the like. Suitable types of plastic may also be satisfactory for this purpose. The body 10 is approximately square in horizontal cross section and is somewhat higher than it is wide. The tank may be considered to be generally divided into an upper section 11 and a lower section 12 each having substantially the same cubic capacity. The upper and lower sections are separated by interconnecting channels 13. Desirably the channels are at the corners of the tank and are square in cross section but may be of any suitable shape.

Another channel 14 extends vertically from the upper to the lower section of the tank and substantially at the center thereof. This channel is of special construction and size and provides for insertion and withdrawal of the film strip 15 as shown in FIGURE 2. The channel 14 is slightly wider than the strip to be processed, is generally rectangular in cross section and is provided with film strip entering and exit slot 16 and 17 in opposite walls thereof.

The slots 16 and 17 are provided with flexible lip portions 18 and 19 which may be made of soft rubber or plastic material and are cemented to opposite edges of the slots in position to lightly contact the inserted film strip.

Access to the tank interior is provided in any suitable manner. As shown herein the upper end thereof is provided with a removable cover 20 fitted with a gasket 21 which engages the upper edge of the tank body to provide a liquid tight seal.

To initiate the treatment of an exposed film strip the cover 20 is removed and the film leader is threaded through the lip 18 at the entrance slot 16 passing between corner channels 13 and a loop 22 is made in the strip. The loop may conveniently be formed in the upper section 11 of the tank and then fed downwardly into the lower section 12 through the channel 14 while holding the free end of the strip which is then fed out through the exit slot 17 passing between corner channels 13 at the opposite side of the tank.

The lower section 12 of the tank is then filled with processing solution 23 substantially to the height shown in FIGURE 2. The strip may be fed through the apparatus by hand at the proper speed to provide the required degree of treatment. Desirably however adjustable automatic means are provided for feeding the strip. To accomplish this the exposed untreated film may be contained in a lower driven feed in device 24 which may be provided with a light tight channel 25 indicated in FIGURE 2, connecting it with and guiding the strip into the slot 16.

The treated film is pulled from the tank by the driven film feed out device 26 from where it may travel to equipment of the same or any desired construction for subsequent treatment. The feed in speed should be equal to the feed out speed to thereby maintain the required configuration of the loop 22.

Under normal operation of the tank the solution remains in the lower tank section 12 and the processing proceeds in the conventional manner. When, however, the tank is subjected to severe shaking or vibration due to rough going of a vehicle in which it is used or any other condition the solution is violently disturbed and splashed upward. In so doing the liquid finds its way into channels 13 and is also bounced backward from the substantial area of the top wall 27 of the lower section 12. The liquid that enters the channels 13 loses its energy and returns to the main body of liquid. If any liquid penetrates to the upper tank section 11 it will return through the channels 13 and possibly through channel 14 without causing leakage. The volume of liquid traversing channel 14 would be small and practically no liquid will penetrate the slots 16 and 17.

When the tank is used in flight it will at times assume horizontal or near horizontal position. Also in certain environments it may be subjected to sudden accidental tipping into horizontal position upon its supporting surface. When this happens the liquid flows freely and quickly through two of the channels 13 and into the upper section 11. Due to the free flow in channels 13 only a small quantity if any at all will enter channel 14. In no event will sufficient liquid be present in channel 14 to cause leakage through the slots 16 and 17 which are lightly sealed by the lip members 18 and 19.

The dimensions of the tank are so chosen that in horizontal position the level of the liquid in the upper and lower sections will never be above the slots 16 and 17 as shown in FIGURE 4. Spilling and leakage of solution is thus prevented under the most adverse conditions.

To assist in maintaining correct conformation of the loop 22 it may be desirable to provide directional guiding means. Such means may consist of a structure such as shown in FIGURE 8 wherein a pair of parallel supports 28 are secured to the bottom of the tank and are provided with vertical slots 29 within which are received

the trunnions of a roll 30 having sufficient weight to hold the film strip in its correct path below the liquid surface.

To place the roll 30 in position it is passed from the upper section 11 through channel 14 between the entering and leaving portions of the strip after the loop is formed and placed in section 12 or during the placement of the loop. When installing the roll it is positioned properly to cause its trunnions to enter the slots 29. The roll will guide the strip and overcome the tendency for the loop to collapse.

A somewhat different but equally effective form of the invention is shown in FIGURES 5, 6, and 7. This structure is provided with upper and lower sections 31 and 32 as in the structure shown in FIGURE 1. These sections are interconnected by a system of vertical channels 33 and 34 extending along the full width of opposite sides of the tank these channels are interconnected laterally at their mid-section by another channel 35 which also vertically interconnects upper and lower sections 31 and 32. All portions of the tank are fabricated to provide a liquid tight structure. The combination of tank sections and channels as above described provide window like outwardly opening recesses 36 and 37 which provide access to film entering and exit slots 38 and 39 in the walls 40 of channel 35. The slots are provided with sealing lips 41 between which the film is fed. The tank is provided with a removable liquid tight cover 42.

This tank structure provides for forming a loop of the film strip within its lower section which contains the liquid for processing the film and into which the strip is immersed as it is fed through the tank at constant speed. During severe shaking and vibration of the tank only a small volume of liquid enters channel 35 and remains only for an instant. The lip members 41 effectively seal the tank against leakage due to such movement of the liquid.

When the tank is tipped into horizontal or near horizontal position or when it is accidentally suddenly tipped over onto its side the solution will in one case flow through one of the channels 33 or 34 into the top section 31 as shown in FIGURE 7. In the other case when it is tipped onto an adjacent side the liquid will flow to the top section through channels 33 and 34. However the cubic capacities of the structure are designed to insure that when the tank is in this latter position the height of the liquid will be below the slots 38 and 39. In either case leakage will be prevented. The tank can then be righted to normal position and processing resumed.

A particularly effective application of the invention is its use for processing photosensitive materials in a monobath solution. The complete processing cycle in this case is accomplished by the simple operation of passing the strip through the tank and such operation may be carried on without losing solution and without contamination of other equipment by spilled solution despite the most violent action of the tank in any direction whether it be in flight processing or rough going in a ground vehicle laboratory or other unstable environment.

What is claimed is:

1. A liquid tight container, comprising a compartmented body consisting of upper and lower spaced main compartments of substantially equal cubic capacity one of which is used to contain a processing liquid, a plurality of elongated enclosed channels interconnecting the upper and lower sections at the plane of the side wall of the body, at least one additional channel adjacent the center of the body and interconnecting said top and bottom sections, entrance and exit slots located respectively in opposite walls of said center channel for permitting a film strip to enter and leave the container and resilient means in said slots to lightly and resiliently engage the film as it passes therebetween whereby when the tank is tipped into an inclined position approaching

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the horizontal the main body of the liquid will flow freely through the side wall channels to the upper compartment and be diverted from substantial flow through said center channel thus avoiding leakage through said slots.

2. A liquid tight container comprising a compartmented body consisting of upper and lower spaced main compartments of substantially equal cubic capacity the bottom one of which contains a processing liquid, a plurality of enclosed vertical channels positioned adjacent the plane of the sides of said body and disposed to provide a centralized horizontal open space between the compartments extending from side to side of said body, an additional vertical channel adjacent the center of said body interconnecting the upper and lower compartments and situated in said horizontal through space, slots in opposite walls of said latter channel for entrance and exit of a strip of sheet material to be processed in said container and means in said slots to lightly engage opposite faces of said strip as it passes therebetween whereby when the container is tipped out of its normal vertical position the liquid will flow through said side channels and be diverted away from the center channel thereby preventing leakage at said slots.

3. A liquid tight container according to claim 1 and wherein the said vertical side channels are situated at the corners of the container.

4. A liquid tight container according to claim 1 and wherein the said central vertical channel is substantially

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square in cross section and slightly larger than the width of the strip of material processed.

5. A liquid tight processing container comprising a compartmented body having upper and lower spaced main compartments the lower one containing the processing liquid, a pair of oppositely disposed vertical side channels at the plane of the side of the container interconnecting said upper and lower compartments and extending entirely across the sides of the body, a single vertical channel interconnecting said main compartments and said side channels at their mid-point, a slot in opposite walls of said single channel for the entrance and exit of the processed strip and soft resilient means in said slots for lightly engaging opposite faces of said strip to prevent leakage of liquid whereby when the container is tipped into a substantial angle from its normal vertical position the liquid will flow through the said vertical side channels into the upper compartment and be diverted away from the slots in the single vertical channel.

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