

Sept. 19, 1961

TAKASHI HORIUCHI

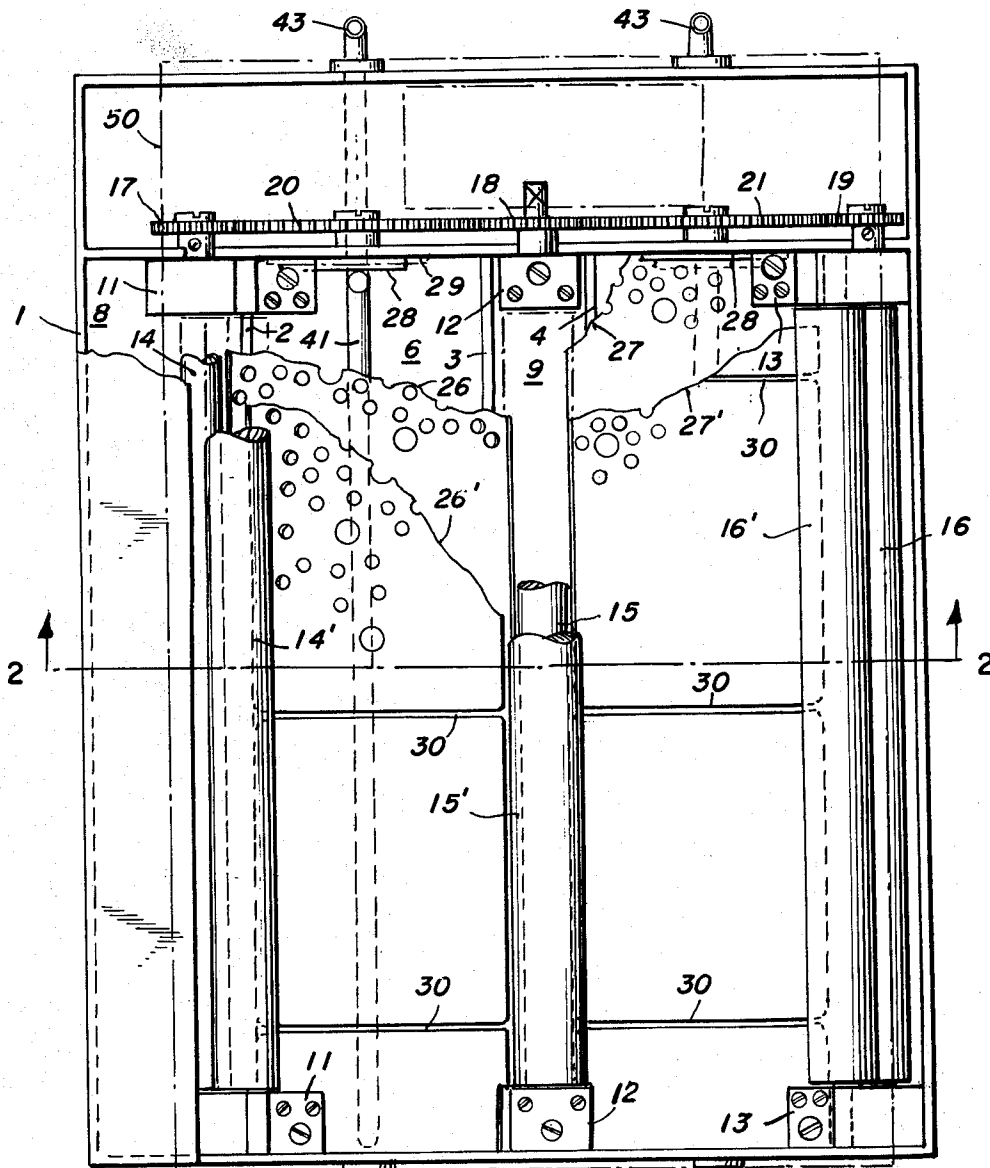
3,000,289

PHOTOGRAPHIC DEVELOPING APPARATUS

Filed Nov. 25, 1959

3 Sheets-Sheet 1

FIG. 1



INVENTOR

TAKASHI HORIUCHI

BY *James M. Drysdale*
ATTORNEY

Sept. 19, 1961

TAKASHI HORIUCHI

3,000,289

PHOTOGRAPHIC DEVELOPING APPARATUS

Filed Nov. 25, 1959

3 Sheets-Sheet 2

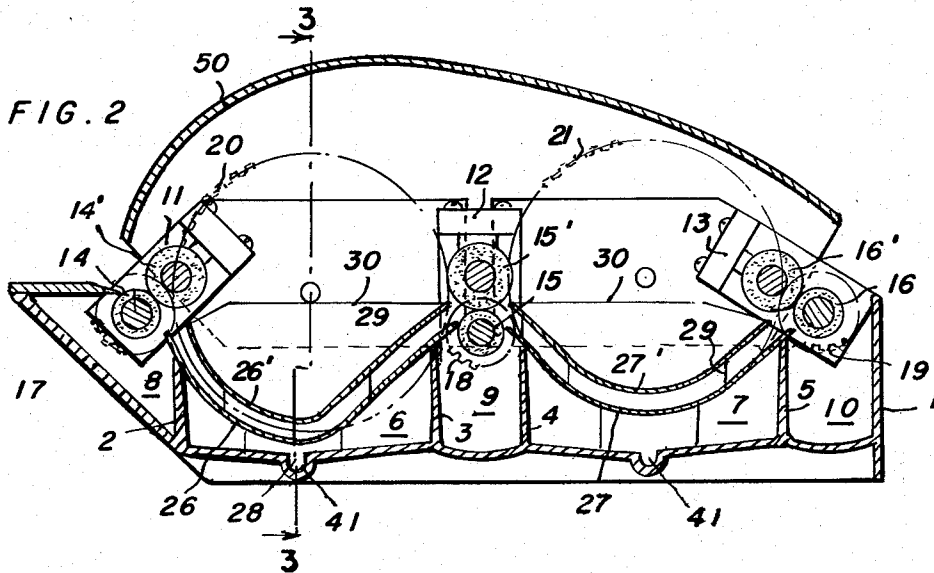


FIG. 3

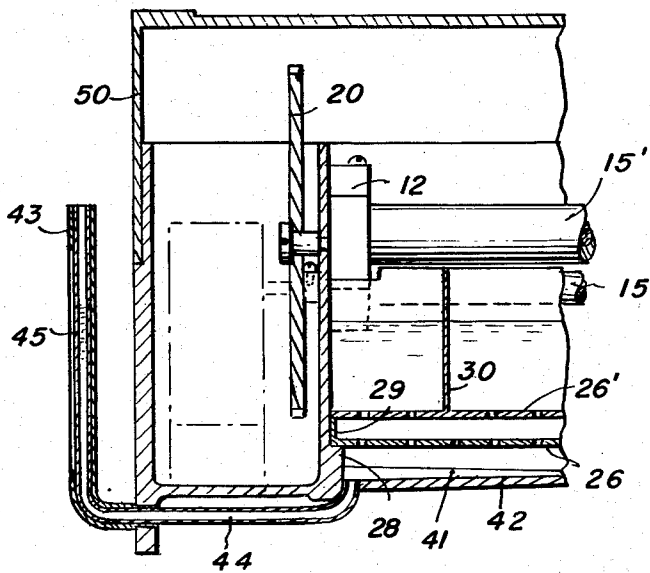
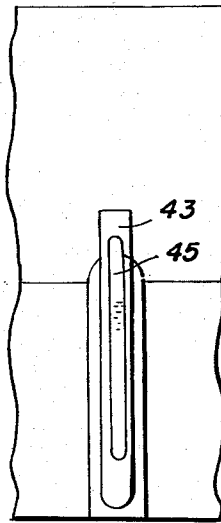


FIG. 4



INVENTOR

TAKASHI HORIUCHI

BY *James M. Drysdale*

ATTORNEY

Sept. 19, 1961

TAKASHI HORIUCHI

3,000,289

PHOTOGRAPHIC DEVELOPING APPARATUS

Filed Nov. 25, 1959

3 Sheets-Sheet 3

FIG. 5

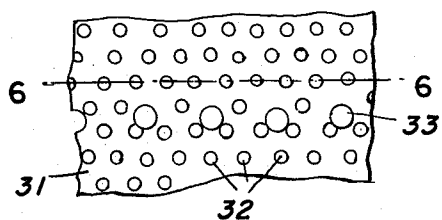


FIG. 6

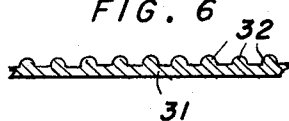


FIG. 9

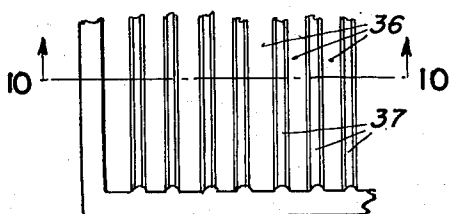


FIG. 10

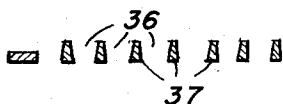


FIG. 13

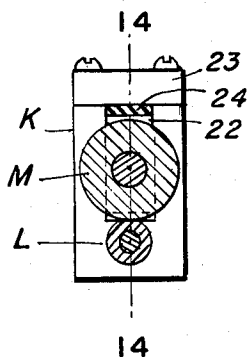


FIG. 14

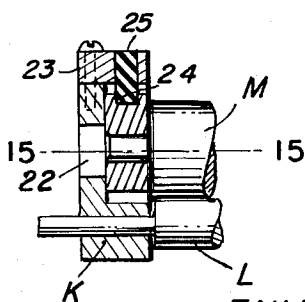
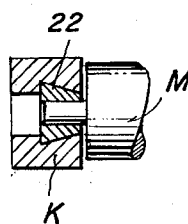


FIG. 15



INVENTOR

TAKASHI HORIUCHI

BY *James M. Drysdale*

ATTORNEY

1

3,000,289
PHOTOGRAPHIC DEVELOPING APPARATUS
Takashi Horiuchi, 8-10 Nino Miya-cho 4 Chome,
Fukiai-ku, Kobe, Japan
Filed Nov. 25, 1959, Ser. No. 855,427
3 Claims. (Cl. 95-94)

This invention relates to a tank having as its characteristic the inside partitioned in its downward part from the middle into a developer chamber, a fixer chamber and three rooms of rollers, one between the two chambers and two respectively at the front end and at the rear end of the tank, said roller rooms having respectively a set of two conveying rollers, upper and lower, fixed in such a way that the line of contact of the rollers of every set keeps nearly level with the upper edge of the partition wall, two pairs of plates running parallel to each other in pairs and corrugated and multi-perforated so as to prevent a conveyed paper from sticking and make it pass submerged through the solution in the developer chamber or in the fixer chamber, one of the pairs connecting between the front room of rollers and the middle one at the level line of contact of the upper and lower rollers and the other between the middle room of rollers and the rear one in the same way, a gearing attached to the outside of the wall of the tank enabling said three sets of rollers to convey sensitive papers in uniform speed between them, and moreover, having the developer chamber and the fixer chamber provided respectively with an inclined groove, a transparent flexible tube connecting the lowest end of the groove with the lowest end of a water gauge which is attached to the outside of the wall of the tank and at its lowest end can freely be turned along the wall of the tank where it is attached and thus acts as a draining pipe when wanted, and the object of this invention is to make a tank simultaneously performing developing and fixing, devised automatically to convey exposed sensitive papers inserted between the front conveying rollers, upper and lower, through developer and fixer successively and send it out of the tank through the rear set of rollers and at the same time, with the tank of this invention, the quantity of the developer and fixer contained in the tank can be found in the water-gauges previously to the processing and the solutions can easily be drained out of the tank after the processing through the draining pipes which are only the water-gauges turned upside down, thus the whole processing in this line can be performed simply and speedily.

Another object of the invention is the provision of a processing unit of the class described which is simple in construction, easy and inexpensive to make, easy to use, clean, rugged and highly effective in use.

Other objects and advantages of the invention will be obvious to those skilled in the art upon a study of the accompanying drawings and the following specification.

To explain this invention more in detail and concretely with the accompanying drawings,

FIG. 1 in the drawings is a plane figure of this invention with a part cut open,

FIG. 2 is a view of a longitudinal section along line 2-2 of FIG. 1 viewed in the direction indicated with arrows,

FIG. 3 is a view of a longitudinal section along line 3-3 of FIG. 2, viewed in the direction indicated with arrows,

FIG. 4 is a facial view of a part of the left end of FIG. 3,

FIG. 5 is a partial plane figure of a corrugated multi-perforate plate used in this invention,

FIG. 6 is a sectional view of FIG. 5 along the line 6-6,

2

FIG. 7 is a partial plane figure of a plate composed of a net with a ball at each mesh.

FIG. 8 is a sectional view of FIG. 7 along the line 8-8,

5 FIG. 9 is a partial plane figure of a plate composed of a lattice with many connecting gaps in the direction of the transit of the paper and with a raised bar attached to every bar of the lattice,

FIG. 10 is a sectional view of FIG. 9 along the line 10-10 looking in the direction of the arrows,

FIG. 11 is a partial plane figure of a plate with lines stretched parallel to one another across the frame which have rolling rings set with proper spaces between them held by different sized distance pieces,

15 FIG. 12 is a sectional view of FIG. 11 along the line 12-12 looking in the direction of the arrows,

FIG. 13 is a face view showing in section the bearings of the conveying rollers,

FIG. 14 is a sectional view of FIG. 13 along the line 14-14 of FIG. 13,

20 FIG. 15 is a sectional view of FIG. 14 along the line 15-15 of FIG. 14.

In FIGS. 1 and 2 the numeral 1 is a tank made of plastics, 2, 3, 4 and 5 are inner partitioning walls about half as high as the tank itself, 6 is a developer chamber to contain developing solution in, 7 a fixed chamber to contain fixing solution in, 8, 9 and 10 are respectively the front room, the middle room and the rear room, of rollers, and 11, 12 and 13 are bearings supporting the shafts of the conveying rollers, said bearings being fixed to the inner side of the tank with bolts. The numerals 14, 14' and 15, 15' and 16, 16' are three sets of conveying rollers supported at both ends of the shafts by said bearings 11, 12 and 13, and one end of each shaft of the lower rollers 14, 15 and 16 passes through its bearing and the wall of the tank and protrudes to the outside, to which gear wheels 17, 18 and 19 of the same diameter are respectively fitted and gear wheels 20 and 21 are inter-fixed between said three gear wheels 17, 18 and 19 connecting them with each other, and one end of the shaft of the middle gear wheel 18 is connected to an electric motor (not shown), so that when the gear wheel 18 is turned, the gear wheels 17 and 19 turn conjointly with it and thus the rollers 14, 15 and 16 are turned in uniform speed.

45 In FIGS. 13, 14 and 15, K shows the body of each of the bearings 11, 12 and 13, L shows each of the lower conveying rollers 14, 15 and 16 supported respectively by bearings 11, 12 and 13, and M shows respectively the upper rollers 14', 15' and 16' supported by bearings 11, 12 and 13. The shaft of the lower roller L is so constructed that it is immediately fixed in and supported by the body K itself, while the shaft of the upper roller M is supported, put in the bearing hole of a dove-tailed sliding piece 22 which is set in a vertical groove in the body K, and a cylindrical rubber 24 is put between the top side of the sliding piece 22 and the under side of a pressing lid 23 that is fixed with a bolt to the upper part of the body K, and a bolt 25 screwed down in the lid 23 presses down the rubber 24, which in its turn presses down the sliding piece 22, so that the periphery of the upper roller M always touches that of the lower roller L with ever down pressing force.

And accordingly in FIGS. 1 and 2, when the lower rollers 14, 15 and 16 are turned in uniform speed, the upper rollers 14', 15' and 16' which are pressed down so that they press the lower rollers from above are simultaneously turned together with them. Design the rollers 14, 15 and 16 to have a similar diameter to each other and the rollers 14', 15' and 16' to have a similar diameter to each other, too, and the carrying speed of a sensitive

paper inserted between, and carried by, the three sets of rollers 14, 14' and 15, 15' and 16, 16' is all alike. This is an important function in preventing the paper from being pulled or pushed by either set of the rollers towards the direction of transit in the process of conveyance, as paper is considerably weaker in tensile strength and elasticity when it is in wet condition soaked in developer or fixer than when it is in dry condition. The bearing 11 supporting the front set of rollers 14, 14' and the bearing 13 supporting the rear set of rollers 16, 16' are attached both inclined towards the interior, but the angle of this inclination can properly be altered according to the direction of taking in, or taking out, of the sensitive paper, and it is not necessary to keep the angle of inclination as illustrated in FIG. 2; for example, when it is needed to take out the processed paper perpendicularly, the bearing 13 may be attached horizontally. The numerals 26, 26' and 27, 27' are the marks for two pairs of the corrugated multi-perforated plates which, having a uniform space between them, run between the rollers 14, 14' and the next ones 15, 15' and between the rollers 15, 15' and the next ones 16, 16', and they respectively lead the paper inserted between the rollers 14 and 14' to the next set of rollers 15, 15' or one inserted between the rollers 15 and 15' to the next set of rollers 16, 16', after soaking it through developing solution or fixing solution. Of these corrugated multi-perforated plates, the lower ones 26, and 27 are supported, as clearly shown in FIGS. 1, 2 and 3, by putting the center of the underside on the shoulder of the top edge of the thick part 28 prepared at the lower part in the center of the side wall of the developer chamber 6 and that of the fixer chamber 7 while both edges are respectively supported by the partitioning walls 2, 3 and 4, 5 and the upper ones 26' and 27' are put on the up-turned edges 29 of the lower plates 26 and 27. As the most part of these corrugated multi-perforated plates 26, 26' and 27, 27' are soaked in developing and fixing solutions it is needful to devise that these solutions can freely flow between the upper and lower sides of these plates to act effectively on the sensitive paper carried between these plates and that the paper in the process does not stick to them though it is wet. FIG. 5 and FIG. 6, FIG. 7 and FIG. 8, FIG. 9 and FIG. 10, and FIG. 11 and FIG. 12 are practical examples of the corrugated multi-perforated plate of this invention. FIG. 5 and FIG. 6 show a plate 31 of plastics with many small hemispheric projections 32 on its surface and with facilitating holes 33 for the flow of the solution properly pierced through it. These projections 32 are put on the surface of the lower plates 26 and 27 and on the underside of the upper plates 26' and 27'. When the paper wet with solution moves between the upper and lower plates, the surface of the paper touches only the topmost points of the projections without touching the surface of the plates, thus is prevented from sticking to them. It is, therefore, neither good for the projections to be too large in their size nor for the spaces between the projections to be too big. Generally speaking, it is effective to make projections of two or three millimeters in diameter irregularly laid with spaces of several millimeters between them. It must be avoided to arrange the projections so regularly that the moving paper touches them with the same linear places on the surface of it, lest linear flecks should be traced in the paper after processing. What is shown by FIG. 7 and FIG. 8 is a plate composed of a net 34 with a ball 35 at each mesh. FIG. 9 and FIG. 10 is a plate composed of a lattice with many connecting gaps 36 in the direction of the transit of the paper and with a raised bar 37 attached to every bar of the lattice, and another practical example shown by FIG. 11 and FIG. 12 is a plate with lines stretched parallel to one another across the frame 38 which have rolling rings 39 set with proper spaces between them held by different sized distance pieces 40. In this example, the rolling rings 39 are so set as to roll

in the direction of the transit of the paper. The size of the meshes of the net 34 of FIG. 7 and FIG. 8, the gaps 36 between the bars 37 of the lattice of FIG. 9 and FIG. 10 and the intervals between the rolling rings 39 of FIG. 11 and FIG. 12 and their disposition are to be properly chosen for the reason mentioned above about the projections 32 of FIG. 5 and FIG. 6.

In FIGS. 1, 2 and 3, the numerals 41 are marks for the grooves severally put in the center of the bottom of the developer chamber 6 and that of the fixer chamber 7. The bottoms of the chambers are both constructed with a gentle slope towards the middle so that each of the grooves occupies the lowest position of the bottom. The numeral 42 in FIG. 3 indicates the bottom of the groove 41 which has an inclination to make itself deeper towards one side wall both in the developer chamber 6 and the fixer chamber 7. The numeral 43 indicates a water gauge fixed to the outside of the wall of the tank freely turning in vertical plane parallel to the wall of the tank, the numeral 44 indicates a flexible and transparent pipe made of a transparent tube or the like, one end of which is connected to the lowest part of the groove 41 and the other end set in the water-gauge 43, and the numeral 45 indicates an eye-hole fitted in the water-gauge 43. Not only the quantity of developing and fixing solutions poured at the beginning of the processing severally into the developer chamber and the fixer chamber can easily be found by the level appearing in the eye-holes 45 of the water-gauges 43, but also, after the processing, by turning the water-gauges 43 upside down from their position shown in FIG. 3, the solutions in the chamber can be collected with a collecting vessel to the last drop.

The numerals 30 in FIGS. 1 and 3 indicate webs to strengthen the multi-perforated plates and 50 indicates the covering of the tank.

As hitherto explained, with the tank of this invention, an exposed sensitive paper inserted between the left hand rollers 14 and 14' in FIGS. 1 and 2 automatically goes by means of the three sets of rollers soaking successively through developing solution and fixing solution and is sent out of the tank and, in this process, as the three sets of rollers have a uniform speed in carrying the paper, it is neither pulled or pushed on its way, thus the tank of this invention has an advantage that the paper is in so much less danger of being torn or crinkled in the processing, and as the corrugated multi-perforated plates 26, 26' and 27, 27' are equipped with a surface which comes in contact with the paper only with the points of projections, the tank of this invention has a second advantage that the paper has no danger of sticking, and a third advantage of the tank of this invention is that as the content of solutions in the developer chamber and in the fixer chamber can be found previously to the processing by the level appearing in the water-gauges 43 attached to the outside wall of the tank and the solutions can easily be collected after the processing only by turning these water-gauges 43 upside down when they act as draining pipes, and difficulties ordinarily encountered are all eliminated and the processing is speedily performed.

Although we have herein shown and described several embodiments of this inventive concept, it is obvious that many changes in the arrangement herein shown and described, may be made without departing from the spirit of the invention. The present application is, therefore, not to be limited except insofar as necessitated by the scope of the appended claims.

I claim:

1. A tank for simultaneously performing developing and fixing having a developer chamber, a fixer chamber and three rooms for rollers, one between the two chambers, one at the front end and another at the rear end of the tank, said roller rooms each having respectively a set of two conveying rollers, upper and lower, positioned so that the line of contact of the rollers of every set keeps nearly level with the upper edge of the partition wall,

5

two pairs of plates running parallel to each other in pairs and corrugated and multiperforated so as to prevent a conveyed paper from sticking and make it pass submerged through the solution in the developer chamber thence through the solution in the fixer chamber, the first pair of plates connecting between the front room of rollers and the middle room of rollers, the second pair of plates connecting between the middle room of rollers and the rear room of rollers in the same way, a gearing attached to the outside wall of the tank enabling said three sets of rollers to convey sensitive papers at uniform speed, the developer chamber and the fixer chamber being each provided with an inclined bottom, an inclined groove attached to the lowest part of said inclined bottom, a water gauge attached to the outside wall of the tank, a flexible transparent tube connecting the lowest end of the groove to the lowest end of the water gauge, said water gauge being adapted to be freely turned along the wall of the tank and thus act as a draining pipe when wanted.

2. A tank for simultaneously performing developing and fixing, as described in claim 1, having as its characteristic a sliding surface for a paper in transit composed of inclined corrugated plates each provided with

6

several facilitating holes and fitted on one side with hemispheric projections.

3. A tank for simultaneously performing developing and fixing, as described in claim 1, having a mechanics of bearings in which the conveying rollers are supported by a bearing fixed to the inside wall of the tank with bolts immediately supporting the shaft of the lower roller, and by a dovetailed sliding piece put in the vertical groove in the body of said bearing supporting the shaft of the upper roller, with a rubber placed between the top side of said dovetailed sliding piece and the under side of a lid which is fixed to the top side of the body of the bearing to press down said dovetailed sliding piece with a bolt screwed down on the lid and make the upper roller always touch the lower roller with pressing force.

References Cited in the file of this patent

UNITED STATES PATENTS

717,021	Pollack	Dec. 30, 1902
2,657,618	Eisbein	Nov. 3, 1953
2,762,281	Kleinstra	Sept. 11, 1956

FOREIGN PATENTS

768,621	Great Britain	Feb. 20, 1957
---------	---------------	---------------