Aug. 23, 1960 T. F. ARONSON ET AL 2,949,839

PROCESSOR FOR PHOTOGRAPHIC PAPER

Filed Jan. 6, 1958

4 Sheets-Sheet 1

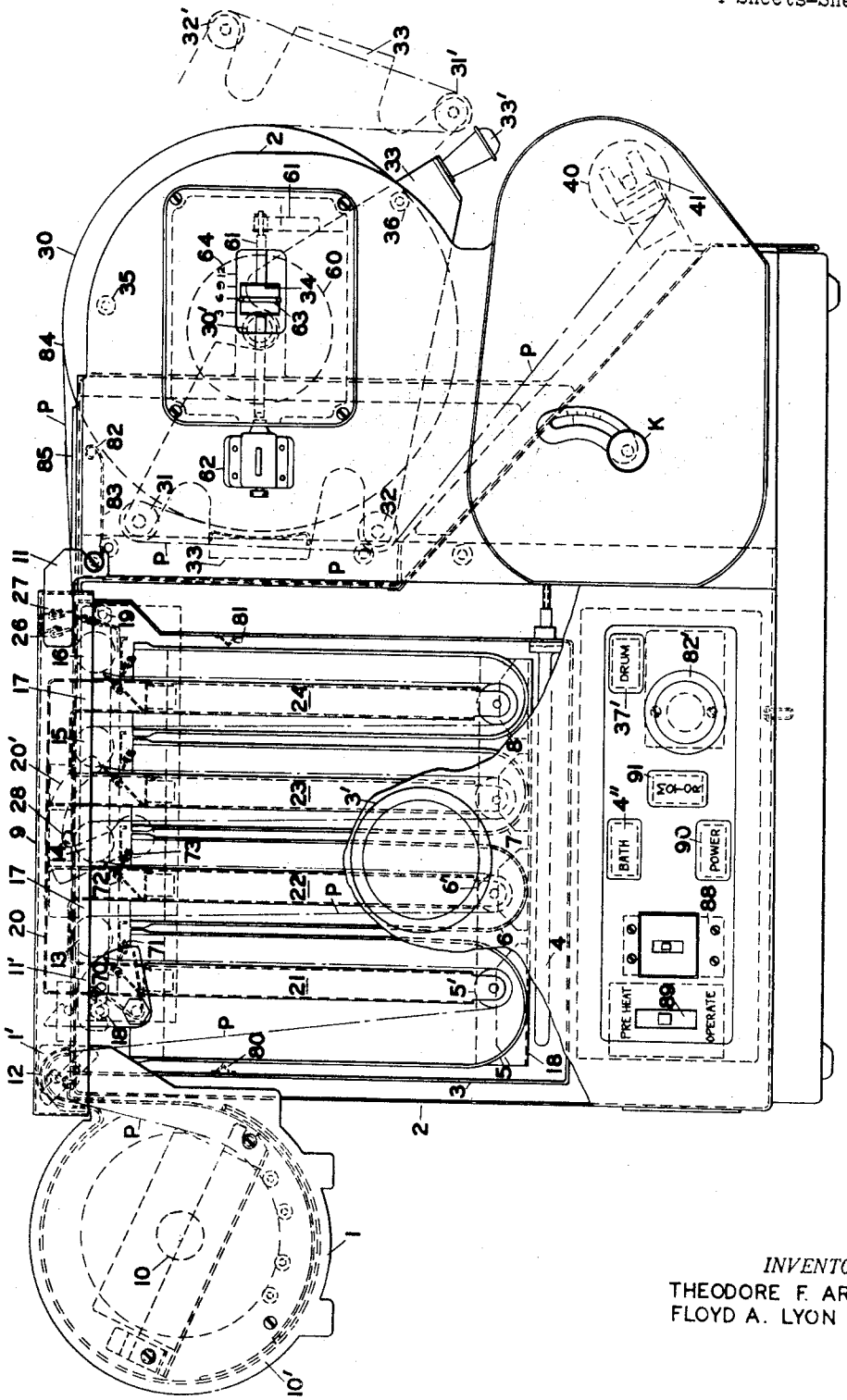



FIG. 1

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4 Sheets-Sheet 2

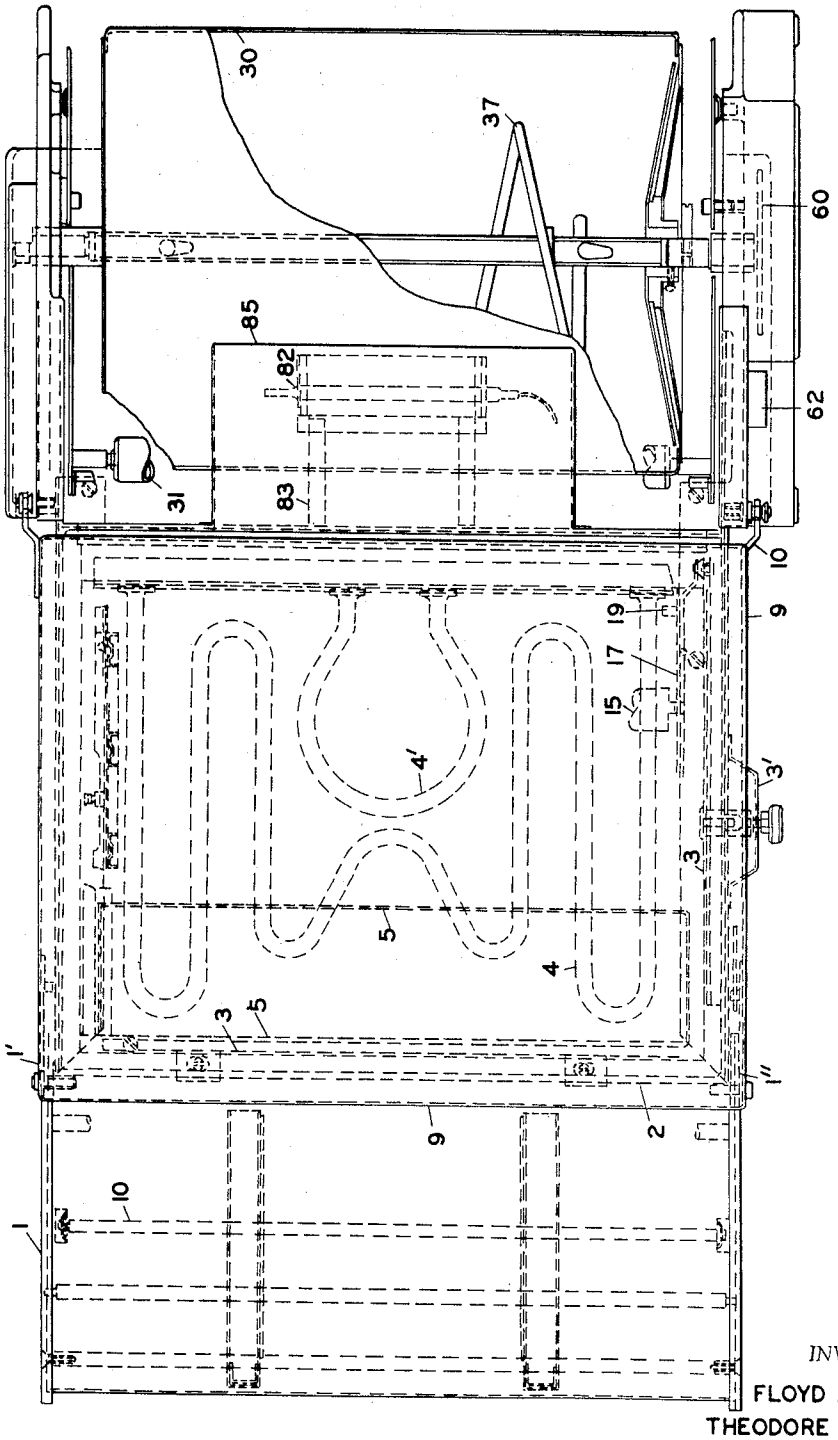



FIG. 2

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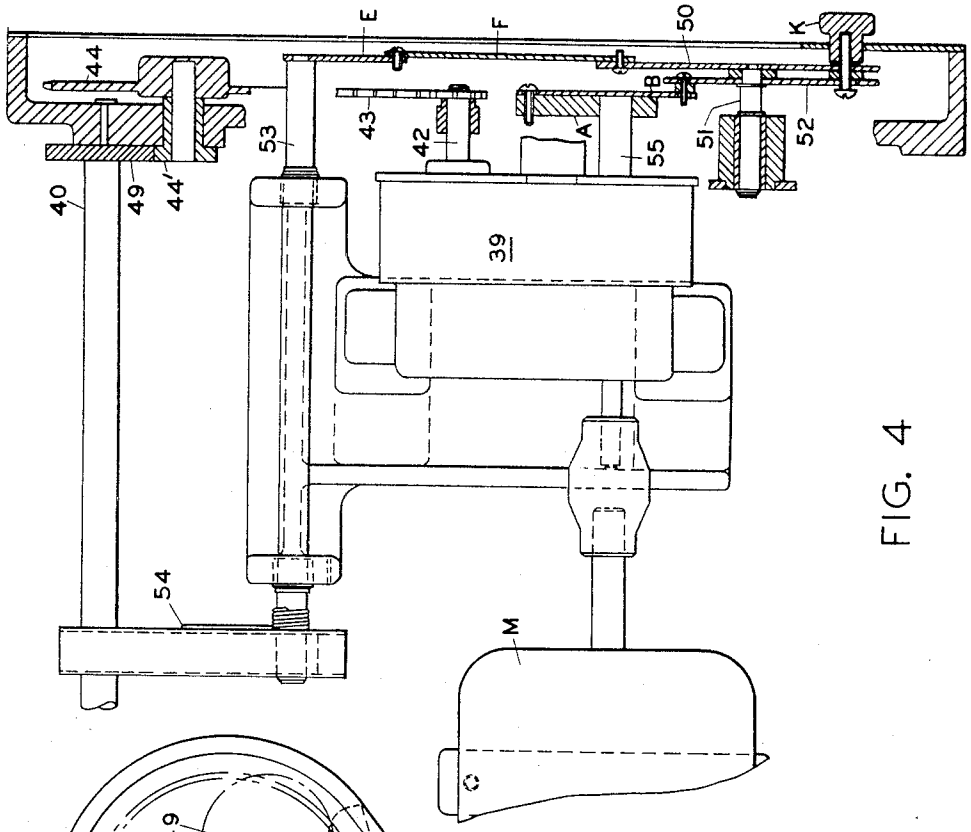



FIG. 4

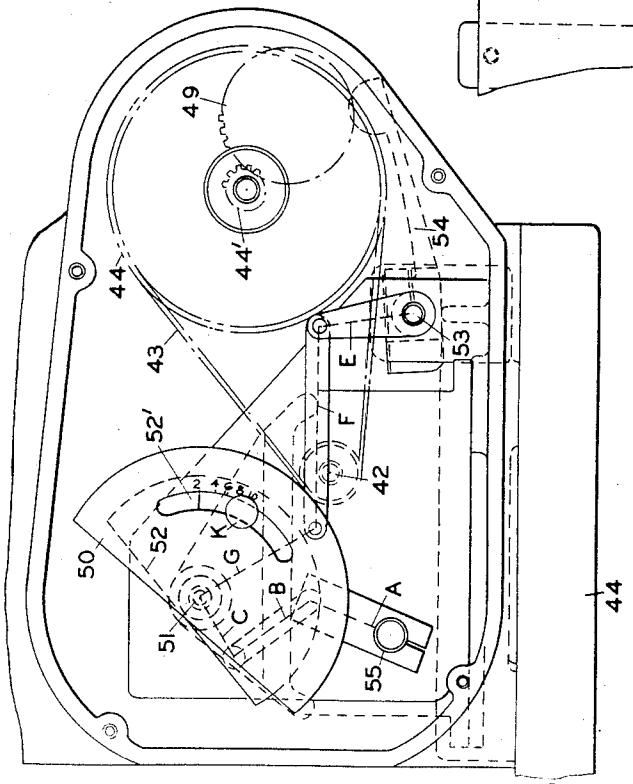



FIG. 3

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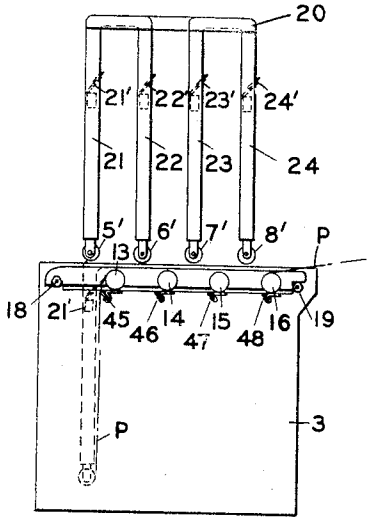



FIG. 5

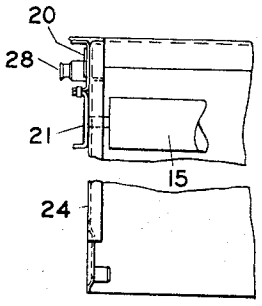



FIG. 5A

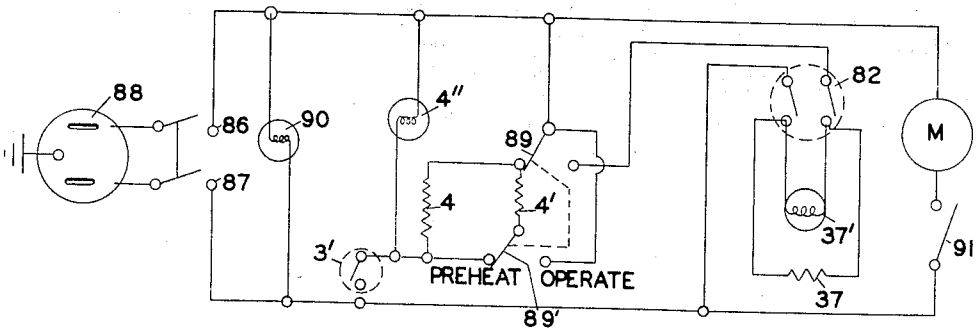



FIG. 6

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United States Patent Office 2,949,839 Patented Aug. 23, 1960



2,949,839

# PROCESSOR FOR PHOTOGRAPHIC PAPER

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6 Claims. (Cl. 95—89)

This invention relates to means for processing photographic paper in a continuous manner. More particularly the invention relates to means for developing and drying photographic paper of the type used in oscillographic recording cameras.

The photographic paper which is processed by the present invention normally comes in rolls of about 250 feet in length and 10 or 12 inches in width. Conventional apparatus generally comprises a paper magazine, a series of baths, namely developing, stopping, and fixing or stabilizing baths. Separate tanks are provided for each bath and all tanks are set in a large temperature controlled bath. Rollers are provided to guide the paper through the baths, and a heated drying drum is provided. Temperature controls are provided for the bath and the drum.

In the present invention in order to provide constant linear speed through the baths, a novel speed control logarithmic linkage is provided which changes the speed as the thickness of the takeup roller increases. Another novel feature is a square footage indicator to measure the use of the chemicals which automatically indicates the number of square feet passed through the chemical baths. A linear footage indicator is not too satisfactory as the rolls have different widths. Novel thermostatic means are also provided for controlling the bath temperature and also the drying drum temperature, as well as novel features permitting easy locking and handling.

Accordingly, a principal object of the invention is to provide new and improved photographic processing means.

Another object of the invention is to provide new and improved photographic processing means including square footage counting means.

Another object of the invention is to provide new and improved photographic processing means including square footage counting means and speed regulator means.

Another object of the invention is to provide new and improved photographic processing means including square footage counting means, speed regulator means and temperature control for processing and drying.

Another object of the invention is to provide new and improved photographic processing means which is easy to load.

Another object of the invention is to provide new and improved photographic processing means including means to eliminate wrinkling of the photographic paper.

These and other objects of the invention will become apparent from the following specification and drawings, of which:

Figure 1 is a side view partially in section of an embodiment of the invention.

Figure 2 is a plan view partially in section of the embodiment of Figure 1.

Figure 3 is a detail view of the speed regulating means.

Figure 4 is a plan schematic view of the speed regulating means.

Figures 5 and 5A are side views illustrating operation of the removable upper and lower roller assemblies, and Figure 6 is a schematic electrical diagram.



Referring to Figures 1 and 2, the processor generally comprises a magazine **1** for undeveloped paper or film, a main casing **2** which includes a large tank **3**, the contents of which are temperature controlled by means of the heater **4**. The large tank **3** contains four smaller tanks **5**, **6**, **7**, and **8**, which are removable. The first tank **5** is adapted to contain a developing solution, the second tank **6** a stopping solution, and the third and fourth tanks **7** and **8** fixing or stabilizing solutions. The small tanks rest on the shelf **18** of tank **3** on bases attached to each tank. The magazine **1** is removably mounted on the main casing **2** by means of brackets **1'** and **1''** which latch on pins on the end of the casing **2**. The magazine **1** contains spindle holding means **10** and bottom rollers for rotatably mounting a spindle containing the undeveloped paper. The paper P is led out of the magazine around the guide **12** down into the first tank **5** around the lower roller **5'**, then around the upper roller **13**, then down into the second tank around roller **6'**, then up around upper roller **14** and into the third tank down around lower roller **7'**, up around upper roller **15**, down into the fourth tank around roller **8'** and up around upper roller **16**. All of the rollers described are idler rollers. A cover **9** for the tanks is fastened in place by hook **11** and latch **11'**.

*Upper roller assembly*

The upper roller assembly, see Figures 5 and 5A, consisting of rollers **13**, **14**, **15**, and **16**, is mounted in removable parallel bracket **17** and a corresponding bracket on the other side. The bracket **17** sets on pins **18** and **19** connected to case **2** and is removable from the main tank **3** in order to remove the separate tanks and to clean the apparatus.

*Lower roller assembly*

The lower roller assembly, see Figure 5, is also removable and comprises the rollers **5'**, **6'**, **7'**, and **8'**, which are mounted on a bracket **20** and a corresponding bracket on the other side by means of long finger members **21**, **22**, **23**, and **24**. Bracket **20** is latched into place on top of bracket **17** by latch **20'** mounted on case **2** which engages a pin **28** on bracket **20**. There is a corresponding latch and pin on the other side. The lower roller assembly is removable in order to clean the apparatus and also in order to easily thread the paper. In threading, Figure 5, the lower roller assembly is removed, the paper P is led over the upper roller assembly and the lower roller assembly is then pressed down, bending the paper around the respective rollers as shown in Figure 1. Figure 5 shows the position of the rollers just before pressing the lower roller assembly down. All of the roller assemblies and tanks are preferably made of stainless steel or other non-corrosive chemically resistant material. The apparatus thus far described is conventional.

Drying wipers **21'**, **22'**, **23'** and **24'** for the paper are mounted on the fingers **21**, **22**, **23** and **24**. Corresponding wipers **45**, **46**, **47** and **48** are mounted on bracket **17**. Note that the wipers tend to bend the paper around them for maximum wiping action with the least amount of drag and tension which causes wrinkles. None of the wipers presses against a roller.

*The drying drum*

The paper is led from the tank **8** past wipers **26**, **27** mounted on the cover and around the large drum **30** which is rotatably mounted in the frame **2** by means of the shaft **30'** which is an idler drum. In order to achieve the maximum drying, the paper is wrapped around approximately 330° of the drum by means of the guide rollers **31** and **32**. They are mounted on a bracket **33** which is pivotally mounted on the frame at the point **34**

which is off center from the shaft **30'** of the drum. The bracket **33** may be rotated by means of the handle **33'** to place the guide rollers **31** and **32** into threading position shown by the dotted lines **31'** and **32'**. When the guide rollers are in threading position, the paper is led down between the rollers and the drum; and the bracket **33** is then rotated around to operate position as shown in Figure 1. This greatly simplifies the threading procedure. The bracket **33** is mounted off center at **34** to provide a greater spacing for threading the paper, and is held in "load" position by suitable detent or latch means **35** and in operating position by suitable detent or latch means **36**. The drum is heated by a spiral heating element **37** shown in Figure 2. The paper is then led to the takeup drive roller **40** which is mounted on brackets **41** connected to the main frame. All the pulling power is applied to the roller **40**.

*Speed control*

One of the primary problems in processing of this type is to maintain a constant linear speed through the chemical baths. This is complicated by the fact that it is difficult to measure the speed, especially since the input and output rollers have variable radii and variable loads as the paper is wound from one to the other. In general the speed of the takeup roller **40** which supplies all the pull to the paper is controlled through a variable speed mechanism which, in turn, is controlled by a preset speed logarithmic dial, and a logarithmic linkage applies a correction proportionally to the thickness of the roll of paper on the takeup roller.

More specifically referring to Figures 3 and 4, the power is supplied by a constant speed motor M through a variable speed transmission **39**, the output shaft **42** of which is connected by a chain **43**, sprocket **44**, and gears **44'** and **49** to the output roller **40**. The speed is set in by moving an index **52'** on inner dial **52** relative an outer dial **50**, which has a logarithmic scale calibrated in feet per minute, and clamping the dials together with knob K. The inner dial is rotatably mounted on a shaft **51** and is moved with respect to the outer dial **50** which is also pivotally mounted on the same shaft **51**. Figure 4 is not a true sectional view of Figure 3 but is an expanded view, the lower portion being a section folded out. The correct speed=pre-set speed×diameter correction factor.

The outer dial is pivotally connected by means of a linkage arm F and a linkage arm E pivotally connected thereto and which is pivotally mounted to the frame on the shaft **53**. Fixedly connected to the arm E is a pickup lever **54** which is spring loaded against the paper on the takeup roller **40**. Therefore, as the radius of the paper on the takeup roller increases, the pickup arm **54** is rotated clockwise about the axis of shaft **53**, which motion is transmitted to the outer dial **50**.

The three members E, F, and G, which is shown by the dotted line across the outer dial **50**, constitute a logarithmic linkage of the type described in Svoboda Patent No. 2,328,306. In other words, the dimensions of the respective members are such that a rotational movement of the pickup arm **54** produces a rotation of the clamped dials which is the logarithm of the rotation of the pickup member. This logarithmic movement is added to the pre-set speed as set on the logarithmic scale on the outer dial **50**.

The anti-logarithm of the dial movement is applied to the control shaft **55** of the variable speed transmission by means of another logarithmic linkage comprising member A fixedly connected to the shaft **55**, member B pivotally connected to the member A at one end and pivotally connected to the inner dial **52** at its other end. The third portion of the linkage is a part of the inner dial shown by the dotted line C. Therefore, the motion applied to the control arm **55** of the variable speed transmission **41** is the product of the pre-set speed and the correction of the pickup **54**. The operation of this type linkage is fully described in the above mentioned patent and rests upon the choosing of the length of the three linkage members in a predetermined ratio so that the output movement is a logarithm of the input movement or vice versa. The present linkage system is an improvement over the alternate method of using cams which are complicated and expensive.

*Square footage counter*

It is important to count the square footage of the paper being processed since the chemicals wear out according to the film area developed. Linear footage measurement is not sufficient since various width rolls of film or paper may be used in sequence. The square footage counter generally comprises a disc **60**, Figure 1, which is fixedly mounted to the drum **30** shaft. A mechanical revolution counter **62** is fixedly mounted on the outer casing **2** and is connected to a keyed shaft **61**. A friction wheel **63** is slidably mounted on the shaft **61**, and the shaft **61** is spring loaded by the spring **61'** so that the wheel bears against the disc **60**. The wheel is adapted to be moved along the shaft **61** and is set in position against a calibrated scale **64** which is calibrated according to the width of the paper roller. Therefore, for paper of greater width, the wheel is set on a larger radius of the disc **60** and will provide more revolutions of the shaft **61** so that the counter **62** will actually indicate square footage of paper processed since the chemicals were changed.

*Thermostatic control*

The drum temperature is controlled by means of a bulb type thermostat **82**, Figures 1 and 2, which is mounted on a bracket **83** and which is positioned close to or touching the drum **30** and which extends along a substantial portion of said drum. The thermostat is the capillary type commercially available which is a sealed metal casing or bulb connected to a remote adjustable contact system **82'** mounted on the control panel. It can withstand the steam and chemical fumes which are very thick at this point adjacent which the wet paper first contacts the hot roller at the point **84**.

A metal cover member **85** is provided which prevents drippings and steam from the wet paper contacting the thermostat and the dry paper on the roller **31**. The paper is being pullled with considerable force, for instance, 5 or 10 pounds, and there is, therefore, considerable tension on the paper which tends to cause wrinkling. It has been found that the construction and location of the cover **85** properly distributes the steam generated at the point **84** in a manner to minimize this wrinkling. This is an important feature since if the wrinkles are not removed before contact of the paper on the hot drum, the wrinkles will be permanently pressed into the paper.

All of the chemical tanks are set in a large tank **3** which is filled with water which is heated to a predetermined temperature by means of the heater coils **4** and **4'**. The heating of the tank **3** is controlled by means of the conventional adjustable thermostat **3'**, Figure 1, which is mounted on the wall of the tank **3** at about one-third of the height of the tank. It has been found that this location of the thermostat is an optimum location for stabilizing the temperature in the tank **3**.

The tanks themselves are spaced by means of the spacers **80** and **81** connected to the large tank **3** and by means of the enlarged lips of the smaller tanks.

Figure 6 shows a schematic circuit diagram. Power is applied on the terminals **86** and **87**. The power is applied by manually closing the circuit breaker **88**, or a separate "on-off" switch may be used. The circuit through the bath heater **4**, **4'** is completed from one side of the line through the thermostat **3'**, heaters **4** and **4'**, the "operate" position of the switch **89**, **89'** to the other side of the line. In the "preheat" position of switch **89**, **89'**, the heaters **4** and **4'** are in parallel. Neon indicator

light 4'' lights when the bath heater is on due to voltage developed across the heaters.

The circuit through the drum heater **37** is from one side of the line through operate position of switch **89**, through thermostat **82** to the other side of the line. The indicator light **37'** lights when the drum heater is on. Power indicator light **90** lights when the power is on. The motor M is operated by the switch **91** which connects it across the line.

*Operation*

The unexposed paper is loaded in the magazine **1** in a dark room. The magazine is then closed and hooked onto the casing **2**. The magazine may be of the type having a sliding cover **10'**. Assuming the tanks are filled and the upper roller assembly in place and the lower roller assembly removed, the paper is led from the magazine across the top of the upper roller assembly over the drum **30** and underneath the guide rollers **31** and **32** which are in the "load" position. Sufficient unexposed paper at the leading end is required in order to thread the machine. If there is not sufficient unexposed paper, a leader should be spliced on in a dark room.

The lower roller assembly is then pressed into position, cover **9** is closed, and the paper is affixed to the takeup roller **40** in conventional manner and the guide roller bracket **33** rotated around to "operate" position as shown in Figure 1. While the paper is being threaded, the bath and drum may be preheated by turning on the electrical power and the switch **89** to preheat position. Switch **89** should then be turned to "operate" position, and the indicator lights on the heaters observed until they go on and off several times indicating that the thermostats are stabilizing the temperatures at the proper values. Then the motor speed is adjusted with knob K, and the motor switch **91** may be turned on to initiate movement of the paper.

We claim:

1. In a photographic processor for strip material of the type having a magazine, a plurality of heated tanks for developing said strip material, a heated drum for drying, and drive means for moving said material through said tanks and over said drum: means to measure the use of chemicals in said tanks, a square footage counter for said material comprising a disc connected to said drum, a keyed shaft mounted perpendicular said disc and spring loaded toward said disc, a wheel slidably mounted on said shaft, a rotation counter connected to said shaft, and dial means adjacent said wheel for setting said wheel for the width of the material being used.

2. In a photographic processor for strip material of the type having a magazine, a plurality of heated tanks for developing said strip material, a heated drum for drying, and motor means for moving said material through said tanks and over said drum: means to measure the use of chemicals in said tanks comprising a square footage counter for said material connected to said drum, and means to maintain constant linear speed of said material including logarithmic linkage means actuated by the output roll of said material and variable speed drive means connected to control the speed of said material.

3. In a photographic processor for strip material of the type having a magazine, a plurality of heated tanks for developing said strip material, a heated drum for drying, and motor means for moving said material through said tanks and over said drum: means to measure the use of chemicals in said tanks comprising a square footage counter for said material connected to said drum, means to maintain constant linear speed of said material including logarithmic linkage means actuated by the output roll of said material and connected to control the speed of said material, and thermostat means for controlling the temperature of said drum comprising a long thing thermostat mounted adjacent the surface of said drum, said thermostat being sealed in a bulb, said thermostat being connected to control the heating of said drum.

4. In a photographic processor for strip material of the type having a magazine, a plurality of heated tanks for developing said strip material, a heated drum for drying, and motor means for moving said material through said tanks and over said drum: means for measuring the use of chemicals in said tanks, a square footage counter for said material comprising a disc connected to said drum, a keyed shaft mounted perpendicular said disc and spring loaded toward said disc, a wheel slidably mounted on said shaft, a rotation counter connected to said shaft, and dial means adjacent said wheel for setting said wheel for the width of the material being used; and means to maintain constant linear speed of said material including logarithmic linkage means actuated by the output roll of said material and connected to control the speed of said material.

5. In a photographic processor for strip material of the type having a magazine, a plurality of heated tanks for developing said strip material, a heated drum for drying, and motor means for moving said material through said tanks and over said drum: means for measuring the use of chemicals in said tanks, a square footage counter for said material comprising a disc connected to said drum, a keyed shaft mounted perpendicular said disc and spring loaded toward said disc, a wheel slidably mounted on said shaft, a rotation counter connected to said shaft, and dial means adjacent said wheel for setting said wheel for the width of the material being used; means to maintain constant linear speed of said material including logarithmic linkage means actuated by the output roll of said material and connected to control the speed of said material, and thermostat means for controlling the temperature of said drum comprising a long thin thermostat mounted adjacent the surface of said drum, said thermostat being sealed in a bulb, said thermostat being connected to control the heating of said drum.

6. In apparatus of the type processing strip material through a liquid bath and then substantially around a drying drum, means to minimize wrinkles in said strip comprising a shield mounted on the frame of said apparatus placed under the wet strip just before it comes in contact with said drying drum said shield extending substantially across the portion of said drum normally used to thereby separate and insulate said wet strip from contact with steam rising from the side of drum.

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