Aug. 6, 1963 H. R. RICHARDS ET AL 3,100,069

ADJUSTABLE WRAP WEB GUIDING APPARATUS

Filed Dec. 20, 1960 3 Sheets-Sheet 1

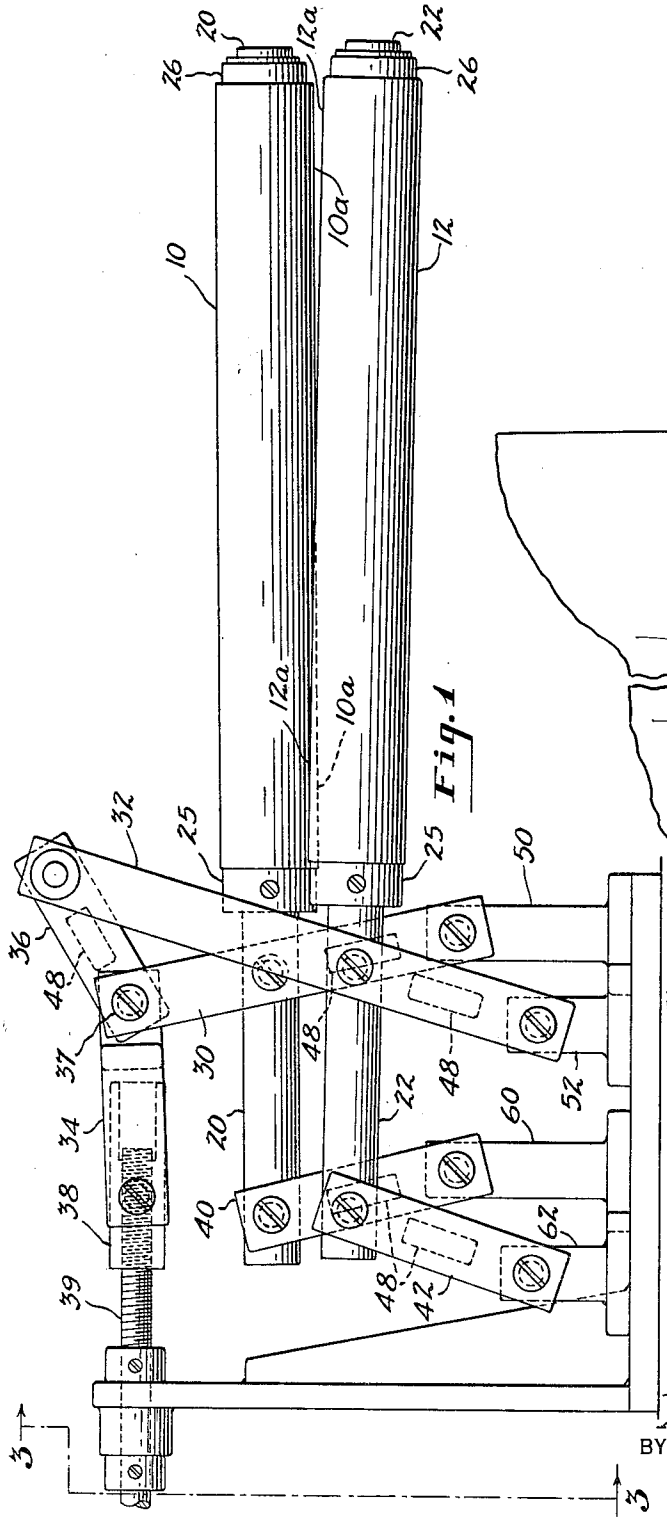


Fig. 1

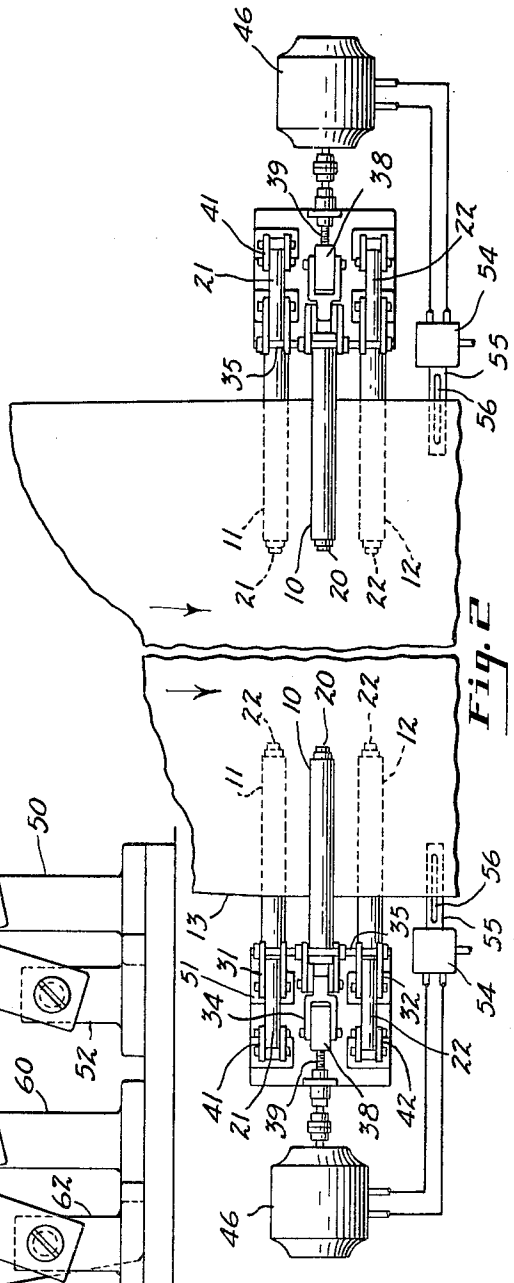


Fig. 2

INVENTORS
Howard R. Richards
Alexander V. Alexeff
BY Ely, Learner & Gordon
ATTORNEYS

Aug. 6, 1963 H. R. RICHARDS ET AL 3,100,069

ADJUSTABLE WRAP WEB GUIDING APPARATUS

Filed Dec. 20, 1960 3 Sheets-Sheet 2

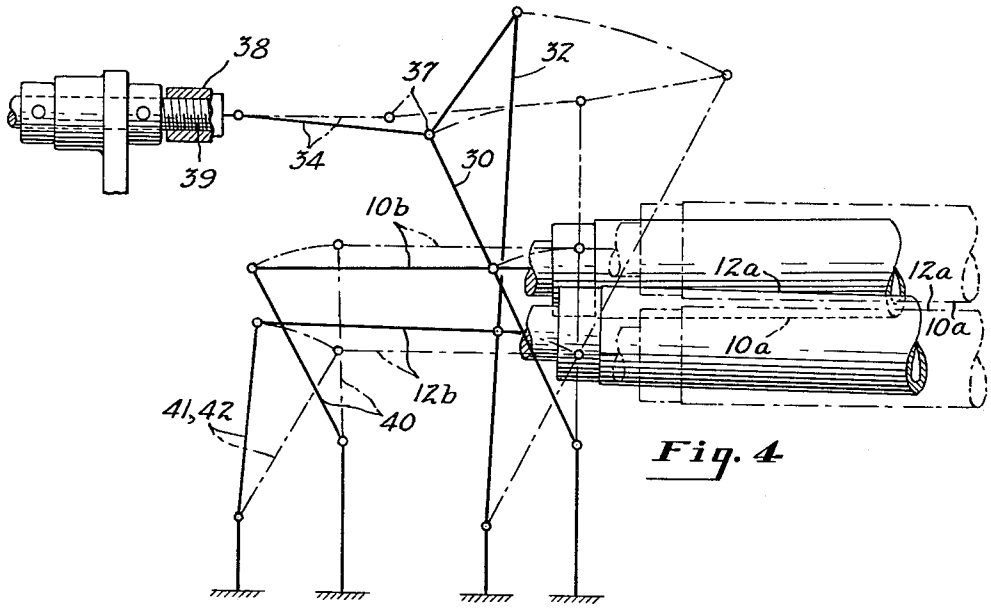


Fig. 4

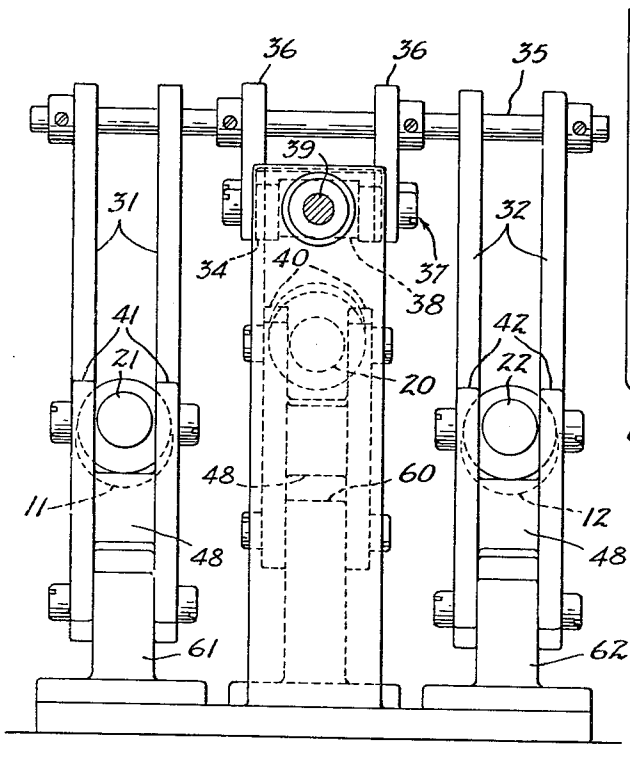


Fig. 3

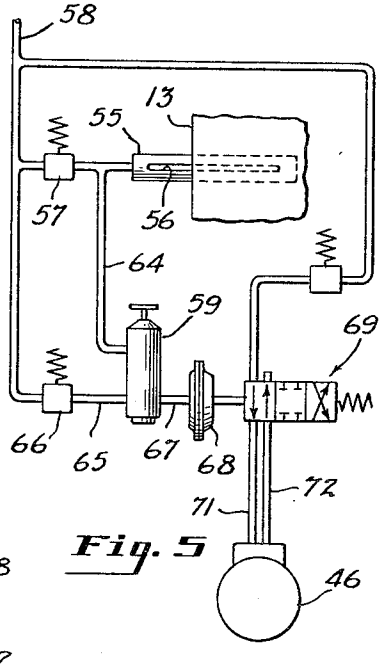


Fig. 5

INVENTORS
Howard R. Richards
Alexander V. Alexeff
BY Pearne & Gordon
ATTORNEYS

Aug. 6, 1963 H. R. RICHARDS ET AL 3,100,069

ADJUSTABLE WRAP WEB GUIDING APPARATUS

Filed Dec. 20, 1960 3 Sheets-Sheet 3

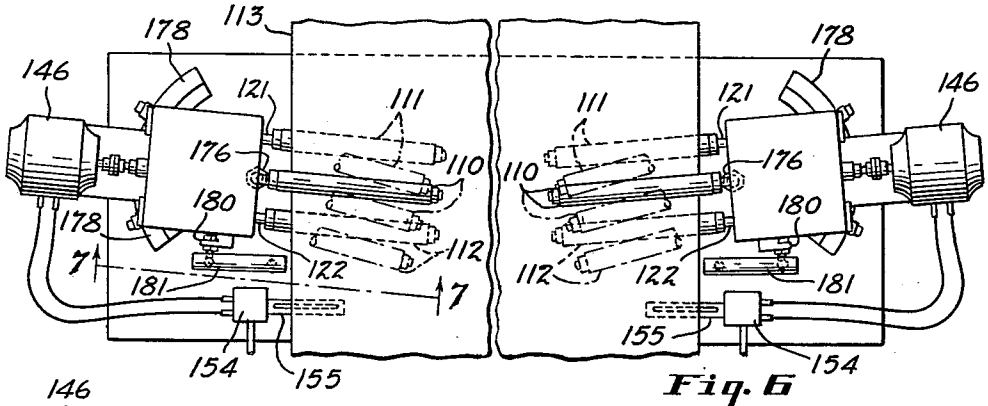


Fig. 6

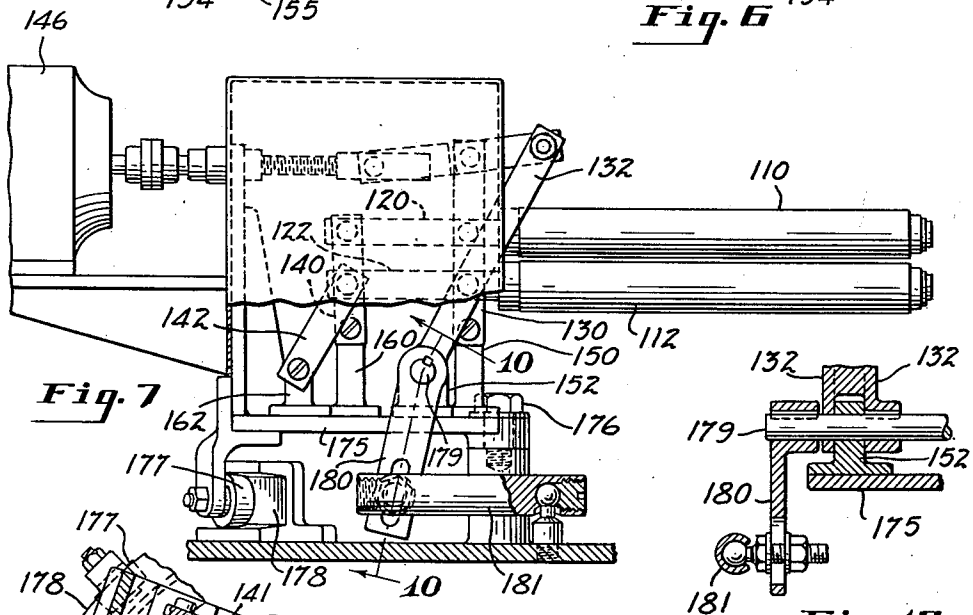


Fig. 7

Fig. 10

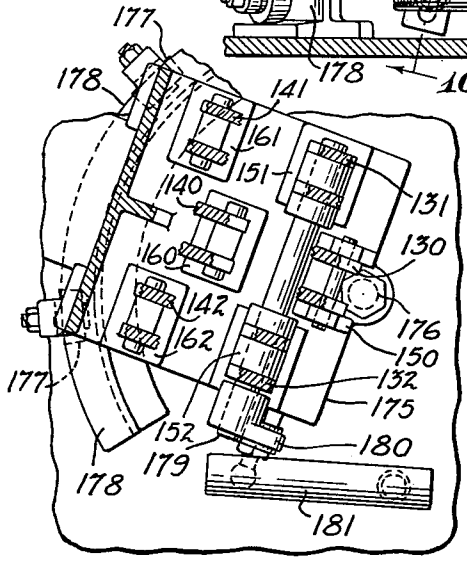


Fig. 8

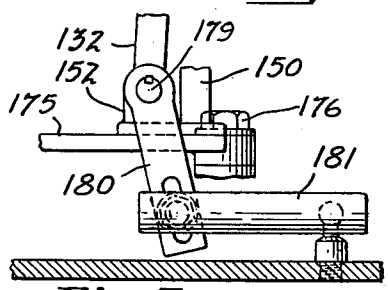


Fig. 9

INVENTORS
Howard R. Richards
Alexander V. Alexeff
BY Ely, Learner & Gordon
ATTORNEYS

United States Patent Office 3,100,069 Patented Aug. 6, 1963

3,100,069

ADJUSTABLE WRAP WEB GUIDING APPARATUS

Howard R. Richards, Lakewood, and Alexander V. Alexeff, Cleveland, Ohio, assignors to Industrial Ovens, Incorporated, Cleveland, Ohio, a corporation of Ohio

Filed Dec. 20, 1960, Ser. No. 77,041
10 Claims. (Cl. 226—17)

This invention relates to apparatus for guiding and centering traveling webs of paper, fabric, film, metal and the like.

The invention involves the provision of a plurality of adjustment factors in a compact web guiding apparatus. According to the invention, a plurality of rolls are provided which are adapted to skew with respect to each other to varying degrees and simultaneously to adjust to different degrees of profile interference. In this connection the present invention contemplates the particularly advantageous provision of such apparatus where the degree of profile interference at any given adjustment of the rolls varies across at least part of the extent of the web width due, for example, to the skewing relationship between the rolls so that there is under most or all conditions a greater amount of wrap of the roll means and the web at the edge of the web than at points on the web located transversely inwardly from the edge.

Stated in other terms, according to the invention a plurality of rolls are provided, planar projections of which are adapted to adjust their angular spacing with respect to each other to varying degrees and simultaneously to adjust to different degrees of interference. The projections of the rolls referred to here are those in a plane transverse to the path of web travel. Such projections will hereinafter be referred to a transverse-plane projections. In this respect the present invention contemplates the particularly advantageous provision of such apparatus where the degree of interference at any given adjustment of the rolls varies across at least a part of the extent of the web width due, for example, to the angular spacing between the transverse-plane projections of the rolls so that there is under most conditions a greater amount of wrap of the roll means and the web at the edge of the web than at points on the web located transversely inwardly from the edge.

In one important aspect of the invention, the apparatus contemplated by the invention also may accomplish quick-correct guiding action with respect to a passing web, in addition to the above features, by bodily shifting the several roll means together transversely with respect to the web.

Other advantageous automatic adjustments are contemplated by certain aspects of the invention, as disclosed below.

Examples of the invention are illustrated in the accompanying drawings, in which:

FIGURE 1 is a side elevation of web guiding apparatus embodying the invention as viewed along a direction directly opposed to the direction of web travel and showing the apparatus in an intermediate position. Thus it will be understood that the rolls as seen in FIGURE 1 are congruent with their transverse-plane projection.

FIGURE 2 is a plan view on a reduced scale showing the apparatus of FIGURE 1 together with like apparatus at the opposite side of the web.

FIGURE 3 is a side elevation taken from the plane of line 3—3 in FIGURE 1.

FIGURE 4 is a view similar to a portion of FIGURE 1 with the mounting linkages being shown in diagrammatic form and with the apparatus shown in two limiting extreme conditions on either side of the intermediate condition illustrated in FIGURE 1.

FIGURE 5 is a schematic illustration of one form of edge sensing means and associated control means for use

in connection with the web guiding apparatus contemplated by the invention.

FIGURE 6 is a plan view similar to FIGURE 2 showing another web guiding apparatus embodying the invention.

FIGURE 7 is a partly broken away elevation on a scale enlarged from FIGURE 6 and taken from lines 7—7 in FIGURE 6.

FIGURE 8 is a sectional plan view of the central portion of the apparatus seen in FIGURE 7.

FIGURE 9 is a view of certain parts of the apparatus of FIGURE 7 in an alternative position.

FIGURE 10 is a fragmentary sectional view taken from the planes of line 10—10 in FIGURE 7.

As shown in the drawings, there are provided first roll means comprising a single roll 10 and second roll means comprising a pair of rolls 11 and 12. The rolls 11 and 12 move with each other. The several rolls are in guiding relationship with respect to a passing web 13 which is moving in the direction indicated by the arrows in FIGURE 2. The roll 11 of the pair of rolls 11 and 12 which comprise the second roll means is located on the approach side of the single roll 10; and the roll 12 of the pair of rolls 11 and 12 which comprise the second roll means is located on the withdrawal side of the single roll 10.

Although in the particular invention described the second roll means comprises the pair of rolls 11 and 12, some aspects of the invention contemplate the provision of only a single roll. In this connection one of the roll means 11 or 12 could be eliminated and many of the features and advantages of the present invention would nevertheless obtain.

Each of the rolls 10—12 is cantilevered from a mounting means to be described below, and each of the rolls 10—12 extend from such mounting means partially across the transverse extent of the passing web 13 as most clearly shown in FIGURE 2. Each of the rolls 10—12 is journaled on its own cantilevered shaft 20—22 by inboard journal means 25 and outboard journal means 26.

If desired, the roll assemblies may not have such an attitude that they are perpendicular or normal to the path of travel of the web as actually shown in FIGURE 2, but rather may be somewhat canted, that is, angularly displaced from a normal-to-web-path attitude. They should be canted in such a rotational direction that the inboard ends or free ends of the rolls 10—12 are furthest downstream with reference to the direction of web travel, that is, as viewed in FIGURE 2, the inboard or free ends of the rolls 10—12 would be closest to the lower margin of the drawing. This degree of cant may be adjusted by bolting the base frame shown in FIGURE 1 at different angular positions with respect to a vertical axis.

The shaft 20 is pivotally affixed to and supported on the doubled lever arms 30 and 40. Similarly the shaft 21 is pivotally affixed to and supported on the doubled lever arms 31 and 41, and the shaft 22 is pivotally affixed to and supported on the doubled lever arms 32 and 42. The doubled lever arms 30—32 and 40—42 are respectively supported on the upstanding brackets 50—52 and 60—62. The top ends of the levers 31 and 32 are joined by a shaft 35 (FIGURE 3). A pair of links 36 extend from the upper end of the doubled lever 30 to the shaft 35 so that shifting of the pivot connections 37 (FIGURES 1 and 3) between the upper end of the lever 30 and the links 36 causes shifting of the shaft 35 and actuation of the levers 31 and 32 pivoted thereto. The central element of the pivot connection 37 is the stem of a yoke 34 (FIGURE 2). The forked end of the yoke 34 is pivoted to a trunnion bar 38 which is engaged by a threaded shaft 39 powered by a reversible air motor 46.

The several doubled levers and similar elements, such

as the links **36**, include suitable cross bars **48** (FIGURE 1).

The apparatus located on the opposite side of the web **13** is virtually a duplicate of the apparatus described above with the correspondingly numbered elements being arranged in symmetrical relationship with respect to the intended center of the path of travel of the web. In connection with this apparatus, only the three rolls and a few other elements are numbered, but it will be clear that the remainder of the apparatus is substantially identical to that described above.

Provided in the vicinity of the guiding apparatus at each side of the web is a senser unit operatively associated with the guiding apparatus at the same side of the web through the control means (including the motor **46**) schematically illustrated in FIGURE 5. Many components of such control means may be positioned within the housing **54** illustrated in FIGURE 2. The edge sensing unit may comprise a tube **55** having a slot **56** and supplied with low-pressure air through a spring-loaded regulator **57** which reduces the pressure of air supplied in the line **58** to say about 5 p.s.i. The static pressure on the tube **55** is imposed on the input side of a pressure multiplier **59** through line **64**. Operating air is supplied by the pressure multiplier through line **65** from the air supply line **58** at a suitable pressure of say 30 p.s.i. established by the spring-loaded pressure regulator **66**. The output line **67** varies in pressure in a well known manner according to the input pressure signal through line **64** to thereby actuate the diaphragm **68** of diaphragm-actuated spring-loaded valve **69** to port air from the air supply line **58** and spring-loaded pressure regulator to the air motor **46** through lines **71** and **72** for forward, zero and reverse rotation thereof according to the position of the edge of the web **13** over the slot **56**. Other edge sensing and web control means may be employed and may comprise mechanical, pneumatic, hydraulic, or electronic means or combinations thereof, a number of variations of such senser and control means being known to the art.

It will be seen from the figures that the web **13**, traveling along its given direction, extends under the roll means **10** and over the roll means **11** and **12** and that the degree of interference between the web engaging profiles of these rolls as viewed along the direction of web travel or along a direction directly opposed to the direction of web travel (the direction of view in FIGURE 1 being the latter) determines the degree of wrap of the web on the rolls. In the particular apparatus illustrated, the web engaging profiles of the rolls **11** and **12** are exactly in alignment and therefore in FIGURES 1 and 4, only the nearest profile, that of the roll **12**, is labeled (with the reference character **12***a*). The relevant profile of the roll **10** is labeled **10***a*. Stated another way, the degree of interference between the transverse-plane projections of the rolls determines the degree of wrap of the web on the rolls.

It will be seen from FIGURES 1 and 3 that the roll mounting means comprising the linkages described above is such as to progressively adjust the profile relationship of the first roll means (the roll **10**) on the one hand and the second roll means (the rolls **11** and **12**) on the other hand relative to each other back and forth between a first condition illustrated in dotted lines in FIGURE 4 where there are relatively low degrees of (1) skewing and (2) profile interference between the first and second roll means and a second condition illustrated in solid lines in FIGURE 4 where there are relatively high degrees of (1) skewing and (2) profile interference. In the particular apparatus illustrated, the degree of profile interference in the first condition illustrated in dotted lines in FIGURE 4 is zero. The degree of skewing is also zero in this first condition so as to establish a parallel relationship between the first roll means (the roll **10**) on the one hand and the second roll means (the rolls **11** and **12**) on the other hand.

The degree of skewing and profile interference at the intermediate position illustrated in FIGURE 1 will be seen to be intermediate that of the first and second limiting end conditions shown in FIGURE 4. The change in skewing and profile interference is progressive as the rolls are moved from the first limiting end condition to the second limiting end condition.

Stated in other terms, it will be seen that the described linkages are such as to adjust the relationships of the first and second roll means relative to each other back and forth between a first condition illustrated in dotted lines in FIGURE 4 where there are relatively low degrees of (1) angular spacing and (2) interference between the transverse-plane projections of the first and second roll means and a second condition illustrated in solid line in FIGURE 4 where there are relatively high degrees of (1) angular spacing and (2) interference between the transverse-plane projections of the first and second roll means. In the particular apparatus illustrated, the degree of angular spacing between the transverse-plane projections of the first and second roll means illustrated in dotted lines in FIGURE 4 is zero. The degree of interference between the transverse-plane projections of the first and second roll means is also zero.

The degree of angular spacing of the transverse-plane projections of the first and second roll means and the degree of interference between the transverse-plane projections of the first and second roll means at the intermediate position illustrated in FIGURE 1 will be seen to be intermediate that of the first and second limiting end conditions shown in FIGURE 4. The change in the degree of angular spacing and the degree of interference is progressive as the rolls are moved from the first limiting end condition to the second limiting end condition.

It is particularly to be noted that in the illustrated apparatus, the linkages comprising the roll mounting means are such as to shift the roll **10** on the one hand and the rolls **11** and **12** on the other hand back and forth together transverse to the direction of web travel incident to the above described adjustment back and forth between the first and second limiting end conditions.

The change in skewing relationshp between the rolls may perhaps most clearly be seen from the change in respective positions of the axis **10***b* of the roll **10** (which axis is also the axis of the shaft **20**) on the one hand and the axis **12***b* of the roll **12** (which is also the axis of the shaft **22**) on the other hand as shown in FIGURE 4. It will be understood that the axis of the roll **11** and the shaft **21** would in the diagrammatic showing of FIGURE 4 remain located immediately behind the axis **12***b*.

It will be seen that the rolls **10**, **11** and **12** are cantilevered on the linkages comprising the mounting means for the several rolls so as to extend from such mounting means partially across the transverse extent of the web. Thus the free ends of the rolls **10**—**12** are spaced from each other and the rolls may be inserted over the web or the web may be threaded between the rolls without disassembly of the apparatus or emptying of the web processing line on which the apparatus is used.

In the illustrated apparatus the roll assemblies at the opposite sides of the web as shown in FIGURE 2 operate independently of each other, each operating in response to the sensed position of the associated edge of the web **13**.

In one aspect, the invention contemplates automatic change of the degree of cant incident to movement of the rolls back and forth between the above-mentioned first and second conditions so that at the first condition of low degrees of skewing and profile interference, there is also a low degree of canting, and at the second condition of high degrees of skewing and profile interference, there is also a high degree of canting.

To this end there may be provided the apparatus shown in FIGURES 6–10 for guiding a web **113**, including rolls **110**, **111**, **112**; shafts **120**, **121**, **122**; lever arms **130**, **131**, **132**, **140**, **141**, **142**; reversible air motors **146**, brackets **150**, **151**, **152**, **160**, **161**, **162**, and edge sensing elements **154**, **155**, all corresponding in structure and func-

tion to those elements of FIGURES 1–5 which are numbered with the same last two digits.

The brackets **150, 151, 152, 160, 161, 162** are carried on a base frame **175** which is similar in shape to the stationary frame shown in FIGURES 1–3. However the frame **175** is pivotally associated with a stationary pivot bolt **176** and carries depending wheels **177** which are guided in arcuate tracks **178**.

The lever arm **132** is pivotally mounted to the bracket **152** by means of a shaft **179** (see FIGURE 10) to which the lever arm **132** is keyed. Also keyed to the shaft **179** is a lever **180**. The lever **180** is linked by a pin-and-slot connection to one end of a link **181**. The opposite end of the link **181** is restrained against anything other than angular movement by a ball-and-socket connection to a fixed point.

The result is that as the apparatus of FIGURES 6–10 moves back and forth between a first condition of low degrees of skewing and profile interference and a second condition of high degrees of skewing and profile interference, it also moves respectively back and forth between a relatively low degree of angular displacement from normal-to-web-path attitude (say 3–5°) to a relatively high degree of such angular displacement (say 10–18°), as illustrated in FIGURE 6. As will be clear from FIGURE 6 the term "normal" as used in the expression "normal-to-web-path attitude" has reference to a relationship of perpendicularity to the centerline of the traveling web or, equivalently, a relationship of perpendicularity to any line or plane parallel to such centerline of the traveling web.

This invention is not restricted to the slavish imitation of each and every one of the details described above which have been set forth merely by way of example with the intent of most clearly setting forth the teaching of the invention. Obviously, devices may be provided which change, eliminate or add certain specific structural details without departing from the invention. For example within some of the broader aspects of the invention, the roll **11** could be eliminated, the roll **12** could be tied to a stationary mounting so that it would permanently remain at the position shown in dotted lines in FIGURE 4, and the roll **10** could be mounted for angular movement only between the dotted line position shown in FIGURE 4 and a second position similar to the angularly disposed solid line position of the roll **10** as actually shown in FIGURE 4 but directly overlying the stationary roll **12**. The roll **10** would be moved between these two positions by the motor **46**.

What is claimed is:

1. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending under one of said first and second roll means and over the other whereby the degree of interference between the web engaging profiles of said first and second roll means as viewed along said direction of web travel determines the degree of wrap of said web thereon, roll mounting means for angularly shifting both said first and second roll means to thereby progressively adjust the profile relationship of said first and second roll means relative to each other back and forth between a first condition where, as between said first and second roll means, there are relatively low degrees of (1) skewing and (2) profile interference and a second condition where, as between said first and second roll means, there are relatively high degrees of (1) skewing and (2) profile interference.

2. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending under one of said first and second roll means and over the other whereby the degree of interference between the web engaging profiles of said first and second roll means as viewed along said direction of web travel determines the degree of wrap of said web thereon, roll mounting means for angularly shifting both said first and said second roll means to thereby progressively adjust the profile relationship of said first and second roll means relative to each other back and forth between a first condition where, as between said first and second roll means, there are relatively low degrees of (1) skewing and (2) profile interference and a second condition where, as between said first and second roll means, there are relatively high degrees of (1) skewing and (2) profile interference with the degree of profile interference between said rolls at said first condition being zero.

3. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending under one of said first and second roll means and over the other whereby the degree of interference between the web engaging profiles of said first and second roll means as viewed along said direction of web travel determines the degree of wrap of said web thereon, roll mounting means to progressively adjust the profile relationship of said first and second roll means relative to each other back and forth between a first condition where, as between said first and second roll means, there are relatively low degrees of (1) skewing and (2) profile interference and a second condition where, as between said first and second roll means, there are relatively high degrees of (1) skewing and (2) profile interference, said roll mounting means including means to shift said first and second roll means back and forth together transverse to the direction of web travel incident to said progressive adjustment back and forth between said first and second conditions.

4. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending under one of said first and second roll means and over the other whereby the degree of interference between the web engaging profiles of said first and second roll means as viewed along said direction of web travel determines the degree of wrap of said web thereon, roll mounting means for angularly shifting both said first and said second roll means to thereby progressively adjust the profile relationship of said first and second roll means relative to each other back and forth between a first condition where, as between said first and second roll means, there are relatively low degrees of (1) skewing and (2) profile interference and a second condition where, as between said first and second roll means, there are relatively high degrees of (1) skewing and (2) profile interference, one of said first and second roll means comprising a single roll and the other of said first and second roll means comprising a pair of rolls one of which is located on the approach side of said single roll and the other of which is located on the withdrawal side of said single roll.

5. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending under one of said first and second roll means and over the other whereby the degree of interference between the web engaging profiles of said first and second roll means as viewed along said direction of web travel determines the degree of wrap of said web thereon, roll mounting means for angularly shifting both said first and said second roll means to thereby progressively adjust the profile relationship of said first and second roll means relative to each other back and fourth between a first condition where, as between said first and second roll means, there are relatively low degrees of (1) skewing and (2) profile interference and a second condition where, as between said first and second roll means, there are relatively high degrees of (1) skewing and (2) profile interference, each of said first and second roll means comprising at least one roll cantilevered from said mounting means to extend therefrom partially across the transverse extent of said web.

6. Web guiding apparatus comprising first and second

roll means for guidingly engaging a web traveling along a given direction and extending under one of said first and second roll means and over the other whereby the degree of interference between the web engaging profiles of said first and second roll means as viewed along said direction of web travel determines the degree of wrap of said web thereon, roll mounting means for angularly shifting both said first and said second roll means to thereby progressively adjust the profile relationship of said first and second roll means relative to each other back and forth between a first condition where, as between said first and second roll means, there are relatively low degrees of (1) skewing and (2) profile interference and a second condition where, as between said first and second roll means, there are relatively high degrees of (1) skewing and (2) profile interference, one of said first and second roll means comprising a single roll and the other of said first and second roll means comprising a pair of rolls one of which is located on the approach side of said single roll and the other of which is located on the withdrawal side of said single roll, each of said first and second roll means comprising at least one roll cantilevered from said mounting means to extend therefrom partially across the transverse extent of said web.

7. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending under one of said first and second roll means and over the other whereby the degree of interference between the web engaging profiles of said first and second roll means as viewed along said direction of web travel determines the degree of wrap of said web thereon, roll mounting means to progressively adjust the profile relationship of said first and second roll means relative to each other back and forth between a first condition where, as between said first and second roll means, there are relatively low degrees of (1) skewing and (2) profile interference and a second condition where, as between said first and second roll means, there are relatively high degrees of (1) skewing and (2) profile interference, said roll mounting means including means for respectively increasing and decreasing the degree of angular displacement of said first and second roll means for a normal-to-web-path attitude as said rolls move back and forth between said first and second conditions.

8. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending over one of said first and second roll means and under the other whereby the degree of interference between the transverse-plane projections of said first and second roll means determines the degree of wrap of the web thereon, roll mounting means for angularly shifting both said first and said second roll means to thereby progressively adjust the relationships of the transverse-plane projections of said first and second roll means with respect to each other back and forth between a first condition where there are relatively low degrees of (1) angular spacing and (2) interference between the transverse-plane projections of the first and second roll means and a second condition where there are relatively high degrees of (1) angular spacing and (2) interference between the transverse plane projections of the first and second roll means.

9. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending over one of said first and second roll means and under the other whereby the degree of interference between the transverse-plane projections of said first and second roll means determines the degree of wrap of the web thereon, roll mounting means to progressively adjust the relationships of the transverse-plane projections of said first and second roll means with respect to each other back and forth between a first condition where there are relatively low degrees of (1) angular spacing and (2) interference between the transverse-plane projections of the first and second roll means and a second condition where there are relatively high degrees of (1) angular spacing and (2) interference between the transverse-plane projections of the first and second roll means, said roll mounting means including means to shift said first and second roll means back and forth together transverse to the direction of web travel incident to said progressive adjustment back and forth between said first and second conditions.

10. Web guiding apparatus comprising first and second roll means for guidingly engaging a web traveling along a given direction and extending over one of said first and second roll means and under the other whereby the degree of interference between the transverse-plane projections of said first and second roll means determines the degree of wrap of the web thereon, roll mounting means to progressively adjust the relationships of the transvserse-plane projections of said first and second roll means with respect to each other back and forth between a first condition where there are relatively low degrees of (1) angular spacing and (2) interference between the transverse-plane projections of the first and second roll means and a second condition where there are relatively high degrees of (1) angular spacing and (2) interference between the transverse-plane projections of the first and second roll means, said roll mounting means including means for respectively increasing and decreasing the degree of angular displacement of said first and second roll means from a normal-to-web-path attitude as said rolls move back and forth between said first and second conditions.

References Cited in the file of this patent

UNITED STATES PATENTS

1,541,190	Smith	June 9, 1925
2,476,070	Solliday	July 12, 1949
2,639,483	Wester	May 26, 1953
2,737,386	Reher	Mar. 6, 1956

FOREIGN PATENTS

483,077	Germany	Sept. 25, 1929
916,707	Germany	Aug. 16, 1954

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,100,069 August 6, 1963

Howard R. Richards et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 59, after "and" insert -- said --; column 7, line 44, for "for" read -- from --.

Signed and sealed this 28th day of January 1964.

(SEAL)
Attest:
ERNEST W. SWIDER

Attesting Officer

EDWIN L. REYNOLDS

Acting Commissioner of Patents