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Schwartz

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[54] **MEANS AND METHOD FOR TRANSPORTING A PHOTOGRAPHIC STRIP**

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[52] **U.S. Cl.** **226/5,** 226/93, 156/584, 226/170, 156/324, 156/344, 156/554

[51] **Int. Cl.** **B65h 17/28**

[58] **Field of Search**.....226/5, 96, 93, 172; 156/324, 344, 554, 584

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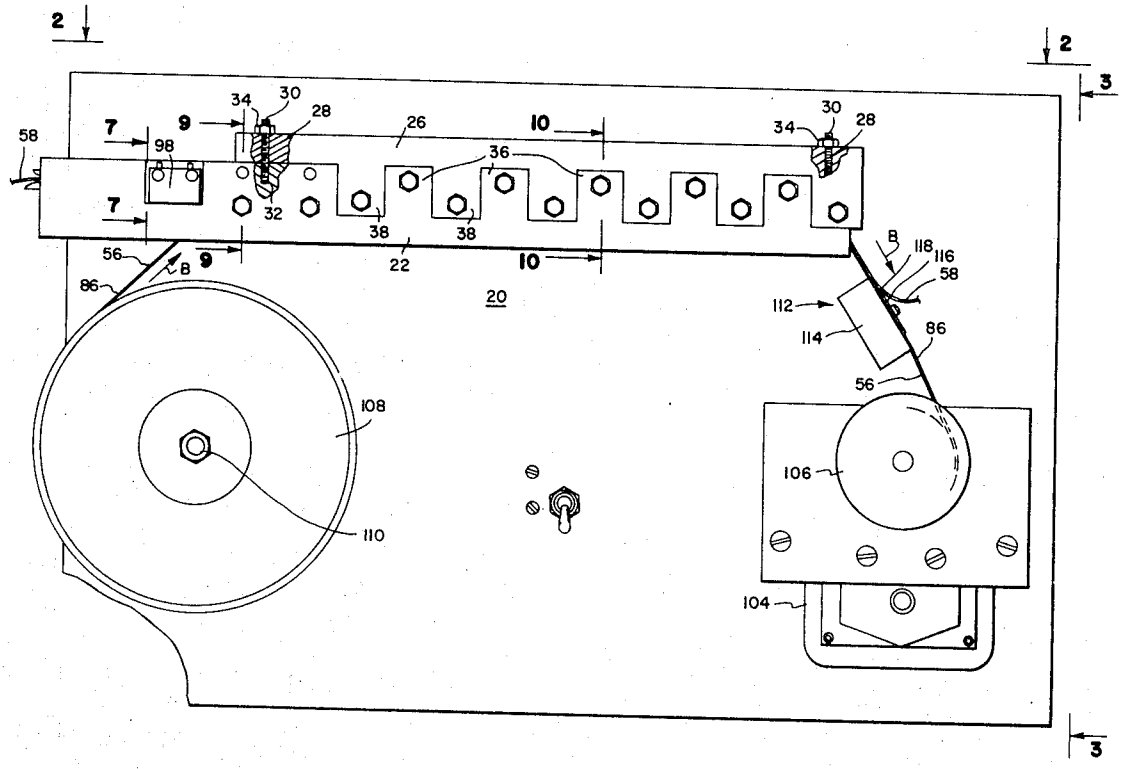
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[57] **ABSTRACT**

A means and method for transporting a photographic section of material by securing tape to a marginal edge of said material and applying tension to the tape for pulling said section through a processing area from a first position to a second position; and means for separating said section from said tape after said tape has pulled said section through said processing area.

16 Claims, 10 Drawing Figures



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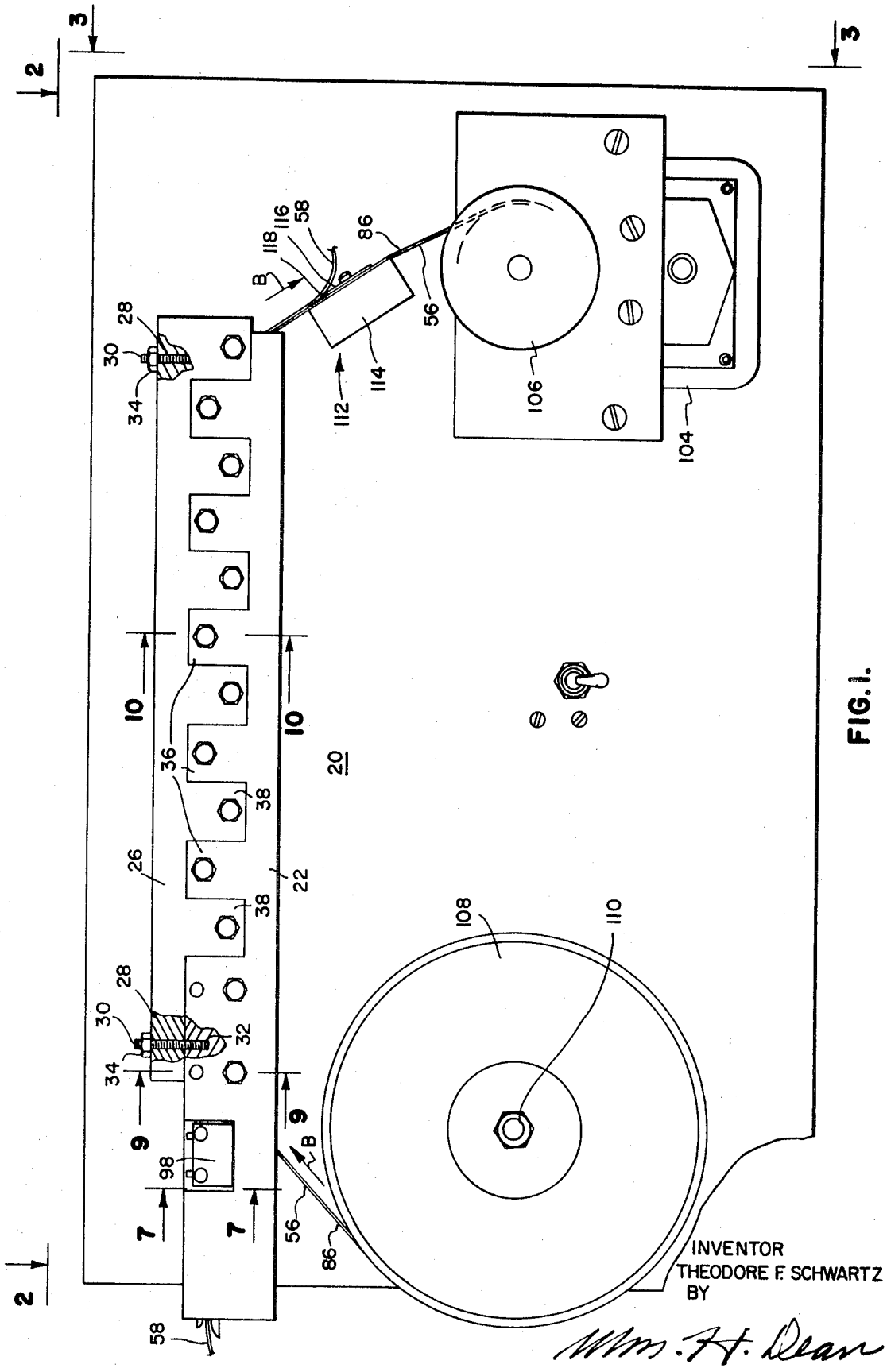


FIG. 1.

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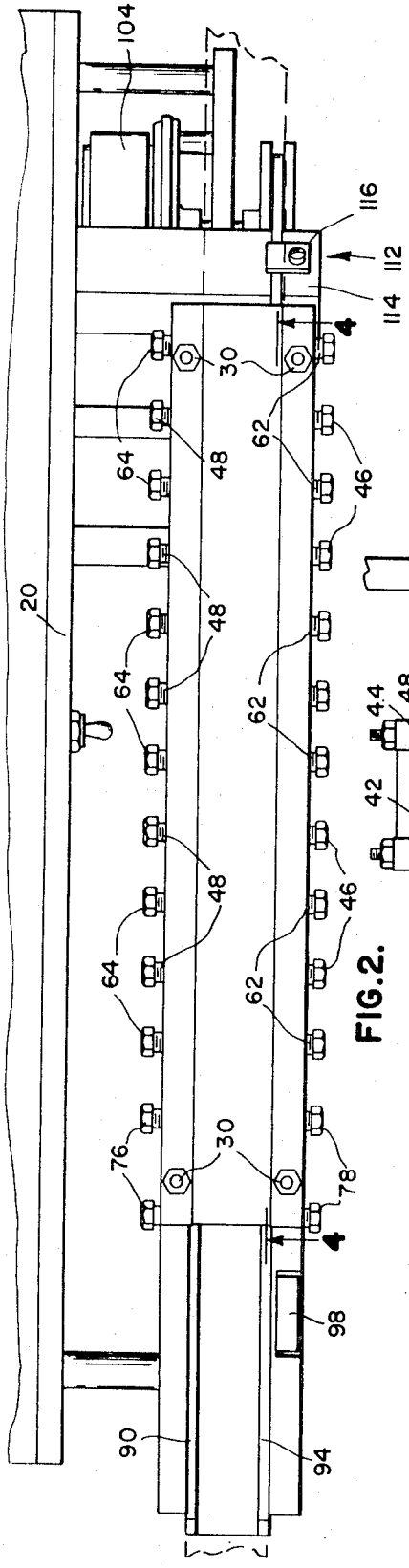


FIG. 2.

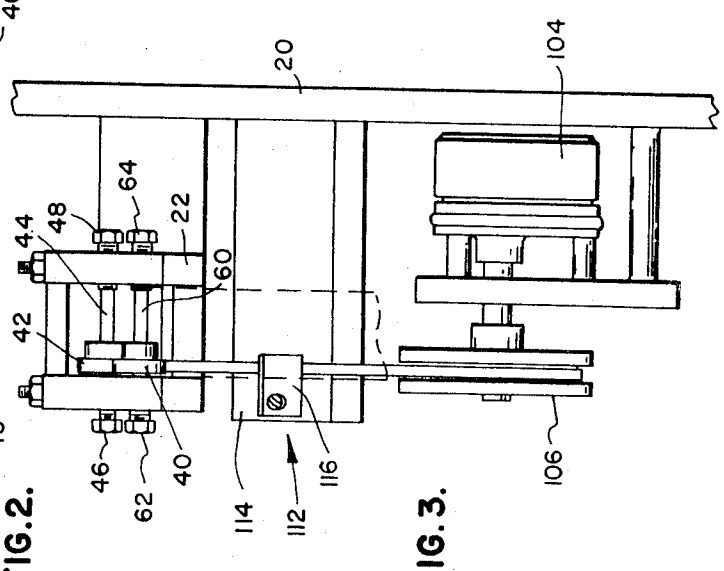


FIG. 3.

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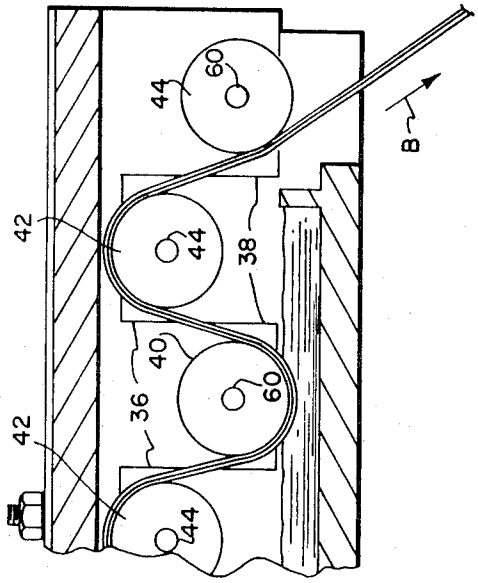


FIG. 4.

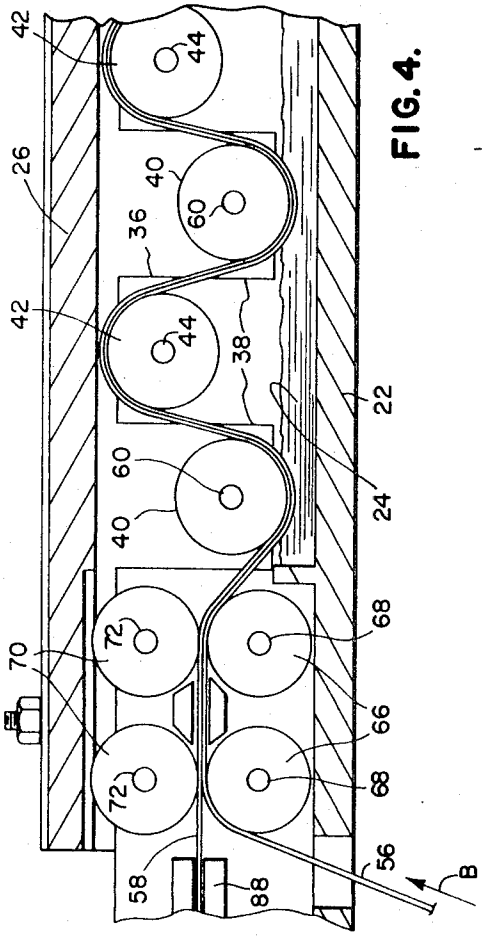
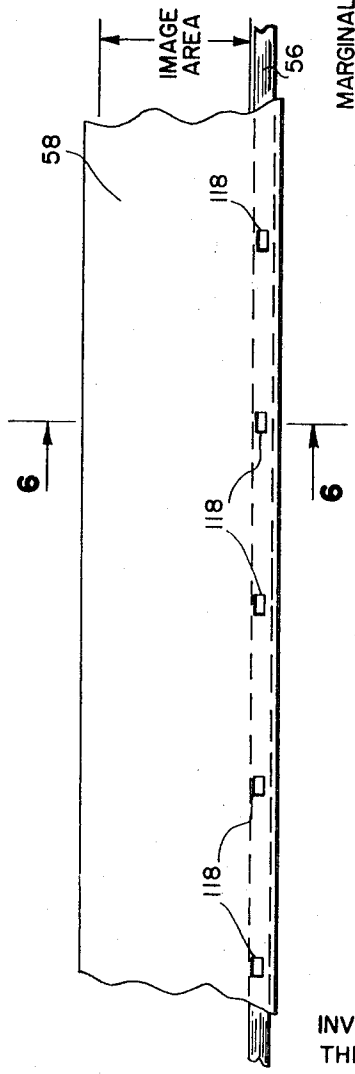


FIG. 5.



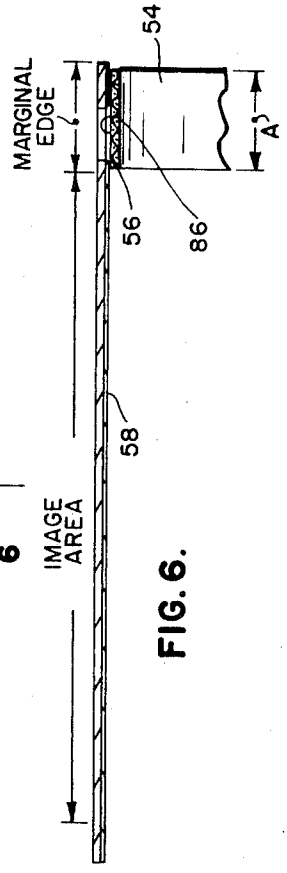


FIG. 6.

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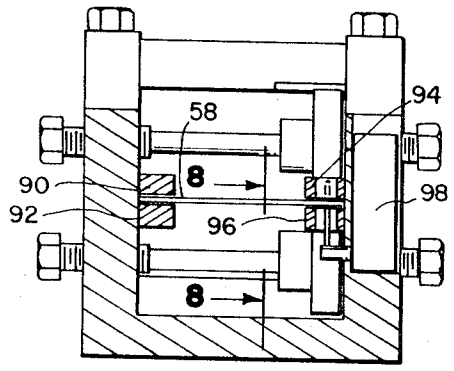


FIG. 7.

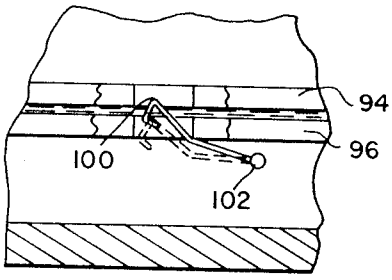


FIG. 8.

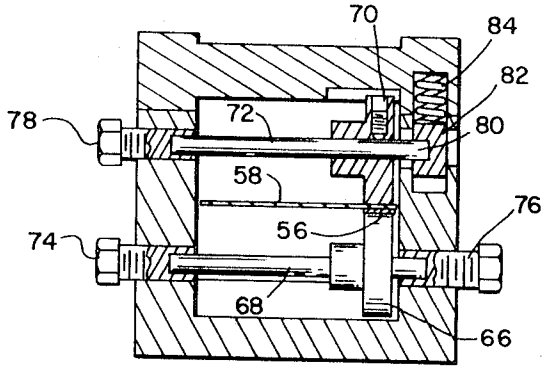


FIG. 9.

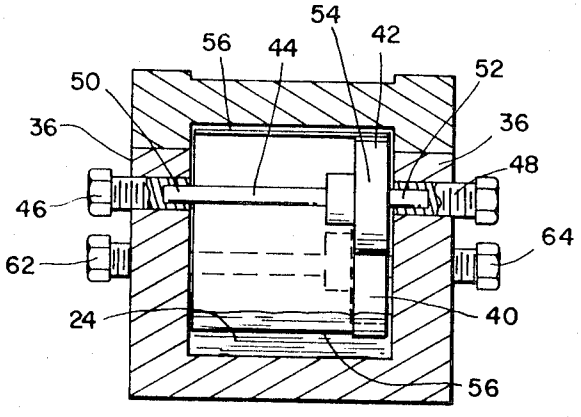


FIG. 10.

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MEANS AND METHOD FOR TRANSPORTING A PHOTOGRAPHIC STRIP

BACKGROUND OF THE INVENTION

Various prior art photographic strip processing machines have utilized continuous film or photographic paper transport means for transporting strips or sections of such material through processing areas of such machines and particularly through areas where these strips or sections are immersed in fluid such as developers or washing fluid or the like. Prior art machines used to transport elongated strips of photographic material have generally relied upon gear-like devices to engage openings in the marginal edge of film or the like; however, it has generally been necessary to attach leaders or threading devices to the film or to otherwise thread the film or film strip through the machine preliminary to continuous operation of the machine with respect to the processing operation thereof. Prior art machines have posed many difficulties relative to the transportation of photographic film or similar strips through such machines.

While the attachment of leaders to photographic strips has been time consuming and costly from the processing and labor standpoint, the threading or feeding of such leader strips through processing machines has sometimes caused substantial difficulties due to improper feeding of the leader through the machine and consequent tangling or jamming of the leader in the various serpentine paths or other avenues taken by the leader as it progresses through the processing machine. Additionally, various prior art processing machines tend to engage various areas of the image portions of film or other strips being processed or developed, and such engagement of the image areas has caused damage and substantial losses of valuable photographic production.

SUMMARY OF THE INVENTION

The present invention comprises a means and method for transporting plastic, paper or film in long or short sections or strips, which means and method is particularly adapted for use in film processing machines or the like, for moving film, photographic paper or other materials in elongated strips through various processing areas. As an example, the invention utilizes a continuous tape which is preliminarily disposed in the machine to follow a processing path and further means for automatically securing film strips or sections of photographic paper to the tape when the end of the film is fed into the transport means of the invention. The method of the invention comprises the securement of the film strip to the aforementioned tape as the film enters the means of the invention, and the method includes also the separation of the film strip section from the tape after the strip or section has been transported from a first location to a second location and specifically the means used for separating the film strip from the tape comprises a cleaving device such as a sharp edged blade or the like, held stationary by the machine of the frame so that as the tape moves in adjacent relation to the cleaving device the film strip is separated from the tape. The tape has sufficient tensile strength to pull the strip through a processing area of the transport means and a preferred embodiment of the tape comprises an adhesive surface which is adhesively

secured to the film strip by rollers between which the film strip and the tape are moved so that pressure between the rollers causes adhesive connection of the film strip with the transport tape. In other instances heat seal welding may be utilized to connect the film strip to the tape and additional modifications may include high frequency welding for connecting the film strip to the tape, and the film strip and tape may be separated in a similar manner to that hereinbefore described or may be combined with other method steps which may include the heating of the marginal areas of the strip and the tape so that they are more readily separable when moved toward and in adjacent relation to a cleaving device such as a sharp edged blade. The cleaving device is provided with a slide support over which the marginal edge of the film strip moves and the cleavage blade is slightly spaced from the slide support so that the transport tape of the invention may move between the slide support and the blade to thereby cause the film strip to be cleaved from the tape and to move at opposite side of the blade to the transport tape, the spacing of the cleavage blade being disposed in spaced relation relative to the slide support a sufficient distance to allow only the passage of the transport tape between the blade and the slide support, so as to ensure accurate cleaving of the marginal edge of the film strip from the tape after the film strip has been transported through the processing area of the transport means of the invention. The transport tape feeds from a continuous roller while the opposite end of the transport tape is motor driven to create tension in the tape for pulling the film strip through the transport means of the invention.

The invention also comprises a novel arrangement of upper and lower rollers disposed in a serpentine path and wherein the lower rollers are carried by a removable portion of the frame and are disposed to be immersed in tank areas between the uppermost rollers of the serpentine arrangement so that the transport tape of the invention may readily be installed in the mechanism of the invention in a serpentine path preliminary to the pulling of film therethrough.

Additionally, the invention comprises a novel guide and switch means for guiding film into connection with the transport tape of the invention and also for tripping a switch and initiating the operation of the transport tape drive means which creates tension in the tape and pulls it, together with the film strip being processed, through the transport means and processing areas of the invention.

Accordingly, it is an object of the invention to provide an improved means and method for transporting film or photographic paper in elongated strips through a photographic processing machine. Additionally, it is an object of the invention to provide a novel means and method for transporting elongated sections of material such as photographic film or the like by engaging a marginal edge of the film sections and supporting the entire image area of the film strip in cantilever disposition so that the film sections may be transported from one position to another without contacting the image portion with any solid object and to thereby greatly improve and facilitate the transportation of film sections or the like from one position to another or through various processing tanks or the like during the processing of such film sections.

Another object of the invention is to provide a novel method for securing an elongated film section or the like to a tension tape having substantial tensile strength and for creating tension in the tape to pull the photographic film section through a processing area of a photo developing machine or from one location to another without causing abrasion of the image area of such photographic film or section.

Another object of the invention is to provide a transport means which greatly facilitates the movement of elongated material such as photographic film sections through a processing machine.

Another object of the invention is to provide a means comprising a novel transport tape and roller mechanism together with a tape drive means which greatly facilitates the movement of a photographic film section or the like through a processing machine without attaching a leader to the strip preliminary to its insertion in the machine.

Another object of the invention is to provide a novel means for transporting photographic film or the like through a machine whereby jamming or damage of the film is alleviated and whereby the marginal edge of the film is protected from damage, so that the conventional drive perforations therein are not deformed or elongated or otherwise damaged so as to allow subsequent accurate handling of the film by conventional gear toothed transport mechanisms.

Another object of the invention is to provide novel means for securing and separating a transport tape relative to a section of photographic material for the purpose of transporting the photographic material by applying tension to the tape.

Further objects and advantages of the invention may be apparent from the following specification, appended claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevational view of a transport means of the invention adapted to transport elongated sections such as photographic film or the like through a processing area from one location to another;

FIG. 2 is a top or plan view of the means shown in FIG. 1 and taken from the line 2—2 of FIG. 1;

FIG. 3 is an end view of the means of the invention taken from the line 3—3 of FIG. 1;

FIG. 4 is an enlarged fragmentary sectional view taken from the line 4—4 of FIG. 2;

FIG. 5 is a side elevational view of an elongated strip of material such as photographic film or the like having a transport tape of the invention secured to a marginal edge of the strip;

FIG. 6 is a transverse sectional view taken from the line 6—6 of FIG. 5 showing the film strip and the transport tape on enlarged scale;

FIG. 7 is an enlarged fragmentary sectional view taken from the line 7—7 of FIG. 1;

FIG. 8 is an enlarged fragmentary sectional view taken from the line 8—8 of FIG. 7;

FIG. 9 is an enlarged fragmentary sectional view taken from the line 9—9 of FIG. 1; and

FIG. 10 is an enlarged fragmentary sectional view taken from the line 10—10 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 1 of the drawings, the invention is provided with a frame 20 carrying a processing tank structure 22 which is shown in section in FIG. 4 of the drawings. This tank 22 is provided with chemicals holding sump structures for holding chemicals 24 therein and a vertically removable roller supporting frame 26 is vertically and upwardly movably mounted relative to the tank structure 22 as shown best in FIGS. 1 and 4 of the drawings. This vertically movable roller supporting structure 26 is provided with openings 28 as shown in FIG. 1 of the drawings, which are slidably movable over bolts 30 having their lower ends 32 secured to side wall structure of the tank structure 22. Nuts 34 on the bolts 30 hold the vertically movable roller support 26 downwardly in secure relation with the tank structure 22.

The tank structure 22 is provided with spaced apart upstanding roller bearing supports 36 as shown best in FIG. 1 of the drawings. These upstanding bearing supports 36 straddle the tank area 22 at opposite sides thereof and the roller bearing supports 36 are spaced apart in a direction longitudinally of the tank 22, all as shown best in FIG. 1 of the drawings.

The vertically movable roller support 26 is provided with downwardly extending roller bearing supports 38 which fit between the supports 36 of the tank structure and this arrangement is shown clearly in FIGS. 1 and 2 of the drawings. Supported by the bearing supports 38 are lower rollers 40 and supported by the bearing supports 36 are upper rollers 42. The upper rollers 42, as shown in FIG. 10 of the drawings, are carried by shafts 44 extending into adjustable bearings 46 which are screw theadably adjustably mounted in the upstanding portions 36 which form the roller bearings supports of the sump tank structure 22. Opposite ends 50 and 52 are disposed in recesses in the bearings 46 and 48 and each roller 42 is provided with a peripheral portion 54 for supporting a transport tape and a photographic film strip or the like, as will be hereinafter described.

The peripheral portion 54 of the rollers 42 is adapted to support a marginal edge of a photographic film as well as a transport tape, and this peripheral portion 54 of each roller is shown generally in FIG. 6 of the drawings wherein the axial length of the roller,as indicated at "A" in FIG. 6, is equal to the width of a transport tape 56 which also substantially coincides with the width of a marginal edge of a photographic film strip or the like, which marginal edge is outside the image area, as shown in FIG. 6.

The transport tape 56 will be hereinafter described in detail, together with the manner in which it is secured to the respective photographic strip indicated at 58 in FIG. 6 of the drawings.

The lower rollers 40, as shown in FIG. 4, are similar to the rollers 54 and are of an axial length similar to that as disclosed in FIG. 6 of the drawings, and correspond with the length A indicated therein. These rollers 40, as well as the rollers 42, are disposed in the structure in alignment with each other as shown in FIG. 10 of the drawings, and the peripheral portions of the rollers 40 are adapted to extend into the chemicals holding sump area 22, as shown in FIG. 4 of the drawings.

The rollers **40** are mounted on suitable axles **60** similar to the axles **44** hereinbefore described, which support the rollers **42**. The axles **60** are supported in bearings **62** and **64** which are similar to the hereinbefore described bearings **46** and **48**; however, the bearings **62** and **64** are carried by the downwardly extending portions **38** of the vertically movable roller support **26**. These rollers may in some instances be synchronically driven by a chain to insure equalization of tension. The rollers **40** and **42** are freely rotatably movable and are simply idler rollers adapted to provide rolling supports for the transport tape **56** and the film strip **58**, as will be hereinafter described.

The invention comprises securing means for securing the film strip **58** to the transport tape **56**, and this means as shown in FIG. **4** comprises a plurality of rollers **66** which are stationarily mounted relative to the frame **20** and which are freely rotatably mounted on axles **68** so that the rollers will rotate when the tape **56** is pulled thereover.

A plurality of rollers **70** are disposed directly above the rollers **66** and are rotatably mounted in relation to spring loaded axles **72** which are shown in detail in FIG. **9** of the drawings.

With reference to FIG. **9** it will be seen that the rollers **66** are each mounted on their respective axles **68**, the opposite ends of which are positioned in bearings **74** and **76** similar to the bearings **46** and **48** described in connection with FIG. **10** of the drawings. The rollers **70** are carried by their axles **72** and each axle **72** at one end is supported in a bearing **78** similar to the bearings **74** and **76**, while an opposite end **80** of each axle **72** is supported in a spring loaded bearing **82** which is forced downwardly by a spring **84** so as to force the periphery of the roller **70** into close proximity to the periphery of the roller **66** shown in FIG. **9** of the drawings.

The rollers **70**, shown in FIGS. **4** and **9**, are thus forced downwardly by the springs **84** toward the roller **66** to compress the transport tape **56** against the marginal edge of the film strip **58** for securing the transport tape and marginal edge of the film strip **58** together. This is accomplished by causing an adhesive layer **86** of the transport tape **56** to be adhesively compressed against one side of the marginal edge of the film strip **58**.

Guide means **88** is aligned with an area between the peripheries of the rollers **66** and **70**. This guide means **88** is shown best in cross section in FIG. **7** of the drawings, and comprises guide bars **90** and **92** adapted to support one edge of the film strip **58** while similar spaced apart guide bars **94** and **96** support opposite edge portions of the film strip **58** to guide an end of the film strip **58** into engagement with the transport tape **56** as it extends between adjacent peripheries of the rollers **66** and **70**. A microswitch **98** is provided with a pivoted arm **100**, mounted on a shaft **102** of the microswitch and this arm **100** is adapted to pivot to activate the microswitch and to energize a motor **104** having a tape take-up roller **106** operable thereby. This take-up roller **106** is adapted to collect the tape **56** and to move it in the direction of arrows "B", shown best in FIGS. **1** and **4** of the drawings. The transport tape **56** is initially mounted in a roll **108**, rotatably carried on a shaft **110** supported by the frame **20** of the invention. This roll **108** is freely rotatable in response to tension of the tape **56** so that it is progressively moved from the roll **108** and onto the take-up roller **106** driven by the motor **104**. The take-up roller **106** may be utilized to dispose of the tape **86** or to rewind it, as desired, and as shown in FIG. **1** of the drawings the roller **106** is merely diagrammatic and may be larger if desired for collecting the tape, or it may be merely a drive and idler roller for disposing of the tape. The roller **106**, however, engages the tape **56** for moving it in the direction of the arrow B and placing it under tension so that it moves through the serpentine path shown in FIG. **10** of the drawings, below the lower rollers **40** and above the upper rollers **42**, so as to carry the film strip **58** secured thereto through the sump area **22** in engagement with liquid therein, and to immerse the film in said liquid as the film strip passes over the rollers **40**.

It will be seen from the disclosure of FIGS. **6** and **10** that the film strip **56** is supported in cantilever disposition from the peripheries of the rollers **40** and **42** on which the transport tape **66** is drivingly supported, and thus the image area of the film as shown in FIG. **6** is held in cantilever disposition such that it does not contact any solid objects and become scratched or otherwise abraded during processing in the sump area **24** as it moves therethrough.

While the adhesive layer **86** on the transport tape **56**, together with the pressure rollers **66** and **70**, may be a preferred embodiment of the invention, it is to be understood that in the area of the rollers **66** and **70** that a heat seal welding process may be used as a securing means for securing the tape **56** to the film strip **58**, or high frequency welding means may be used as a securing means or method for securing the tape to the film strip **58**.

A separating means, generally indicated at **112**, comprises a slide plate **114** stationary mounted on the frame **20**, and adjacent to this slide plate **114** is a cleavage member **116** having a sharp edge **118** disposed so as to separate the film strip **58** from the tape **56** as the tape **56** pulls the film strip past the edge **118**. The spacing of the edge **118** from the slide plate **114** is equal substantially to the thickness of the transport tape **56** and thus causes cleavage of the film strip **58** from the tape **56** and allows the film strip to pass at the opposite side of the cleavage blade **116** from the tape **56**. Thus the film strip **58** is automatically separated from the transport tape **56** after the film strip has been moved from one location to another through the processing areas of the invention, all as hereinbefore described.

In operation of the means of the invention it will be seen that the upper frame **26** may be removed, thereby removing the rollers **40** together with the shaft **60** to allow the transport tape **56** to be readily disposed over the rollers **42**, whereupon replacement of the rollers **40** will force the tape downwardly into a serpentine path, as shown in FIG. **4** of the drawings, whereupon subsequent insertion of the film strip **58** between the rollers **66** and **70** will cause adhesive or other connected relation of the film strip **58** with the transport tape **56**.

It will be understood that the transport tape **56**, as shown in FIGS. **5** and **6** of the drawings, overlies or engages with the marginal edge portion of the photographic strip **58** and that the usual transport perforations **118** in the photographic strip **58** are protected by the transport tape **56**, and these perforations **118**, ac-

cording to the present invention, are not used in the transport of the film strip through the processing area of the invention.

The method of the invention comprises the securing of the photographic strip to the transport tape, then the application of tension to the tape to pull the photographic strip through a processing area from one location to another, and then the separation of the photographic strip from the transport tape, all as hereinbefore described. It will be seen that the support of the transport tape and the marginal edge of the photographic strip **58**, by means of the rollers **40** and **42**, disposed in a serpentine path, provide for cantilever support of the image portion of the photographic strip **58**, all as hereinbefore described and as disclosed in the drawings.

Accordingly, the method of the invention efficiently utilizes tension of a transport tape for moving a photographic section through a processing area from one position to another by applying tension to the tape and also the tape provides means by which the photographic section may be supported in cantilever relationship from rollers so that the image portion of the section is not contacted with or abraded by solid objects while being processed through various processing areas such as chemicals containing tanks or the like, such as the tank area **24**, as shown in FIG. **4** of the drawings.

The term "strip" as used herein shall be construed to mean long or short sections of various materials.

The method as set forth herein may be used for transporting various materials for performing various processes.

It will be obvious to those skilled in the art that a plurality of the tanks **24** and related rollers **40** and **42**, together with the entire transport means disclosed herein, may be used in series for processing various photographic products in elongated strip form.

It will be obvious to those skilled in the art that various modifications may be resorted to without departing from the spirit of the invention.

I claim:

1. A method for transporting and processing a strip of photographic film having an image area and a marginal area; preparing an elongated tape of a width not substantially greater than the width of said marginal portion comprising: moving said tape and concurrently feeding an end of said film into engagement with said elongated tape; progressively securing said marginal area of said strip of film substantially outside said image area to said elongated tape, and thereby leaving both sides of said image area of said strip of film unobstructed by said tape and applying tension to said tape to pull said tape and said strip through a processing area and subjecting said strip of film to liquid chemicals in said processing area.

2. The invention as defined in claim **1**, wherein; and continuing to apply tension to said tape and thereby moving said tape together with said strip; and then separating said strip from said tape as it reaches said second location.

3. The invention as defined in claim **1**, wherein; and continuing to apply tension to said tape and thereby moving said tape together with said strip; and cleaving said strip from said tape as it reaches said second location.

4. In a means for transporting a strip of photographic film or paper having a marginal edge portion and an image portion, comprising the combination of: a frame; tape supply means on said frame; tension resisting tape carried by said tape supply means; said tape being of a width not substantially greater than the width of said marginal edge portion outside said image portion; tape drive means on said frame and spaced from said tape supply means; said tape drive means drivingly engageable with tape extending from said tape supply means; said tape drive means adapted to apply tension to said tape for moving it from said tape supply means to said tape drive means; securing means on said frame disposed for progressively securing said marginal edge portion of said photographic strip to said tape outside said image portion as said tape moves from said tape supply means to said tape drive means.

5. The invention as defined in claim **4**, wherein; separating means is carried by said frame in a location adapted for separating said strip from said tape before said tape reaches said tape drive means.

6. The invention as defined in claim **5**, wherein; said separating means comprises a cleaving device having a separating edge held stationarily on said frame and disposed to permit said strip and said tape to separate at said edge and pass separately at opposite sides of said edge, in a direction in which said tape is driven by said tape drive means.

7. The invention as defined in claim **4**, wherein; said tape is an adhesive tape; said securing means being rollers having adjacent peripheries and supported by said frame in position to receive said strip and said tape therebetween to progressively press said adhesive tape into secure adhesive connected relation to said strip while said tape drive means pulls said tape and said strip between said rollers.

8. The invention as defined in claim **4**, wherein; a plurality of guide roller means on said frame are disposed for engagement with and for guiding said tape and said strip; said guide rollers disposed in serpentine relation to each other such that said strip and tape in engagement with said guide rollers are disposed in an up and down serpentine path; said guide rollers, including upper and lower rollers operating in upper and lower roller positions; and processing tank means carried by said frame adapted to hold processing fluid in positions occupied by said lower rollers for immersing said strip therein as it moves over and below said lower rollers in the lower serpentine positions thereof.

9. The invention as defined in claim **8**, wherein; said upper and lower rollers are disposed in alternate relation to each other; said frame having a stationary guide roller support and vertically movable guide roller support; said guide rollers in said lower positions carried by said vertically movable guide roller support so as to provide for removal of said guide rollers from said lower positions for convenience in placing said tape between said guide rollers and in said serpentine path therebetween.

10. The invention as defined in claim **8**, wherein: said guide rollers are provided with peripheral portions which extend for a distance in an axial direction therdof, which corresponds with the dimension of a marginal edge portion of said strip, whereby the image portion of said strip is supported in cantilever disposition relative to said marginal edge portion while said mar-

ginal edge portion of said strip is supported by said peripheral portions of said rollers.

11. The invention as defined in claim 4, wherein; said tape supply means is a roll of tape rotatably mounted on said frame; said tape drive means being a motor driven roller means.

12. The invention as defined in claim 8, wherein; said tape supply means is a roll of tape rotatably mounted on said frame; said tape drive means being a motor driven roller means.

13. The invention as defined in claim 7, wherein; resilient means is disposed and tends to force said adjacent peripheries of said securing means together.

14. The invention as defined in claim 7, wherein; guides are disposed for guiding said tape and said strip into position between said adjacent peripheries of said securing means.

15. The invention as defined in claim 7, wherein; switch means is disposed near said adjacent peripheries of said securing means; said switch means being disposed to be engaged by said strip and being coupled to said tape drive means for energizing said tape drive means automatically when said strip engages said switch means as said strip is placed into a position between and adjacent said peripheries of said securing means.

16. A method for transporting a strip of material such as photographic film or paper having an image area and a marginal area comprising: progressively securing an elongated tape having substantial tensile strength to said marginal area outside said image area of said elongated strip of photographic material; movably supporting said tape and said marginal edge of said strip to carry an image portion of said strip in cantilever relation to said tape and said marginal edge portion; applying tension to said tape to pull said tape and said strip through a processing area from a first location to a second location; and thus progressively moving said strip through said processing area and through processing fluid therein without touching said image portion by any solid object.

* * * * *