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J. B. ELLIS

3,226,111

MACHINE FOR PASSING SHEET MATERIAL THROUGH A LIQUID

Filed Feb. 26, 1964

3 Sheets-Sheet 1

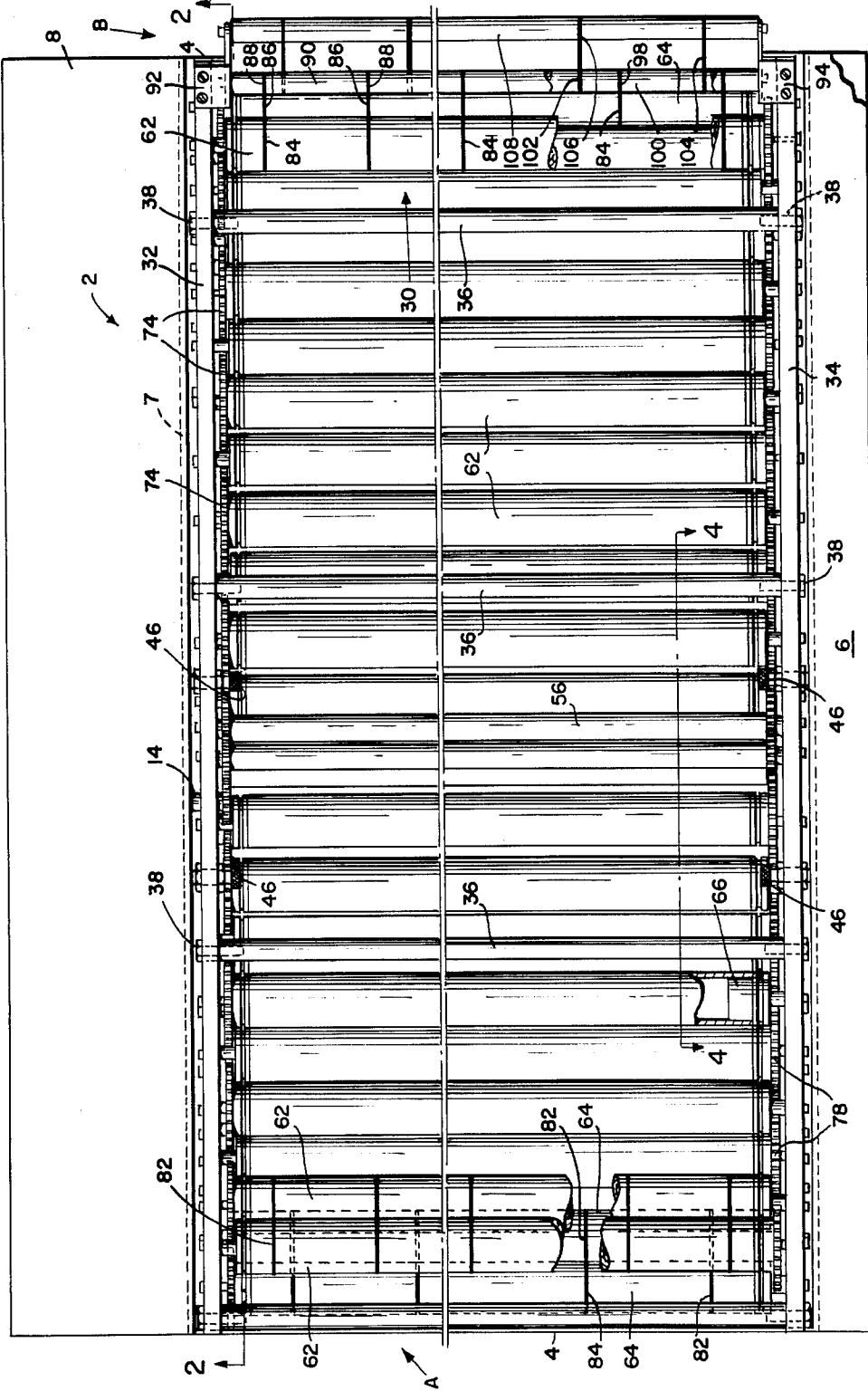


FIG. 1.

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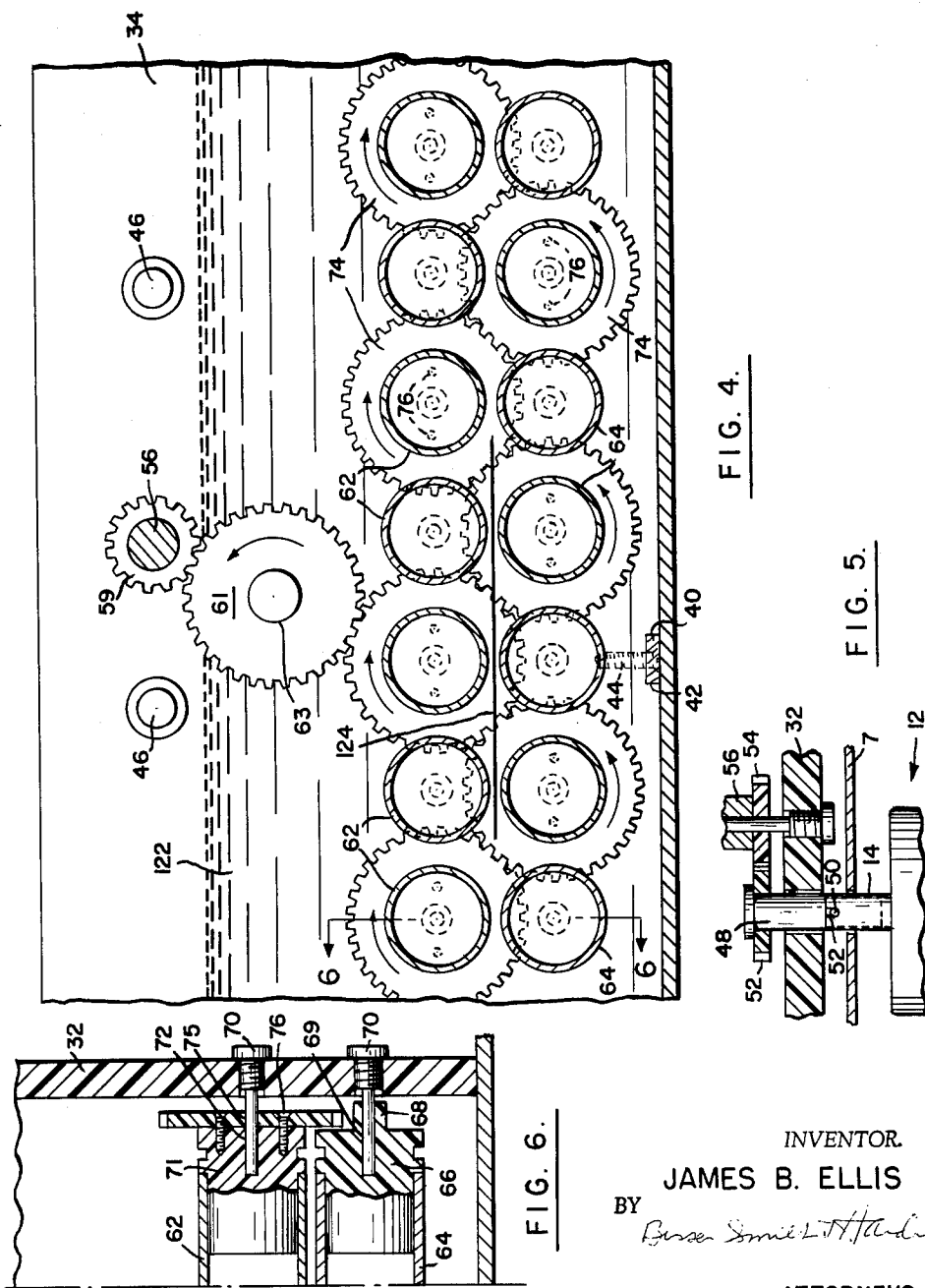


FIG. 4.

FIG. 5.

FIG. 6.

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MACHINE FOR PASSING SHEET MATERIAL THROUGH A LIQUID

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This invention relates to a machine for passing sheet material through a liquid. It can be used, for example, for passing a lithographic negative through a liquid lithographic paper developer. It will be evident that the machine of this invention can be applied to a wide variety of processes where it is desired to pass a sheet through a liquid.

The machine of this invention is highly advantageous since it is capable of advancing a sheet through the desired liquid without the mechanism touching the sheet while it is in contact with the liquid. This is obviously a very marked advantage in many processes such as, for example, in the process of developing a negative.

In addition, the machine of this invention is relatively simple to construct and of relatively low cost compared to the presently available machines for fulfilling the same function.

Further, the machines of this invention are advantageous in that any number of them can be coupled together providing, for example, the capability of subjecting a sheet to a series of processes.

The advantages and objects of the invention will be further clarified on reading the following description in conjunction with the drawings in which:

FIGURE 1 is a top plan view of a machine in accordance with the invention;

FIGURE 2 is a vertical section taken on the plane indicated by the line 2—2 in FIGURE 1;

FIGURE 3 is a rear elevation partly broken away of the machine of FIGURE 1;

FIGURE 4 is a vertical section taken on the plane indicated by the line 4—4 in FIGURE 1;

FIGURE 5 is a horizontal section taken on the plane indicated by the line 5—5 in FIGURE 1; and

FIGURE 6 is a fragmentary vertical section taken on the plane indicated by the line 6—6 in FIGURE 4.

A machine 2 in accordance with the invention has a tank 4 formed from a sheet 5 of metal which is welded to a flanged front plate 6 and a rear plate 7. A casing 8 is welded to plate 7 and has a removable rear side 9 which is secured in place by means of machine screws indicated at 10 (FIGURE 3). An electric motor 11 and a reduction gear mechanism 12 (FIGURE 3) driven by motor 11 are mounted within casing 8. Reduction gear mechanism 12 has an output shaft 14. A control panel 15 is mounted on panel 9 and has an on-off switch 16, a reversing switch 18 and a speed control 20 for controlling the electric motor 11. An indicator light 22 is lighted when the switch 16 is in the on position.

A roller assembly 30 which is removably secured in tank 4 has a frame member 32 and a frame member 34 secured together by a plurality of bars 36 which are held in position by means of headed screws 38 which pass through frame members 32 and 34, respectively, and are threadably secured to rods 36. As best seen in FIGURE 4, frame members 32 and 34 are connected by a bar 40 which is held in slot 42 in each of members 32 and 34 (only the slot in member 34 being shown) by means of machine screws 44 (only one being shown). The roller assembly 30 is held in place in tank 4 by means of knurl headed screws 46 (FIGURE 1) which pass through frame members 32 and 34, respectively, and engage

threaded openings in front plate 6 and rear plate 7, respectively.

A shaft 48 (FIGURE 5) is mounted for axial sliding in frame member 32 and has a pair of opposed pins 50 which engage a pair of opposed slots 52 (only one being shown) in the hollow end of shaft 14 to provide a detachable coupling. Shaft 48 has fixedly secured thereto a gear 52 which engages a gear 54 secured to a rotatably mounted shaft 56. Gear 54 in turn engages a gear 58 (FIGURE 1) secured to a rotatably mounted stub shaft 60. A gear 59 on shaft 56 engages a gear 61 mounted on a stub shaft 63 (FIGURE 4).

A series of upper rollers 62 and lower rollers 64 forming sets of opposed upper and lower rollers are mounted between frame members 32 and 34. Rollers 62 and 64 are hollow for lightness since they are preferably made of steel. Each roller has secured in one end a plug 66 carrying a hub 68 and having an opening 69 which is engaged by the unthreaded portion of a screw 70 threaded through one of the frame members 32 or 34. In its other end, each roller has secured a plug 71 having an opening 72 for the reception of a screw 70. A gear 74 having an opening 75 for the passage of a screw 70 is secured to each plug 71 by, for example, screws 76. The gears 74 on adjacent rollers are at opposite ends of these rollers. The gears 74 on adjacent rollers 64 are at opposite ends of these rollers and lie opposite an end of an upper roller 62 which does not carry a gear 74. Each gear 74 on a roller 62 meshes with a pair of immediately adjacent gears 74 on rollers 64. Gears 58 and 61 engage an adjacent gear 74 to cause the rotation of all the rollers 62 and 64 with the rollers 62 all rotating counterclockwise as viewed in FIGURE 2 and all the rollers 64 rotating clockwise as viewed in FIGURE 2.

Each of the last two upper rollers 62 and lower rollers 64 at the inlet end of machine 2 indicated at A has a plurality of spaced grooves 82 with rubber bands 84 carried in the oppositely positioned grooves 82 of the upper end rollers and in the oppositely positioned grooves 82 in the lower end rollers with the rubber bands acting as guides for a sheet being introduced into machine 2 to insure the sheet follows the correct path.

At the discharge end B of machine 2, the end upper roller 62 and the end lower roller 64 are each provided with spaced peripheral grooves 84. Rubber bands 86 engaging the grooves 84 in end upper roller 62 also engage grooves 88 in a roller 90 which is mounted in bracket 92 secured to frame 32 and bracket 94 secured to frame 34. Rubber bands 96 engage grooves 84 in end lower roller 64 and also engage grooves 98 in roller 100 which is mounted for rotation in brackets 92 and 94. Roller 100 is provided with spaced peripheral grooves 102 which carry rubber bands 104 which engage grooves 106 in roller 108 which is mounted for rotation in brackets 92 and 94. None of the rubber bands extends beyond the periphery of the associated roller.

Panel 9 is provided with a door 120 hinged at 121. Behind door 120 is a drain opening 116 in rear plate 7 to which is connected a drain hose 114, the discharge end of which is held above the liquid level of the tank 118.

Operation

In operation, a sheet of, for example, lithographic negative is introduced between the end rollers 62 and 64 at the inlet end of machine 2 and fed downwardly with the rubber bands 84 insuring that the paper does not deviate from the desired path and pass between adjacent rollers 62 or adjacent rollers 64. The rotation of the opposed rollers 62 and 64 causes a flow of liquid developer 122 which may, for example, be in the direction the sheet is desired to travel. Further, the liquid tends to flow

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away from the periphery of the opposed rollers 62 and 64 and hence tends to keep the sheet from touching these rollers. A typical sheet 124 is shown in FIGURE 4 being conveyed to the left as viewed in FIGURE 4 with the sheet spaced from the opposed rollers 62 and 64. While the distance between opposed rollers 62 and 64 can vary considerably, it will always be greater than the thickness of the sheet being employed and advantageously, in the range of from about .003 to about 0.11. Thus, the sheet is conveyed from left to right as seen in FIGURE 2 until it is conveyed between the terminal rollers 62 and 64 at the discharge end B of machine 2 where the sheet is guided by rubber bands 86 and 96 with the rollers 90 and 100 rotating in a direction to discharge the sheet. The sheet will fall over onto roller 108 and rubber bands 104 which are moving in a direction to discharge a sheet.

When it is desired to remove the liquid 122, hose 114 has its discharge end removed from clip 118 and is lowered below the level of tank 4.

The roller assembly 30 can readily be removed from tank 4 by unscrewing screws 46 to disengage them from plates 6 and 7. After gear 52 has been pulled inwardly to retract shaft 48 from shaft 14, the roller assembly 30 can be freely lifted from tank 4.

It will be appreciated that the above described embodiment is by way of illustration and is not intended to be limiting.

What is claimed is:

1. A machine for passing sheet material through a liquid comprising:

a tank for containing a liquid,
a plurality of sets of spaced opposed upper and lower rollers mounted for rotation in the tank,
the rollers of each set being closely spaced but separated by a distance greater than the thickness of the sheet material,
and means to rotate the upper and lower rollers in opposite directions to cause a flow of liquid between each set of opposed upper and lower rollers to advance the sheet material through the tank.

2. A machine in accordance with claim 1 in which the sets of rollers form a path from a sheet inlet end of the tank to a sheet discharge end of the tank.

3. A machine in accordance with claim 2 having guide means adjacent the rollers at the sheet inlet end of the tank.

4. A machine in accordance with claim 2 having guide means adjacent the rollers at the sheet discharge end of the tank.

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5. A machine in accordance with claim 2 having guide means adjacent the rollers at the sheet inlet end of the tank and guide means adjacent the rollers at the sheet discharge end of the tank.

6. A machine in accordance with claim 1 in which the rollers are mounted for rotation in the tank on a frame removably secured in the tank.

7. A machine for passing sheet material through a liquid comprising:

a tank for containing a liquid,
a plurality of sets of spaced opposed upper and lower rollers mounted for rotation in the tank,
a gear secured to one end of each upper roller with the gears on adjacent upper rollers being at opposite ends,
a gear secured to the end of each lower roller which is opposed to a gearless end of said upper roller, the gears secured to the lower rollers meshing with the adjacent gears on the upper rollers,
means to drive said gears to cause the rotation of said upper and lower rollers in opposite directions to cause the flow of liquid between each set of opposed upper and lower rollers to provide a current of liquid to advance the sheet material through the tank.

8. A machine in accordance with claim 7 in which the sets of rollers form a path from a sheet inlet end of the tank to a sheet discharge end of the tank.

9. A machine in accordance with claim 8 having guide the sets of rollers form a path from a sheet inlet end of tank.

10. A machine in accordance with claim 8 having guide means adjacent the rollers at the sheet discharge end of the tank.

11. A machine in accordance with claim 8 having guide means adjacent the rollers at the sheet inlet end of the tank and guide means adjacent the rollers at the sheet discharge end of the tank.

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