

[72] Inventor Einar W. Jensen
Rochester, N.Y.
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[73] Assignee Eastman Kodak Company
Rochester, N.Y.

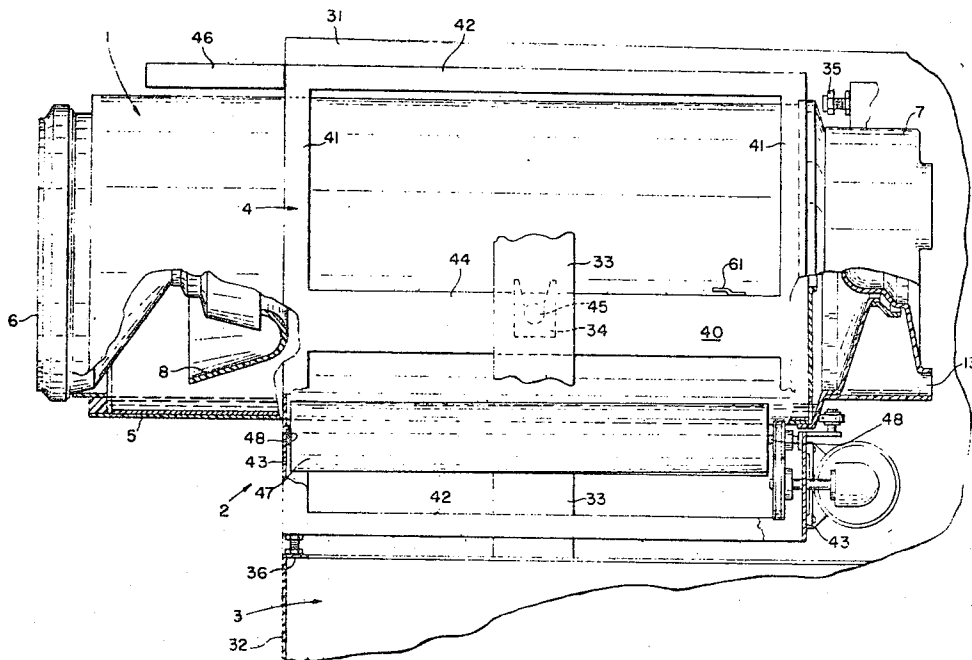
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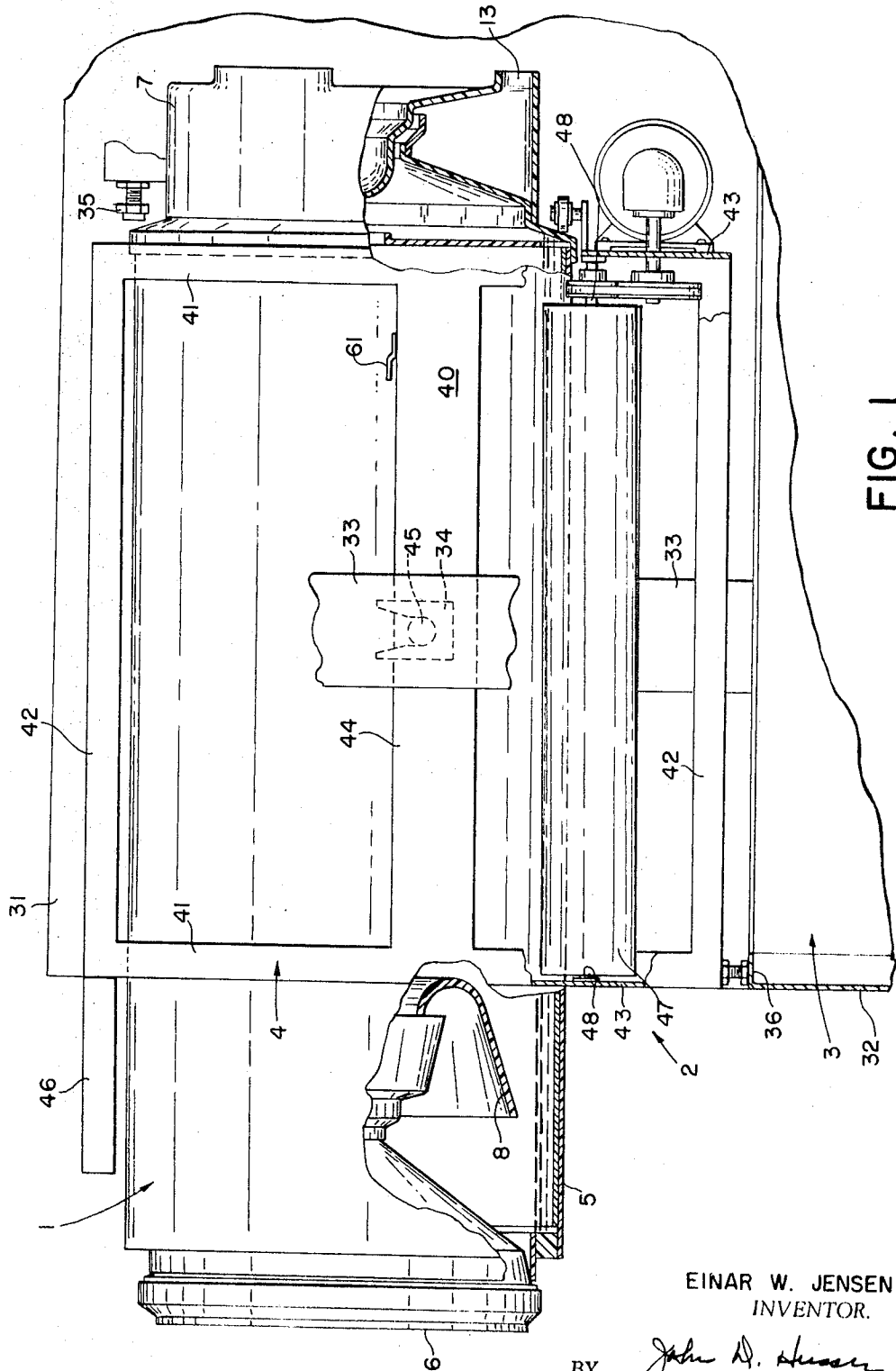
Primary Examiner—Samuel S. Matthews
Assistant Examiner—Robert P. Greiner
Attorneys—Robert W. Hampton and John D. Husser

[54] **PHOTOGRAPHIC PROCESSOR HAVING
MOVEMENT RESPONSIVE ROTATION CONTROL**
14 Claims, 5 Drawing Figs.

[52] U.S. Cl..... 95/93,
95/97
[51] Int. Cl..... G03d 13/04
[50] Field of Search..... 95/93, 89,
97, 90.5

ABSTRACT: A processing apparatus having a tiltable cradle adapted for supporting a tubular processor of the type which is ordinarily filled in one orientation and rotated in another orientation. The cradle is movable between the processor filling and rotating positions and means responsive to cradle movement between these positions are provided for controlling the application of rotative drive from a pair of spaced rollers to the processor.





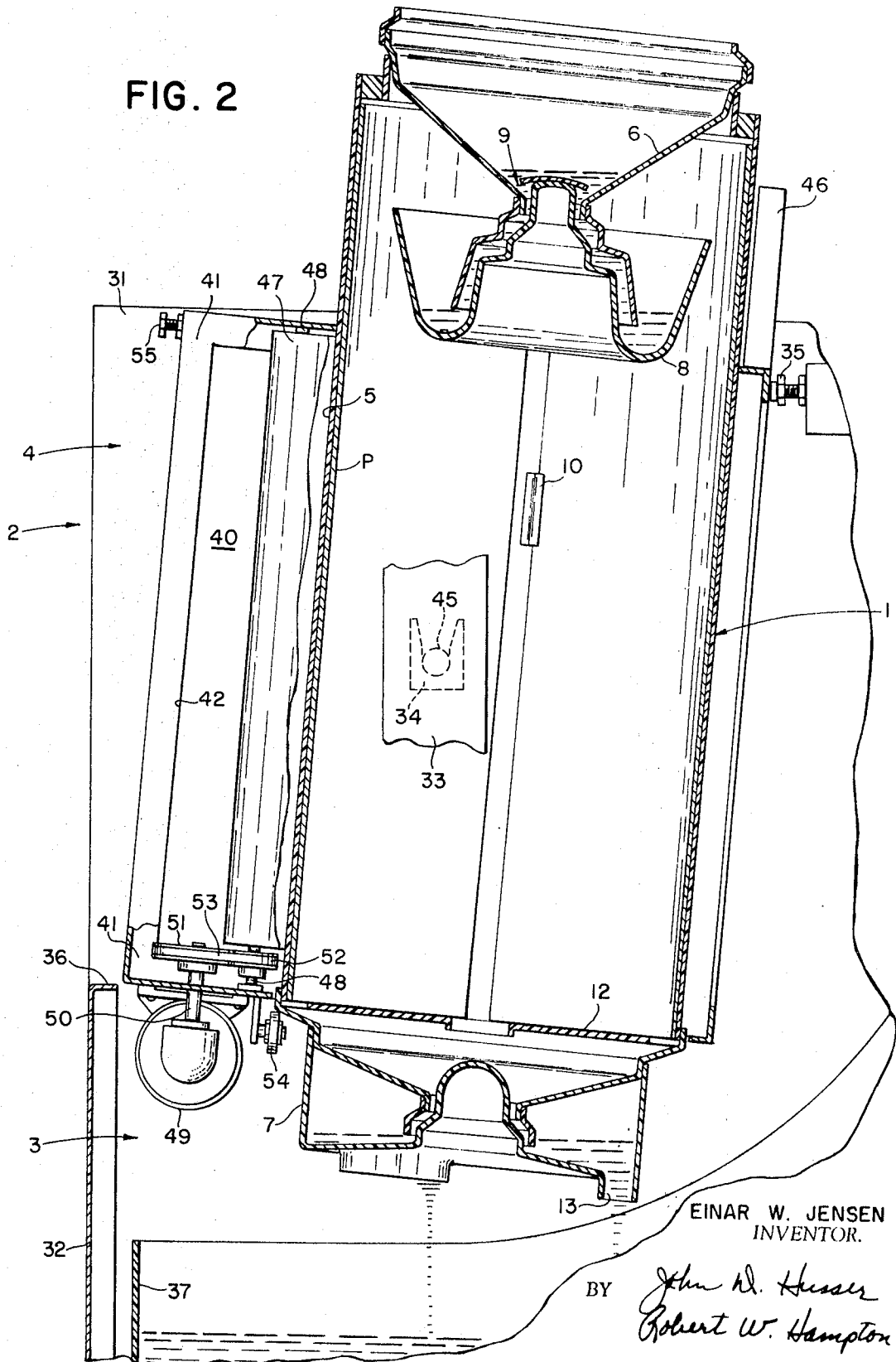
EINAR W. JENSEN
INVENTOR.

BY

John D. Shaver
Robert W. Hampton

ATTORNEYS

FIG. 2



EINAR W. JENSEN
INVENTOR.

BY

John H. Hesser
Robert W. Hampton

ATTORNEYS

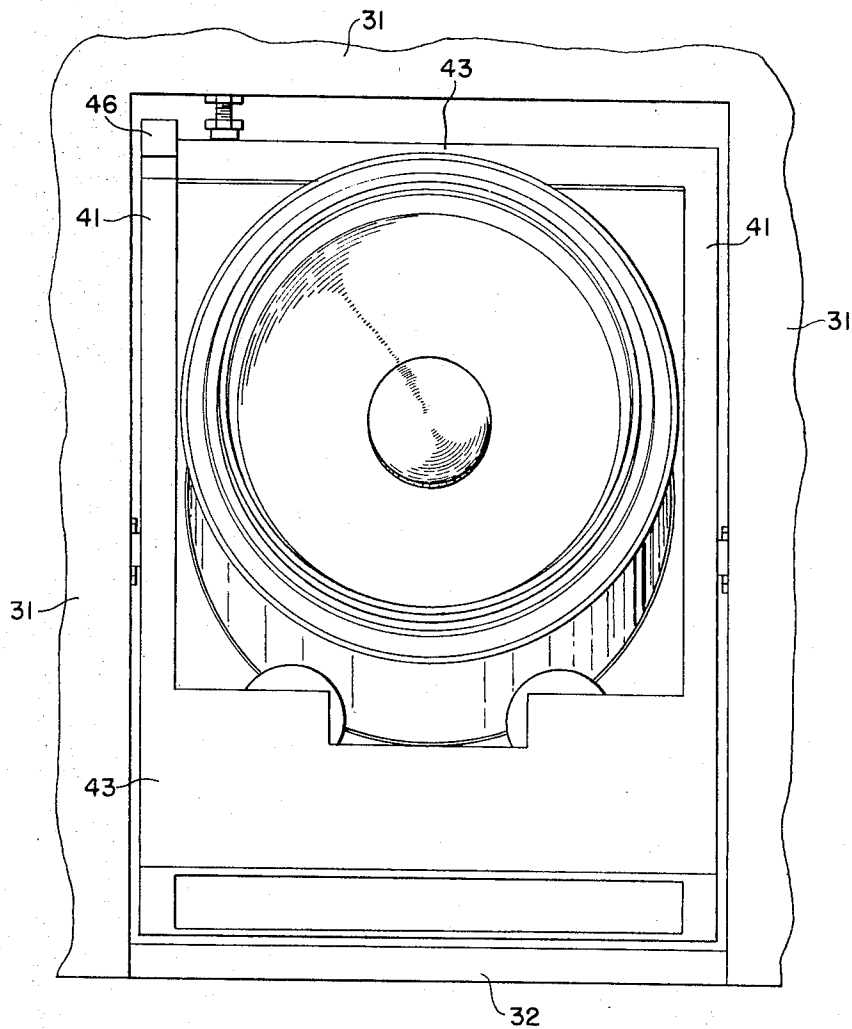


FIG. 3

EINAR W. JENSEN
INVENTOR.

BY *John W. Husser*
Robert W. Hampton
ATTORNEYS

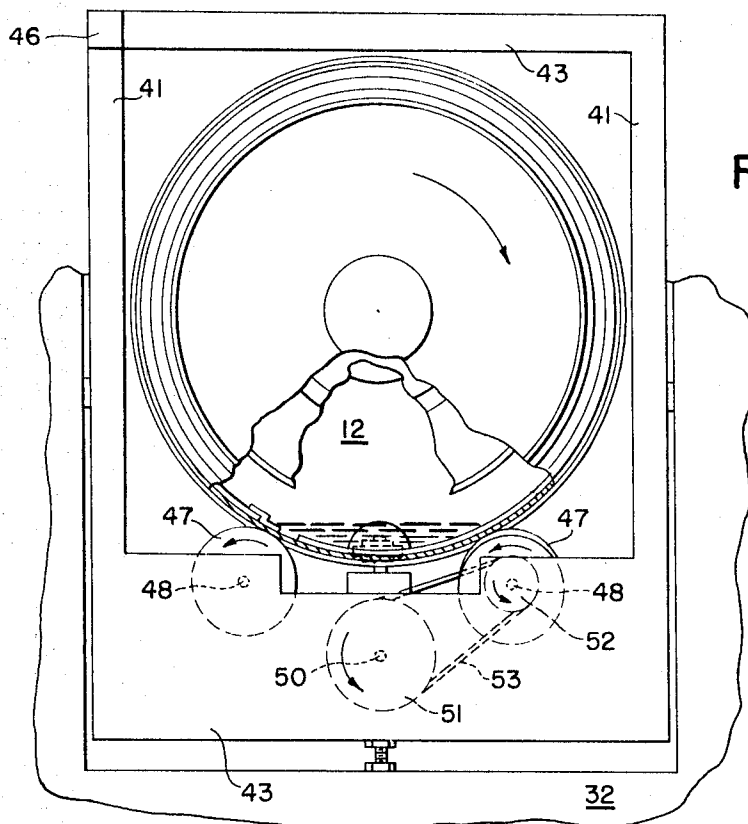


FIG. 4

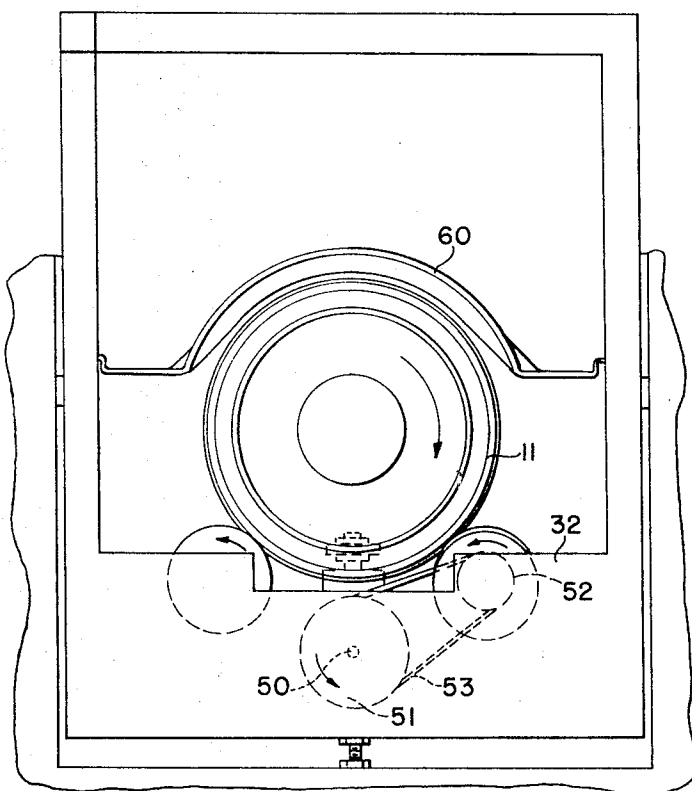


FIG. 5

EINAR W. JENSEN
INVENTOR.

BY *John W. Hesser*
Robert W. Hampton
ATTORNEYS

PHOTOGRAPHIC PROCESSOR HAVING MOVEMENT RESPONSIVE ROTATION CONTROL

CROSS-REFERENCE TO RELATED APPLICATIONS

Reference is made to commonly assigned copending U.S. Pat. application Ser. No. 454,543, entitled "Tubular Processor," filed May 10, 1965 in the name of Roy D. Porter.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus for processing photographic materials and more particularly to such apparatus having improved structural means for selectively, imparting processing rotation to a tubular processing drum and disposing the processing drum for liquid introduction and/or discharge.

2. Description of the Prior Art

Various cylindrical drum processors of the type adapted to receive photographic materials and processing liquids and be rotated around the drum axis to provide intimate contact between the materials and liquids are known in the photographic processing art.

Recently a novel photographic drum-type processor has been devised which, when in one orientation, allows introduction of processing liquid into the processing drum while a used processing liquid in the drum is drained. This novel capability is achieved by provision of a storage reservoir within the drum and by locating the liquid introducing and discharge openings at opposite ends of the drum. One embodiment of such a tubular processor is disclosed in copending U.S. application Ser. No. 454,543, noted above. In such a processor, the processing liquids are introduced and drained while the processing tube is orientated with its longitudinal axis in a generally vertical position. When it is desired to cause the liquid in the reservoir to contact the processing chamber of this processor, the tube is reoriented to a generally horizontal position. In the horizontal position the processor is properly disposed for processing rotation about its longitudinal axis.

SUMMARY OF THE INVENTION

It is therefore one object of the present invention to provide means for conveniently moving such a processor between a stationary vertical disposition and a rotating horizontal disposition.

It is another object of the present invention to provide an improved support and drive means for facilitating the use of a drum type processor.

It is another object of the present invention to provide an improved processing apparatus of the type utilizing a drumlike processing chamber.

It is a further object of the present invention to provide an improved support and drive control means for a tubular processor of the type which is advantageously filled in one orientation and rotated in another orientation.

Yet another object of the present invention is to provide an improved photographic processing apparatus having means to facilitate introduction and discharge of processing liquid into and from the processing chamber and automatic control of the transmission of rotative drive to the processing chamber.

Another object of the present invention is to provide improved means for controlling the transmission of rotative drive to a tubular processor.

Still another object of the present invention is to provide improved means for selectively, by a change of drum orientation, connecting rotating drive to a tubular processing drum and supporting the drum in a stationary position for introduction of processing liquids.

Briefly, one embodiment of the present invention accomplishes these and other objects by means comprising a tiltable cradle which loosely supports a processing drum of the type

described, in a manner affording a small movement of the tube or drum with respect to the cradle during movement of the cradle from a generally vertical to a generally horizontal position. A pair of spaced rollers are mounted on the cradle in a location such that a drum supported in the cradle will rest by gravity on the rollers when the cradle is in its horizontal position. Rotative drive is provided for at least one of the rollers and is transmitted to a supported drum when the cradle is in its horizontal position. Because it is often desirable to continue processing operations without manually shutting off the processing tube drive, the present invention provides means which are responsive to movement of the cradle to its vertical, processor-filling position for disengaging rotating drive from the tube. In this embodiment of the invention, hereinafter disclosed in detail, this inactivation of tube rotation is accomplished by providing the limit for the cradle's vertical movement slightly beyond the tub's 90° arc of travel from horizontal to vertical position. In this manner the processing tube will fall away from the rotating rollers and rest in a stationary position in the cradle for filling.

It will of course be appreciated that the same objective can be achieved by providing inclined support structure at the bottom of the cradle, in its vertical position, so that a processing tube resting thereon will fall away from the rotating drive in any generally vertical cradle position. Likewise the objective can be achieved by mounting the drive rollers separate from the cradle, in a horizontal position and selectively moving the cradle between the vertical filling position and a horizontal position in which the processing drum or tube supported thereby rests on the rollers. Also, the means for selectively imparting rotation to the cradle-supported processing drum can comprise switch means which is actuated by movement of the cradle to its horizontal position to commence rotation of the drive rollers and which is opened during movement of the cradle from its horizontal position. In the last-mentioned embodiment the rollers can be mounted either on, or separate from, the cradle.

Each of the above-described embodiments is considered to be within the broader aspects of the present invention which relate to the unique structural concept of providing selective stationary and rotative support means for a tubular processor with rotation to the supported drum being responsive to a change in its orientation.

BRIEF DESCRIPTION OF DRAWINGS

The novel aspects of the present invention will be readily apparent to one skilled in the art from the following detailed description of several embodiments of the invention, with reference to the drawings in which like characters denote like parts and wherein:

FIG. 1 is a right side view, partially in section, of one embodiment of the present invention with the cradle in the horizontal position;

FIG. 2 is a sectional view of the embodiment shown in FIG. 1 viewed also from the right side but with the cradle in the generally vertical position;

FIG. 3 is a top view of the apparatus shown in FIG. 2 with the cradle in the generally vertical position;

FIG. 4 is a front view of the apparatus shown in FIG. 1, with the cradle in the horizontal position and with portions removed to show portions of the processing drum interior; and

FIG. 5 is a front view of another embodiment of the present invention with the cradle in the horizontal position.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the embodiment of the invention disclosed in FIGS. 1—4 it can be seen that a processing tube or drum 1, of the type adapted to receive photographic material to be processed, is removably supported in the rotating and support assembly denoted generally by the numeral 2. The rotating and support assembly 2 is comprised of two main elements, its stationary housing 3 and the tiltable, tube drive and support cradle 4.

The processing tube 1 is comprised of a large cylindrical drum 5 and top and bottom end closures 6 and 7 respectively. Within the processing tube 1 is a liquid reservoir 8, which maintains liquid introduced through light-tight opening 9 out of contact with photographic material P in the processor.

When the processing tube 1 is positioned in a generally vertical orientation such as is shown in FIG. 2, the material P is inserted in the processor in a single, nonoverlapping coil and expands by its own resilience against the interior walls of the processor housing. The material P is held against sliding and/or skewing by one edge under an "L"-shaped strip 10, see FIG. 2. Also a spidered end plate 12 serves to prevent movement of the material P while allowing drainage of used processing liquid through a drain opening 13 in the bottom end closure 7 when the processing tube 1 is oriented in the generally vertical position shown in FIG. 2.

The stationary housing 3 comprises back and sidewalls 31 and a partial front wall 32. Upright support members 33 are correspondingly located on each sidewall 31 and bearing notches 34 are formed at the same height on each upright support member 33. An adjustable stop member 35 is supported on an extension of the top of the back wall 31 to locate the cradle 4 in its generally vertical position. A top 36 of partial front wall 32 serves as a stop for the cradle 4 in the horizontal position. The bottom of the housing 3 encloses a sump 37 for used liquids draining from the processing tube 1, see FIG. 2. The sump 37 can be removable or affixed to the housing 3 and a pump connected to discharge liquid therefrom.

The tiltable, tube drive and support cradle 4 comprises a boxlike frame 40 which is open at both ends. Referring to FIGS. 1 and 4 it can be seen that the frame 40 is formed of front and rear upright members 41, top and bottom longitudinal members 42 and crossmembers 43 which define a chamber in which the processing tube 1 can rest in a loosely supported relation. The frame 40 also has middle longitudinal members 44 on opposite sides of which support lugs 45 extend outwardly at a location such that the frame can be easily pivoted in bearing notches 34 of the housing 3. A handle 46 is provided on the front of the frame 40 to facilitate pivoting the frame between the substantially horizontal position shown in FIG. 1 and the generally vertical position shown in FIG. 2. It is to be noted that the term "generally vertical" as used herein is intended to include positions of the cradle 4 and supported processing tube 1 which are upright, but not necessarily normal, with respect to the horizontal orientation. As best seen in FIG. 2, in the generally vertical position the cradle 4 is pivoted slightly beyond a normal upright position through an arc of slightly more than 90° from its horizontal position in FIG. 1.

Between the front and rear bottom-crossmembers 43, a pair of longitudinal rollers 47 are mounted for rotation on shafts 48. By referring to FIG. 4, it can be seen that the rollers 47 are mounted in a generally uniformly spaced relation so that the processing tube 1 can rest with a portion of its peripheral surface between the rollers 47. It will be noted that the right roller 47, as viewed in FIG. 4, has its axis slightly nonparallel with respect to left roller 47 to direct the drums toward the roller 54 thereby preventing the drum 5 from creeping out of the cradle 4 during rotation. As can be seen in FIGS. 2, 4 and 5, a motor 49 is mounted on the rear of a lower cross member 43 and has a drive shaft 50 extending between the rollers 47, beneath the processing tube 1 in the horizontal cradle position. The drive shaft 50 is connected to one of the rollers 47 by pulleys 51 and 52 and belt 53.

In FIGS. 1 and 2, it can be seen that the cradle 4 also has a roller 54 mounted thereon in a position to engage and support an inclined section of a bottom end closure 7 of the processing tube 1. The roller 54 supports the processing tube 1 as shown in FIG. 2 when the cradle 4 is in a generally vertical position and serves as a bearing against which the processing tube 1 is urged during rotation of the processing tube 1 in the horizontal position as shown in FIG. 1. The cradle 4 also has a set-bolt 55 which engages top 36 of partial front wall 32 in the horizontal position and can be used to adjust the horizontal frame position to a level condition.

In operation of the above-described embodiment, a sheet of material P can be inserted into the processing tube 1 while it is removed from the cradle 4. The top end closure 6 is removable from housing 5 for this purpose. The cradle 4 is moved to its generally vertical position shown in FIG. 2, and the processing tube 1 is placed in the chamber defined by frame 40 as shown in FIG. 2. The motor 49 is now started and can remain running through successive treatments of the material P. Drive is transmitted from motor shaft 50 to the connected roller 47. It slightly pass-normal be noted that no drive is as yet transmitted to the processing tube because in the slightly-past-normal position of the cradle 4 shown in FIGS. 2 and 3 the processing tube 1 rests against wall 43 of frame 40 and away from the rollers 47.

A change of processing liquid is introduced through opening 9 and passes into reservoir 8 within the housing 5 of the processing tube 1. The cradle 4 is then moved to the horizontal position shown in FIG. 1 and as the processing tube 1 moves to the horizontal position the liquid passes from reservoir 8 into contact with the material P. As the cradle 4 is moved from the vertical to the horizontal position, the processing tube 1 is moved by gravity within frame 40 to rest on rollers 47; and drive from the rollers 47 is transmitted to the processing tube in the directions indicated by the arrows in FIG. 4.

When the desired processing time has elapsed, the cradle 4 is moved back to the original position shown in FIG. 2 and the processing tube 1 shifts by gravity back against the wall 43 of cradle 4 and away from the rollers 47. Transmission of drive from the rollers 47 to the processing tube 1 ceases and the processing tube 1 is supported in the cradle 4 in a stationary disposition.

The next processing solution can then be introduced to reservoir 8 while used liquid drains from the processing tube 1 through opening 13 into the sump 37 as shown in FIG. 2. When the new charge of liquid has been introduced and the used charge drained, the cradle 4 is again moved to the horizontal position shown in FIG. 1; and the next processing operation occurs in the same manner described above.

In FIG. 5 another embodiment of the present invention is disclosed. In this embodiment a crossmember 60 is inserted between the middle longitudinal members 44 of frame 40 at a position which will support a smaller tube 11 when the cradle 4 is moved to a vertical position such as disclosed in FIG. 2. The operation of this embodiment is otherwise the same as that described above. By referring to FIG. 1, the one of a pair of retaining brackets 61 which are adapted to mount crossmember 60 can be seen.

It has been found that better processing results are achieved with both of the disclosed embodiments when a print to be processed in the drum 5 is treated with tempered water prior to application of any developer. This step serves both to pre-heat the drum 5 and to wet the emulsion surface of the paper. Prewetting the paper decreases the undesirable effects due to splatter and irregular wetting when liquid is discharged from reservoir 8.

The invention has been described in detail with reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

I claim:

1. A photographic processing apparatus for use with a cylindrical processing drum with an axis of rotation, the processing drum being adapted to receive material to be processed and having a fluid introducing opening at one end thereof, said apparatus comprising:

a. base means;

b. frame means mounted on said base means for movement to a first frame means position and to a second frame means position and including chamber defining means for receiving the processing drum and supporting the processing drum in a manner to facilitate movement of the processing drum with respect to said frame means;

- c. means mounted on said frame means for rotating the processing drum when the processing drum is in a coupling relation therewith;
 - d. means for moving said frame means from said first frame means position to said second frame means position; and
 - e. said frame means supporting the processing drum to permit the movement of the processing drum with respect to said frame means from a first drum position in said coupling relation with said means for rotating in response to the movement of said frame means to said second frame means position, and to permit the movement of the processing drum to a second drum position out of said coupling relation with said means for rotating in response to the movement of said frame means to said first frame means position.
2. The invention defined in claim 1 wherein said frame means is constructed and movably mounted on said base means in a manner such that the processing drum is disposed with its axis of rotation generally horizontal in said first drum position and with its axis of rotation generally vertical in said second drum position.
3. Apparatus as claimed in claim 1, wherein said first and second frame means positions are so located that the processing drum is moved from said second drum position to said first drum position by gravity in response to the movement of said frame means from said first frame means position to said second frame means position.
4. Apparatus for processing photographic materials including:
- a. a processing tube with axis of rotation, said processing tube having a reservoir means for receiving processing liquids, said processing tube being disposable in a first tube position to receive the processing liquids into said reservoir means and to maintain the liquids out of contact with the photographic material to be processed, and being disposable in a second tube position for discharging the liquid into contact with the photographic material;
 - b. a frame for receiving said processing tube and for moving said processing tube from said first tube position to said second tube position to thereby affect the discharge of the liquid into contact with the photographic material;
 - c. drive means for being selectively coupled to said processing tube and;
 - d. means responsive to the movement of said processor tube to said second tube position to rotatably couple said drive means to said processing tube.
5. The invention defined in claim 4 wherein said processing tube has liquid introducing and discharge openings located at opposite ends and is disposed with said axis of rotation being disposed in a generally vertical orientation in said first tube position.
6. The invention defined in claim 5 wherein said processing tube is disposed with said axis of rotation substantially horizontal in said second tube position and said drive means is located beneath said processing tube.
7. The invention defined in claim 6 wherein said drive means is mounted on said frame and said tube moves with respect to said drive means and said frame in response to gravitational forces acting thereon during movement of said frame from said first tube position to said second tube position.
8. Photographic processing apparatus of the type using a tubular processing drum with an axis of rotation, said axis of rotation disposable in a generally vertical position so that liquid may be disposed in said processing drum, and said axis of rotation being disposable in a generally horizontal position so that said processing drum may be rotated, said photographic processing comprising:
- a. means for supporting said processing drum in a substantially stationary position when said axis of rotation is disposed generally vertical;
 - b. means responsive to movement of said axis of rotation to a generally horizontal position for rotating said drum about said axis of rotation; and

- c. said means for supporting being movable from a first position in which said axis of rotation is generally horizontal to a second position in which said axis of rotation is generally vertical.
9. The invention defined in claim 8 wherein said means for rotating is mounted on said means for supporting.
10. Apparatus for supporting a processing drum for selective rotation, said apparatus comprising:
- a. drive means for selectively rotating the processing drum; and
 - b. support means for receiving and supporting the processing drum for movement between a first and second drum position with respect to said support means, in said first drum position the processing drum is disengaged from said drive means and is disposed in a stationary relationship with respect to said support means, in the said second drum position the processing drum is rotatably engaged with said drive means, said support means being movable from a first support means position to a second support means position to effect the movement of the processing drum with respect to said support means from said first drum position to said second drum position.
11. Apparatus for supporting a processing drum for selective rotation, said apparatus comprising:
- a. drive means for selectively rotating the processing drum;
 - b. support means for receiving the processing drum and for supporting the processing drum for relative movement from a first drum position to a second drum position with respect to said support means, in said first drum position the processing drum is disengaged from said drive means and is disposed in a stationary relationship with respect to said support means, in said second drum position the processing drum is rotatably engaged with said drive means, said support means being movable from a first support means position to a second support means position;
 - c. to effect the movement of the processing drum with respect to said support means from said first drum position to said second drum position.
12. Processing apparatus for receiving and supporting a processing tube adapted to receive photographic material to be processed, the processing tube having an axis of rotation, said processing apparatus comprising:
- a. frame means mounted for movement from a first frame means position to a second frame means position;
 - b. drive means mounted upon said frame means for selectively rotating the processing tube; and
 - c. said frame means supporting the processing tube for relative movement with respect to said frame means under influence of gravity so that in said first frame means position, the processing tube is disposed in a stationary relationship with respect to said frame means, and so that in said second frame means position the processing tube is rotatably coupled to said drive means.
13. Apparatus for processing photographic materials including:
- a. a processing tube with an axis of rotation, said processing tube having a reservoir means for receiving processing liquid;
 - b. means for supporting said processing drum in a substantially stationary position when said axis of rotation is disposed in a substantially vertical position to facilitate the disposition of the processing liquid into said reservoir means, said reservoir means maintaining in its substantially vertical position the liquid out of contact with the photographic materials to be processed; and
 - c. means responsive to the movement of said axis of rotation to a generally horizontal position for rotating said drum about said axis of rotation and for discharging the liquid into contact with the photographic materials to be processed.
14. Apparatus for supporting the processing drum for selective rotation, said apparatus comprising:

- a. drive means for rotating selectively the processing drum;
- b. support means for receiving and supporting the processing drum for movement relative with respect to said support means between a second drum position wherein the processing drum is disengaged from said drive means and is disposed in a stationary relationship with respect to said support means and a first drum position wherein the processing drum is rotatably engaged with said drive means, said support means being movable from a first support means position to a second support means position and including spaced wall members defining an open-ended chamber for facilitating the movement of the processing drum with respect to said support means in response to the movement of said support means from said first support means position to said second support

means position;

- c. said drive means comprising at least one driven roller having an axis of rotation mounted for movement with said support means and located so that said axis of rotation is disposed substantially horizontal and beneath the processing drum when said support means is disposed in said first support means position, and is generally vertical in said second support means position; and
- d. said support means disposing the processing drum on said one driven roller and said support means in said first support means position and disposing the processing drum in a spaced relationship from said one driven roller when said support means is in said second support means position.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,589,264 Dated June 29, 1971

Inventor(X) Einar W. Jensen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, Line 10 - delete "slightly-past-normal" and insert --will--.

Column 6, Line 39, - insert before "to" --means responsive to the movement of said support means from said first support means position to said second support means position--

Signed and sealed this 28th day of December 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents