The tapered rollers of this web transport mechanism are specifically constructed and arranged to apply driving force to only the marginal edge portions of the web being transported to minimize the possibility of scratching and pressure marking of the central image-bearing sensitized surface of the web and also maintain frictional driving contact without close fitting tolerance between each pair of rollers. The mechanism includes a plurality of pairs of oppositely tapered rollers having opposed surfaces spaced apart a distance slightly greater than the thickness of the web to be transported, the rollers of adjacent pairs being oppositely tapered and arranged to alternately offset the marginal edge portions of the web path defined thereby and produce a zigzag, twisting action on the web to cause the frictional driving pressure to be exerted only on the marginal edge portions of said web and also permit a spacing wider than the web thickness be maintained between each pair of rollers.

6 Claims, 4 Drawing Figures
TAPERED ROLLER TRANSFER MECHANISM FOR WEB OF PHOTOGRAPHIC MATERIALS AND THE LIKE

It has constantly been a problem to provide a transport mechanism for photographic web materials such as film and print paper, to prevent surface scratching and pressure marking of the relatively soft photographic surface being processed by the particular processing equipment through which the transport mechanism carries the web.

It is an object of the present invention to provide a transport mechanism for photographic equipment which is particularly designed to produce roller contact pressure along only the marginal edge portions of the web of photographic material being transported.

It is another object of the present invention to provide a web transport mechanism including pairs of oppositely tapered rollers spaced apart a distance greater than the thickness of the web being transported and mounted on opposite parallel axes which define the center line of the web path therebetween for simplicity of manufacture and application of driving motion to the rollers, the edges of the web path through adjacent pairs of rollers being offset to produce a zigzag, twisting motion of the web about said center line and thus exert driving pressure on only the marginal edge portions of said web and eliminate roller contact with the center principal image-bearing area of the web.

These and other objects and advantages of this invention will more fully appear in the following description made in connection with the accompanying drawings in which like reference characters refer to similar parts throughout the several views, and, in which:

FIG. 1 is a side elevational view of the transport mechanism with the oscillating plate removed;
FIG. 2 is an end elevation of the transport mechanism taken substantially along the line 2-2 of FIG. 1;
FIG. 3 is a fragmentary horizontal sectional view taken substantially along the line 3-3 of FIG. 2; and,
FIG. 4 is a fragmentary vertical sectional view taken substantially along the line 4-4 of FIG. 2.

The photographic processor which embodies this invention is best shown in FIG. 1 and includes an outer housing or casing designated by the letter C. The particular processor illustrated includes four separate processing tanks respectively designated by the numerals 10, 11, 12 and 13. Tanks 10, 11 and 12 each contain a different liquid used in the processing system and tank 13 defines a drying chamber. The transport mechanism includes a pair of side panels or plates respectively designated by the numerals 14 and 15.

The transport mechanism includes a plurality of pairs of tapered rollers 16. Each roller is mounted for rotation between the plates 14 and 15 on suitable supporting shafts 17 respectively rotating on axes 17a.

Any suitable means for imparting rotary driving motion to the rollers 17 may be provided such as the DRIVING MECHANISM FOR A ROLLER TRANSPORTING DEVICE disclosed in my U.S. Pat. No. 3,608,807. This mechanism includes a single oscillating plate (not shown herein) to which a plurality of driving pins 18b are fixed. One shaft 17a of each pair of rollers has a crank arm 18a fixed in radially outstanding relation thereto and these crank arms 18a are respectively engaged by the crank pins 18b which in turn are driven by said oscillating plate in the manner set forth in said prior patent. Instead of the two oscillating plates 40 and 42 disclosed in said patent, the present mechanism includes only one such plate which is designed to drive only one of each pair of rollers. In the mechanism disclosed herein, the other roller in each pair is driven by a pair of meshed gears 19 respectively fixed to the ends of the shafts 17 opposite to the ends to which the crank arms 18a are fixed. This is best shown in FIGS. 2 and 3.

As best shown in FIG. 1 the axes of adjacent pairs of rollers are oriented in such a manner to define a continuous web path through the processing tanks 10, 11, 12 and 13. A plurality of rollers 16 are provided which are tapered from one end to the other and the opposed surfaces thereof are spaced apart a distance greater than the thickness of a web W of material to be transported. The direction of taper of one roller in each pair is opposite to the direction of taper of the other roller in that pair as best shown in FIG. 3. The direction of taper of each pair of rollers is opposite to the direction of taper of adjacent pairs of rollers. The web of photographic material W is best shown in FIGS. 3 and 4 which illustrate the zigzag path followed by the marginal edge portions of the web W through the roller train and the photographic processing tanks.

The alternating of the direction of taper of adjacent rollers not only produces the zigzag path of the web as described but also maintains the web in transversely centered relationship along the center line of its desired web path. We have found that an even number of pairs of transport rollers at the curved ends of each loop of the web path serves to maintain the web W in this centered relationship as it passes around the curved portion of the path. It seems to be important that an even number of pairs of rollers are provided for carrying the web through each of the various conditions encountered along the web path to avoid any tendency to cause the web to travel off the center line of the path.

Since the spacing between the rollers of each pair is wider than the thickness of the web being transferred it has been found to be desirable to provide a pair of squeeze rollers 20 at the top of the exit portion of the path in each liquid confining tank. These squeeze roller 20 are in surface contact and are positioned above the liquid level of each of the liquid tanks, 10, 11 and 12. They are of soft yieldable material and are position to press against both sides of the web to "squeeze off" substantially all of the liquid from the surface of the web W as it is transported out of each tank.

It will be seen that the opposite orientation of adjacent rollers produces an offset of both marginal edge portions of the web thus causing a tensioning of edge portions to provide maximum drive pressure therealong and eliminate the driving contact pressure on the central image-bearing areas of the web. The requirement for close tolerances of the spacing between each pair of rollers 17 has also been eliminated.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of this invention as set forth in the appended claims.

What is claimed is:

1. A transport mechanism for elongated webs of sheet material comprising a roller supporting structure,
a plurality of pairs of tapered transport rollers mounted on said structure, the spacing between the rollers of each pair being greater than the thickness of the web being transported, the taper of each roller being opposite to its adjacent rollers and said rollers being oriented to produce a zigzag path for the marginal edge portions of a web of material being transported through said rollers, and means for driving said rollers to produce the movement of such web through the spacing between the respective pairs along the desired web path.

2. The structure set forth in claim 1 wherein the axes of rotation of the rollers are parallel and define the center line of desired web path therebetween.

3. The structure set forth in claim 2 and said web path having a number of U-shaped loops with an even number of pairs of rollers disposed at the closed curved portion of each loop.

4. The structure set forth in claim 2 and the number of pairs of rollers for all of the respective conditions en-countered along the web path being an even number to avoid any tendency of the tapered rollers to move the web off the center line of its desired path.

5. The structure set forth in claim 1 and a number of liquid confining tanks through which the web is transported and a pair of soft yieldable squeegee rollers at the exit end of each tank to remove substantially all of the liquid from the web surfaces.

6. The structure set forth in claim 1 and adjacent pairs of rollers being oriented to produce a web path center portion through which a substantial central image-bearing area of the web is free from contact with said rollers, the web diagonally transversing the width of the space between each pair of rollers with the marginal edge portion of one side of the web in frictional driving contact with a larger portion of one of said rollers and the marginal edge portion of the other side of the web in frictional driving contact with a larger portion of the other roller of each pair.