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METHOD AND APPARATUS FOR CLEANING ROLLER ASSEMBLIES

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3 Sheets-Sheet 1

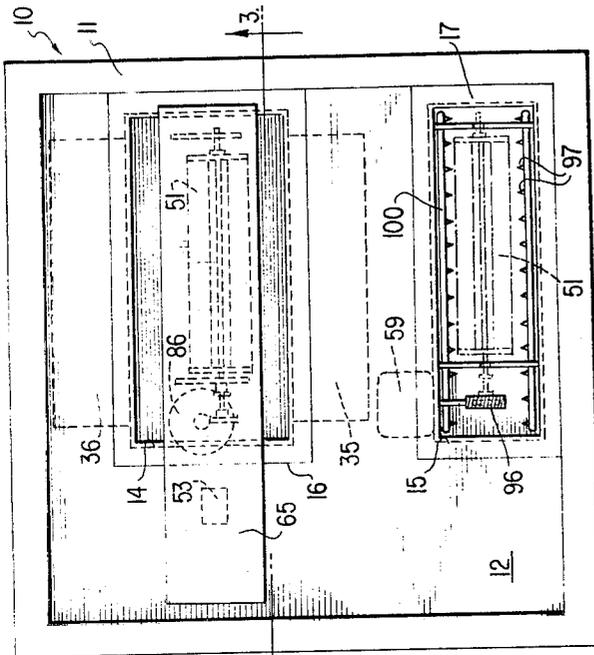


FIG. 1

FIG. 2

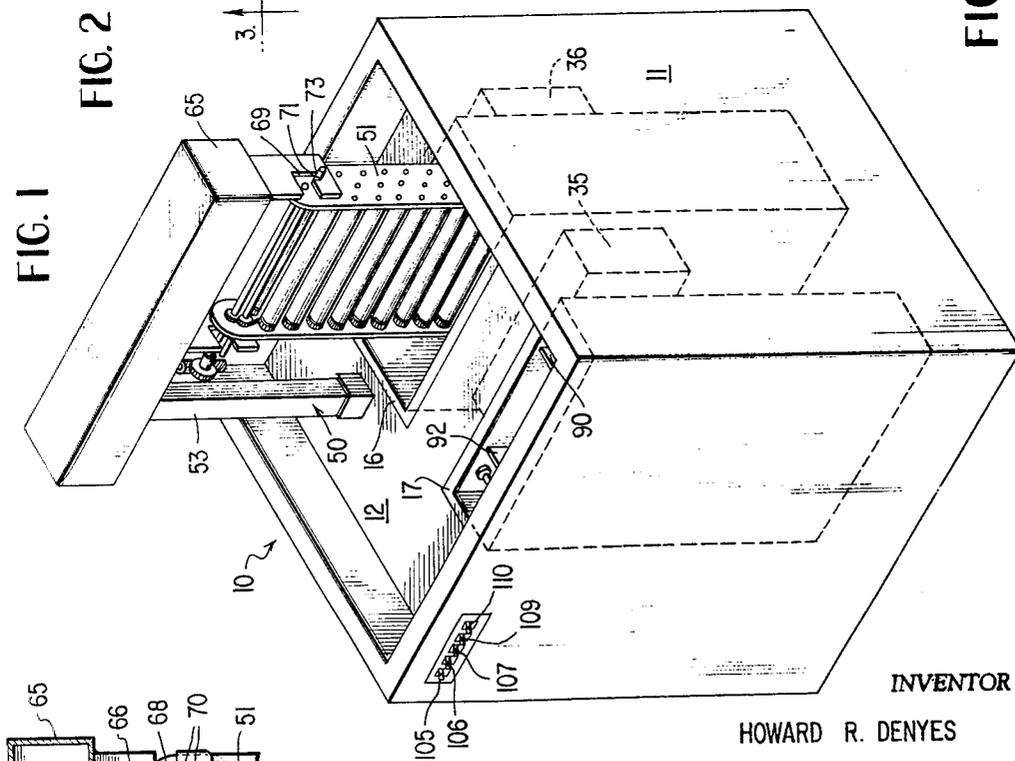


FIG. 3

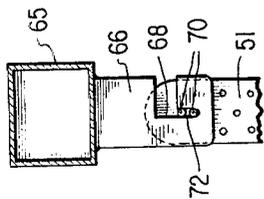


FIG. 4

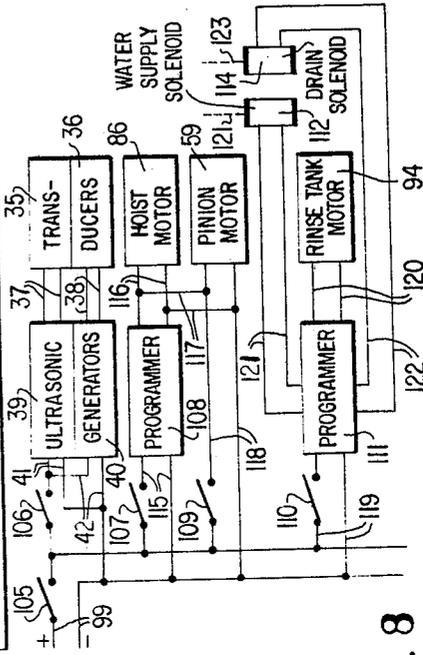


FIG. 5

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3 Sheets-Sheet 2

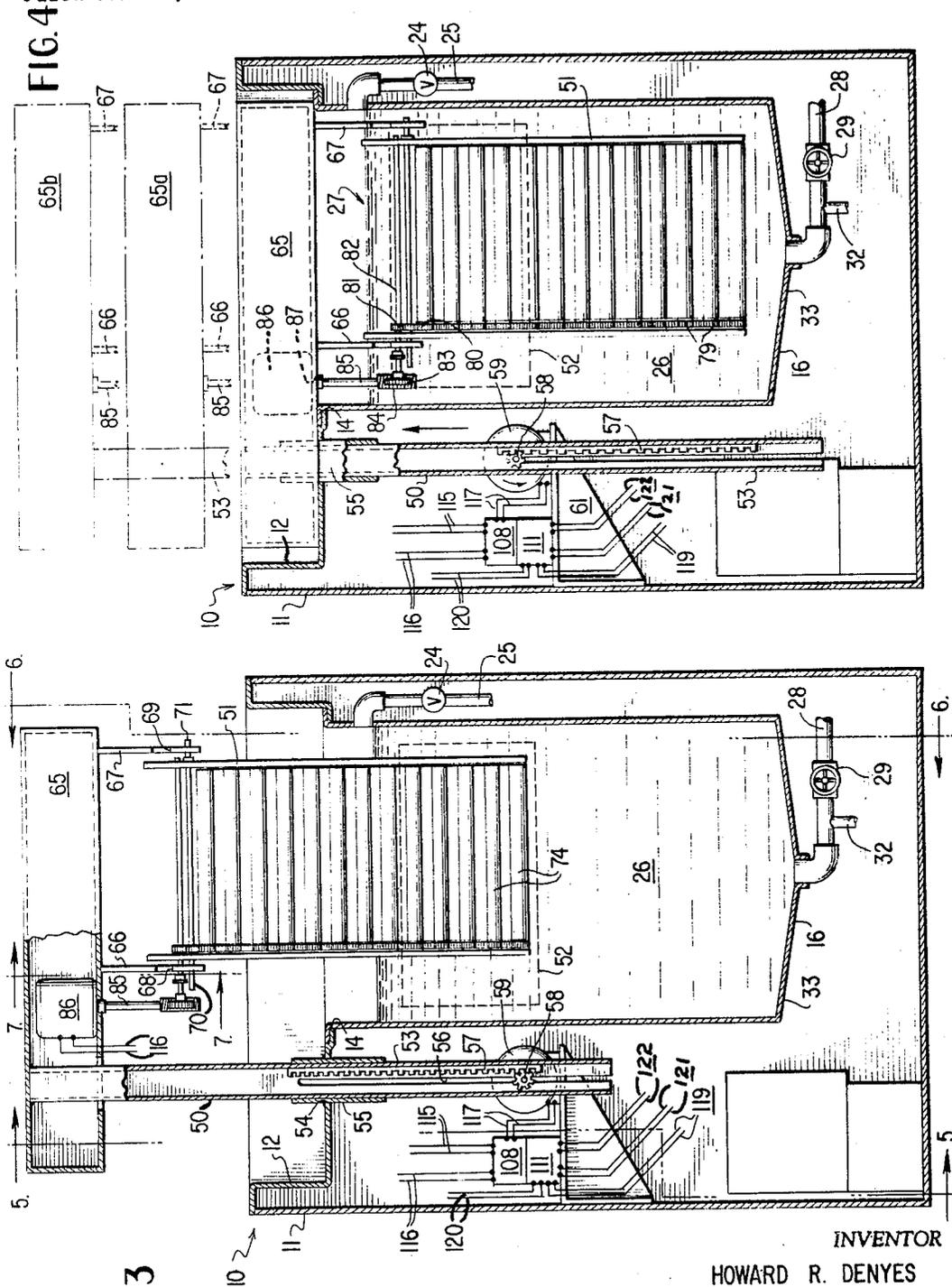


FIG. 3

FIG. 4

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## METHOD AND APPARATUS FOR CLEANING ROLLER ASSEMBLIES

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9 Claims

### ABSTRACT OF THE DISCLOSURE

An ultrasonic cleaning apparatus and method of using the same to accomplish the cleaning of multiple roller assemblies which may be constructed so as to preclude effective hand cleaning or cleaning by other prior art methods.

This invention relates to an improved ultrasonic apparatus for automatically cleaning multiple roller assemblies in a rapid and efficient manner. The invention further relates to a novel method of cleaning multiple roller assemblies by means of ultrasonic energy, and especially multiple roller assemblies which are constructed so as to preclude efficient hand cleaning;

Multiple roller assemblies are essential component parts of a wide variety of different types of apparatus. For example, multiple roller assemblies are used in commercial apparatus for processing photographic film wherein continuous lengths of film to be developed are guided by the rollers through various baths and chemically treated therein. A large number of relatively small diameter rollers are used in each of roller assemblies, and the individual rollers are staggered and arranged to provide separate paths for guiding the length of film into and from the processing apparatus. The individual rollers may have surfaces formed from rubber or plastic and they are mounted in the roller assembly in a critical predetermined spaced relationship to thereby assure that the film is properly guided. The roller surfaces and other exposed surfaces of the roller assemblies gradually collect foreign matter thereon with continued normal usage, and must be cleaned periodically to prevent the collected deposits from damaging the surface of the film. It is impossible to hand clean each of the individual rollers effectively without completely dismantling the roller assembly and then reassembling it following cleaning, and this is a time consuming task. Also, hand cleaning and the other cleaning methods available heretofore have not been entirely satisfactory as the deposits which form on the roller surfaces are very difficult to remove and chemical cleaning agents are usually necessary. The chemical cleaning agents are absorbed or retained to some extent by the roller surfaces and often change the critical chemical composition of the baths which are used in processing the film. In other instances, the entering film to be developed is contacted by a roller which has a residue thereon of a chemical cleaning agent, and the chemical residue damages the undeveloped surface of the film and prevents the film from being developed properly. In view of the foregoing, there is a great need for an entirely satisfactory apparatus and method for cleaning roller assemblies which do not require the use of strong chemicals, and which allow the roller assemblies to be effectively cleaned in a rapid and efficient manner without having to dismantle the same.

It is an object of the present invention to provide an improved apparatus for cleaning roller assemblies by means of ultrasonic energy.

It is still a further object to provide a novel method of cleaning by means of ultrasonic energy multiple roller assemblies which are constructed so as to preclude effective hand cleaning.

It is still a further object to provide a novel method

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and improved apparatus for automatically cleaning multiple roller assemblies of the type normally employed in continuous commercial film processing equipment, wherein the roller assemblies include a plurality of individual rollers which are arranged in a critical, predetermined, staggered spaced relationship which precludes effective hand cleaning.

Still other objects and advantages of the invention will be apparent from the following detailed description and the illustrative drawings, wherein:

FIGURE 1 is a perspective view of the ultrasonic cleaning apparatus of the invention;

FIGURE 2 is a top or plan view of the ultrasonic cleaning apparatus of FIGURE 1;

FIGURE 3 is a sectional view in elevation taken along the line 3—3 of FIGURE 2 wherein the hoist mechanism is illustrated in the elevated position;

FIGURE 4 is a sectional view in elevation which is also taken along the line 3—3 of FIGURE 2, but which illustrates the elevator mechanism in the lowest position;

FIGURE 5 is a sectional view in elevation taken along the line 5—5 of FIGURE 3;

FIGURE 6 is a sectional view in elevation taken along the line 6—6 of FIGURE 3;

FIGURE 7 is a fragmentary sectional view in elevation taken along the line 7—7 of FIGURE 3, illustrating the details of the slot for supporting the roller assembly without undue swinging movement; and

FIGURE 8 is a wiring diagram illustrating the manner in which the various electrical components of the apparatus of the invention are electrically connected to achieve the desired overall operation.

Referring now to the drawings, the ultrasonic cleaning apparatus generally designated as 10 includes a rectangular cabinet 11 provided on its upper end with a recessed sink 12. The sink 12 has a pair of spaced openings 14 and 15 therein for receiving cleaning tank 16 and rinse tank 17. The upper ends of cleaning tank 16 and rinse tank 17 are provided with flange portions 18 and 19 which extend past the peripheries of openings 14 and 15, respectively, and over the upper surface of sink 12 a sufficient distance to support the tanks in spaced upright positions within rectangular cabinet 11. As is best seen in FIGURE 6, preferably the peripheral portions around openings 14 and 15 are deformed downwardly to form ledge portions 20 and 21 for receiving flange portions 18 and 19, respectively, and thereby provide a continuous smooth surface. This aids in maintaining the sink 12 in a sanitary condition, and it is easy to remove liquid which inadvertently splashes into sink 12 from tanks 16 and 17 during operation of the apparatus 10.

The tank 16 is provided with a conduit 25 including control valve 24 for supplying thereto liquid 26, which may be water or a prior art cleaning solution. A drain conduit 28 and control valve 29 are also provided to drain the contents of tank 16 when desired. The cleaning liquid 26 may be withdrawn when desired from conduit 32, which is in communication with conduit 28 upstream from valve 29, passed to a chemically resistant pump 31, and recycled via conduit 30 into tank 16. The cleaning liquid 26 may be continuously withdrawn via conduit 32 and recycled back to tank 16 as described to thereby continuously mix and agitate it, or this may be done intermittently. Also, in instances where a cleaning aid of limited solubility is suspended in the liquid 26, the suspended matter tends to collect in conduit 28 due to the sloped bottom wall 33 of tank 16, and it is re-suspended in and recycled with the liquid.

The tank 16 is provided with two transducers 35 and 36 which are mounted on opposite side walls thereof and at points below the level 27 of cleaning liquid 26. The transducers 35 and 36 are of similar construction, and

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an ultrasonic energy zone is produced therebetween, whereby objects to be cleaned that are passed through the zone are subjected to ultrasonic sound waves moving in opposite directions. The transducers 35 and 36 may be of prior art construction and design, and are preferably side mounted solid pack magnetostrictive transducers which are available from commercial sources. As is best seen in FIGURE 5, the transducers 35 and 36 are electrically connected via electrical leads 37 and 38 to prior art generators 39 and 40, respectively. The generators 39 and 40 are connected via electrical leads 41 and 42, respectively, to a source of alternating current, such as 60 cycles per second, 110-440 volt alternating current, which is converted thereby to an electrical current having a frequency above 16,000 cycles per second, and preferably about 20,000-40,000 cycles per second. The resulting high frequency electric current is conducted from the generators 39 and 40 via electrical leads 37 and 38 to transducers 35 and 36, respectively, which convert it into mechanical energy in the form of ultrasonic sound waves having a frequency similar to that of the high frequency electric current, i.e., above 16,000 cycles per second and preferably 20,000-40,000 cycles per second. The ultrasonic energy is then directed into the cleaning liquid 26 between transducers 35 and 36. Inasmuch as the ultrasonic sound waves travel in a straight line, the ultrasonic energy zone 52 is that volume of liquid 26 which is immediately between the transducers 35 and 36.

A hoist mechanism 50 is provided for raising and lowering the roller assembly 51 between the highest position which is illustrated in FIGURE 3, and the lowest position which is illustrated in FIGURE 4. This allows the entire roller assembly to be subjected to the relatively small cleaning zone 52 of liquid 26 which is activated by ultrasonic energy. The upper and intermediate positions 65-a and 65-b assumed by the member 65 as the roller assembly 51 is moved from the upper position illustrated in FIGURE 3, to the lower position illustrated in FIGURE 4, are shown in phantom line in FIGURE 4. The hoist mechanism 50 includes a hollow rectangular, upright member 53 which passes through opening 54 in sink 12. A rectangular, vertically extending, hollow, guide or supporting member 55 is also mounted between upright member 53 and the peripheral surface of opening 24, and it has internal dimensions which allow upright member 53 to be slidably mounted therein in a close fitting relationship. The member 55 is joined by welding or other suitable means to sink 12, and it extends thereabove and below substantial distances so as to have a bracing and guiding effect on member 53. Also, by extending substantially above the surface of sink 12, member 55 prevents liquid which may be splashed in sink 12 during the operation of apparatus 10 from running down into the member 53 and thereby corroding the same. A dry friction reducing lining, which may be a thin layer or sheet of polytetrafluoroethylene containing a filler such as SiO<sub>2</sub> or Al<sub>2</sub>O<sub>3</sub> to give it more body and temperature resistance, may be attached to the surface of member 55 which is in contact with the surface of member 53.

The member 53 extends downward into cabinet 11 a distance sufficient to provide for moving the roller assembly 51 through the necessary vertical distance. The member 53 is laterally spaced from tank 16 and is provided with a vertically extending slot 56 and an internally mounted rack 57 whereby the member 53 may be raised or lowered by pinion 58. As is best seen in FIGURES 3 and 5, the pinion 58 is driven by electric motor 59 by means of shaft 60 which is inserted through slot 56. The motor 59 is conveniently mounted within cabinet 11 on support 61, as is best seen in FIGURES 3 and 4.

A hollow horizontally extending member 65 of generally rectangular cross-section is mounted on the upper end of upright member 53. One end of member 65 extends over the top of tank 16, and a pair of spaced downwardly extending members 66 and 67, which have slots

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68 and 69, respectively, formed therein, are provided for receiving the rod-like extensions 70 and 71 on the upper end of roller assembly 51. As is best seen in FIGURES 1 and 3, a single rod-like extension 71 is inserted into slot 69, and it is retained therein by a downwardly extending slot portion 73. Similarly, as is best seen in FIGURES 3 and 7, a pair of rod-like extensions 70 on roller assembly 51 are securely held in a downwardly extending portion 72 of slot 68. It may be noted that portion 72 of slot 68 is substantially deeper than portion 73 of slot 69, thereby allowing the pair of extensions 70 to be retained therein to prevent swinging movement of roller assembly 51.

The specific roller assembly 51 illustrated in the drawings is a type which is often employed in continuous commercial photographic film processing equipment. Such roller assemblies are provided with a large number of individual rollers 74 which are mounted on rotatable rods 78 and arranged in the three rows 75, 76 and 77. As is best seen in FIGURE 6, the individual rollers 74 of the vertically extending rows 75, 76 and 77 are staggered. An individual roller 74 in each of the rows 75 and 77 is mounted at approximately the same level, and the resulting pairs of rollers are spaced vertically. Row 76 has individual rollers which are mounted at points approximately halfway between the pairs of the rollers for rows 75 and 76. The rollers 74 are each provided with a sprocket 79 at one end thereof which meshes with a continuous link chain drive 80 that is driven by sprocket 81 on rod 82. Rod 82 is driven by means of a gear 83, which in turn is driven by worm gear 84 carried by shaft 85 of electric motor 86. The motor 86 is mounted within the member 65 of the shaft 85 and extends downward through an opening 87 therein. It may be noted that the motor 86, the shaft 85 and the worm gear 84 are constructed and arranged so as to engage the gear 83 upon positioning the rod-like extensions 70 and 71 in slots 68 and 69 of roller assembly 51. Worm gear 84 drives gear 83 and rod 82 is rotated. This drives sprocket 81 on rod 82 which in turn moves chain 80 and the sprockets 79 on the rollers 74 are driven, thereby rotating rollers 74. This arrangement assures that the individual rollers 74 are rotated continuously throughout the cleaning operation, thereby allowing the entire surface of each roller 74 to be subjected to the cleaning action of the ultrasonic energy as the roller assembly 51 is raised and lowered through the ultrasonic energy zone 52. After the roller assembly 51 has been passed through one or more of the cleaning cycles illustrated in FIGURES 3 and 4, with rotation of the individual rollers 74 as described, the hoist 50 is returned to the position illustrated in FIGURE 3, and the roller assembly 51 is removed from slots 68 and 69 and placed in rinse tank 17 for rinsing.

The top of rinse tank 17 is provided with a pair of spaced straps 92 having slots 93 in the upper surfaces thereof for receiving the rod-like extensions 70 and 71 on roller assembly 51, to thereby support the same in rinse tank 17 as shown in phantom line in FIGURE 6. The upper portion of tank 17 is also provided with an electrical motor 94, which is mounted on the side wall of tank 17 with the driven shaft 95 extending therethrough. A worm gear 96 is carried by shaft 95 and positioned whereby it drives gear 83 on rod 82 of roller assembly 51, and rollers 74 are continuously rotated thereby in the manner previously described. The tank 17 is also provided with an overflow conduit 91, and a plurality of sprays 97 which are mounted on water conduit 100. Water is supplied to conduit 100 via conduit 102 at a rate controlled by solenoid-operated valve 103. The sprays 97 are positioned so that the rollers 74 on roller assembly 51 are intimately contacted with sprayed water. The tank 17 is also provided with a drain conduit 101 through which water is withdrawn at a desired rate controlled by solenoid-operated valve 104.

FIGURE 8 of the drawings diagrammatically illustrates the electrical wiring of the apparatus of the invention. Main switch 105 in electrical leads 99, which are connected to a convenient source of electrical current, such as 110-115 volt, 60 cycles per second alternating current, is closed to thereby energize the equipment. Then, switch 106 is closed to energize ultrasonic generators 39 and 40 via electrical leads 41 and 42, respectively, which provide a high frequency electric current that is supplied via electrical leads 37 and 38, to operate the transducers 35 and 36, respectively, as previously described. At this time, a roller assembly 51 to be cleaned is placed on apparatus 10 in the position illustrated in FIGURE 3 of the drawings. The switch 107 in electrical leads 115 is then closed, thereby energizing the programmer 108 which controls the cleaning cycle in tank 16 and causes the hoist motor 86 and/or pinion motor 59 to be operated by means of electrical current supplied thereto via electrical leads 116 and 117, respectively, over a predetermined timed cycle or cycles which will be described more fully hereinafter. Switch 109 in electrical leads 118 may be closed and switch 107 allowed to remain open in instances where it is not desired to operate the hoist motor 86 and/or pinion motor 59 automatically by means of the programmer 108. Thus, the pinion motor 59 and hoist motor 86 may be operated individually or together as desired on a manual basis.

After the cleaning cycle in tank 16 has been completed and the cleaned roller assembly 51 has been transferred to the rinse tank 17, switch 110 in the electrical leads 119 is closed to thereby energize programmer 111 which controls the rinse cycle and operates motor 94 and solenoids 112 and 114 in valves 103 and 104, respectively. Programmer 111 causes electrical current to be supplied to the rinse motor 94 via electrical leads 120, whereby the motor 94 is operated and the rollers 74 on roller assembly 51 are rotated during rinsing. The water supply solenoid 112 is opened and closed as desired by means of an electrical signal transmitted from programmer 111 via electrical leads 121, and the valve 103 is operated accordingly by means of a mechanical connection 121, thereby controlling the rate of flow of water in conduit 103 to conduit 100 for sprays 97. The water level in tank 17 is controlled by opening or closing the drain solenoid 114 by means of an electrical signal transmitted from programmer 111 via electrical leads 112, and the drain valve 104 is operated accordingly by means of a mechanical connection 123. The drain conduit 101 is sufficiently large to be capable of withdrawing water from tank 17 at a substantially faster rate than it is supplied via sprays 97, whereby it is possible to control the water level in tank 17 at any desired level, or to cause the water level to rise or recede gradually, even when the sprays 97 are operating at full capacity.

In operating the above described apparatus, the basic cleaning cycle usually requires approximately 6 minutes, and consequently the programming cycle for programmer 108 is predetermined accordingly. If a roller assembly should be heavily contaminated, or if the contaminate should be unusually difficult to remove, then the programmer 108 is constructed so that the basic cleaning cycle may be repeated for up to, for example, 5 times for a total cleaning time of up to 30 minutes or more. The programmer 108 may control the cleaning cycle and operate the hoist motor 59 so that the roller assembly 51 is in each of the three positions illustrated in FIGURE 4 of the drawings for approximately one-third of the cleaning time, i.e., about 2 minutes when a 6 minute cycle is used, and with the rollers 74 being rotated continuously by motor 86 during this time as previously described. In operating the hoist mechanism 50, it is preferred that the programmer 108 be programmed so the roller assembly 51 is passed from the uppermost position shown in FIGURE 3 to the lowermost position shown in FIGURE 4, where the top one-third is cleaned

over the two minute residence time. Then, the hoist mechanism is operated to move the member 65 and the roller assembly 51 carried thereby to the intermediate position 65-a illustrated in FIGURE 4 of the drawings, where it is allowed to remain for a residence time of 2 minutes. Thereafter, the hoist mechanism is operated again to move the roller assembly to the uppermost position illustrated in FIGURE 3 of the drawings for a 2 minute residence time, whereby the lower one-third thereof is cleaned. This allows a less expensive hoist motor 59 to be employed as a breaking mechanism as not necessary, as would be true if the programming is reversed and the roller assembly 51 is lowered, rather than raised during the cleaning sequence. Also, it is more difficult to stop the motor 86 quickly, and thereby assure that roller assembly 51 is correctly positioned within the ultrasonic energy zone 52.

After the rollers 74 have been thoroughly cleaned and the roller assembly 51 has been placed in tank 17 for rinsing as previously described, it is preferred that the programmer 111 be programmed so that a flood-rinse cycle is employed. For instance, the water from sprays 97 may be allowed to rise in tank 17 and completely flood the rollers 74 while the rollers 74 are rotated continuously. This may be conveniently accomplished by allowing drain solenoid 114 to remain in a closed position, and water supply solenoid 112 to remain in an open position whereby water is supplied to sprays 97 continuously. When the tank 17 has been filled to a desired level and the rollers 74 are flooded, the programmer 111 operates drain solenoid 114, which in turn opens the drain valve in conduit 101. This causes the water level to recede gradually in tank 17. The drain solenoid 114 is allowed to remain in an open position throughout the remainder of the rinse cycle, thereby assuring that the tank 17 is completely drained and all contamination is removed and rinsed from the roller surfaces. Usually, the spraying is continued for a period of time after the water has drained completely from tank 17. The resulting cleaned and rinsed roller assembly 51 is then ready for use.

The generators 39 and 40 and the transducers 35 and 36 are commercially available, and it is not necessary to describe these components in greater detail for an understanding of the invention. Similarly, the programmers 108 and 111 and solenoid operated valves 103 and 104, are available commercially.

The generators 39 and 40 and transducers 35 and 36 should be capable of producing ultrasonic energy of at least 16000 cycles per second, but much higher levels are possible, such as up to 100-150 kilocycles per second. As a general rule, for best results the frequency should be between about 20,000 and 40,000 cycles per second. Usually, lower frequencies give better results or more effective and faster cleaning action within the preferred range mentioned above, but this may vary somewhat depending upon the specific type of transducer which is employed. Often about 20,000 cycles per second is the optimum frequency. The power density in ultrasonic energy zone 52 may be in accordance with prior art practice, such as about 2.5-10 watts per square inch.

The ultrasonic cleaning liquid 26 that is employed in tank 16 may be in accordance with prior art practice. The cleaning liquid should dissolve either the contaminant which is present on the roller surfaces, or the binder or adhesive which is holding the contaminant to the roller surfaces. The cleaning liquid may be water or water containing a detergent when cleaning roller assemblies that are used in processing photographic film. This assures that no residue will be present on the roller surfaces to damage the film. The present invention offers an important advantage in this respect, as quite often the prior art cleaning procedures resulted in damaged photographic film when the roller assemblies were placed in service again. The cleaning liquid 26 may include hydrocarbon

solvents, chlorinated hydrocarbon solvents, and other types of organic solvents in instances where such solvents are necessary for the removal of grease, or other contaminants from the roller surfaces.

The foregoing detailed description and the drawings are for purposes of illustration only, and are not intended as being limiting to the spirit or scope of the appended claims.

What is claimed is:

1. An ultrasonic cleaning apparatus comprising vessel means for containing an ultrasonic cleaning liquid, the vessel means having an opening in the top thereof for receiving a multiple roller assembly to be cleaned, spaced ultrasonic energy producing means mounted on opposite sides of the vessel means whereby ultrasonic energy waves are directed therebetween, the ultrasonic energy producing means forming an ultrasonic energy zone therebetween when the cleaning apparatus is in use which is subjected to ultrasonic energy waves moving in generally opposite directions, hoist means mounted above the opening in the top of the vessel means for raising and lowering a multiple roller assembly to be cleaned into the vessel means whereby the roller assembly is passed through the said opening and between the two sources of ultrasonic energy and into the ultrasonic energy zone, means for rotating the individual rollers of the roller assembly while the roller assembly is in the ultrasonic energy zone and is being subjected to the cleaning action of the ultrasonic energy, means for spraying the roller assembly with a rinsing liquid after it has been subjected to the cleaning action of the ultrasonic energy, and means for rotating the rollers while they are sprayed with the rinsing liquid.

2. The apparatus of claim 1 wherein there is provided means for flooding the rollers of the roller assembly with sprayed liquid whereby the rollers are immersed in a body of the rinsing liquid, and automatic programing means is provided for controlling the spraying means, the roller rotating means and the roller flooding means whereby the rollers are sprayed with the liquid for a predetermined time while they are rotated, then the rollers are flooded with the rinsing liquid for a predetermined time, and thereafter the rollers are sprayed with the liquid for a predetermined time while they are rotated.

3. The apparatus of claim 2 wherein the said ultrasonic energy zone is substantially smaller than at least one dimension of the roller assembly, and an automatic programing means is provided for controlling the hoist means and the roller rotating means whereby successive portions of the roller assembly are passed through the ultrasonic energy zone and subjected to the cleaning action of the ultrasonic energy for a predetermined period of time until the roller assembly is cleaned.

4. An ultrasonic cleaning apparatus comprising vessel means for containing an ultrasonic cleaning liquid, the vessel means having an opening in the top thereof for receiving a multiple roller assembly to be cleaned, spaced ultrasonic energy producing means mounted on opposite sides of the vessel means whereby ultrasonic energy waves are directed therebetween, the ultrasonic energy producing means forming an ultrasonic energy zone therebetween when the cleaning apparatus is in use which is subjected to ultrasonic energy waves moving in generally opposite directions, rack and pinion driven hoist means mounted above the opening in the top of the vessel means for raising and lowering a multiple roller assembly to be cleaned into the vessel means whereby the roller assembly is passed through the said opening and between the two sources of ultrasonic energy and into the ultrasonic energy zone, and means for rotating the individual rollers of the roller assembly while the roller assembly is in the ultrasonic energy zone and is being subjected to the cleaning action of the ultrasonic energy.

5. The apparatus of claim 4 wherein the said ultrasonic energy zone is substantially smaller than at least one dimension of the roller assembly, and an automatic pro-

graming means is provided for controlling the hoist means and the roller rotating means whereby successive portions of the roller assembly are passed through the ultrasonic energy zone and subjected to the cleaning action of the ultrasonic energy for a predetermined period of time until the roller assembly is cleaned.

6. A method of cleaning a multiple roller assembly comprising the steps of immersing at least a portion of a roller assembly to be cleaned in a body of an ultrasonic cleaning liquid, the body of ultrasonic cleaning liquid having a zone therein activated by ultrasonic energy emitted from at least two spaced sources, the said zone being substantially smaller than at least one dimension of the roller assembly, passing successive immersed portions of the roller assembly through the said zone and subjecting the same to the cleaning action of the ultrasonic energy emitted from the said two spaced sources thereof until the roller assembly has been cleaned, the ultrasonic energy sources being located on opposite sides of the roller assembly and spaced therefrom, the ultrasonic energy which is emitted from each source being directed toward the surfaces of the rollers, and rotating the rollers of the roller assembly while they are being subjected to the cleaning action of the ultrasonic energy.

7. A method of cleaning a multiple roller assembly comprising the steps of immersing at least a portion of a roller assembly to be cleaned in a body of an ultrasonic cleaning liquid, subjecting an immersed portion of the roller assembly to the cleaning action of ultrasonic energy emitted, from at least two spaced sources, the ultrasonic energy sources being located on opposite sides of the roller assembly and spaced therefrom, the ultrasonic energy which is emitted from each source being directed toward the surfaces of the rollers, rotating the rollers of the roller assembly while they are being subjected to the cleaning action of the ultrasonic energy, and thereafter removing the roller assembly from the ultrasonic cleaning liquid and rinsing the same with sprayed liquid while rotating the rollers.

8. The method of claim 7 wherein the rinsed roller assembly is thereafter flooded with water whereby the rollers are immersed in a body of water, and then rinsed again with sprayed water while rotating the rollers.

9. The method of claim 8 wherein the body of ultrasonic cleaning liquid has a zone therein activated by ultrasonic energy emitted from the said two spaced sources, the roller assembly has a plurality of rollers transversely mounted along its length and the said zone is substantially shorter than the length of the roller assembly, the roller assembly is passed lengthwise through the said zone and with the longitudinal axis of the rollers thereof being at about 90° to a vertical plane passing through the said two spaced sources of ultrasonic energy, and successive portions of the roller assembly are passed through the zone and subjected to the cleaning action of the ultrasonic energy until the roller assembly has been cleaned.

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D. G. MILLMAN, Assistant Examiner

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75 134—86, 89, 116, 140, 161; 259—1