

Description

The present invention relates to a photographic processing unit and a photographic photosensitive material processing apparatus, in accordance with the generic clauses of claims 1 and 5.

Such an apparatus is already disclosed in document US-A-3,641,911, which discloses a processing apparatus for the rapid processing of film, which comprises a tank, an open-ended processing chamber which is composed of two symmetrical sections, which defines a substantially horizontal path for the material to be processed and which is located above the level of the liquid in the tank, a transport roller pair at the entry and at the outlet opening of said chamber and means for directing streams of processing liquid towards the plane of said path in the processing chamber. The developing solution is fed through two channels and can then flow into the process chamber through a slit.

Document DE-A-1 293 586 describes a photographic processing unit, whereby photosensitive materials are processed while being moved in a horizontal direction with the help of conveyance rollers, whereby a developing solution is fed through two channels arranged perpendicular to the conveyance direction, whereby the developing solution reaches a developing chamber between the channels, by an aperture.

In professional and amateur photographic processing places, hospitals, clinics and so forth, an exposed black and white photographic photosensitive material, such as a black and white photographic film, black and white photographic printing paper and an X-ray film, is conventionally developed in a constant-temperature vessel by an operating person in a darkroom while the developed image on the material is inspected by his naked eyes. For such manual development, the operator must control the period of time of the development based on his hunch and also must control the temperature of the developing and the fixing solutions for the material based on his hunch, while looking at a thermometer. For that reason, he cannot always carry out the development operation under optimal conditions, and an unskilled person cannot properly perform the development operation. This is a problem. Additionally, the darkroom occupies a considerably large amount of space. This is another problem. Since it is dark in the darkroom, it is not easy to perform the development operation. This is yet another problem. If a dentist enters into the darkroom to develop every single exposed dental X-ray film, the efficiency of his work is greatly deteriorated. This is a big problem.

In order to solve the above problems, a roller-type automatic developing apparatus, as shown in Fig. 6, for performing development in a darkroom was proposed and has been put into practical use. The devel-

oping tank 2 of the apparatus 1 is divided into at least four sections, including a developing chamber 3, a fixing chamber 4, a rinsing chamber 5 and a drying chamber 6. Since a developing solution 8, a fixing solution 9 and rinsing water 10 are simply contained in the developing chamber 3, the fixing chamber 4 and the rinsing chamber 5, respectively, an exposed photographic film 11 needs to be moved carefully in a zigzag vertical path, as shown in Fig. 6, so as to be dipped in the processing liquids in the respective chambers, as the film is conveyed. For that reason, some film conveyance rollers 12 are within the developing and the fixing solutions 8 and 9, thereby likely causing the rollers to become contaminated or damaged. This is a problem. Since as many as forty-eight film conveyance rollers 12 are provided to convey the film 11, the length of the apparatus 1 is so large that it cannot be made compact. This is another problem. Since the film conveyance rollers 12 are moved down by a prescribed distance so as to be dipped in the developing and the fixing solutions 8 and 9 and the rinsing water 10, the line of the rollers meanders up and down so that the film 11 being conveyed by the rollers is moved in zigzag fashion. For that reason, the film 11 repeatedly undergoes bending, and is therefore likely to be damaged. This is yet another problem. Since the film conveyance rollers 12 are likely to become contaminated, they will not rotate smoothly, and the development of the film 11 is likely to be nonuniform. This is yet another problem.

Photographic processing apparatus each for processing a photographic photosensitive material while moving it in a horizontal direction is disclosed in German Patent No. 1,293,586 and United States Patent No. 4,577,949. Each such apparatus includes upper and lower processing liquid chambers divide from each other so that a processing chamber is defined between the processing liquid chambers. Conveyance rollers are provided at the front and rear of the processing liquid chambers. The photosensitive material is conveyed in the horizontal direction through the processing chamber as the material is moved between the conveyance rollers. At that time a processing liquid is supplied from the upper and the lower processing liquid chambers to the processing chamber to process the material. However, the constitution of the processing liquid chambers is complicated. This is a problem. In particular, the constitution of the processing liquid chambers of the apparatus disclosed in the United States Patent is very complicated because of the presence of a comb-like member provided in a liquid passage in the processing chamber in order to improve the uniformity of the processing liquid therein. Also, the conveyance rollers are present in the processing liquid or retain the liquid, so that the rollers are contaminated, causing them to rotate erratically and result in nonuniform development of the material. This is another problem.

The present invention was made in order to solve the above-mentioned problems of the conventional arts.

Accordingly, it is an object of the present invention to provide a photographic processing unit of very simple constitution for processing photographic photosensitive material, in which conveyance rollers for the material are not dipped in a processing liquid and are therefore hardly contaminated with the liquid.

It is another object of the present invention to provide a photographic processing unit suitable for a compact automatic photographic processing apparatus in which a photographic photosensitive material is processed while being moved in a horizontal direction.

It is yet another object of the present invention to provide a photographic processing unit suitable for a compact automatic photographic processing apparatus which can be used in a light room.

It is yet another object of the present invention to provide a photographic processing unit suitable for an automatic photographic processing apparatus which is used in a light room so that a photosensitive material of relatively small size, such as exposed dental X-ray film, is processed in a very short time.

In each of the photographic processing units, a photographic photosensitive material exposed to imaging light is processed while being moved in a horizontal direction.

These objects are met by the characterizing features of claims 1 and 5.

Each of the photographic processing units is used to process photographic photosensitive material, such as color film, black and white film, X-ray film, color printing paper and black and white printing paper, which has been exposed to imaging light. The processing steps include development, bleaching, fixation, rinsing, drying or the like. The specific processing depends on the type of photosensitive material being processed. Each photographic processing unit is suitable for a compact automatic photographic processing apparatus in which development, fixation, rinsing, drying and the like are compactly performed. Each unit is particularly suitable for a compact automatic processing apparatus by which a dental X-ray film is processed in a dental clinic or the like.

Fig. 1 is a perspective view of a photographic processing unit according to a preferred embodiment of the present invention.

Fig. 2 is a perspective view of an automatic photographic processing apparatus having three such photographic processing units for the development, fixation and rinsing of a dental X-ray film.

Fig. 3 is a perspective view of the drive mechanism and interior of the apparatus.

Fig. 4 is a partial sectional view of the apparatus.

Fig. 5 is a side view of the drive mechanism.

Fig. 6 is a sectional view of a conventional roller-

type automatic photographic processing apparatus for processing in a darkroom.

An embodiment of the present invention is hereafter described with reference to the drawings attached hereto.

Fig. 1 is a perspective view of a photographic processing unit used in an automatic developing apparatus for developing a dental film in a room which need not be darkened. Another kind of black and white film, color film, printing paper or the like may be also developed by the apparatus. The photographic processing unit includes a pair of developing chamber definition members 24 extending from a developing solution stand 52a perpendicularly across the direction B of the movement of the dental film 31, over the total width thereof. One of the members 24 extends between two pairs of film conveyance rollers 29 extending in parallel with each other perpendicularly to the direction B of the movement of the film 31 and having a prescribed clearance between the rollers, and is located at a prescribed distance from the rollers. The other member 24 is located in front of the upstream pair of film conveyance rollers 29 with regard to the direction B of the movement of the film 31, and extends between the upstream pair of rollers and another pair of film conveyance rollers not shown in the drawing. Although it is preferable that the two developing chamber definition members 24 are provided to increase the speed of development of the film 31, the present invention is not confined thereto but may be otherwise embodied so that only one developing chamber definition member is provided. Each of the members 24 has an upper groove 24a and a lower groove 24a, together constituting a developing chamber in the member, and has an inlet slot 24b and an outlet slot 24b in the front and rear portions of the member so that the film 31 enters into the member through the inlet slot and goes out of the member at the outlet slot. The members 24 are secured at the butts thereof to the developing solution stand 52a and closed at the tips -- not shown in the drawing -- of the members.

The developing solution stand 52a is provided with developing solution feed ports 52b at the butts of the developing chamber definition members 24 so that a developing solution 43 sent from a pump 58 to the stand through a feed pipe 58b is fed, under pressure, to the developing chambers in the members 24 through the feed ports in directions A perpendicular to that of the movement of the film 31, to develop the film in the developing chambers. It has been confirmed that the developing solution 43 very smoothly flows through the developing chambers, nearly without leaking out of the slots 24b of the members 24 at the intermediate portions of the chambers, at the beginning of the feed of the solution to the chambers. When the developing solution 43 has reached the tips of the members 24 and fills the developing chambers,

the solution begins to flow out of the slots 24b of the members. At that time, the solution 43 develops the film 31 being conveyed by the conveyance rollers 29 and passing through the slots 24b and the developing chambers. The developing solution 43 which flows out of the slots 24b is accumulated in the developing tank 23 at the bottom thereof and sent again to the developing solution stand 52a by the pump 58 through the drain hole 23f of the bottom of the tank, a recovery pipe 58a and a feed pipe 58b. An appropriate gap is set between each developing chamber definition member 24 and each conveyance roller 29 so that the developing solution 43 flowing out of the slots 24b is prevented from coming into contact with the roller.

Although the bottoms of the developing chamber definition members 24 are secured to the bottom plate of the developing tank 23, the present invention is not confined thereto but may be otherwise embodied so that the members are supported at both the ends thereof and the bottoms of the members are out of contact with the bottom plate of the tank.

Fig. 2 is a perspective view of an automatic processing apparatus 21 with its cover 34 removed. The apparatus 21 includes developing, fixing and rinsing units, the constitution and operation of each being the same in principle as those of the photographic processing unit shown in Fig. 1. The development casing 22 of the apparatus 21 is made of a material which blocks external light from reaching an already-exposed dental X-ray film. The casing 22 has an observation window 32 through which the interior 22a of the apparatus 21 can be observed. The window 32 is made of a special glass and located in the top plate 33 of the casing 22 at the center of the width thereof. The glass absorbs the rays of light to which the film is sensitive. Although the interior 22a of the development casing 22 looks dark and red through the observation window 32, the interior can be seen through the window clearly enough to take out the film from a case therefor and insert the film in between film conveyance rollers 29. An opening 22b is provided in the upper half of the front of the development casing 22. The cover 34 can be removably fitted on the opening 22b, and has handling holes 34a through which the arms of the person who operates the apparatus 21 are inserted so that he performs handling in the apparatus. Arm covers 36 made of a black cloth are attached to the cover 34 around the handling holes 34a thereof. Rubber rings 36a are provided on the arm covers 36 at the front ends thereof to prevent light from entering into the covers through openings between the arms of the person and the arm covers.

The front portion of the developing tank 23 of the automatic processing apparatus 21 has a space 22c in which the case for the film 31 is placed so that the film can be taken out from the case. The tank 23 is disposed inside the development casing 22. A bracket 38 is secured to the left-hand side 22d of the casing

22. A developing solution drain pipe 39, a fixing solution drain pipe 40 and a rinsing water drain pipe 41 are inserted into the bracket 38 at the ends 39a, 40a and 41a of the pipes and held by the bracket. A temperature control knob 46 for adjusting the temperature of a developing solution 43 and that of a fixing solution 44, a speed control knob 49 for adjusting the rotation speed of the film conveyance rollers 29 of the apparatus 21, a fuse 48 and a power supply cord 37 are attached to the side 22d of the casing 22. A power supply switch 50 and a power supply lamp 51 are attached to the front 22e of the casing 22.

Fig. 3 is a perspective view of the drive mechanism and interior of the automatic processing apparatus 21. Fig. 4 is a partial sectional view of the apparatus 21. Fig. 5 is a side view of the drive mechanism. The processing tank 23 of the apparatus 21 has a developing section 52, a fixing section 53, a rinsing section 54 and a drying chamber 55, which are located in that order in the direction of the movement of the film 31. The developing unit including developing chamber definition members 24 and some film conveyance rollers 29 is provided at the developing section 52. The fixing unit including fixing chamber definition members 25 and other film conveyance rollers 29 is provided at the fixing section 53. The rinsing unit including rinsing chamber definition members 26 and yet other film conveyance rollers 29 is provided at the rinsing section 54. The developing solution 43, the fixing solution 44 and rinsing water are handled in the same manner as in the photographic developing unit shown in Fig. 1. A pair of hot air feed ports 28 are provided in a side wall 69 for the drying chamber 55 so that hot air sent by a fan 66 driven by a motor 65 is blown into the drying chamber through a duct 55a and the feed ports perpendicularly to the direction of the movement of the film 31. Immediately after the hot air is blown into the drying chamber 55, the air freely diffuses so that the air flows mainly near the passage for the film 31 and dries the top and bottom thereof. The hot air thereafter goes out through a film outlet port 23k. The drying mechanism of the apparatus 21 is not confined thereto, but may be otherwise constituted so that the mechanism is made of members of the same form as the developing chamber definition members 24 and the hot air is caused to flow through the members. An appropriate blocking plate or film not shown in the drawings is set up between the rinsing section 54 and the drying chamber 55 to prevent the hot air from entering into the developing, the fixing and the rinsing sections 52, 53 and 54.

The developing section 52, the fixing section 53, the rinsing section 54 and the drying chamber 55 are separated from each other by partition walls 23a, 23b and 23c. The sections 52, 53 and 54 are provided with drain holes 23f, 23g and 23h at the bottoms of the sections so that the processing liquids flow out of the sec-

tions through the drain holes and are sent again to a developing solution stand 52a, a fixing solution stand 53a and a rinsing water stand 54a through recovery pipes 58a, 59a and 60a and feed pipes 58b, 59b and 60b by pumps 58, 59 and 60 and fed again to the processing sections during the processing of the film 31.

The film conveyance rollers 29 are disposed along a straight horizontal line, upstream and downstream to the developing chamber definition members 24 of the developing unit, the fixing chamber definition members 25 of the fixing unit, the rinsing chamber definition members 26 of the rinsing unit and the hot air feed ports 28 with regard to the direction of the movement of the film 31, and constitute vertical pairs so that the rollers convey the film and squeeze off the developing solution 43, the fixing solution 44 and the rinsing water 45 from the film. The rollers 29 are made of rubber or the like, which is resistant to chemicals, water and heat. The cross section of each of the rollers 29 is circular. The core of each roller 29 is a rotary shaft 29a secured to the rubber and rotatably supported at both ends of the shaft by a pair of plastic bearing plates 69 secured at a prescribed distance from each other. The rotary shaft 29 is loosely fitted in the bearing plates 69 so that the upper film conveyance roller 29 is in pressure contact with the corresponding lower film conveyance roller 29 because of the weight of the upper roller. The height of the point of the pressure contact is the same as that of the slots 24b of the developing chamber definition members 24 and the slots of the fixing and the rinsing chamber definition members 25 and 26, namely, the height is the same as that of the conveyance passage for the film 31. The total number of the film conveyance rollers 29 of the apparatus 21 is twenty-four.

The drive mechanism 30 of the apparatus 21 is for rotating the film conveyance rollers 29, and comprises twenty-four drive gears 70 provided for the rotary shafts 29a of the rollers, ten idle gears 71 which connect the drive gears to each other to transmit motive power and make the directions of the rotation of the gears the same as each other, a pair of sprockets 72 and 73 secured to rotary shafts 80 and 81 coaxial with particular ones 71A and 71B of the idle gears, a chain 74 engaged with the sprockets, a motor 76, a sprocket 75 secured to the rotary shaft 76a of the motor, and a chain 77 engaged with the sprockets 73 and 75. Motive power is transmitted from the motor 76 to the sprocket 73 through the sprocket 75 and the chain 77 and then transmitted to the sprocket 72 through the chain 74. Motive power is transmitted from the sprocket 73 to the idle gear 71B so that the twelve drive gears 70 shown in the righthand half of Fig. 4 are driven through the idle gear. Motive power is transmitted from the sprocket 72 to the idle gear 71A so that the other twelve drive gears 70 shown in the left-hand half of Fig. 4 are driven through the idle gear. Although the drive gears 70 and the idle gears 71 are all spur

gears, worm gears may be provided instead.

The film 31 is conveyed by the film conveyance rollers 29 so that the film moves in a straight horizontal direction through the developing chamber definition members 24, the fixing chamber definition members 25 and the rinsing chamber definition members 26 in that order and then moves through hot air pipes 28 for drying the film.

The processing of the film 31 by the automatic processing apparatus 21 will now be described with reference to Figs. 2, 3, 4 and 5. The developing solution 43 is poured from the developing solution drain pipe 39 into the developing section 52 so that the drain holes 23f, the developing solution recovery pipe 58a and the developing solution pump 58 are filled with the developing solution and the pump is operated. The fixing solution 44 is poured from the fixing solution drain pipe 40 into the fixing section 53 so that the drain holes 23g, the fixing solution recovery pipe 59a and the fixing solution pump 59 are filled with the fixing solution and the pump is operated. The rinsing water 45 is poured from the rinsing water drain pipe 41 into the rinsing section 54 so that the drain holes 23h, the rinsing water recovery pipe 60a and the rinsing water pump 60 are filled with the rinsing water and the pump is operated. Thus, the pumps 58, 59 and 60, which are special liquid pumps made of ceramic, are lubricated with the processing liquids 43, 44 and 45 so that electricity may be applied to the pumps to drive them. When the power supply switch 50 is turned on, the power supply lamp 51 is lit and the pumps 58, 59 and 60, the motors 65 and 76 and the hot air fan 66 are driven. When the developing solution 43 is sent from the developing solution feed pipe 58b to the developing solution stand 52a and ejected from the feed ports 52b thereof, the solution very smoothly flows in the form of bars of quadrangular cross section in the developing chambers of the developing chamber definition members 24 as shown in Fig. 1. After the developing solution 43 reaches the tips of the members 24, the solution flows out through the slots 24b thereof and falls onto the bottom plate 23d of the processing tank 23. The developing solution 43 is thereafter sucked into the developing solution pump 58 through the drain holes 23f and the developing solution recovery pipe 58a and fed again to the developing chambers through the developing solution feed pipe 58b as shown by arrows A in Fig. 1. The developing solution 43 and the fixing solution 44 are kept at an appropriate temperature such as 28°C by setting the temperature control knob 48. The hot air is sent, under pressure, from the hot air fan 66 and blown out from the hot air feed ports 28 into the drying chamber 55 to make the temperature therein high enough to dry the film 31. In the drive mechanism 30, the motor 76 begins to rotate to revolve the chain 77, the sprocket 73, the chain 74 and the sprocket 72. As a result, the twelve drive gears 70 shown in the right-

hand half of Fig. 5 are rotated through the sprocket 73 and the idle gear 71B so that the twelve film conveyance rollers 29 are rotated. At the same time, the other twelve drive gears 70 shown in the left-hand half of Fig. 5 are rotated through the sprocket 72 and the idle gear 71A so that the other twelve film conveyance rollers 29 are rotated. With regard to Fig. 4, the upper film conveyance rollers 29 are rotated clockwise and the lower film conveyance rollers 29 are rotated counterclockwise. The rotation speed of the film conveyance rollers 29, which corresponds to the conveyance speed of the film 31, can be adjusted by setting the speed control knob 49 to regulate the motor 76.

After the preparations for the processing of the film 31 by the automatic processing apparatus 21 are made in the above-described procedure, the operator removes the cover 34 from the casing 22 of the apparatus, puts the case containing the exposed dental film 31 in the space 22c of the casing, attaches the cover back to the casing, inserts both of his arms into the arm covers 36, takes out the film from the case, and inserts the film in between the foremost pair of film conveyance rollers 29 at the developing section 52. Since the rollers 29 have already begun to rotate, the film 31 is pulled in by the rollers so that the film passes through the developing solution 43 circulating through the slots 24b of the front developing chamber definition member 24 at the developing section 52, as shown in Fig. 4. The film 31 is thus subjected to first development. After that, the developing solution clinging to the film 31 is squeezed off therefrom by the following pair of film conveyance rollers 29. The film 31 then passes through the developing solution 43 in the rear developing chamber definition member 24 so that the film is subjected to second and finishing development. After that, the developing solution 43 clinging to the film 31 is squeezed off therefrom by the next following pair of film conveyance rollers 29. The squeezed-off developing solution 43 is recovered through the drain holes 23f, the developing solution recovery pipe 58a and the developing solution pump 58 together with the developing solution having flowed down from the slots 24b of the developing chamber definition members 24.

After that, the fixation and rinsing of the film 31 are performed by the automatic processing apparatus 21 in the same manner as the development of the film.

The film 31 is thereafter conveyed into the drying chamber 55 so that the film is dried by the hot air 47 ejected from the hot air feed ports 28. The dried film 31 is conveyed out from the processing tank 23 and the casing 22 through the slot 23k of the tank as shown by an arrow B in Fig. 4. The processing of the film 31 is thus completed. The time which it takes to perform the development, fixation, rinsing and drying of the dental X-ray film 31 is about two minutes and

thirty seconds.

Since the film 31 is conveyed along a straight line path by the twenty-four film conveyance rollers 29 and is not bent as in the conventional apparatus, the film is very unlikely to be damaged due to the conveyance. Since the rollers 29 are not dipped in the developing and the fixing solutions 43 and 44, the rollers are less likely to be contaminated and therefore need to be cleaned less frequently than in the conventional apparatus art.

Although the processing of the dental X-ray film 31 is described above, the use of the automatic processing apparatus 21 is not confined thereto but other black and white films, color films, color printing paper or the like can be processed by the apparatus if appropriate processing units and appropriate processing liquids are selected depending on the kind of the processed material.

Claims

1. A photographic processing unit in which a photographic photosensitive material (31) exposed to imaging light is processed while being moved in a horizontal direction, whereby said unit includes two pairs of conveyance rollers (29), and a processing chamber definition member (24) having a butt end and a tip end; said rollers (29) extending in parallel with each other and said two pairs of rollers being disposed at a prescribed distance from each other in said direction so as to convey said material in said direction; said member (24) is disposed between said pairs of conveyance rollers and extends in parallel with said rollers perpendicularly across said direction, over the total width of said material; a processing chamber is defined in said member (24); said member has an inlet and an outlet slot (24b) along said direction so that said material is moved into said member through said inlet slot and moved out of said member through said outlet slot; and a processing liquid feed port (52b) for feeding a processing liquid into said chamber is provided in said member at the butt thereof
characterized in that
said processing chamber definition member (24) is constituted by an elongated upper groove (24a) and a mating elongated lower groove (24a) facing each other with their open portions thereby defining said processing chamber, whereby the developing solution is fed through the developing solution feed ports (52b) at the butt of the developing chamber definition members (24), directly to the developing chamber (24) in a direction perpendicular to that of the movement of the film; and said inlet slot (24b) and said outlet slot (24b) communicate with said upper and lower grooves



hand half of Fig. 5 are rotated through the sprocket 73 and the idle gear 71B so that the twelve film conveyance rollers 29 are rotated. At the same time, the other twelve drive gears 70 shown in the left-hand half of Fig. 5 are rotated through the sprocket 72 and the idle gear 71A so that the other twelve film conveyance rollers 29 are rotated. With regard to Fig. 4, the upper film conveyance rollers 29 are rotated clockwise and the lower film conveyance rollers 29 are rotated counterclockwise. The rotation speed of the film conveyance rollers 29, which corresponds to the conveyance speed of the film 31, can be adjusted by setting the speed control knob 49 to regulate the motor 76.

After the preparations for the processing of the film 31 by the automatic processing apparatus 21 are made in the above-described procedure, the operator removes the cover 34 from the casing 22 of the apparatus, puts the case containing the exposed dental film 31 in the space 22c of the casing, attaches the cover back to the casing, inserts both of his arms into the arm covers 36, takes out the film from the case, and inserts the film in between the foremost pair of film conveyance rollers 29 at the developing section 52. Since the rollers 29 have already begun to rotate, the film 31 is pulled in by the rollers so that the film passes through the developing solution 43 circulating through the slots 24b of the front developing chamber definition member 24 at the developing section 52, as shown in Fig. 4. The film 31 is thus subjected to first development. After that, the developing solution clinging to the film 31 is squeezed off therefrom by the following pair of film conveyance rollers 29. The film 31 then passes through the developing solution 43 in the rear developing chamber definition member 24 so that the film is subjected to second and finishing development. After that, the developing solution 43 clinging to the film 31 is squeezed off therefrom by the next following pair of film conveyance rollers 29. The squeezed-off developing solution 43 is recovered through the drain holes 23f, the developing solution recovery pipe 58a and the developing solution pump 58 together with the developing solution having flowed down from the slots 24b of the developing chamber definition members 24.

After that, the fixation and rinsing of the film 31 are performed by the automatic processing apparatus 21 in the same manner as the development of the film.

The film 31 is thereafter conveyed into the drying chamber 55 so that the film is dried by the hot air 47 ejected from the hot air feed ports 28. The dried film 31 is conveyed out from the processing tank 23 and the casing 22 through the slot 23k of the tank as shown by an arrow B in Fig. 4. The processing of the film 31 is thus completed. The time which it takes to perform the development, fixation, rinsing and drying of the dental X-ray film 31 is about two minutes and

thirty seconds.

Since the film 31 is conveyed along a straight line path by the twenty-four film conveyance rollers 29 and is not bent as in the conventional apparatus, the film is very unlikely to be damaged due to the conveyance. Since the rollers 29 are not dipped in the developing and the fixing solutions 43 and 44, the rollers are less likely to be contaminated and therefore need to be cleaned less frequently than in the conventional apparatus art.

Although the processing of the dental X-ray film 31 is described above, the use of the automatic processing apparatus 21 is not confined thereto but other black and white films, color films, color printing paper or the like can be processed by the apparatus if appropriate processing units and appropriate processing liquids are selected depending on the kind of the processed material.

Claims

1. A photographic processing unit in which a photographic photosensitive material (31) exposed to imaging light is processed while being moved in a horizontal direction, whereby said unit includes two pairs of conveyance rollers (29), and a processing chamber definition member (24) having a butt end and a tip end; said rollers (29) extending in parallel with each other and said two pairs of rollers being disposed at a prescribed distance from each other in said direction so as to convey said material in said direction; said member (24) is disposed between said pairs of conveyance rollers and extends in parallel with said rollers perpendicularly across said direction, over the total width of said material; a processing chamber is defined in said member (24); said member has an inlet and an outlet slot (24b) along said direction so that said material is moved into said member through said inlet slot and moved out of said member through said outlet slot; and a processing liquid feed port (52b) for feeding a processing liquid into said chamber is provided in said member at the butt thereof
characterized in that
said processing chamber definition member (24) is constituted by an elongated upper groove (24a) and a mating elongated lower groove (24a) facing each other with their open portions thereby defining said processing chamber, whereby the developing solution is fed through the developing solution feed ports (52b) at the butt of the developing chamber definition members (24), directly to the developing chamber (24) in a direction perpendicular to that of the movement of the film; and said inlet slot (24b) and said outlet slot (24b) communicate with said upper and lower grooves



such that said material entering said inlet slot and exiting said outlet slot will pass through and be immersed in the processing liquid flowing through said chamber.

2. A photographic photosensitive material processing apparatus of the type having at least developing (52), fixing (53) and rinsing (54) processing units for applying developing, fixing and rinsing solutions to a said material to be processed and for conveying said material in a conveyance direction to said solutions and between said units, wherein each of said processing units comprises: two pairs of conveyance rollers (29) and a processing chamber definition member (24) having a butt end and a tip end; said rollers (29) extending in parallel with each other and two of said pairs of rollers (29) being disposed at a prescribed distance from each other in said direction so as to convey said material in said direction; said member (24) is disposed between said pairs of conveyance rollers and extends in parallel with said rollers perpendicularly across said direction, over the total width of said material; a processing chamber is defined in said member (24); said member has an inlet and an outlet slot (24b) along said direction so that said material is moved into said member through said inlet slot and moved out of said member through said outlet slot; a processing liquid feed port (32b) for feeding a processing liquid into said chamber is provided in said member at the butt thereof

characterized in that

said processing chamber definition member (24) is constituted by an elongated upper groove (24a) and a mating elongated lower groove (24a) facing each other with their open portion thereby defining said processing chamber, whereby the developing solution is fed through the developing solution feed ports (52b) at the butt of the developing chamber definition member (24), directly to the developing chamber (24) in a direction perpendicular to that of the movement of the film; and said inlet slot (24b) and said outlet slot (24b) communicate with said upper and lower grooves such that said material entering said inlet slot and exiting said outlet slot will pass through and be immersed in the processing liquid flowing through said chamber.

3. A photographic processing unit as claimed in claim 1, further comprising a tank (23) positioned below said processing chamber definition member (24) and said conveyance rollers (29) to catch the processing liquid (43) exiting said chamber via said slots (24a) and squeezed off said material by said rollers (29), and pumping conveyance means (58) for conveying said liquid in said tank

to said processing liquid feed port (52b).

4. A photographic processing unit as claimed in claim 2, wherein said processing chamber definition member (24) is closed at the tip end thereof.
5. A photographic processing unit as claimed in any of claims 1 to 3, further comprising a second processing chamber definition member (24) disposed downstream of said pair of conveyance rollers (29) which are downstream, in turn, from said first processing chamber definition member, and a third pair of conveyance rollers positioned downstream of said second processing chamber definition member; said second member being substantially identical to said first member, and all of said pairs of rollers and said processing chamber definition member being positioned to guide said material therethrough in a straight horizontal path without vertical zigzag motion.
6. A photographic photosensitive material processing apparatus as claimed in claim 5, further comprising a tank (23) positioned below said processing chamber definition member (24) and said conveyance rollers (29) to catch the processing liquid (43) exiting said chamber via said slots (24b) and squeezed off said material by said rollers (29), and pumping conveyance means (58) for conveying said liquid in said tank to said processing liquid feed port (52b).
7. A photographic photosensitive material processing apparatus as claimed in claim 6, wherein said processing chamber definition member (24) is closed at the tip end thereof.
8. A photographic photosensitive material processing apparatus as claimed in any of claims 5 to 9, further comprising a second processing chamber definition member (24) disposed downstream of said pair of conveyance rollers (29) which are downstream, in turn, from said first processing chamber definition member, and a third pair of conveyance rollers positioned downstream of said second processing chamber definition member; said second member being substantially identical to said first member, and all of said pairs of rollers and said processing chamber definition members being positioned to guide said material therethrough in a straight horizontal path without vertical zigzag motion.
9. A photographic photosensitive material processing apparatus as claimed in claim 8, wherein each of said processing units is placed relative to all other said processing units such that said material travels in a straight horizontal path through



and between all of said processing units.

Patentansprüche

1. Photographische Prozeßeinheit in welcher ein mit bildgebenden Licht belichtetes photographisches photosensitives Material (31) behandelt wird, während es in eine horizontale Richtung bewegt wird, wobei die Einheit zwei Förderrollenpaare (29) einschließt, und ein prozeßkammerbildendes Teil (24), das ein unteres Ende und ein Kopfende aufweist; wobei die Rollen (29) sich parallel zueinander erstrecken und die zwei Rollenpaare in einem bestimmten Abstand voneinander in der besagten Richtung angebracht sind, so daß sie das Material in dieser Richtung fördern; wobei das Teil (24) zwischen dem Förderrollenpaar angeordnet ist und sich parallel zu den Rollen senkrecht zu der besagten Richtung über die gesamte Breite des Materials erstreckt; wobei eine Prozeßkammer in dem Teil (24) definiert ist; und das Teil einen Eingangs- und einen Ausgangsschlitz (24b) entlang der besagten Richtung aufweist, so daß das Material in das Teil durch den Eingangsschlitz bewegt wird und aus dem Teil durch den Ausgangsschlitz bewegt wird; und einen Prozeßflüssigkeitseinlaß (52b) zum Zuführen einer Prozeßflüssigkeit in die Kammer an der dem unteren Ende Teils vorgesehen ist; **dadurch gekennzeichnet**, daß das prozeßkammerbildende Teil (24) aus einer länglichen oberen Nut (24a) und einer passenden länglichen unteren Nut (24a) zusammengesetzt ist, die einander mit ihren offenen Bereichen gegenüberliegen und so die Prozeßkammer bilden, wobei die Entwicklerlösung durch den Einlaß (52b) für die Entwicklerlösung an dem unteren Ende des prozeßkammerbildenden Teils (24) direkt in die Entwicklungskammer (24) in einer Richtung senkrecht zu der der Filmbewegung, geleitet wird; und der Einlaßschlitz (24b) und der Auslaßschlitz (24b) mit der oberen und unteren Nut kommunizieren, so daß das Material, das durch den Eingangsschlitz eintritt und durch den Ausgangsschlitz austritt durch die Prozeßflüssigkeit, die durch die Kammer fließt, durchtritt und darin eingetaucht wird.
2. Photographische Prozeßeinheit nach Anspruch 1, die weiter einen Tank (23) umfaßt, der unter dem prozeßkammerbildenden Teil (24) und den Förderrollen (29) angeordnet ist, um die Prozeßflüssigkeit (43) aufzunehmen, die aus der Kammer über die Schlitze (24a) austritt und aus dem Material durch die Rollen (29) herausgedrückt wird, und eine Pumpförderereinrichtung (58) zum fördern der Flüssigkeit in dem Tank zu dem Ein-

laß (52b) für die Prozeßflüssigkeit.

3. Photographische Prozeßeinheit nach Anspruch 2, wobei das prozeßkammerbildende Teil (24) an seinem Kopfende geschlossen ist.
4. Photographische Prozeßeinheit nach einem der Ansprüche 1 bis 3, die weiter ein zweites prozeßkammerbildendes Teil (24) aufweist, das abwärts in bezug auf das Förderrollenpaar (29) angeordnet ist, das wiederum abwärts in bezug auf das erste prozeßbildende Teil ist, und ein drittes Förderrollenpaar, das abwärts in bezug auf das zweite prozeßkammerbildende Teil angeordnet ist; das zweite Teil ist im wesentlichen identisch mit dem ersten Teil und alle Rollenpaare und die prozeßbildenden Teile sind so angeordnet, daß sie das Material auf einem geraden horizontalen Weg durchführen ohne vertikale Zick-zack-Bewegung.
5. Prozeßvorrichtung für photographisches photosensitives Material, die zumindest Entwickler- (52), Fixier- (53) und Spül- (54) Prozeßeinheiten aufweisen, um zu behandelndes Material mit Entwickler-, Fixier- und Spülflüssigkeiten zu versehen und zum Fördern des Materials in Förderrichtung zu den Flüssigkeiten und zwischen den Einheiten, wobei jede der Prozeßeinheiten umfaßt: zwei Förderrollenpaare (29) und ein prozeßkammerbildendes Teil (24), das ein unteres Ende und ein Kopfende aufweist; wobei sich die Rollen (29) parallel zueinander erstrecken und zwei der Rollenpaare (29) in einem bestimmten Abstand voneinander in der besagten Richtung angeordnet sind, um so das Material in dieser Richtung zu fördern; wobei das Teil (24) zwischen dem Förderrollenpaaren angeordnet ist, und sich parallel zu den Rollen und senkrecht über die besagte Richtung über die gesamte Breite des Materials erstreckt; und eine Prozeßkammer in dem Teil (24) gebildet ist; wobei das Teil einen Eingangs- und einen Ausgangsschlitz (24b) hat, der entlang der besagten Richtung verläuft, so daß das Material in das Teil durch den Eingangsschlitz bewegt wird und aus dem Teil durch den Ausgangsschlitz bewegt wird; ein Einlaß für eine Prozeßflüssigkeit (32b) zum Zuführen einer Prozeßflüssigkeit in die Kammer an dem hinteren Ende des Teils vorgesehen ist, **dadurch gekennzeichnet**, daß das prozeßkammerbildende Teil (24) aus einer länglichen oberen Nut (24a) und einer passenden länglichen unteren Nut (24a) aufgebaut ist, deren offene Bereiche gegenüberliegen, wodurch die Prozeßkammer definiert wird, wobei die Entwicklerlösung durch den Einlaß (52b)



für die Entwicklerlösung an dem hinteren Ende des entwicklungskammerbildenden Teils (24), direkt in die Entwicklungskammer (24) in einer Richtung senkrecht zu der Bewegungs des Films geleitet wird; und der Eingangsschlitz (24b) und der Ausgangsschlitz (24b) mit den oberen und unteren Nuten kommunizieren, so daß das Material das in den Eingangsschlitz eintritt und aus dem Ausgangsschlitz austritt durch die Prozeßflüssigkeit, die durch die Kammer fließt durchtritt und darin eingetaucht wird.

6. Prozeßvorrichtung für photographisches, photosensitives Material nach Anspruch 5, die weiter einen Tank (23) umfaßt, der unter dem prozeßkammerbildenden Teil (24) und den Förderrollen (29) angebracht ist, um die Prozeßflüssigkeit (43), die aus der Kammer über die Schlitz (24b) austritt und aus dem Material durch die Rollen (29) gedrückt wird, aufzunehmen, und eine Pumpfördereinrichtung (58) zum Fördern der Flüssigkeit in dem Tank zu dem Einlaß (52b) für die Prozeßflüssigkeit.
7. Prozeßvorrichtung für photographisches, photosensitives Material nach Anspruch 6, wobei das prozeßkammerbildende Teil (24) an seinem Kopfende geschlossen ist.
8. Prozeßvorrichtung für photographisches, photosensitives Material nach einem der Ansprüche 5-9, die weiter ein zweites prozeßkammerbildendes Teil (24) umfaßt, das stromabwärts in bezug auf das Förderrollenpaar (29) angeordnet ist, welches wiederum abwärts in bezug auf das erste prozeßkammerbildende Teil angeordnet ist und einem dritten Förderrollenpaar, das abwärts in bezug auf das zweite prozeßkammerbildende Teil angeordnet ist, wobei das zweite Teil im wesentlichen identisch zu dem ersten Teil ist, und alle Rollenpaare sowie die prozeßkammerbildenden Teile so angeordnet sind, damit das Material entlang eines geraden horizontalen Weges durchgeführt wird, ohne vertikale Zick-zack-Bewegung.
9. Prozeßvorrichtung für photographisches, photosensitives Material nach Anspruch 8, wobei jede der Prozeßeinheiten bezüglich all der anderen Prozeßeinheiten so angeordnet ist, daß das Material auf einem geraden horizontalen Weg durch und zwischen allen Prozeßeinheiten läuft.

Revendications

1. Unité de traitement photographique dans laquelle un matériau photographique photosensible

(31) exposé à la lumière d'une image est traité tandis qu'il est déplacé dans une direction horizontale, ladite unité comprenant deux paires de rouleaux de convoyage (29), et un élément (24) pour définir une chambre de traitement, ledit élément possédant une extrémité de souche et une extrémité terminale; lesdits rouleaux (29) s'étendant parallèlement l'un à l'autre et lesdites deux paires de rouleaux étant disposées à une distance prescrite l'une de l'autre dans ladite direction de manière à convoyer ledit matériau dans ladite direction; ledit élément (24) étant disposé entre lesdites paires de rouleaux de convoyage en s'étendant parallèlement auxdits rouleaux et perpendiculairement à ladite direction, sur la largeur totale dudit matériau; une chambre de traitement étant définie dans ledit élément (24), ledit élément possédant une fente d'entrée et une fente de sortie (24b) le long de ladite direction de sorte que ledit matériau est entré dans ledit élément à travers ladite fente d'entrée et sorti dudit élément à travers ladite fente de sortie; et un orifice d'alimentation de liquide de traitement (52b) afin d'alimenter un liquide de traitement dans ladite chambre étant prévu dans ledit élément à la souche de celui-ci, caractérisée en ce que ledit élément (24) qui définit la chambre de traitement est constitué par une gorge supérieure allongée (24a) et une gorge inférieure allongée appariée (24a) qui se font mutuellement face avec leurs parties ouvertes, définissant ainsi ladite chambre de traitement, grâce à quoi la solution de développement est alimentée via les orifices d'alimentation (52b) pour la solution de développement au niveau de la souche de l'élément (24) qui définit la chambre de développement, directement vers la chambre de développement (24) et dans une direction perpendiculaire à celle du déplacement du film; et en ce que ladite fente d'entrée (24b) et ladite fente de sortie (24b) communiquent avec lesdites gorges supérieure et inférieure, de telle manière que ledit matériau pénétrant dans ladite fente d'entrée et sortant par ladite fente de sortie passera à travers le liquide de traitement qui s'écoule à travers ladite chambre, en étant immergé dans ledit liquide.

2. Unité de traitement photographique selon la revendication 1, comprenant en outre un réservoir (23) placé au-dessous dudit élément (24) qui définit la chambre de traitement et desdits rouleaux de convoyage (29) afin de recueillir le liquide de traitement (43) qui sort de ladite chambre via lesdites fentes (24a) et qui est exprimé hors dudit matériau par lesdits rouleaux (29), et des moyens de pompage (58) pour entraîner ledit liquide dans ledit réservoir jusqu'audit orifice d'alimentation de liquide de traitement (52b).



3. Unité de traitement photographique selon la revendication 2, dans laquelle ledit élément (24) qui définit la chambre de traitement est fermé à son extrémité terminale.

4. Unité de traitement photographique selon l'une quelconque des revendications 1 à 3, comprenant en outre un second élément (24) qui définit une chambre de traitement, disposé en aval de ladite paire de rouleaux de convoyage (29) qui sont à leur tour en aval dudit premier élément qui définit la chambre de traitement, et une troisième paire de rouleaux de convoyage placés en aval dudit second élément qui définit une chambre de traitement ; ledit second élément étant sensiblement identique audit premier élément, et toutes lesdites paires de rouleaux et tous lesdits éléments qui définissent lesdites chambres de traitement étant placés de manière à guider ledit matériau à travers eux dans un trajet horizontal rectiligne sans déplacement en zigzag.

5. Appareil de traitement pour un matériau photographique photosensible, du type comprenant au moins des unités de traitement de développement (52), de fixation (53) et de rinçage (54) afin d'appliquer des solutions de développement, de fixation et de rinçage audit matériau qui doit être traité, et pour convoier ledit matériau dans une direction de convoyage vers lesdites solutions et entre lesdites unités dans lequel chacune desdites unités de traitement comprend : deux paires de rouleaux de convoyage (29) et un élément (24) qui définit une chambre de traitement, ayant une extrémité de souche et une extrémité terminale ; lesdits rouleaux (29) s'étendant parallèlement les uns aux autres et deux desdites paires de rouleaux (29) étant disposées à une distance prescrite l'une de l'autre dans ladite direction de manière à convoier ledit matériau dans ladite direction ; ledit élément (24) étant disposé entre lesdites paires de rouleaux de convoyage et s'étendant parallèlement auxdits rouleaux perpendiculairement à ladite direction, sur la largeur totale dudit matériau ; une chambre de traitement étant définie dans ledit élément (24) ; ledit élément comportant une fente d'entrée et une fente de sortie (24b) le long de ladite direction, de telle sorte que ledit matériau est entré dans ledit élément à travers ladite fente d'entrée et sorti hors dudit élément à travers ladite fente de sortie ; un orifice d'alimentation en liquide de traitement (32b) pour alimenter un liquide de traitement dans ladite chambre étant prévu dans ledit élément au niveau de la souche de celui-ci, caractérisé en ce que ledit élément (24) qui définit la chambre de traitement est constitué par une gorge supérieure allongée (24a) et une gorge inférieure

allongée appariée (24a) qui se font mutuellement face avec leur partie ouverte, en définissant ainsi ladite chambre de traitement, grâce à quoi la solution de développement est alimentée via les orifices d'alimentation (52b) pour la solution de développement au niveau de la souche de l'élément (24) qui définit la chambre de développement, directement vers la chambre de développement (24) dans une direction perpendiculaire à celle du mouvement du film ; et en ce que ladite fente d'entrée (24b) et ladite fente de sortie (24b) communiquent avec lesdites gorges supérieure et inférieure de telle manière que le matériau entrant par ladite fente d'entrée et sortant par ladite fente de sortie passera à travers le liquide de traitement qui s'écoule à travers ladite chambre, en étant immergé dans ledit liquide.

6. Appareil de traitement pour un matériau photographique photosensible, selon la revendication 5, comprenant en outre un réservoir (23) placé au-dessous dudit élément (24) qui définit la chambre de traitement et desdits rouleaux de convoyage (29), afin de recueillir le liquide de traitement (43) qui sort de ladite chambre via lesdites fentes (24b) et exprimé hors dudit matériau par lesdits rouleaux (29), et des moyens de pompage (58) afin d'entraîner ledit liquide dans ledit réservoir jusqu'àudit orifice d'alimentation de liquide de traitement (52b).

7. Appareil de traitement pour matériau photographique photosensible selon la revendication 6, dans lequel ledit élément (24) qui définit la chambre de traitement est fermé à son extrémité terminale.

8. Appareil de traitement pour matériau photographique photosensible selon l'une quelconque des revendications 5 à 9, comprenant en outre un second élément (24) qui définit une chambre de traitement, disposé en aval de ladite paire de rouleaux de convoyage (29) qui sont à leur tour en aval dudit premier élément qui définit la chambre de traitement et une troisième paire de rouleaux de convoyage positionnée en aval dudit second élément qui définit la chambre de traitement ; ledit second élément étant sensiblement identique audit premier élément, et toutes lesdites paires de rouleaux et tous lesdits éléments qui définissent la chambre de traitement étant positionnés de manière à guider ledit matériau à travers eux dans un trajet horizontal rectiligne sans mouvement de zigzag vertical.

9. Appareil de traitement pour matériau photographique photosensible selon la revendication 8, dans lequel chacune desdites unités de traite-



ment est placée par rapport à toutes les autres unités de traitement de telle manière que ledit matériau se déplace dans un trajet horizontal rectiligne à travers toutes les unités de traitement et entre celles-ci.

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