Dec. 3, 1968 M. FRIEDEL 3,413,904

FILM PROCESSOR

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FIG. 1

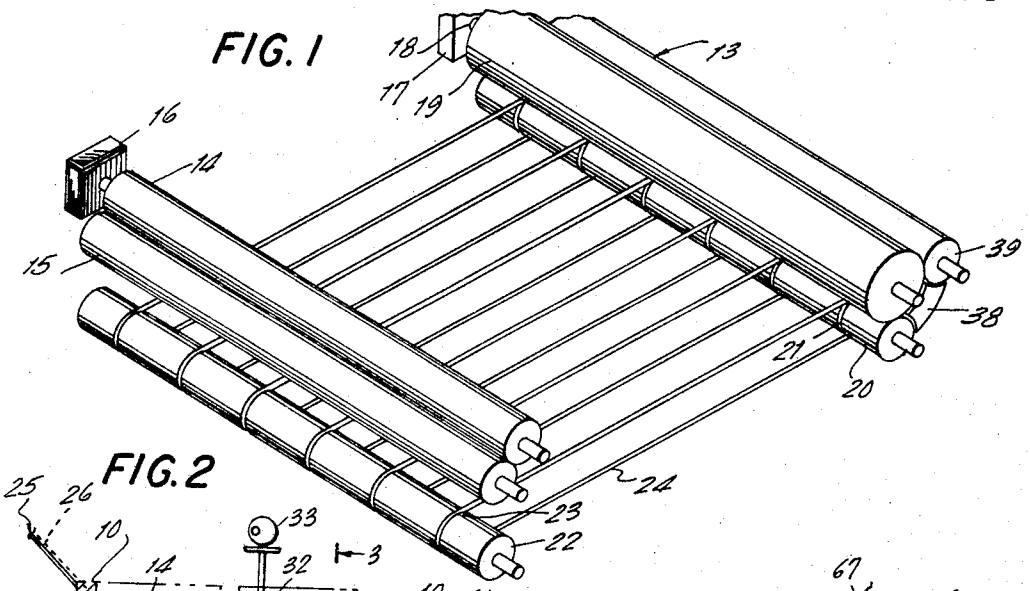


FIG. 2

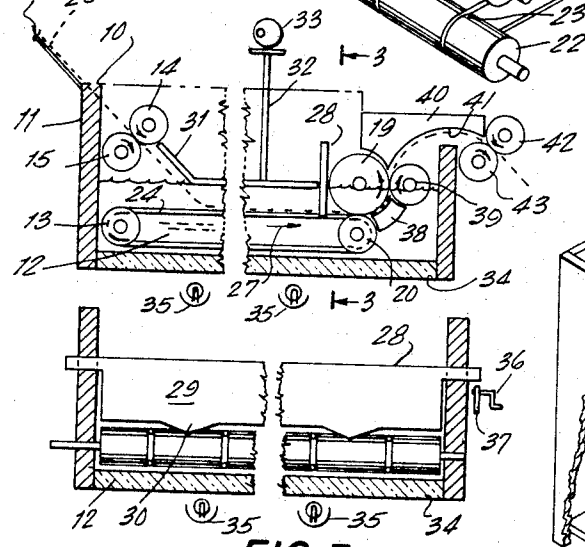


FIG. 3

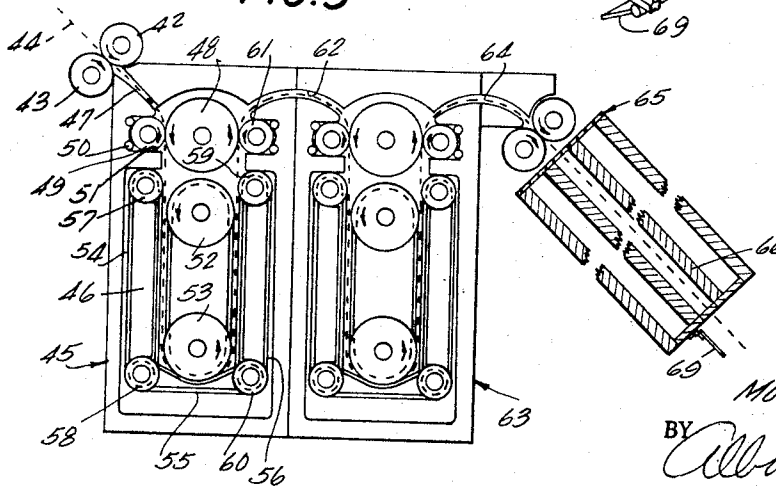


FIG. 4

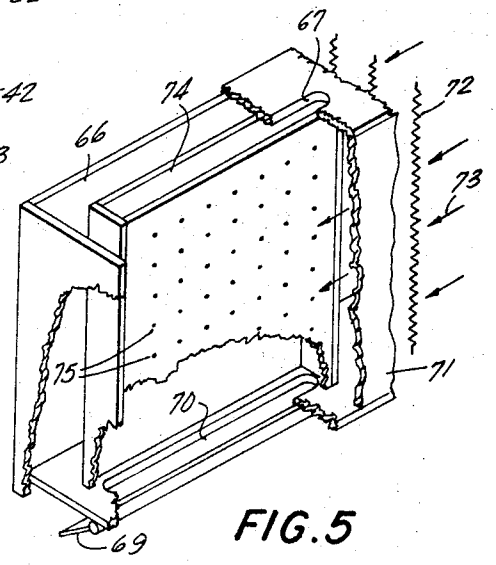


FIG. 5

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FIG. 6

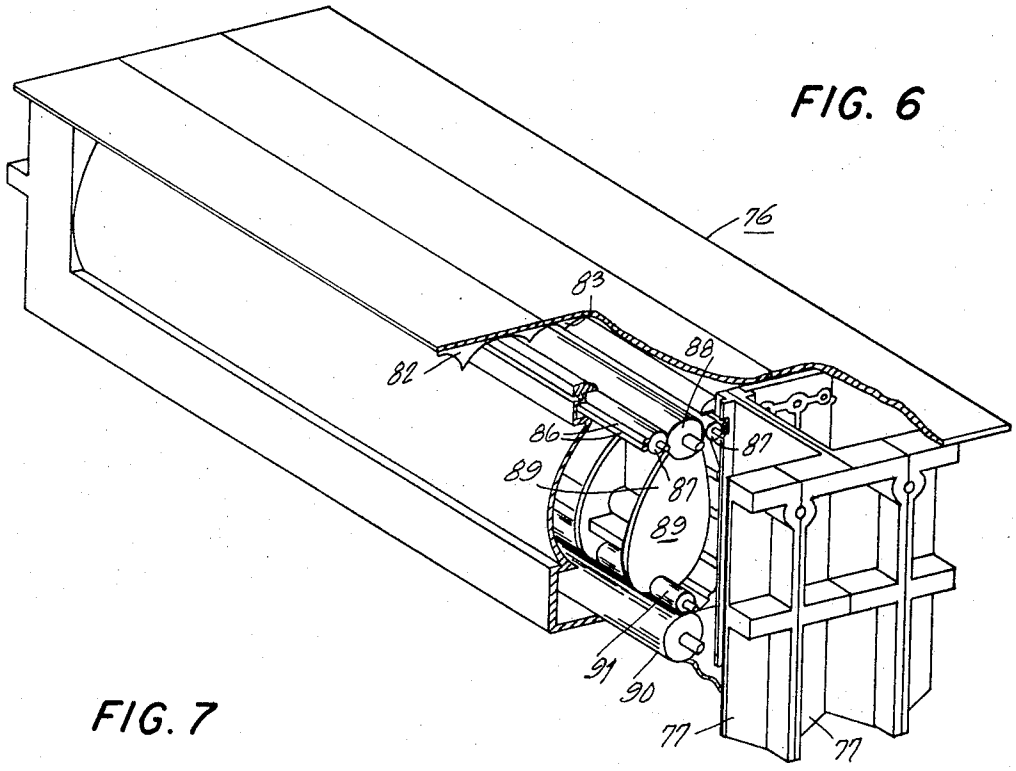


FIG. 7

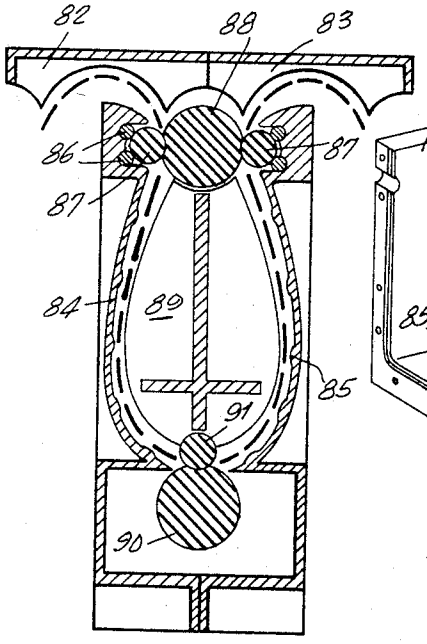
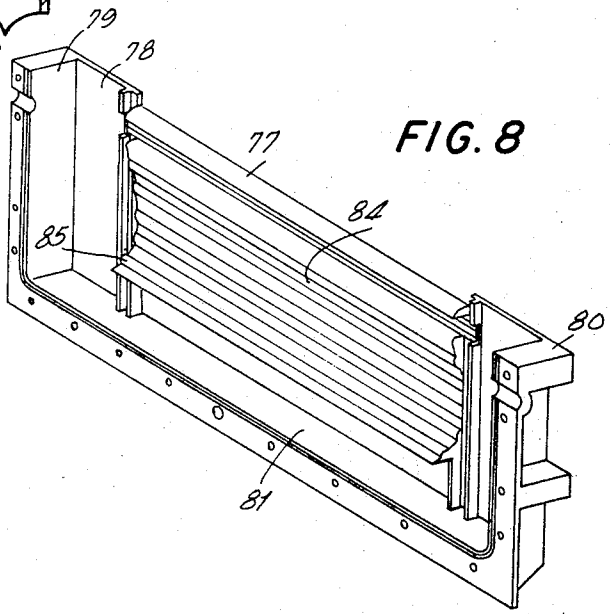


FIG. 8



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FILM PROCESSOR

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4 Claims. (Cl. 95—94)

ABSTRACT OF THE DISCLOSURE

A device for processing exposed photographic sheet material in which the material is led into a developing tank having a fluid tight transparent actinic light filtering material bottom. Transport belts within the tank lead the sheet material across the tank and a swingable dam holds the sheet material within the developing solution for the required interval of time. Release of the sheet material by the dam permits the transport belts to carry the developed sheet material out of the tank and into subsequent developing and drying chambers.

This invention relates to apparatus for processing photographic film, paper, and the like.

Where it is desired to process exposed photographic film or paper on a continuous basis, it is customary to employ deep tanks and a large number of rotating rollers to guide the sensitized material through the chemicals within the tanks. In addition to the tendency of the rollers to scratch the softened surface of the sensitized material, it is not possible with prior art devices to inspect the progress of the development once the paper or film enters the tanks.

Accordingly, it is an object of the present invention to provide an automatic processor for photographic film or paper which will greatly reduce the possibility of scratching of the sensitive surface.

Another object of the present invention is to provide an automatic photographic film processor in which the progress of film development can be observed and controlled.

A further object of the present invention is to provide a low cost, highly simplified automatic film processor.

Still another object of the present invention is to dry the developed film or paper in a blast of air while in a substantially unsupported state.

An object of the present invention is to reduce the time required for the processing of exposed sensitized film or paper.

A feature of the present invention is its use of belts moving within the solution within a developing tray to control the movement of the film being processed therein.

Another feature of the present invention is the use of a translucent or transparent developing tray to facilitate operation control.

A further feature of the present invention is the use of a floating guide member in the developing tray which also serves to agitate the solution therein.

Still another feature of the present invention is the use of a movable dam within the developing tray to control the time interval of development.

A feature of the present invention is its continuous transport of film or paper from one tank to another. Another feature of the present invention is its novel drying section for the developed sensitized material.

The invention consists of the construction, combination and arrangement of parts, as herein illustrated, described and claimed.

In the accompanying drawings, forming a part hereof, there is illustrated two forms of embodiment of the invention, in which drawings similar reference characters designate corresponding parts, and in which:

FIGURE 1 is a somewhat isometric view of the film advancing mechanism of a developing tray according to the present invention with certain parts omitted for the sake of clarity.

FIGURE 2 is a somewhat diagrammatic view in longitudinal section on a reduced scale of a film development tank employing the advancing mechanism of FIGURE 1.

FIGURE 3 is a sectional view taken on line 3—3 in FIGURE 2.

FIGURE 4 is a somewhat diagrammatic view in longitudinal section on a reduced scale of additional film processing tanks and a film drying section according to the present invention.

FIGURE 5 is a somewhat isometric view, partially broken away of the film drying section shown in FIGURE 4.

FIGURE 6 is a somewhat isometric view, partially broken away, of another form of film processor in accordance with the present invention.

FIGURE 7 is cross-sectional view taken on line 7—7 in FIGURE 6.

FIGURE 8 is a somewhat isometric view of one-half of the film processing tank shown in FIGURES 6 and 7.

Referring to the drawings and particularly FIGURES 1, 2 and 3, **10** indicates a film development apparatus comprising a tank **11**, to receive and hold developing fluid **12**.

A film or sensitized paper handling and transporting apparatus, best shown in FIGURE 1, is also carried within the tank **11**. The handling and transporting apparatus **13**, includes a first feed roller **14**, a second feed roller **15**, and a motor **16**, in driving engagement with the feed roller **14**.

A second motor **17** in the handling and transporting apparatus **13**, is coupled to the shaft **18**, of a squeegee **19**. The squeegee roller **19** is in frictional contact with a transport roller **20**, and serves to drive it by reason of said contact. The squeegee roller **19** is made of some elastomeric material such as neoprene, rubber, or the like, which also improves its ability to drive the transport roller **20**.

The transport roller **20** is provided with a series of spaced annular grooves **21**, along its entire length. A second transport roller **22** is carried within the tank **11**, and is spaced from the first transport roller **20** as shown in FIGURES 1 and 2. The second transport roller **22** is also provided with a series of spaced annular grooves along its length. A plurality of transport belts **24** in the form of continuous resilient members interconnect the transport rollers **20**, **22**, and are carried within each of the roller grooves **21**, **23**, in the manner shown in FIGURE 1. The transport belts **24** transmit the rotary motion of the first transport roller **20** to the second transport roller **22**. The transport belts **24** also set up slight eddy currents within the fluid **12** of the tank **11**, as they are driven by the rollers **20**.

As shown in FIGURE 2, photographic film or paper (not shown) is inserted into the device along a feed guide **25** and follows a path indicated by the dashed lines **26**. The paper moves into the bite of the feed rollers **14**, **15**, and is directed downwardly into the developing fluid **12** within the tank **11**. As the paper moves into the tank (emulsion side up) it comes into contact with the transport belts **24** which are being turned in the direction of the arrow **27**. The paper is thus carried toward the squeegee roller **19**. However, before the paper can reach the roller **19** it is intercepted by a stop or dam **28**, which is carried within the tank **11**, in front of the squeegee roller **19**. The stop or dam **28**, as best shown in FIGURE 3, consists of a plate-like member **29**, having downwardly

depending teeth **30**. The teeth **30** project into the path of the paper within the tank and prevent it from moving forward as long as the dam is in place.

The photographic paper or film is further led into the tank **11** by means of a guide plate **31**. The guide plate **31**, best shown in FIGURE 2, is preferably made of some transparent material such as Lucite, glass, or the like, and is disposed in a plane substantially parallel to and above the transport belts **24**. The guide plate **31** may be disposed upon the surface of the developing fluid **12**, or be slightly submerged. An arm **32** is secured to the guide plate **31**, and extends upwardly therefrom, out of the tank **11**. A cam **33**, in operative engagement with the top of the arm **32**, serves to raise and lower the guide plate **31** in response to a source of rotary power (not shown). In this manner, a slight agitation can be imparted to the fluid **12** within the tank. The agitation of the fluid can be controlled to meet the developing requirements of the processor.

The bottom of the tank **11** is made of a transparent material such as transparent acrylic, glass or the like. The bottom **34** of the tank **11** is also made with a red filtering material therein so that a light source indicated at **35**, can illuminate the interior of the tank **11** with a non-actinic illumination. As a result of this illumination, the operator can observe the progress of the development within the tank **11** as it is being carried on.

When the film or paper has been sufficiently developed, the dam **28** is lifted either manually by means of the small crank **36**, or automatically by means of the cams **37**, and some suitable power source (not shown). As the dam is raised, the transport belts **24** urge the film or paper into the bite between the squeegee roller **19**, and the transport roller **20**. The film is thus driven against the guide **38** which directs it upwardly between the squeegee roller **19** and a second squeegee roller **39**.

Since the operator can watch the progress of the development, he can shorten or lengthen the period during which the paper is within the tank as required. Once the optimum time and conditions have been established, the operator can put the processor on automatic operation.

As the film leaves the squeegee roller **19** it is directed against an upper guide member **40**. The guide member **40** has a curved surface **41** which directs the film into the bite between two rollers **42, 43**, which are located exterior of the tank **11**. The rollers **42, 43**, feed the film along the dooted path **44** shown in FIGURE 4, into a processing tank **45**. It is to be understood that the rollers **42, 43**, are driven by a suitable power source (not shown) which may also be used to drive the rollers in the processing tank **45**.

The processing tank **45** may contain a fixative solution **46**, for the further processing of the film or paper as it passes therethrough. The film enters the processing tank **45** through a guide slot **47**, and is led into the bite between a drive roller **48** and an idler roller **49**. The idler roller is rotatably supported upon small Teflon rollers **50**, to minimize friction. The idler roller is further carried within a small recess **51** in the wall of the tank **45** as shown in FIGURE 4. A second and third drive roller **52, 53**, are carried within the tank **45** and are in frictional contact with a plurality of drive belts **54, 55, 56**. The drive belts **54, 55** and **56** are carried in annular grooves (not shown) in the spaced transport rollers **57, 58, 59, 60**, within the processing tank **45**. As shown in FIGURE 4, the paper or film is led down into the space between the drive rollers **52, 53**, and the drive belts **54, 55, 56**, which drive the paper through the tank and into the bite between idler roller **61** and drive roller **48**.

The paper or film is then led out of the processing tank **45** along guide **62** and into a second identical processing tank **63**. The second processing tank may contain a stop solution to complete the processing of the photographic film or paper.

The paper or film leaves the processing tank **63** by means of guide **64** and is led into a drying apparatus indicated at **65**.

The drying apparatus **65** (best shown in FIGURE 5) is built within a hollow box-like plenum chamber **66**. A slot **67** is provided in the top of the chamber **66** through which the paper or film is fed. The bottom **68** of the plenum **66** is formed with a flap member **69**, which is swyingably mounted over a bottom slot **70**. The flap **69** holds the paper within the drying apparatus until the drying process is completed. Therefater, the flap **69** can be swung away from the flap **70** to permit the paper to slide out of the drying apparatus **65**. One side of the drying apparatus **65** is opened as indicated at **71**, to receive air heated by the resistance element **72**, coming from a blower (not shown) and indicated by the arrows **73**. The air enters the plenum **66** on both sides of a flattened box-like holder **74**. The holder **74** is in register with the slots **67, 70**, so that the paper can slide into and out of the holder **74** through the said slots. The side walls of the holder **74** are perforated as indicated at **75** to permit the warm air to reach the film or paper therein. Since theair comes through the holder **74** from both sides thereof, the paper is substantially held in space free of iontact with the walls of the holder **74**. In this manner, the paper quickly dries without danger of scratching or damaging the softened emulsion face thereof.

At the end of the necessary time for drying the paper, the flap **69** is swung away and the paper emerges in a finished state from the apparatus.

Referring to FIGURES 6, 7 and 8, there is shown another processing tank **76**, made in accordance with the present invention. The tank **76**, is built within two tank halves **77**, best shown in FIGURE 8. The tank halves **77** are preferably molded of some suitable plastic and are made with left and right hand sections which can be bolted together or cemented together to form a fluid tight enclosure. Each of the tank halves consist of a side wall **78**, end walls **79, 80**, and a bottom **81**. The tops of the tank are open and adapted to be overlain by cover members **82, 83**, for the purpose of guiding the film or paper into and out of the processing tank. It will be apparent from an examination of FIGURES 6 and 7, that a series of tanks may be assembled in side-by-side relationship to handle a succession of processing steps.

Each of the tank halves **77** is provided with a curve wall portion **84**, into which there is molded a plurality of horizontal ribs **85**. The upper end of the wall portion **84** serves to support Teflon rollers **86**, upon which spaced idler rollers **87** rotate. The idler rollers **87** are in the frictional contact with a drive roller **88**, and the said rollers **87, 88**, serve to substantially close the top of the processing tank **76**.

A series of baffle plates **89** are carried within the processing tanks transversely thereof, and serve to guide the paper in its passage through the fluid within the tanks. A second drive roller **90** is disposed at the bottom of the processing tank **76**, and is in frictional contact with an idler roller **91**. The nip of the idler roller **91** and the second drive roller **90** lies in the path of the paper as it passes through the processing tank **76**. Power for the drive rollers **88, 90**, can be supplied from any suitable source (not shown) in the manner well known in the art.

As the paper enters the processing tank **76**, it is led by the guide member **82** into the nip of the rollers **86, 88**. The drive roller **88** is made of a relatively soft elastomer as compared with the material forming the idler roller. As the result of this difference in hardness, the idler roller presses into the surface of the drive roller **88** and the paper or film is slightly bent in the direction of the wall **84** as it emerges into the interior of the processing tank **76**. This operation is further enhanced by making the diameter of the drive roller **88** somewhat larger than that of the idler roller **87**.

The chamber walls **84** direct the paper down into the nip of the lower rollers **90, 91**. Here again, a hardness

differential is employed between the lower drive roller **90** and the lower idler roller **91** whereby the paper is bent and rises upwardly along the walls **84** and into the nip of the drive roller **88** and idler roller **87**. The paper then leaves the processing tank under the direction of the guide **83** and passes to the next processing step.

From the foregoing it will be seen that there has been provided apparatus for handling and processing photographic paper or film which assure the minimum of injury to the sensitive surface and provides substantially automatic processing and drying of the photographic material.

Having thus fully described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States, is:

1. A device for processing exposed photographic sheet material comprising a first developing tank to receive a quantity of developing fluid, said tank having spaced side walls, spaced end walls and a fluid tight bottom, horizontally spaced parallel transport roller members in the tank below the fluid level, a series of spaced belts horizontally interconnecting the transport rollers, a source of rotary power for at least one of said transport rollers, guide means within the tank to lead the sheet material into the fluid and into contact with the belts, a dam swingably carried within the tank overlying the transport belts and in the path of the sheet material to limit the travel of the sheet material, means to remove the dam from the path of the sheet material to release the sheet material, guide means to lead the released sheet material out of the first tank, a second developing tank adjacent the first tank to receive developing fluid, means to guide the sheet material into the second tank, drive means within the second tank to pass the sheet material therethrough, a dryer for the sheet material adjacent the second tank, means to lead the sheet material from the second tank into the drier

and means to remove the dried sheet material from th drier.

2. A device according to claim **1** in which the first tan guide means includes a plate overlying the transport bel and in contact with the fluid and means to reciprocat the plate to agitate the fluid.

3. A device according to claim **2** in which the plat is made of a transparent material, and the bottom of th first tank is made of a transparent actinic light filterin material whereby light entering the first tank will il luminate the sheet material without affecting the develop ment thereof.

4. Apparatus according to claim **1** in which the guid means is a plate made of a transparent material, an the bottom of the first tank is made of a transparent actini light filtering material whereby light entering the firs tank will illuminate the sheet material without affectin the development thereof.

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