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PROCESSING MACHINE FOR SENSITIZED PAPER AND THE LIKE

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2 Sheets-Sheet 1

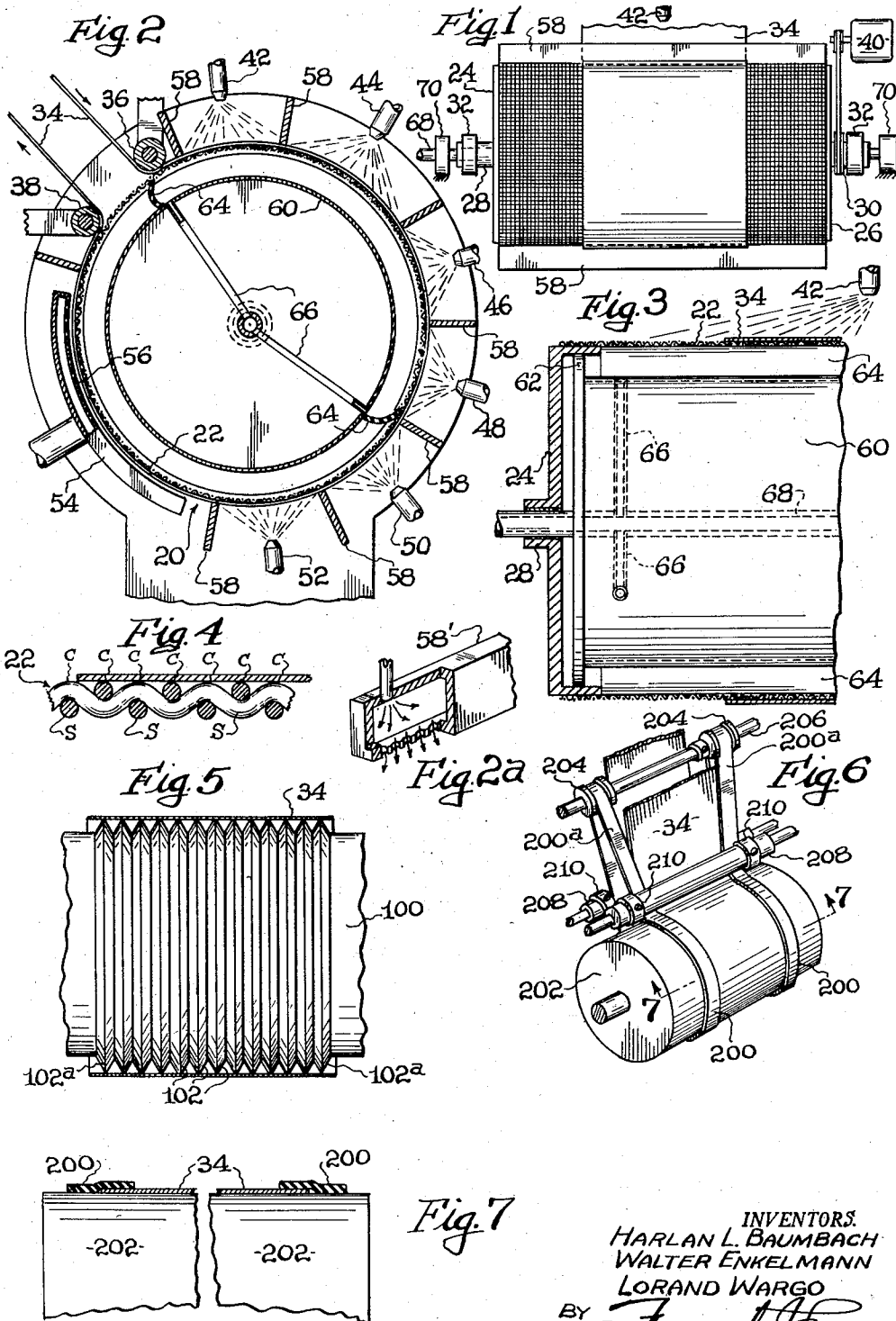


Fig. 7

Fig. 3

Fig. 4

Fig. 5

Fig. 2a

Fig. 6

Fig. 7

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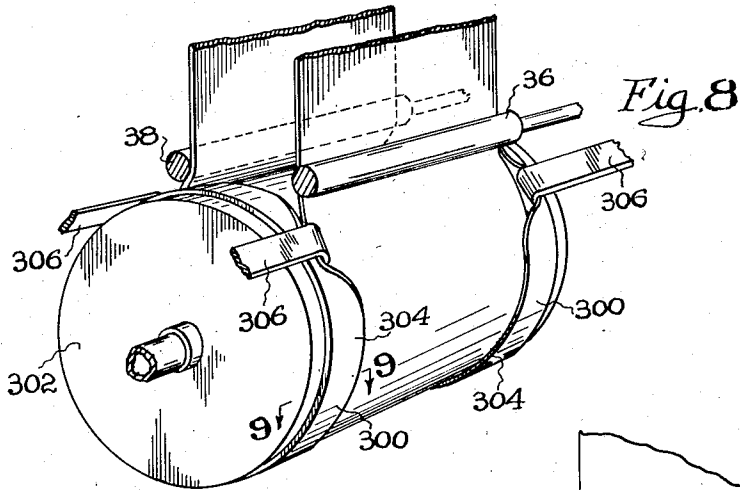
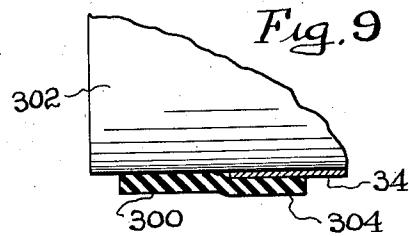
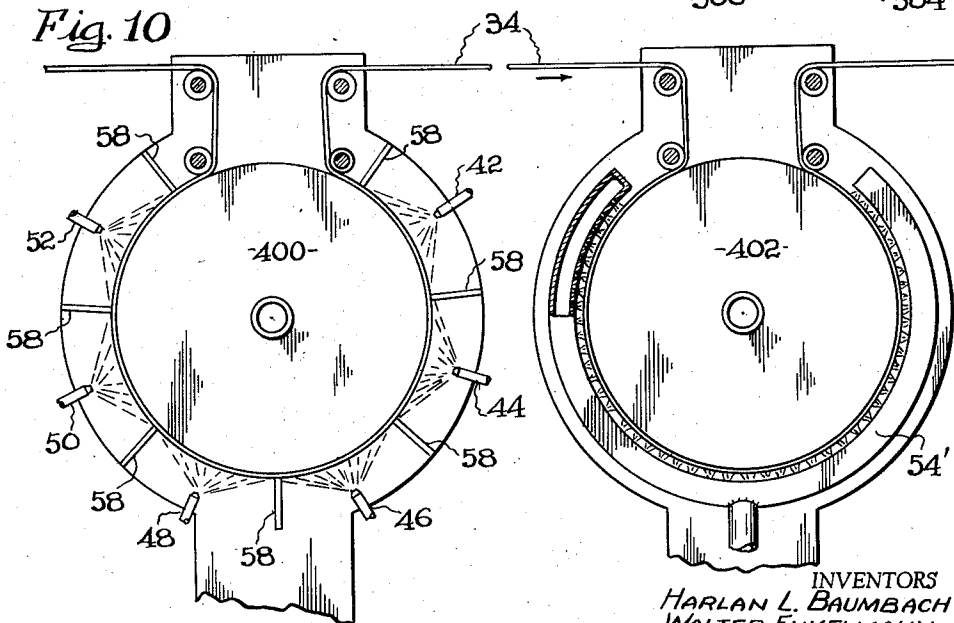
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2 Sheets-Sheet 2



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1

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PROCESSING MACHINE FOR SENSITIZED PAPER AND THE LIKE

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6 Claims. (Cl. 95—94)

This invention relates to apparatus for treating moving webs bearing an exposed, light sensitive emulsion layer, and particularly to a so-called paper processing machine.

Machines of the type to which this invention pertains are employed for developing relatively wide webs of exposed, sensitized paper, comprising, for example, an oscillograph record.

In the past, paper processing machines have comprised a series of solution tanks containing the various developing, fixing and rinsing solutions. The paper being processed was supported on a series of idler and feed rollers and had successive portions immersed in the different processing solutions.

During operation of the machine, the paper was fed through the solutions in successive fashion to accomplish developing and fixing of the latent images on the emulsion of the paper. After emerging from a final wash solution, the paper was fed through a series of drying cabinets.

The prime deficiency of the existing paper processing machines resides in the fact that the paper was immersed in the processing solutions. The fibers of the paper thus became saturated with the solutions.

As a result, the paper had to be subjected to rigorous and prolonged washing and rinsing operations to assure complete rinsing of the developing and fixing solutions from the fibers. Also, prolonged drying periods were required to dry the saturated paper. Owing to this necessity of prolonged washing and drying periods, the tanks and drying cabinets of the machine had to be relatively large and the rate of movement of the paper relatively slow.

Existing paper processing machines are, therefore, relatively complex in construction, costly to manufacture, require substantial space, and permit only a slow paper speed.

The above and other deficiencies of existing paper processing machines are overcome in the present machine by virtue of the fact that only the emulsion side of the paper is wetted by the processing solutions. Since the emulsion is relatively impervious to the solutions, the latter may be quickly and easily rinsed off. The fibers of the paper are not wetted by the solutions, with the result that the drying time required is also appreciably reduced.

In view of what has been said, a broad object of the invention may be stated as being the provision of a new and improved paper processing machine which avoids the noted and other deficiencies of existing paper processing machines.

A more specific object of the invention is the provision of a paper processing machine wherein only the emulsion side of the paper is wetted by the processing solutions.

Another object is the provision of a paper processing machine wherein the washing, rinsing and drying times required are appreciably reduced.

Yet another object of the invention is the provision of

2

a paper processing machine which is relatively simple in construction, extremely compact in size, and inexpensive to manufacture.

A further object is the provision of a paper processing machine which is uniquely adapted to the application of processing solutions to the paper by spraying rather than by immersion.

Other objects will become apparent as the description proceeds.

Briefly, the above and other objects are achieved in the illustrative embodiments of the invention by the provision of a rotary drum around the periphery of which are located a series of successively arranged, stationary nozzles and an impingement drier. The nozzles are connected to sources of the various processing solutions and serve to direct sprays of the solutions toward the drum.

The paper to be processed is fed from a supply roll, around the drum, to a take-up roll with its emulsion side out. In the alternative, the machine may comprise a series of drums around which the paper is successively fed. For instance, the solution nozzles may be arranged about one drum and the drier about a following drum or some of the nozzles might be arranged about one drum and the remainder of the nozzles and drier about one or more succeeding drums.

During operation of the present paper processing machine, the drum or drums rotate with the paper as the latter is fed and the paper moves through the solution sprays and past the drier in succession. A typical sequence of these sprays is developing spray, rinse spray, fixing spray, rinse spray, salt spray, and wash spray.

In those machines wherein more than one nozzle is associated with a drum, as in the case of a machine comprising a single drum, the spray zones of the nozzles are separated by suitable barriers to restrict the different sprays to their respective zones of the drum. Also, the nozzles are so arranged that their sprays impinge only the emulsion side of the paper.

Even though the sprays are thus directed, it was found that if the drum had a smooth cylindrical surface, the latter was gradually wetted by the solutions due to capillary action and other causes. This solution on the drum was absorbed by the fibers on the back side of the sensitized paper, which is undesirable for the reasons previously stated.

A primary feature of this invention involves the provision of means for preventing this seepage of the processing solutions to the back of the paper, so that only the emulsion side of the paper becomes wet during passage of the latter through the machine. The washing, rinsing and drying times necessary are thereby reduced sufficiently to allow complete processing and drying of the paper during travel of the latter around a single drum.

According to the preferred practices of avoiding solution seepage to the back of the paper, the drum is made of screen mesh formed into a cylinder. A series of essentially point contacts, therefore, exist between the drum and paper. Capillary action tending to cause seepage of solution to the underside of the paper is thus virtually eliminated. In this form of the drum, the latter encloses a cylindrical shield to avoid spraying solution through the holes in the screen onto the back of the paper on the opposite side of the drum.

Other disclosed means for avoiding wetting of the underside of the paper involve the use of travelling bands, or other seals, at the edges of the paper for sealing the latter to the drum, the provision of raised, peripheral ribs on the drum to reduce capillary action between the drum and paper to a minimum and establish essentially only line contact between the drum and paper, and the coating of the back of the paper with a suitable sealing compound.

A better understanding of the invention may be had from the following detailed description taken in connection with the attached drawings, wherein:

Figure 1 is a view of a preferred form of the present processing apparatus, certain solution spray nozzles and spray confining partitions being omitted for the sake of clarity;

Figure 2 is an enlarged transverse section of the apparatus of Figure 1;

Figure 2a illustrates a modified form of partition, partially in section, for use in the apparatus of Figure 1;

Figure 3 is an enlarged longitudinal section of one end of a drum comprising the apparatus of Figure 1;

Figure 4 is an enlarged section illustrating the point contact between the drum of the illustrated apparatus and the web being treated;

Figure 5 illustrates a modified form of drum which may be used in the present apparatus;

Figure 6 illustrates a further modified form of the present apparatus;

Figure 7 is an enlarged section taken along line 7—7 of Figure 6;

Figure 8 illustrates, in perspective, a still further modified form of the present apparatus.

Figure 9 is an enlarged section taken along line 9—9 of Figure 8; and

Figure 10 illustrates a form of the present apparatus embodying two drums.

Referring first to Figures 1—4, the preferred form of the invention comprises a drum 20 including a screen mesh cylinder 22. It has been found that the gauge of the mesh most suitable for a particular application varies with the various solution pressures and temperatures used. In one paper developing machine constructed in accordance with the invention 40 gauge mesh was found to be optimum.

Received in opposite ends of the cylindrical screen 22 are a pair of peripherally flanged discs 24 and 26 to which the screen is firmly attached. The discs 24 and 26 have hollow, coaxial shafts 28 and 30, respectively, which extend outwardly from the drum and are journaled in bearings 32.

The exposed sensitized paper 34 to be processed leads from a supply roll, not shown, around a stationary guide roller 36 proximate to and paralleling the drum 20. The paper is wrapped around the major portion of the drum and leads from the latter around a second stationary guide roller 38 proximate to and paralleling the drum to a driven take-up roll, not shown. The paper has its emulsion side outermost and its uncoated side bearing on the drum. During operation of the machine, the paper is fed in the direction indicated, the drum 20 preferably being driven, in direction of movement of and at approximately the same speed as the paper, by any suitable drive means such as illustrated at 40.

Arranged in zones spaced about the periphery of the drum 20 are a series of stationary nozzles 42—52 connected to pressurized supplies, not shown, of the various processing solutions. These nozzles direct sprays of their respective solutions onto the emulsion side of the paper 34.

A typical sequence of these sprays is as follows: nozzle 42 sprays a developing solution, nozzle 44 a rinse spray, nozzle 46 a fixing solution, nozzle 48 a rinse spray, nozzle 50 a salt spray, and nozzle 52 a final wash spray. Located in the final processing zone of the drum is a curved impingement drier 54 connected to a source, not shown, of heated pressurized air. The curved inner face 56 of this drier is slightly spaced from the drum and perforated, as shown, for directing jets of warm air against the paper to dry the latter.

In some cases it may be desirable to confine the sprays from the nozzles 42—52 by enclosing the nozzles in separate chambers (not shown), having open sides facing

and flexible wall edges slideably engaging the drum. For purposes of illustration, the spray zones are shown as separated by a series of fixed partitions 58. These partitions may comprise thin rubber squeegees which extend the length of and have their inner edges slideably bearing against the drum and paper 34 to scrape or squeegee the paper. The squeegees may, in some cases, be hollow, have their inner edges perforated, and connected to a source of pressurized air, as shown at 58' in Figure 2a, for blowing solution from the openings in the screen cylinder 22 at opposite edges of the paper 34.

The drum 20 is made slightly longer than the width of the widest paper to be handled, so that paper of different widths may be treated. Accordingly, if the paper is relatively narrow, the drum will extend some distance beyond the edges of the paper.

The several nozzles 42—52 are located centrally of the ends of the drum and direct their sprays as shown in Figure 3. In this figure, it will be observed that the sprays are directed away from the paper 34 at the edges of the latter so as to impinge only its emulsion side. In order to prevent the spray, passing through the openings in the screen 22 beyond the edges of the paper, especially in the case of relatively narrow paper, from wetting the uncoated back of the paper at the opposite side of the drum, the latter has a shield 60 positioned therein.

Shield 60 is cylindrical in form and approximately co-extensive with but radially spaced a distance from the inner surface of the drum. Opposite ends of the shield 60 carry annular, radial wipers 62 (only one shown) of rubber or the like which slideably engage the inner surfaces of the peripheral flanges on the end disks 24 and 26 of the drum. The shield is held stationary by means described below and has a pair of longitudinally extending wipers 64 which slideably engage the inner surface of the drum 20 just before the first spray zone, containing nozzle 42, and just following the spray zone containing the nozzle 48.

A portion of the shield thus forms a tray for catching any spray from the nozzles 42—48 which passes through the screen at the edges of the paper. The liquid which collects in the lowermost edges of this tray is drained off through tubes 66. Tubes 66 connect to a common drain 68 which passes to the exterior of the drum through the hollow shaft 28 and 30 thereof for connection to a suitable drain pump, not shown. The shield 60 prevents wetting of the back of the paper by spray from nozzles at the opposite side of the drum.

As just mentioned, shield 60 is held stationary. To this end, the shield is rigidly fixed to the drain pipe 68 and opposite ends of the latter are supported on fixed supporting structure 70, exterior of the drum.

In operation of the present paper processing machine, the paper 34 is fed and the drum 20 is rotated in the directions indicated. Each incremental length of the emulsion side of the paper, therefore, passes successively through the developing, rinsing, fixing, rinsing, salt and wash sprays from the nozzles 42—52, and finally through the jets of warm air from the drier 54. The latent images on the paper, which may comprise an oscillograph record, for example, are developed and fixed and the paper is washed and dried during its brief travel around the drum 20.

As preliminarily noted, the reason that the paper can be processed and dried during its brief travel about the drum is that the uncoated base or back of the paper is not wetted by the processing solutions. Thus, in prior equipment for this purpose, prolonged rinsing and washing periods were necessary to thoroughly remove the developing and fixing solutions with which the fibers of the paper became saturated. Also, since the uncoated back of the paper become wetted to saturation in this prior equipment, a prolonged drying period was necessary.

5

In the present processing machine, however, only the emulsion side of the paper becomes wet, as described more fully below. The emulsion is relatively impervious to the solutions and the latter are, therefore, not absorbed by the paper. Accordingly, there are rinsed from the emulsion side of the paper relatively quickly by the rinse and wash sprays. Also, since the fibers of the paper do not become wet, the paper is quickly dried by the impingement drier 54.

The reason that the back of the paper remains dry is readily apparent from Figures 3 and 4. Thus, it will be seen in Figure 3 that only the emulsion side of the paper is impinged by the sprays from the nozzles. Accordingly, the back of the paper will become wet only as a result of seepage of solution between the drum and paper. However, in Figure 4, it will be observed that only a series of essentially point contacts C exist between the paper 34 and screen 22 of the drum 20, owing to the interweaving of the strands S comprising the screen. Accordingly, capillary action between the drum and paper and, therefore, seepage of solution adhering to the screen to the underside of the paper, are virtually eliminated.

The only locations where any capillary action might occur are at the contact points C adjacent the edges of the paper 34. Any wetting of the paper occurs at these latter points. Because the area of contact at each point is extremely small, only minute, spaced areas of the back of the paper can possibly become wetted by the solutions. The fibers of the paper, therefore, to all intents and purposes, remain completely dry and uncontaminated by the processing solutions, with the resultant advantages recited above.

Spray which strikes the drum beyond the edges of the paper, especially when the latter is relatively narrow, passes through the screen rather than accumulating on the drum and seeping to the underside of the paper as would occur if the surface of the latter were solid and smooth.

In lieu of forming the drum from a screen mesh as just described, it may be of ribbed and grooved construction, as illustrated in Figure 5. The nozzle and drier arrangement of the apparatus is the same as that just described. Accordingly, only the drum is illustrated and will be described.

The paper 34 is wrapped around the drum 100 so as to bear on the tips of the spaced ribs 102 thereof. The number of ribs will be made such as to accommodate the widest and narrowest paper to be processed. In this form of the invention only line contact exists between the paper and drum.

The ribs 102a nearest the edges of the paper form seals which preclude entrance of solution to the underside of the paper except by capillary action between the rib and paper. Even if such action occurs, the back of the paper becomes wet only along the lines of contact thereof with the ribs. Accordingly, the back of the paper remains substantially completely dry so as to be capable of being thoroughly rinsed and dried during its brief travel along the drum.

A further modified form of seal is shown in Figures 6 and 7. In this figure, the numerals 200 designate a pair of travelling endless bands which overlie and press the side edges of the paper 34 against the smooth cylindrical surface of the drum 202 to form substantially liquid-tight seals. Liquid is thus prevented from seepage to the underside of the paper.

Bands 200 may comprise metal or any other suitable material and are trained about guide pulleys 204, carried on a shaft 206, and paper guide rollers 208. The portions of the bands leading to and from the drum diverge, as shown, to enable the paper to feed to and from the undersides of the bands, rollers 208 mounting guide collars 210 engaging the outer edges of the bands.

The guide pulley 204 and collars 210 associated with at least one of the bands, may be axially adjustable to per-

6

mit relative adjustment of the bands toward and away from one another. Paper of various widths may thereby be accommodated by the apparatus. The nozzles and drier, which are arranged about the drum 202 in the same manner as in Figure 2, have been omitted from Figure 6, for the sake of clarity.

Numerous other sealing arrangements are, of course, possible. Thus, a pair of annular rubber bands 300 can be carried on the drum 302 and provided with annular lips 304 adapted to overlie and sealingly engage the side edges of the paper 34, as shown in Figure 8.

In this case, stationary guides 306 are provided for flexing the lips 304 away from the drum 302, in the zone of entrance of the paper to the drum, as shown, to permit feeding of the paper below the lips 304. Another set of these guides, not shown, are located in the zone of emergence of the paper from the drum to permit feeding of the paper from beneath the lips 304.

In the alternative, of course, a water-proofing liquid or wax, such as silicone or a suitable plastic, for example, may be applied to the back of the paper to prevent seepage of solution at the edges of the paper or to entirely water-proof the back of the paper.

The present paper processing machine may comprise more than one drum. Thus, as schematically illustrated in Figure 10, the machine may comprise two drums 400 and 402 around which the paper 34 feeds in successive fashion. These drums and the sealing means employed therewith may be of any of the previously described forms of the invention.

In Figure 10, drum 400 is illustrated as comprising a "wet drum" having the nozzles 42-52 arranged thereabout, as shown. The second drum 402 comprises a "dry" drum about which extends only a curved impingement drier 54'. In operation of this form of the apparatus, the paper is fed in the direction indicated and is developed, fixed and rinsed on the wet drum 400. Drying of the paper is accomplished on the dry drum 402.

In the alternative, of course, as preliminarily pointed out, some of the nozzles might be arranged about a first drum, and the remainder of the nozzles and drier about one or more succeeding drums.

The drum or drums of the present apparatus preferably rotate about a horizontal axis, the excess liquid between the partition 58 merely flowing to the ends of the drum and dropping into collecting trays, not shown. If desired, of course, the drum might rotate about a vertical axis to facilitate the flow of excess liquid from the drum.

While certain embodiments of the invention have been disclosed for illustrative purposes, numerous modifications in design and arrangement of parts are possible within the scope of the following claims.

We claim:

1. A photographic processing machine for treating a moving web of material bearing on one side an exposed, sensitized emulsion, comprising: frame means, rotary drum means journaled on said frame means about which said web is adapted to be trained with its emulsion side away from the drum means, a plurality of partitions mounted on said frame means in circumferentially spaced, radial planes of said drum means and defining therebetween a series of treatment zones, a series of separate spray nozzles in said treatment zones for spraying different photographic processing liquids toward said drum means, said partitions confining the spray from each nozzle to the respective treatment zone and having radially inner surfaces engageable with a web trained about said drum means for removing liquid from the web as the latter moves from one treatment zone to the next, and a drier for drying said web after emergence of the latter from the final treatment zone comprising a curved plenum chamber partially encircling said drum means and including an inlet through which air under pressure may be introduced to the interior of said chamber and a curved wall proximate to said drum means having perforations

7

through which air may exhaust from said chamber toward said drum means.

2. The subject matter of claim 1 wherein said drum means comprises a single cylindrical drum having said partitions in circumferentially spaced, radial planes thereof, and said plenum chamber partially encircling said drum.

3. The subject matter of claim 1 wherein said drum means comprise first and second cylindrical drums, said web being trained about said drums so as to move about the latter in succession, said partitions being located in circumferentially spaced, radial planes of said first drum, and said plenum chamber partially encircling said second drum.

4. The subject matter of claim 1 wherein said drum means comprises a cylindrical drum having said partitions in circumferentially spaced, radial planes thereof, said drum comprising a cylinder of relatively fine mesh screen having a mesh on the order of 40 gauge, a stationary imperforate cylinder concentrically journaled within said drum with its cylindrical wall spaced from said screen mesh cylinder, means stationarily supporting said imperforate cylinder on said frame means, a pair of partitions fixed to opposite sides of said imperforate cylinder and slideably engaging the inner surface of said screen mesh cylinder, said latter partitions and imperforate cylinder forming a pair of generally upwardly opening troughs for catching liquid passing through the upper portion of said

8

screen mesh cylinder, and means for draining liquid from said troughs to the exterior of said drum.

5. The subject matter of claim 1 wherein said drum means comprises a cylindrical drum having said partitions located in circumferentially spaced, radial planes thereof, said drum having a plurality of raised, relatively sharp edged annular ribs encircling the drum and spaced longitudinally of the latter for supporting a web trained about said drum, said ribs minimizing seepage of liquid to the underside of the web.

6. The subject matter of claim 1 wherein said drum means comprises a cylindrical drum having said partitions in circumferentially spaced, radial planes thereof, a pair of flexible bands trained about said drum for overlying and pressing opposite side edges of a web trained about the drum against the latter to prevent seepage of liquid to the underside of the web, a series of guide rollers at one side of the drum around which said bands are trained, the runs of the bands extending from the drum to the guide rollers diverging to permit a web to feed into and off of the drum.

References Cited in the file of this patent

UNITED STATES PATENTS

25	1,589,007	King	June 15, 1926
	1,704,439	Langsner	Mar. 5, 1929

FOREIGN PATENTS

282,246	Germany	Feb. 19, 1915
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