March 12, 1968 R. T. OTEPKA ETAL 3,373,288

PHOTOSENSITIVE WEB SHIFTING APPARATUS

Filed Aug. 26, 1965 2 Sheets-Sheet 1

Fig. 1

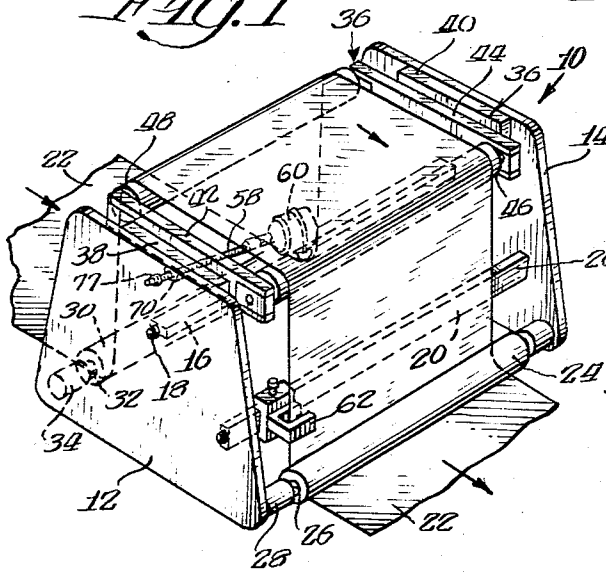


Fig. 10

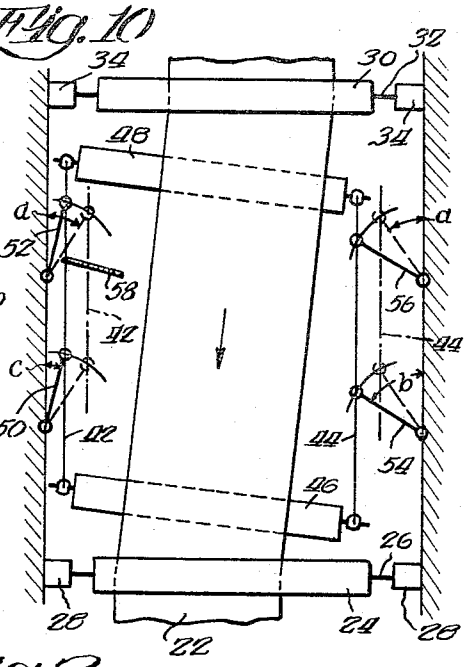
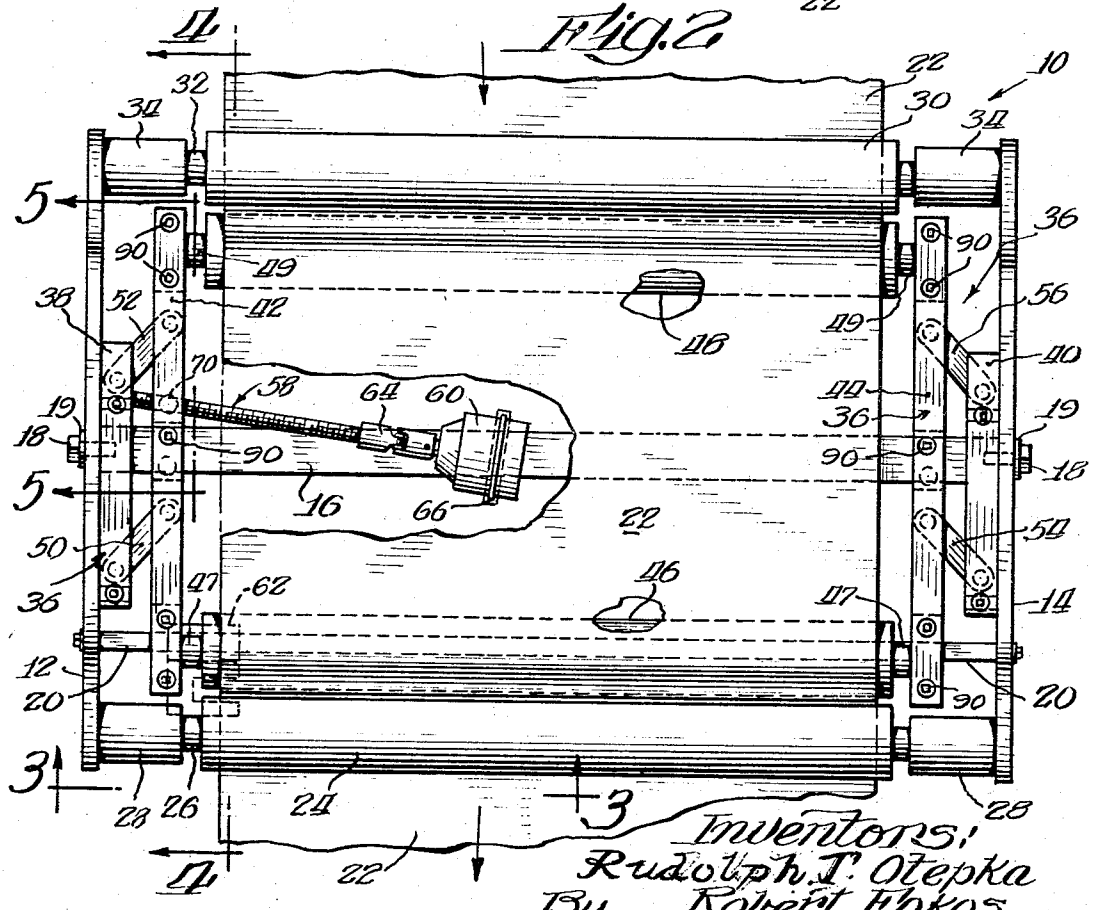


Fig. 2



Inventors:
Rudolph T. Otepka
Robert Flokos
By Bair, Freeman & Molinare Attys.

March 12, 1968 R. T. OTEPKA ETAL 3,373,288

PHOTOSENSITIVE WEB SHIFTING APPARATUS

Filed Aug. 26, 1965 2 Sheets-Sheet 2

Fig. 3

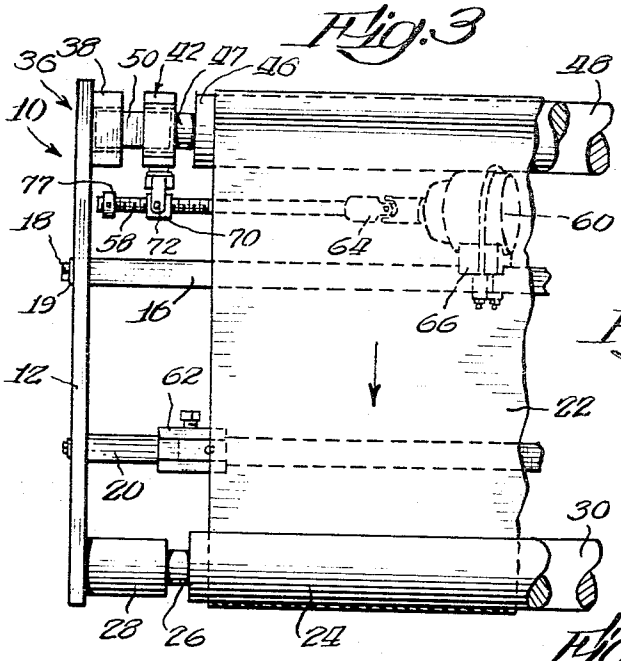


Fig. 8

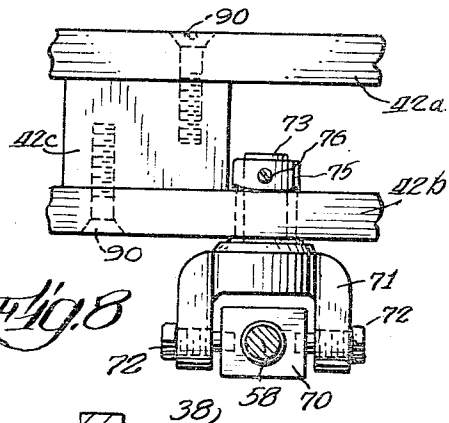


Fig. 9

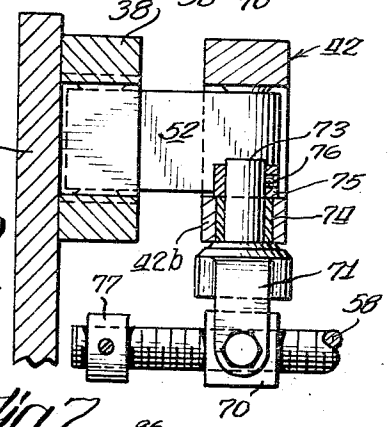


Fig. 4

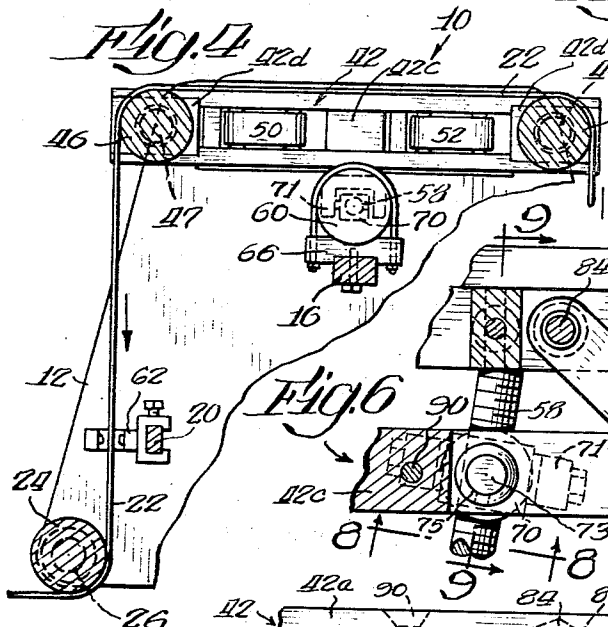


Fig. 7

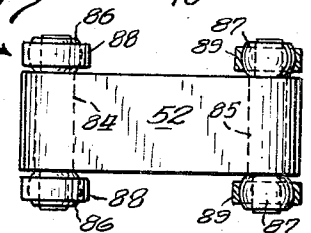
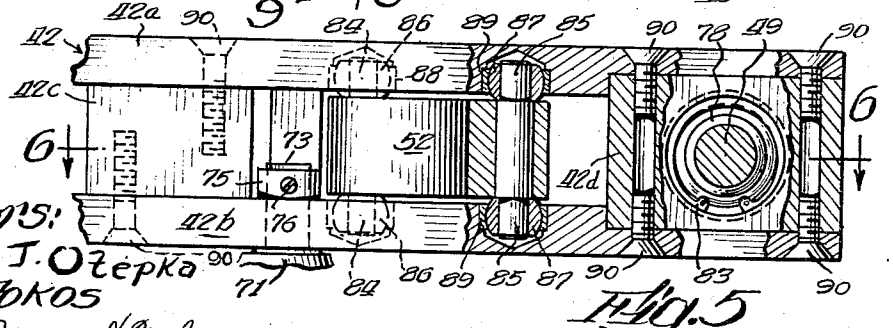


Fig. 6

Fig. 5



Inventors:
Rudolph T. Otepka
Robert Fokos
By Bair, Freeman & Molinare Attys.

United States Patent Office 3,373,288 Patented Mar. 12, 1968

3,373,288

PHOTOSENSITIVE WEB SHIFTING APPARATUS

Rudolph T. Otepka, Lombard, and Robert Fokos, Addison, Ill., assignors to Web Press Engineering, Inc., Addison, Ill., a corporation of Illinois

Filed Aug. 26, 1965, Ser. No. 482,739
8 Claims. (Cl. 250—219)

Ths invention relates to apparatus for shifting moving webs or ribbons of sheet material, such as paper, and more particularly, to a box tilt assembly for straightening moving webs.

When a web travels over an extended path, there is a tendency for the web to shift laterally on the support or guide rollers supporting it and deviate from a desired straight line of travel. Such lateral movement may be caused by variation in web thickness on either side of its longitudinal center line causing the web to creep toward the tighter side of the web. Slackening of the web's taughtness resulting from bearing wear in the web support or guide rollers or stretch of the web material also causes lateral shifting of the web.

In many operations, it is necessary that the web be aligned with precision and that straight line web travel be maintained. For example, in printing operations, the web must be properly guided in its movement to provide for accurate printing on the moving web, with a minimum of waste, and with a minimum of jam up of the printing equipment.

Heretofore, web shifting apparatus comprising a single roller or a pair of rollers has been provided to compensate for web slackening and accompanying lateral shifting of the web. Such web shifting apparatus has been difficult to control with precision and has required relatively complex control mechanism.

An object of the present invention is to provide a novel tilt box assembly for effecting desired shifting of a moving web to maintain the moving web in a straight line of travel, the tilt box assembly including entrance and exit rollers having their axes fixed transversely of the line of travel of the moving web and a pair of tilt rollers journaled in a tilt frame for simultaneously canting the tilt rollers in a plane parallel to a plane through the axes of the entrance and exit rollers to effect desired alignment of the moving web.

Other objects and advantages of the present invention will become more apparent hereafter.

The attached drawing illustrates a preferred embodiment of the present invention in which:

FIG. 1 is a perspective view of a box tilt assembly for shifting a moving web of paper or the like embodying the principles of the present invention;

FIG. 2 is a plan view of the box tilt assembly of FIG. 1, with a portion of the web being broken away to illustrate the control for actuating the tilting roll support means;

FIG. 3 is a fragmentary cross-sectional view taken generally along the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary cross-sectional view taken generally along the line 4—4 of FIG. 2;

FIG. 5 is a fragmentary cross-sectional view of the tilting roll support means taken generally along the line 5—5 of FIG. 2;

FIG. 6 is a fragmentary cross-sectional view illustrating the connection of the tilting roll support means to the support frame, taken generally along line 6—6 of FIG. 5;

FIG. 7 is a detail side view illustrating a connecting link between the tilting roll support means and the support frame;

FIG. 8 is a fragmentary detail view taken generally along the line 8—8 of FIG. 6, illustrating the connection

of the actuating screw to the tilting roll support means;

FIG. 9 is a fragmentary cross-sectional view taken generally along line 9—9 of FIG. 6, further illustrating the connection of the actuating screw to the tilting roll support means; and

FIG. 10 is a schematic view of the box tilt assembly of the present invention, with the various angles beween components being exaggerated to better illustrate the principles of this invention.

Referring to FIGS. 1 and 2, there is seen a box tilt assembly 10 embodying the principles of this invention. The box tilt assembly 10 comprises support frame means including a pair of spaced side plates 12 and 14 which are interconnected by a center support or cross brace 16 rigidly connected to the side plates 12 and 14 by suitable fastening means, for example, machine screws 18 and washers 19. Another cross brace or support member 20 is connected at its ends to the side plates 12 and 14.

A plurality of rolier means are journaled in the support frame means for supporting and guiding a moving web 22 of sheet material, such as paper or the like. An entrance roller 30 is carried on shaft 32 that is journaled at its ends in bosses 34 that are carried on the side plates 12 and 14. The bosses may be formed as separate members joined to the side plates or they may be integrally formed on the side plates. An exit roller 24 is carried on a shaft 26 that is journaled at its ends in bosses 28 affixed on the side plates 12 and 14, respectively. The bosses 28 are like the bosses 34 and may be separately joined to the side plates 12 and 14 or may be integrally formed thereon.

Adjacent the top of the support frame means is a tilting roll subassembly 36 comprising bracket members 38 and 40 affixed rigidly to the side plates 12 and 14, tilt roll support members 42 and 44 journaling a pair of tilt rollers 46 and 48 thereon, and pairs of link arms 50, 52 and 54, 56 operatively supporting the support members 42 and 44 and the tilt rollers 46 and 48 for movement in a plane generally parallel to a plane extending through the axes of shafts 26 and 32.

As best seen in FIG. 1, the web 22 is trained under the entrance roller 30, over the tilt rollers 46 and 48, and under the exit roller 26. Movement of the tilt rollers 46 and 48 will adjust the web 22 carried thereon transversely of its desired line of travel to properly align the web 22. The control means for actuating the tilt roll subassembly 36, including the tilt rollers 46 and 48 comprises screw actuating means 58 operatively connected to a motor 60 that is operative in response to a misalignment signal sensed by a photoelectric scanner 62 carried on the cross brace 20.

The photoelectric scanner 62 comprises a light source and receiver disposed adjacent the edge of the moving web for sensing misalignment of the web. The photoelectric scanner 62 is operatively connected to the correction motor 60 through a suitable electric circuit for actuating the motor to rotate the screw shaft 58 to effect desired movement of the tilt roll subassembly to automatically align the web 22.

The correction motor 60, which is operatively joined to the screw shaft 58 by means of a universal joint 64, is a synchronous alternating current motor provided with appropriate reduction gearing. The motor 60 is clamped or otherwise affixed to cross brace 16 by suitable fastening means 66.

In FIGS. 3, 6, 8 and 9, it is seen that the screw shaft 58 extends through an internally threaded ball nut 70 that is connected to yoke 71 by ball joint yoke bolts 72. The yoke 71 includes a shaft or rod 73 rigidly affixed thereto which is journaled in a bearing 74 supported in an opening in frame member 42. A collar 75 is affixed to the rod 73 by a set screw fastener 76. Thus, the yoke 71 will be rotatably supported in bearing 74 on frame mem-

ber 42 and will be confined against movement toward or away from the frame member 42.

Rotation of screw shaft 58 in one direction within the ball nut 70 will cause movement of frame member 42 toward the side plate 12 and rotation of the screw shaft 58 in the opposite direction will cause movement of frame member 42 away from side plate 12. Stop 77 is provided on screw shaft 58 to prevent the screw shaft from becoming disassociated from the ball nut 70. Since the frame members 42 and 44 and the tilt rollers 46 and 48 are interconnected as a subassembly, the tilt rollers will be moved to move the web transversely of the line of travel of the moving web 22 and the support frame means.

Referring to FIGS. 2, 5, 6 and 7, there is seen the connection of the tilt rollers 46 and 48 to the frame members 42 and 44 and the connection of the frame members 42 and 44 to the bracket members 38 and 40. Each roller 46 and 48 is carried on a shaft 47 and 49, respectively, that is journaled at its ends in the frame members 42 and 44, respectively. Only one shaft bearing arrangement is shown in detail and it will be understood that the roller shafts 47 and 49 are similarly journaled at each end. Carried on the end of roller shaft 49 is a spherical bearing 78 having a convex outer surface that is adapted to cooperate with a complementary bearing 79 having a concave surface thereon. Retaining means comprising a washer 80 and screw 81 are provided to maintain spherical bearing 78 in place against shoulder 82 on shaft 49 that carries roller 48. Retaining means 83 comprising a retaining ring is provided to hold bearing 79 in place on frame member 42.

Elongated pins 84 and 85 are non-rotatably affixed in openings extending through connecting link 52 at each end thereof. Spherical bearings 86 and 87 are provided at each end of each pin 84 and 85. The spherical bearings 86 and 87 cooperate with complementary bearings 88 and 89. When assembled on the box tilt support frame, the bearings 88 and 89 are disposed in recesses or counterbores in the upper and lower frame parts 42^a and 42^b of frame member 42. The frame parts 42^a and 42^b are retained in spaced relationship by block means 42^c and 42^d which are connected to the frame parts 42^a and 42^b by screw means 90 which cooperate with internally threaded openings or bores in blocks 42^c and 42^d. Block 42^c functions as a spacer and block 42^d receives the bearings for journaling an end of roller shaft 49.

Rollers 24, 30, 46 and 48 are each provided with an opening therethrough for receiving the respective roller support shaft 26, 32, 47 and 49. Suitable means, such as retaining collars are provided to fixedly secure each roller to its shaft for rotation therewith.

Considering FIGS. 2 and 10, there will be better understood the movement of the rollers 46 and 48 with respect to one another and to the moving web 22. Links 50, 52 and links 54, 56 are maintained parallel to one another. Frame members 42 and 44 are maintained parallel to bracket members 38 and 40. However, as the tilt frame subassembly 36 is moved from its central position, shown in FIG. 2, by virtue of rotation of actuating shaft 58 in response to a misalignment signal sensed by photoelectric scanner 62, the angle between each connecting link and its associated bracket member changes, causing canting of the tilt rollers with respect to the line of web travel. As seen in FIG. 10, the screw shaft 58 has moved frame member 42 to the left. The angle *a* defined between the connecting links and the bracket members when the web is centered changes. An angle *c*, which is less than angle *a*, is defined between connecting links 50 and 52 and bracket member 38. The angle *b* is defined between the connecting links 54, 56 and the bracket member 40. The angle *b* is larger than the angle *a*. as a consequence, rollers 46 and 48 are retained in parallel relationship to one another, however, the rollers are canted and the geometric figure defined by the rollers 46 and 48 and the frame members 42 and 44 shifts from a rectangle to a rhomboid.

The simultaneous movement of the tilt rollers 46 and 48 acts upon the moving web 22 to effect a precise realignment thereof. The tilt box assembly 10 may be spaced close to a printing machine or like piece of equipment that requires introduction of a moving web thereinto in a precise manner.

There has been provided by the present invention a novel box tilt assembly comprising an entrance roller, an exit roller, and a pair of tilt rollers carried in a tilt frame for supporting and guiding the moving web between the entrance and exit rollers. The tilt frame is moved responsive to actuation of a screw shaft to cant the tilt rollers with respect to the line of travel of the moving web. The screw shaft is driven by a control motor responsive to a misalignment signal sensed by a photoelectric scanner disposed adjacent the edge of the moving web. Canting of the tilt rollers will cause realignment of the moving web by physically moving the web transversely.

An important feature of a presently preferred form of the invention is that the plane passing through the axes of the tilt rollers is maintained parallel with the plane passing through the axes of the entrance and exit rollers. The tilt roll subassembly movement is capable of maintaining a precise alignment of the moving web—within plus or minus .005 inch tolerance from the guide edge of the moving web.

The box tilt assembly may be mounted horizontally as shown or it may be mounted at an angle to the horizontal. The scanning means may be adapted to control from an edge of the moving web, as illustrated, or a scanning control means may be used that is operative to maintain the moving web centered between two fixed points.

While I have shown a preferred embodiment of the present invention, it will be understood by those skilled in the art that the invention is not so limited, since it may be otherwise embodied within the scope of the following claims.

We claim:

1. A box tilt assembly for straightening moving webs comprising in combination, a support frame comprising a pair of spaced side walls, an entrance roller over which the web travels journaled in said side wall, a pair of parallel tilt roller each journaled at it end in a tilt frame, parallel links supporting said tilt frame on said side walls, each parallel link forming a variable acute angle with the support frame, the acute angles of all parallel links being on the same side with respect to the direction of web travel, means on said support frame for actuating said tilt frame in response to a predetermined position of the web to provide a canting movement of the pair of tilt rollers to move the web transversely to maintain web alignment, and an exit roller over which the web travels journaled in said side walls, the axes of the entrance roller and exit roller being parallel to one another.

2. A box tilt assembly as in claim 1 wherein said actuating means comprises a motor driven screw shaft cooperating with said tilt frame.

3. A box-tilt assembly as in claim 2 wherein said actuating means includes a photoelectric scanner carried on said support frame.

4. A box-tilt assembly as in claim 3 wherein the photoelectric scanner for sensing the transverse position of the moving web is disposed on the support frame between the exit roller and the tilt rollers.

5. A box-tilt assembly as in claim 2 wherein yoke means are pivotally carried on the tilt frame and a ball nut is carried by the yoke means, said screw shaft cooperating with said ball nut, whereby rotation of said screw shaft will cause movement of said tilt frame transversely of the line of travel of the moving web in a plane parallel to the plane passing through the axes of the entrance and exit rollers.

6. A box-tilt assembly as in claim 1 wherein the rollers are at each end carried on the tilt frame in spherical

bearings to accommodate rotation of the rollers and also canting of the rollers with respect to the tilt frame.

7. A box-tilt assembly for straightening moving webs comprising, in combination, a support frame including a pair of spaced side walls, entrance roller means rotatably carried in said side walls, exit roller means rotatably carried in said side walls, a tilt-frame assembly including a pair of tilt roller means rotatably carried in a tilt frame, a pair of parallel link members at each side of said tilt frame for supporting said tilt frame on said side walls, the moving web being trained over said entrance roller means, said tilt roller means, and said exit roller means, each link member being pivotally joined at one end to a side wall and at the other end to the tilt frame, with the planes passing through the pivot axes of the link members at one side of the tilt frame converging with the planes passing through the pivot axes of the link members at the other side of the tilt frame in a direction opposite the longitudinal direction of travel of the moving web, and means on the support frame for actuating the tilt frame to cant the tilt rollers for moving the moving web transversely of its longitudinal line of travel to maintain web alignment, the plane passing through the axes of the entrance roller means and exit roller means being parallel to the plane passing through the axes of the tilt rollers.

8. A box-tilt assembly for straightening moving webs comprising, in combination, a support frame including a pair of spaced side walls, an entrance roller rotatably supported between said side walls, an exit roller rotatably supported between said side walls in parallel relationship to said entrance roller, a tilt frame, a pair of tilt rollers journaled on said tilt frame, the axes of the tilt rollers being parallel, a pair of parallel links at each side of said tilt frame for movably supporting said tilt frame between said side walls, the moving web being guided under said entrance roller, over said tilt rollers, and under said exit roller, each link being pivotally joined at one end to a side wall and at the other end to the tilt frame, the axes of the links on opposite sides of the tilt frame converging, with at least a component of the force acting on the links being in a direction opposite to the force applied to the tilt frame and tilt rollers carried thereby responsive to the longitudinal direction of travel of the moving web, and means on the support frame for actuating the tilt frame responsive to misalignment of the moving web from a predetermined position to cant the tilt rollers with respect to the longitudinal line of travel of the moving web to move the web transversely to realign the web.

References Cited

UNITED STATES PATENTS

2,797,091	6/1957	Fife	226—22
2,797,794	7/1957	Bradley	198—202
3,204,109	8/1965	Goodwin	250—219 X

WALTER STOLWEIN, *Primary Examiner.*

J. D. WALL, *Assistant Examiner.*