Oct. 8, 1963 G. W. KARR 3,106,365

COMPOUND BOWED D BAR SPREADER

Filed Feb. 27, 1961 2 Sheets-Sheet 1

Fig-2

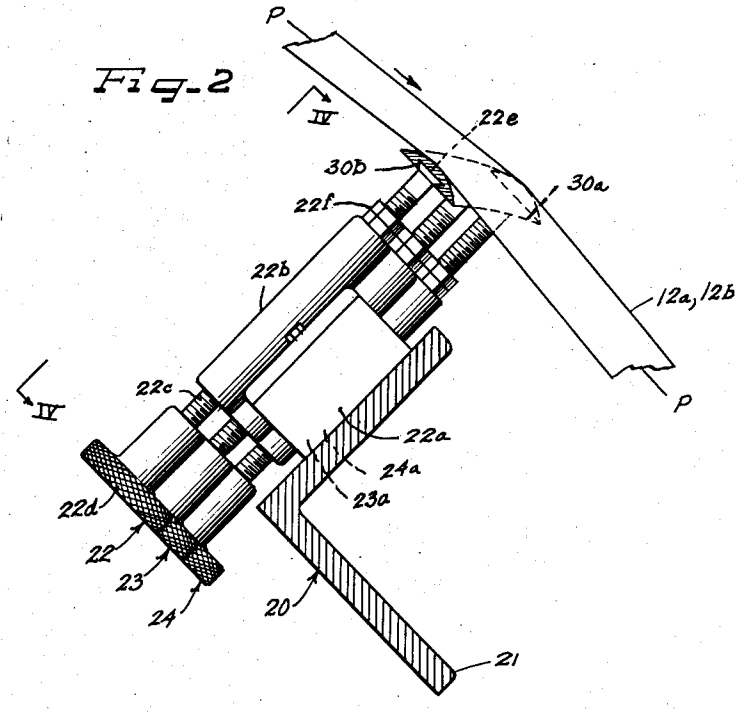


Fig-3

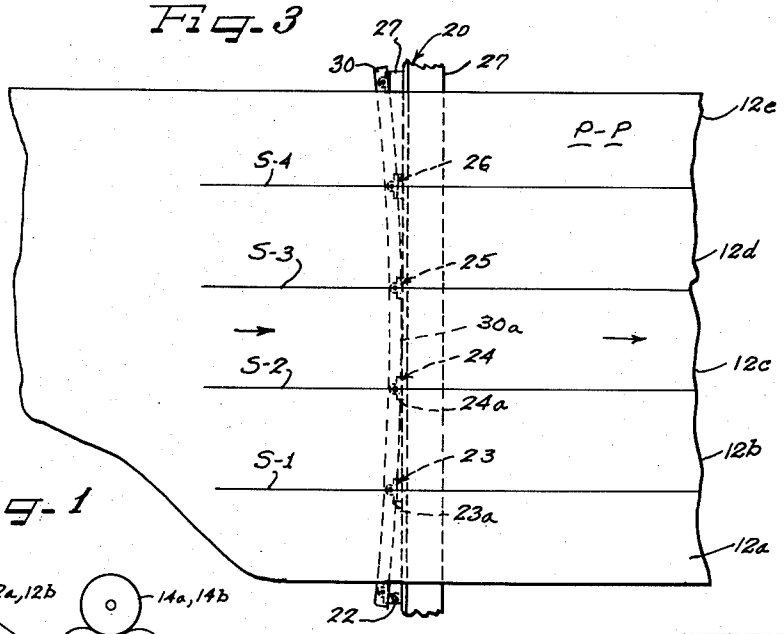
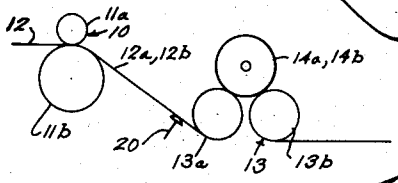


Fig-1



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Filed Feb. 27, 1961 2 Sheets-Sheet 2

Fig-4

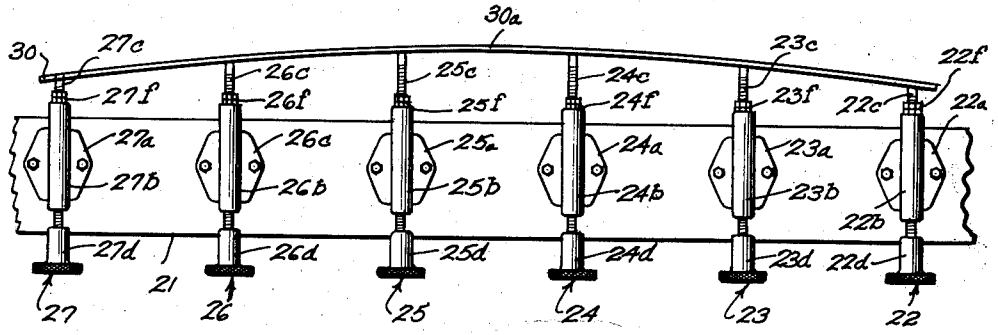


Fig-5

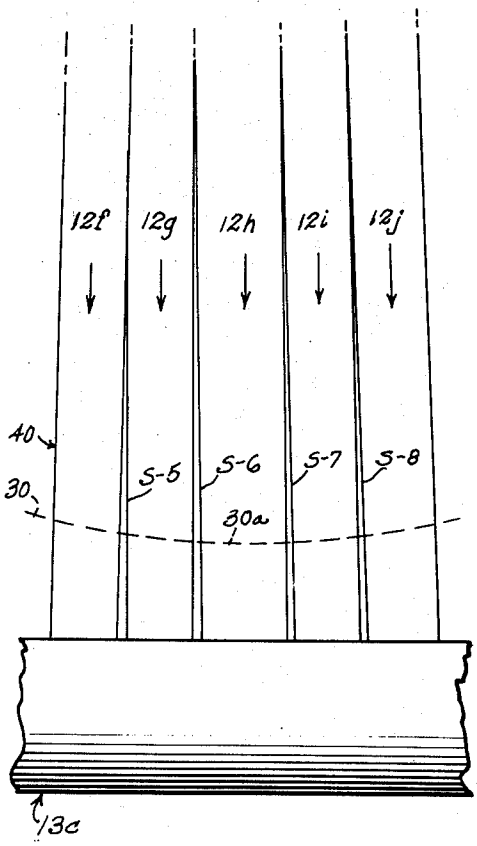
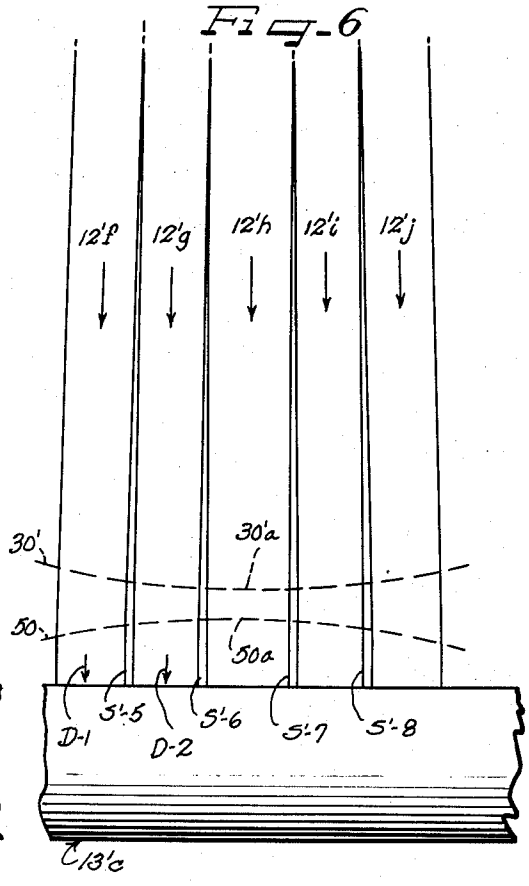


Fig-6



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United States Patent Office 3,106,365 Patented Oct. 8, 1963

3,106,365

COMPOUND BOWED D BAR SPREADER

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Filed Feb. 27, 1961, Ser. No. 91,914
4 Claims. (Cl. 242—76)

The instant invention relates to means for handling traveling sheet material, and more particularly, to means for guiding traveling sheet material in such a manner as to maintain the elements of a traveling uniplanar sheet material in substantial alignment with the direction of travel, without convergence of such elements laterally or transversely to a direction of travel.

Although the instant invention has practical application in the maintenance or spreading of the elements of a single traveling uniplanar sheet (e.g. so as to avoid folding of the sheet elements upon themselves), the instant invention is particularly useful in the spreading of slit paper sheets just prior to windup. In the conventional slitting arrangement, a slitter divides a traveling paper web into a plurality of closely adjacent (e.g. contiguous or slightly spaced) paper sheets, which continue to travel substantially uniplanarly into a windup device whereat the individual sheet elements are wound upon themselves to form a plurality of adjacent (generally coaxial) paper rolls. The term "uniplanar" is used herein to denote the condition of the adjacent traveling sheets at any particular location, i.e., it is appreciated that the overall travel of the sheets from the slitting device to the windup device may follow a curvilinear path, but at any particular location (and for a practical matter during substantially the entire travel between these devices) the plurality of contiguous sheets will lie in substantially the same plane. The instant invention provides a guide bar system which actually engages the traveling sheets and, as will be explained in detail hereinafter, deflects the same slightly out of a "true" uniplanar relationship, although retaining the sheets in a substantially uniplanar relationship.

One of the most significant difficulties involved in slitter arrangements of this type resides in the tendency of the individual slit sheets to move out of precisely the desired longitudinal alignment or direction of travel. If these sheet elements overlap, then it will be appreciated that adjacent wound paper rolls will be interlocked. Also, if the sheets approach the windup means in a direction that is not in substantial alignment with the direction of travel, they will approach the windup core and/or winder drums at a slight deviation from alignment directly perpendicular to a plane passing through the axis of the roll or core and the desired line of contact between the paper sheet and the surface of the roll or core, so as to effect an undesirable "spiral" windup. The extremely high speeds at which many slitter and windup operations are carried out also tend to complicate the considerations involved in obtaining the desired windup conditions.

The instant invention provides a guide means which may be interposed between the slitter and windup devices in order to effect the desired alignment of the slit sheets. This is obtained by the use of a guide bar or so-called D bar which is bowed in the center (and which in cross-section resembles the letter "D," hence the name). The guide bar of the instant invention, however, is unique in that it is bowed in the center not only against the plurality of traveling sheets which it engages but also in the direction of the travel of said sheets and any partial length thereof can be independently adjusted in either direction to compensate for any unusual conditions in web. Also the bar may be bowed to a true radius or in a parabola. This compound bowing effect results in a unique and

highly practical arrangement for obtaining the desired alignment of the traveling sheets. It effects spreading of the traveling sheets to the extent desired and further effects alignment thereof in the direction of travel in a highly desirable manner. In addition, it has been found that even better results may be obtained in certain devices using in combination with the aforementioned compound bowed D bar spreader a second bowed D bar spreader closely spaced from the first at the off-running side thereof, with the second bar being bowed centrally against the traveling sheets, but in a direction opposite to the direction of travel, rather than in the same direction of travel for the sheets.

It is, therefore, an important object of the instant invention to provide an improved guide means for traveling sheet material, and more particularly, an improved guide means for maintaining desired alignment for a plurality of substantially uniplanar traveling sheets.

It is a further object of the instant invention to provide guide means for a plurality of substantially uniplanar traveling sheets, comprising a guide bar engaging one side of said sheets, said guide bar being bowed in the center against the sheets and in the direction of travel of said sheets to separate the sheets transversely to the direction of sheet travel.

A more specific object of the instant invention is to provide, in a paper sheet handling device, a slitter dividing a traveling paper web into a plurality of closely adjacent uniplanar sheets, a first guide bar spaced from the slitter in the direction of sheet travel and engaging one side of said sheets, said guide bar being bowed in the center against the sheets and in the direction of travel of said sheets to separate the sheets transversely to the direction of sheet travel, a second guide bar closely spaced from the first in the direction of web travel, said second guide bar being bowed in the center against the sheets and away from the direction of travel of said sheets to align the sheets, as separated by the first guide bar, in the direction of travel so as to substantially maintain the spacing therebetween effected by said first guide bar, and windup means spaced from the second guide bar in the direction of sheet travel winding the sheets into a plurality of laterally spaced rolls.

Other and further objects, features and advantages of the present invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings attached hereto and made a part hereof.

On the drawings:

FIGURE 1 is an essentially diagrammatic view of a slitter and windup device using the guide means embodying the instant invention;

FIGURE 2 is a detailed side elevational view of the compound bowed D bar spreader;

FIGURE 3 is a top plan view showing the plurality of closely spaced adjacent uniplanar paper sheets passing over the top of the compound D bar spreader shown in detail in FIGURE 2;

FIGURE 4 is a generally elevational view taken substantially from the position indicated at IV—IV of FIGURE 2 showing the compound D bar spreader in reduced transverse dimension and with an exaggerated bow;

FIGURE 5 is essentially a top plan diagrammatic view of the closely adjacent uniplanar sheets passing over a guide bar of the invention, comparable to the view of FIGURE 3 but showing the spreading of the sheets in exaggerated manner; and

FIGURE 6 is a view corresponding to that of FIGURE 5, except that a second D bar spreader is shown in cooperation with the first.

As shown on the drawings:

Referring to FIGURE 1, it will be seen that the overall slitting and winding device indicated diagrammatically

therein by the reference numeral 10 comprises a slitter 11*a*, 11*b* of conventional design for slitting a traveling paper web 12 into a plurality of closely adjacent substantially uniplanar traveling sheets indicated at 12*a*, 12*b*, etc. The traveling sheets 12*a*, 12*b*, etc. move from the slitter 11*a*, 11*b* to a windup device indicated generally at 13. The windup device may involve a single windup mandrel in the position 13*a* on which a plurality of closely spaced rolls are wound from each of the traveling sheets 12*a*, 12*b*, etc., or the windup device 13 may comprise, as is actually indicated in the drawing, a pair of underwinder drums 13*a*, 13*b* which wind the paper rolls 14*a*, 14*b*, etc. coaxially in the nip between the underwinder drums 13*a*, 13*b*. The first roll 14*a* winds up the sheet 12*a*, the second roll 14*b* (hidden by the first) winds up the second sheet 12*b*, etc. In order to obtain the desired spreading and alignment of the traveling sheets 12*a*, 12*b*, etc., guide means in the form of a compound bowed D bar spreader 20 embodying the instant invention is mounted so as to engage one side of the traveling sheets 12*a*, 12*b*, which is here shown as the bottom side.

Referring now to FIGURE 3, it will be seen that the plurality of substantially uniplanar traveling sheets 12*a*, 12*b*, 12*c*, 12*d* and 12*e* are shown in top plan view. The direction of travel is indicated by the arrows. The sheets 12*a*, 12*b*, etc. are substantially uniplanar and they are closely adjacent (so closely spaced, in fact, that in this view the spaces therebetween S–1, S–2, etc. are indicated merely as lines). It will be seen later that the spaces are shown in greatly exaggerated manner in FIGURES 5 and 6.

As indicated in FIGURES 2 and 3, the guide bar assembly 20 comprises a frame element 21 extending transversely the full width of the sheets 12*a* through 12*e* and suitably mounted on a fixed support (not shown). The frame element 21 carries a plurality of mounting means 22 through 27 spaced laterally to the direction of sheet travel maintaining a guide bar 30 in position such that it is bowed in the central portion 30*a* thereof in the direction of travel of the sheets (as shown in FIGURE 3) and also against or into the plane P—P of the sheets 12*a*, 12*b*, etc. (as indicated generally in FIGURE 2). The outside individual mounting means 22 shown in FIGURES 2 and 3 comprises a footing 22*a* (which preferably is adjustable in height, e.g. by shims not shown) secured to the frame 21 and mounting a sleeve 22*b* generally normal to the plane P—P of the sheets 12, 12*b*, etc. The sleeve 22*b* threadedly receives an adjusting rod 22*c* provided at its rear with turning knob 22*d* and at its front end with an adjusting head 22*e* which is rotatably received by a socket 30*b* in the back of the bar 30. Axial movement of the rod 22*c* in the sleeve 22*b* adjusts the position of the head 22*e* and thereby adjusts the position of the portion of the bar 30 in the immediate region of the socket 30*b*. A lock nut assembly 22*f* maintains the adjusting rod 22*c* in adjusted operative position. The other adjusting means 23, 24 visible in FIGURE 2, of course, function in substantially the same manner, except that these adjusting means 23 and 24 are mounted on successively lower footing elements 23*a*, 24*a* so as to be closer to the frame 21 and thereby to impart to the central portion 30*a* of the bar 30 a bowing effect in the direction of travel of the sheets 12*a*, 12*b*, etc. Also, the adjusting means 23 and 24 urge the central portion 30*a* of the bar 30 to an increasingly greater extent against the sheets 12*a*, 12*b* (or into the plane P—P of such "substantially" uniplanar traveling sheets 12*a*, 12*b*, etc.). In this way the bar 30 is bowed in its center not only in the direction of travel of the sheets 12*a*, 12*b*, etc. but also against the same. This is compound bowing effect; and it has been found to provide a number of advantages in the guidance of the plurality of traveling sheets 12*a*, 12*b*, etc. For example, it tends to effect spreading of the sheets so that they do not readily reconverge in a subsequent operation and it assists in the combination of spreading of the sheets 12*a*, 12*b*, etc. and realignment thereof.

Referring also to FIGURE 4, it will be seen that the bowing in the central portion 30*a* of the bar 30 is shown in exaggerated manner for purposes of simplification. In other respects, the plurality of spaced adjustable mounting means 22 through 27 are shown with parts corresponding to those already described in connection with FIGURES 2 and 3 indicated by the corresponding reference numerals.

Referring now to FIGURE 5, it will be seen that there is shown in FIGURE 5 an essentially diagrammatic top plan view of a guiding arrangement 40 embodying the instant invention, wherein the guide bar 30 is shown diagrammatically. In the device 40, a plurality of substantially uniplanar traveling sheets 12*f* through 12*j* pass in the direction indicated by the arrows over the guide bar 30 and against the first drum of a winding device 13*c*. The spaces S–5 through S–8 shown therebetween are shown in exaggerated form for purposes of simplification. The guide bar 30 has a spreading effect upon the group of sheets 12*f* through 12*j* so as to effect an increase in the spaces S–5 through S–8 as a result of contact with the bar 30. The compound bow of the bar 30 has a self-correcting effect so that the individual sheets 12*f*, 12*g*, etc. passing thereover do not converge immediately after passing over the bar 30. Nor are they forced out of alignment to such an extent that they will wind spirally or improperly in the windup arrangement 13*c*. It will be appreciated that, if the sheets 12*f* and 12*g*, for example, were to converge immediately after passing over the bar 30, or at any time during windup in the windup device 13*c*, there would result an interlocking between the rolls ultimately formed (i.e. the rolls indicated at 14*a*, 14*b* in FIGURE 1) along the contiguous faces of the rolls. This interlocking must be avoided, but it cannot be avoided at the expense of directing the individual sheets 12*f*, 12*g*, etc. at such angles to the direction of travel (indicated by the arrows in FIGURE 5) that the sheets will wind up upon themselves in a "spiral" fashion, or will wrinkle or fold upon themselves or otherwise be defective.

Although the compound bar arrangement indicated in FIGURE 5 is advantageous for a number of purposes, it has also been found that particularly in certain cases there are additional advantages in the use of a reverse compound bar in conjunction with the first compound bowed D bar spreader hereinbefore described, and indicated by the reference numeral 30. This embodiment is shown in FIGURE 6 wherein all of the elements of FIGURE 5 are shown by primed reference numerals corresponding to those shown in FIGURE 5. The additional element in FIGURE 6 is the reversed compound bowed D bar spreader indicated generally at 50. The D bar spreader 50 is bowed against the traveling sheets 12'*f* and 12'*g*, etc. to the same extent as is indicated best in FIGURE 2 hereinbefore described. In other words, it is bowed so as to penetrate centrally into the so-called plane P—P of the sheets to substantially the extent indicated in FIGURE 2. On the other hand, the bowed D bar spreader 50 in FIGURE 6 is also bowed in its central portion 50*a* in a direction opposite to the direction of travel of the individual sheets 12'*f*, 12'*g*, etc. The bowing of the central portion 50*a* of the bar 50 in the reverse direction and opposite to the direction of web travel is carried out to an extent corresponding to the forward bowing of the central portion 30'*a* of the first bar 30' shown in FIGURE 6, so as to effect alignment of the sheets 12'*f*, 12'*g*, etc., as separated by the first guide bar 30', in the direction of travel so as to substantially maintain the spacing S'–5 through S'–8 which is effected by the combined effect of the two bars 30' and 50. The guide bar 50 provides an additional correction in the alignment of the sheets 12'*f*, 12'*g* which is particularly important in many operations, in that its net effect in conjunction with the bar 30' is to

substantially align the sheet **12'***f*, for example, in a direction D–**1** that is substantially parallel with the direction D–**2** of the immediately adjacent sheet **12'***f*.

In the preferred embodiment of the invention the **D** bar **30** "penetrates" the plane P—P of the sheets **12***a* through **12***e* (i.e. is deflected against the sheets) in an amount equal to about 0.1 to about 0.5 inch per 100 inches of **D** bar width; and the bar **30** is deflected centrally in the direction of travel of the web sheets about 0.1 to about 0.5 inch per 100 inches of width. The deflection of the bar **50** (FIGURE 6) is the same except that its deflection with respect to the direction of sheet travel is opposite to the direction of travel, rather than in the same direction.

It will be appreciated that separate and independent means are provided for deflection of the bar **30** against the sheets **12***a*, etc. and in the direction of sheet travel. The angle between the oncoming sheet (**12***a*) portion approaching the bar **30** and the off-running portion of the same sheet **12***a* leaving the bar **30** is slightly less than 180°, being preferably within the range of 175° to 179½°.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. Guide means for a plurality of substantially uniplanar traveling sheets, comprising a first stationary guide bar engaging one side of said sheets, said guide bar being bowed in the center against the sheets and in the direction of travel of said sheets to separate the sheets transversely to the direction of sheet travel and a second stationary guide bar closely spaced from the first in the direction of web travel, said second guide bar being bowed in the center against the sheets and away from the direction of travel of said sheets to align the sheets, as separated by the first guide bar, in the direction of travel so as to substantially maintain the spacing therebetween effected by said first guide bar.

2. Guide means for substantially uniplanar travelling sheets comprising, a guide bar held against rotation and engaging one side of said sheets, and mounting means for the guide bar spaced laterally to the direction of sheet travel maintaining the bar bowed centrally in the direction of travel of said sheets, said mounting means including means for bowing the guide bar centrally against the sheets to separate the sheets from each other in a direction transverse to the direction of sheet travel.

3. Guide means for substantially uniplanar travelling sheets comprising, a guide bar held against rotation and engaging one side of said sheets, and mounting means for the guide bar spaced laterally to the direction of sheet travel maintaining the bar bowed centrally in the direction of travel of said sheets, said mounting means including adjustable means for adjustably bowing the guide bar centrally against the sheets to separate the sheets from each other in a direction transverse to the direction of sheet travel.

4. Guide means for substantially uniplanar travelling sheets in accordance with claim 3 and including a second stationary guide bar closely spaced from the first in the direction of web travel, said second guide bar being bowed in the center against the sheets and away from the direction of travel of said sheets to align the sheets, separated by the first guide bar, in the direction of travel so as to substantially maintain the spacing therebetween effective by said first guide means.

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