July 5, 1927.

C. A. DICKHAUT

1,634,984

SHEET STRAIGHTENER

Filed Dec. 28, 1925

6 Sheets-Sheet 1

Fig. 1

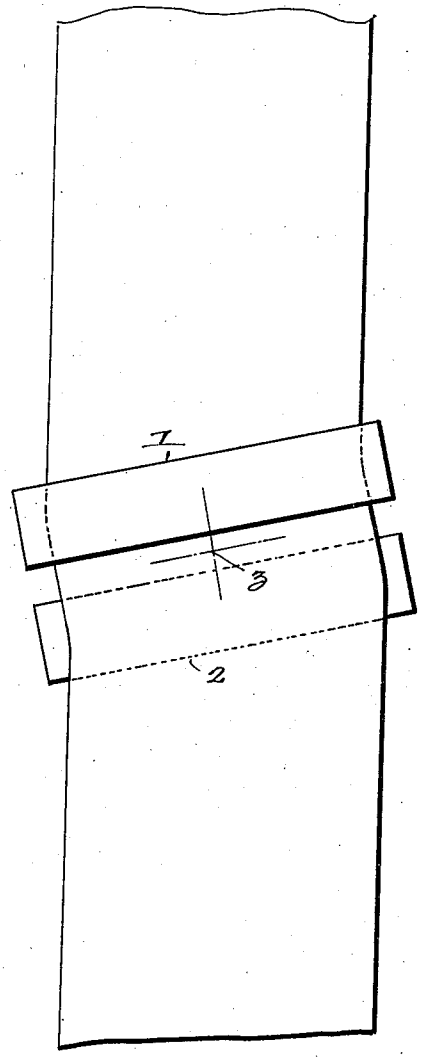
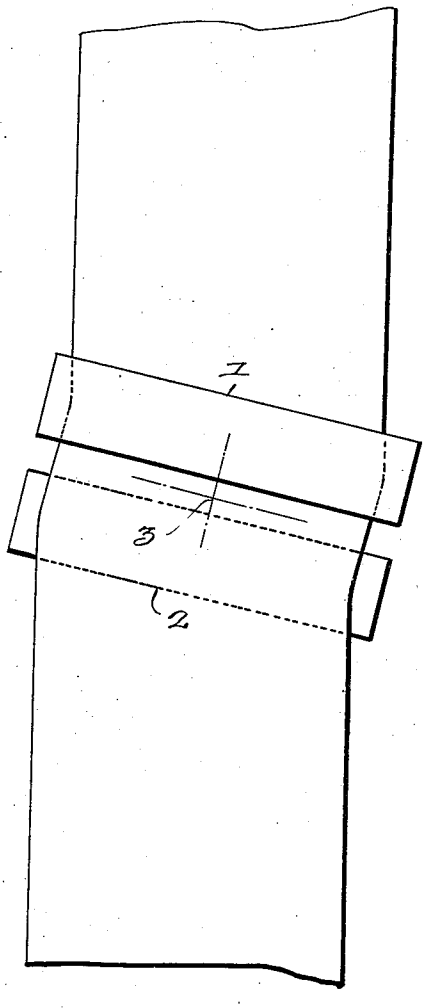


Fig. 2.



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by his Attorneys.—
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6 Sheets-Sheet 2

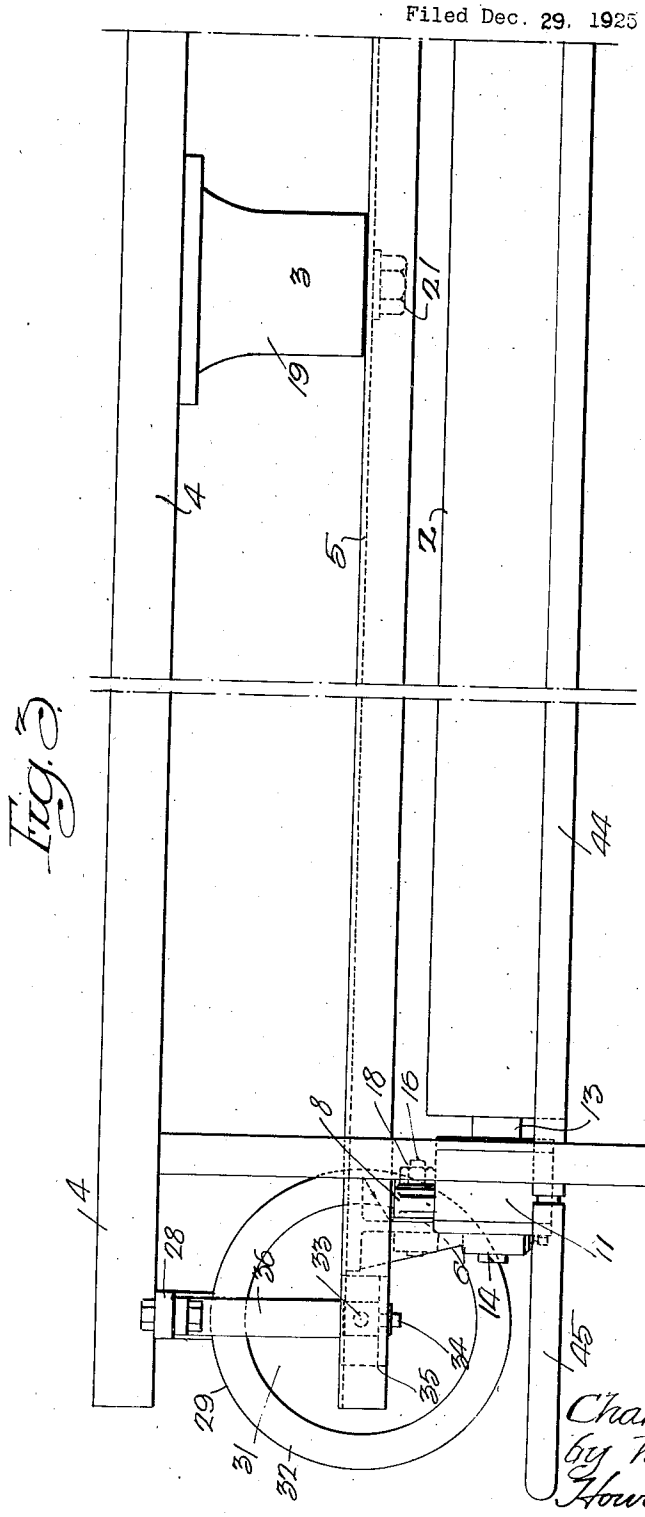

Fig. 2.

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6 Sheets-Sheet 3

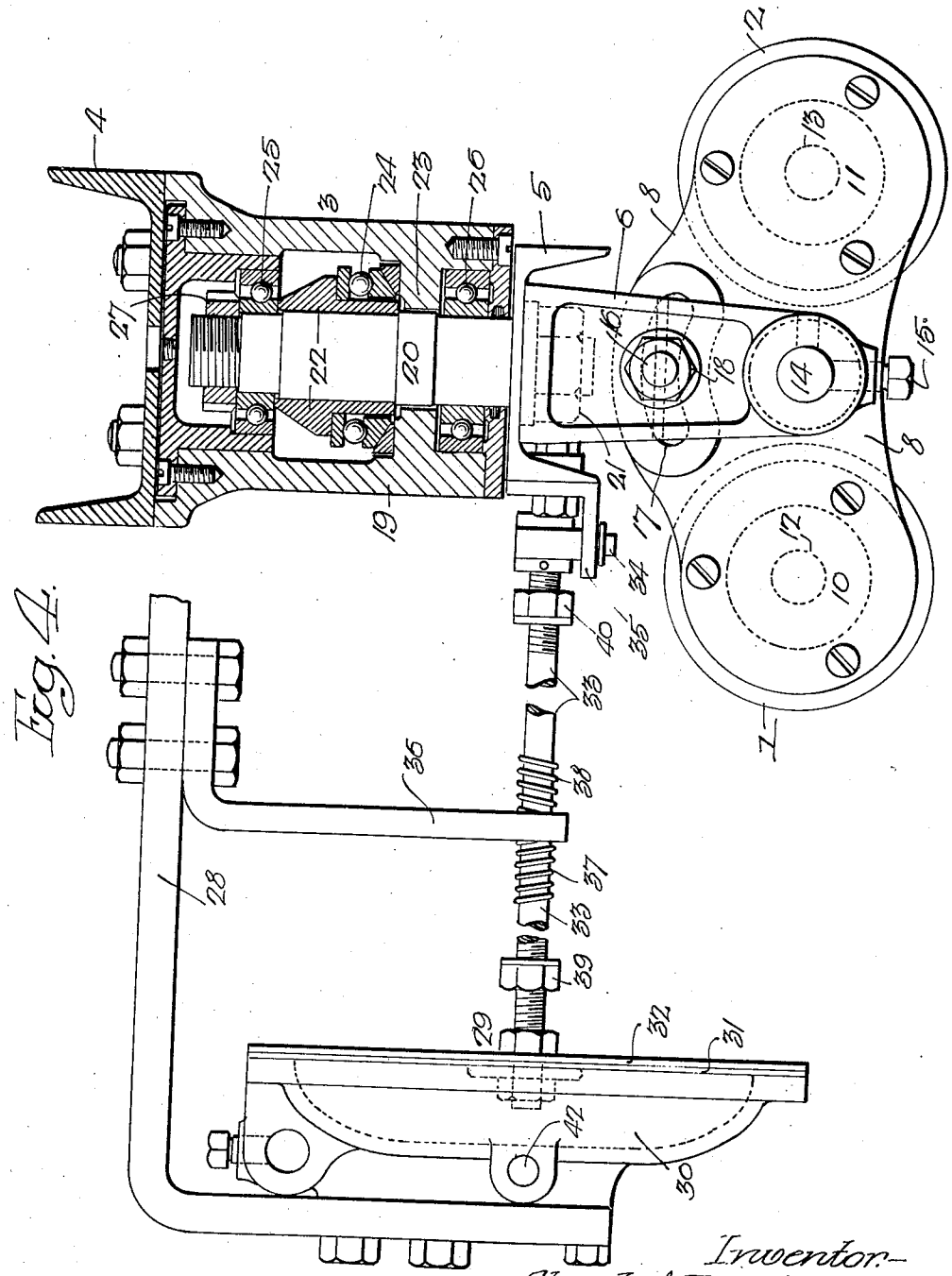

Fig. 4.

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6 Sheets-Sheet 4

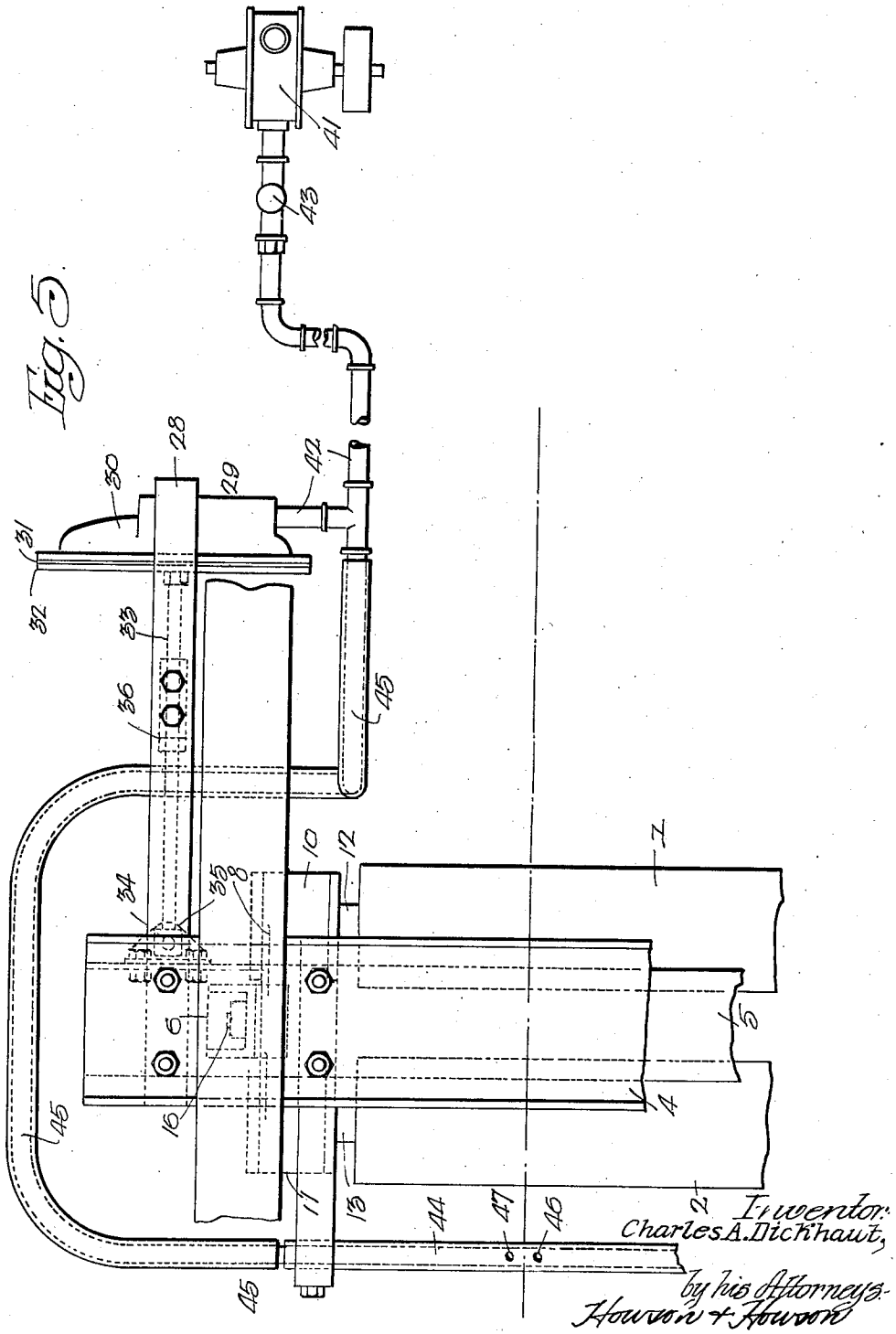

Fig. 6.

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6 Sheets-Sheet 5

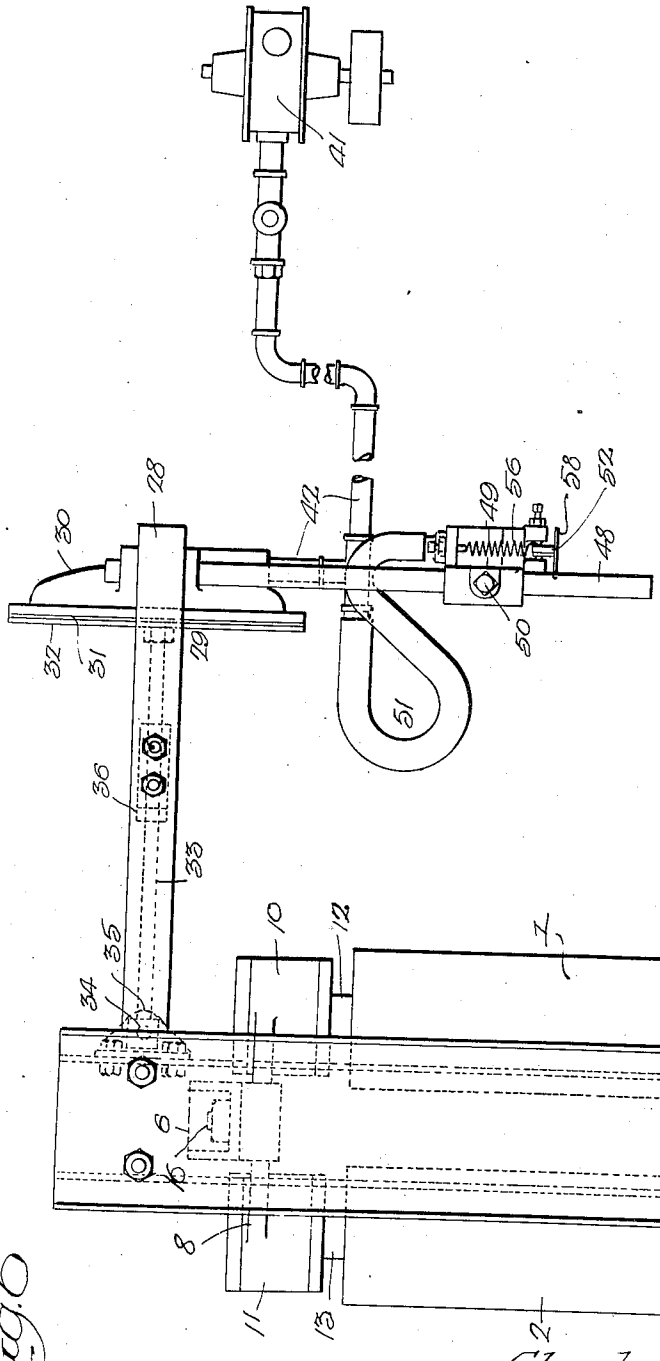

Fig. 6

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SHEET STRAIGHTENER

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6 Sheets-Sheet 6

Fig. 9

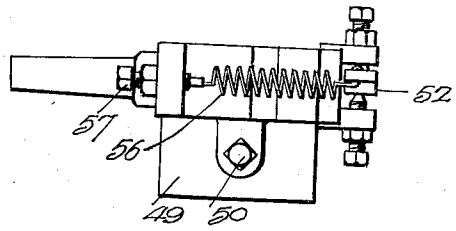


Fig. 7

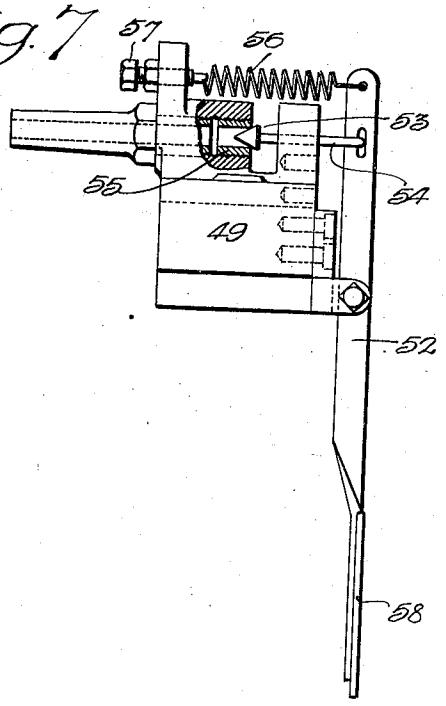
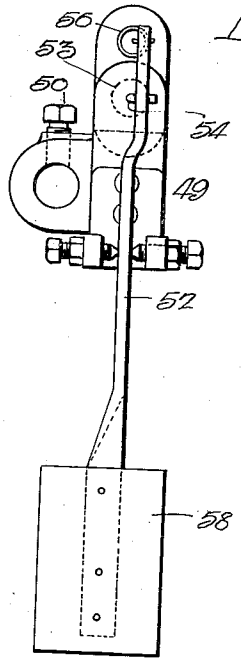


Fig. 8.



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Patented July 5, 1927. 1,634,984

UNITED STATES PATENT OFFICE.

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SHEET STRAIGHTENER.

Application filed December 29, 1925. Serial No. 78,182.

This invention relates to a mechanism adapted to be used in the manufacture and in the handling of paper, cloth or other sheet material which is manufactured in long strips or webs and which must be continuously fed from one position to another, or from one operation to another.

The principal object of the invention is to provide a mechanism for use in guiding the sheet or web material while under tension so that it may move in a predetermined path without lateral deviation therefrom. The mechanism embodying the invention serves to correct or compensate for lateral deviations in the sheet due to inaccuracies of manufacture, and uneven shrinking or stretching. The invention is particularly adapted for use when the web material is being fed from one operation to another or when it is being wound or folded to form a roll or bundle.

More specifically the object of the invention is to provide angularly adjustable guides or guide rollers for lateral shifting or offsetting the path of the sheet.

Another object of the invention is to provide automatic means for adjusting the guides or rollers to guide the web in the desired fixed path.

Further objects of the invention are to provide various improved features of construction which enable me to carry out the main objects of the invention as above set forth.

In the accompanying drawings I have shown one embodiment of the invention together with an alternate construction for one of the features, but it will be understood that the drawings are for illustrative purposes only and are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawings:

Figures 1 and 2 are diagrammatic views showing the principle which is used in the invention;

Fig. 3 is a front view of a mechanism embodying the invention;

Fig. 4 is a combined end and transverse sectional view, the view being partly in section along the line 4—4 of Fig. 3;

Fig. 5 is a plan view with the upper supporting framework omitted for the sake of clearness;

Fig. 6 is a fragmentary plan view similar to Fig. 5, but showing an alternate form of device for controlling the adjustment of the rollers;

Fig. 7 is a front view of the valve mechanism shown in Fig. 6;

Fig. 8 is an end view of the valve mechanism, and

Fig. 9 is a plan view of the valve mechanism.

In accordance with the invention as illustrated diagrammatically in Figures 1 and 2, I provide two parallel guides 1 and 2 which are connected together and adapted to be angularly adjusted about a vertical axis at 3. These guides are preferably cylindrical in form, and ordinarily will be rotatable rollers. The sheet of paper, cloth or other material to be straightened or offset passes under one of these guides, as for instance 1, and over the other of the guides, as for instance 2. If the guides or rollers were adjusted to a position exactly perpendicular to the direction of movement of the sheet, the alignment of the sheet would not be changed. However, when the guides or rollers are inclined as shown for instance in Figure 1, the web is caused to follow the angle of inclination of the guides and to be offset in the direction of the said inclination. By inclining the guides in the other direction as shown in Figure 2, the web can be offset in the other direction. From the foregoing it will be clear that by changing the angle of inclination of the guides, the sheet can be controlled so that the portion thereof beyond the guides follows a predetermined path notwithstanding lateral variations in the position of the portion in advance of the guides. In accordance with the invention as will presently appear, automatic means controlled by the sheet itself are provided for adjusting the guides so as to maintain the portion of the sheet which is beyond them in the required predetermined path.

Referring particularly to Figures 3 and 4, it will be seen that I provide a suitable supporting framework 4 on which the other parts of the mechanism are carried. As shown the framework 4 is above the other parts which are suspended from it, but it will be understood that this exact arrangement is not essential.

For carrying the two guides or rollers 1 and 2 I provide a swiveled frame member

5 which is adjustable with respect to the framework 4 about the aforesaid vertical axis 3. As shown, the frame-member 5 comprises an inverted channel bar. I preferably provide means whereby relative bodily adjustment may be effected between the two guides or rollers in a direction parallel with the swivel axis or perpendicular to the planes of the sheets. For this purpose the frame-member 5 is provided at each end with a depending bracket 6, and the two rollers are carried by these brackets. Intermediate carrying yokes 8, 8 are interposed between the brackets and the rollers. As illustrated, each of the yokes is provided with bearings, preferably ball bearings, 10 and 11 for supporting shafts 12 and 13 upon which the respective rollers 1 and 2 are mounted. In order that the two rollers may be bodily adjusted as aforesaid, the yokes 8, 8 are made adjustable with respect to the brackets about a horizontal axis. Each of the yokes 8 is provided with a pivot stud 14 which projects through an aperture in the corresponding bracket 6 and is adapted to be held by means of a set screw 15. As shown, each of the brackets 6 is provided with a stud 16 which extends through a slot 17 formed in the upper part of the corresponding yoke 8. By means of a nut 18 on the stud 16 the corresponding yoke can be firmly clamped to the adjacent bracket. It will be seen that by means of the construction which I have described, the two rollers 1 and 2 are held in parallelism but are adapted to be adjusted about a horizontal axis extending through the pivot studs 14, 14.

The pivot structure whereby the frame member 5 is suspended from the main framework 4 is shown in detail in Figure 4. As illustrated there is an outer housing 19 which is bolted or otherwise secured to the framework 4, and a vertically extending bearing stud 20 is rigidly secured to the frame member 5, as for instance by means of the nut 21. This stud 20 extends upward through the center of the housing 19, and is provided with a collar 22 which is rigidly held in place. A flange 23 projects inward from the wall of the housing 19, and a ball thrust bearing 24 is interposed between a part of the collar 22 and the flange 23. This ball thrust bearing serves to support the frame member 5 together with all of the parts connected thereto. Other ball bearings 25 and 26 are provided to carry the radial load and to hold the bearing stud 20 in its proper aligned vertical position. It will be seen that the before-mentioned collar 22 is held in place by means of the inner raceway of the ball bearing 25, which in turn is held in place by a nut 27.

From the foregoing description it will be seen that the two rollers 1 and 2 are so supported that they can be readily turned to any desired angle with respect to the direction of movement of the sheet. By changing this angle, the extent and direction of the offset of the two portions of the web can be changed. The amount of offset resulting from a given inclination can be increased or decreased by relatively adjusting the two rollers as already described. If the yokes 8, 8 together with the rollers are adjusted in the clockwise direction from the position shown in Fig. 4 the amount of offset will be decreased; and if they are adjusted in the counterclockwise direction the amount of offset will be increased.

Preferably means such as now to be described are provided for adjusting the angles of inclination of the rollers to so properly control the movement of the sheet. As shown there is a bar 28 projecting horizontally from the main frame 4 near one end thereof, and this bar carries a suitable adjusting device 29. As concerns the broader phases of my invention, I do not desire to limit myself to any one type of adjusting device, but I prefer and for purposes of illustration have shown a device adapted to be operated by fluid. As illustrated this device includes a diaphragm exposed to the atmosphere at one side and adapted to be operated by vacuum or by pressure. There is a casing 30 which is carried by the bar 28 and which is provided with an open side which faces toward the adjacent end of the frame member 5. This open side of the casing is covered by means of a flexible diaphragm 31 which is held in place by a retaining ring 32. Connected with the central part of the diaphragm is an operating rod 33 which extends horizontally and is connected at its opposite end with the frame member 5. The connection is preferably a pivotal one, there being a vertical pivot pin 34 which projects through a vertical hole in a lug 35 secured to the frame member.

Depending from the supporting bar 28 is an abutment finger 36, and this finger has an aperture through which the operating rod 33 extends. Coil springs 37 and 38 surround the rod 33 and abut against the finger 36. At their opposite ends they abut against washers on the rod which are adjustably held by means of nuts 39 and 40. By means of the nuts 39 and 40 the compression of the springs can be varied so that the frame member 5 with the rollers can normally be held either in a position perpendicular to the direction of travel of the web or at any desired angle thereto.

In order that the angle of the frame member and the rollers may be changed as required, the diaphragm 31 is moved by means of pressure or vacuum. Preferably I use vacuum as this has certain advantages which will presently be fully apparent. As illustrated in Figure 5, I provide a suitable

vacuum device, as for instance a pump 41 which is connected with the casing 30 by means of suitable piping 42. Preferably a relief valve 43 is provided in the piping to prevent the formation of more than a predetermined vacuum.

In accordance with the invention, the angle of the rollers is preferably varied automatically in accordance with the position of one portion or the other of the sheet. When a vacuum means is provided as described, an automatically operating device serves to regulate or control the amount of vacuum. For this purpose a means for reducing or regulating the vacuum is connected with the pipe 42 and this means serves to correspondingly control the position of the diaphragm 31. As shown in Figure 5, I provide a tube 44 which extends transversely of the moving sheet and is arranged to directly contact therewith either at the top surface or the bottom surface. I have shown the tube as adapted to contact at the top surface of the sheet, and I have further shown the tube as being square in cross section. One end of the tube is connected with the pipe 42 by means of a flexible hose 45, and the opposite end of the tube is plugged or otherwise closed. Formed in the tube 44 at the side adjacent the sheet are two or more holes 46 and 47. These holes are so located as to lie adjacent the edge of the moving sheet. As shown, with the sheet in its desired normal position, the hole 46 is covered by the sheet and the hole 47 is not covered.

With the vacuum device 41 in operation and with the springs 37 and 38 properly adjusted, the frame member 5 together with the rollers 1 and 2 are normally held in positions at right angles to the line of movement of the sheet. If the sheet tends to shift toward the right, the hole 46 is uncovered and the vacuum is correspondingly reduced. This causes the diaphragm to move outward, thus swinging the rollers in the counterclockwise direction and offsetting the sheet toward the left so as to again cover the hole 46. If the sheet tends to move toward the left so as to cover the hole 47, the vacuum is built up beyond the normal amount, with the result that the diaphragm moves inward and causes the movement of the rollers in the clockwise direction. The rollers serve to offset the sheet toward the right to again uncover the hole 47. Thus the two holes 46 and 47 serve to control the amount of vacuum in the control device so as to maintain the sheet in its proper path as it leaves the rollers. It will be understood that I do not restrict myself to the two holes 46 and 47, as under some circumstances it may be desirable to have a larger number of holes which are covered or uncovered successively as the sheet shifts toward one side or the other.

The tube 44 is bodily adjustable endwise so as to change the normal position of the sheet. The endwise adjustment of the tube can also be used to adapt the mechanism for handling sheets of different widths.

In Figures 6 to 8 I have shown a somewhat different mechanism for regulating the vacuum in the control device. As illustrated, a supporting bar 48 projects laterally from the casing 30, and a valve mechanism 49 is adjustably mounted on this supporting bar, being adapted to be held in adjusted position by means of a set screw 50. A flexible hose 51 serves to connect the valve mechanism with the pipe 42. Pivoted to the main body of the valve mechanism is a lever 52, and this lever serves to operate a needle valve 53. The needle valve comprises a conical member carried by a rod 54, which rod is operatively connected with the lever 52. The conical member is adapted to engage a seat formed on a bushing 55 threaded into the body of the valve. A spring 56 tends to hold the valve in closed position, and the tension of this spring can be adjusted by turning a screw 57. The lower end of the lever 52 is provided with a plate 58 which is adapted to contact directly with the edge of the sheet which is to be guided.

It will be noted that the valve mechanism 49 is so located that the plate 58 engages the sheet in advance of the rollers instead of after the rollers. The plate thus registers the amount of variation of the sheet from its normal position, which variation must be corrected by the inclination of the rollers. In operation, the valve 53 is normally partly open and the springs 37 and 38 are so adjusted as to maintain the rollers perpendicular to the line of travel of the sheet when the valve 53 is in its normal position. If the plate 58 is moved toward the left as shown in Figure 6, the needle valve 53 is opened, thus reducing the vacuum and causing the diaphragm 31 to move outward. This causes the movement of the rollers in the counterclockwise direction and results in the offsetting of the sheet toward the left. If the plate 58 is permitted by the sheet to move toward the right as shown in Fig. 6, the needle valve 53 is closed, thus increasing the vacuum and causing the diaphragm 31 to move inward. This causes the rollers to be turned in the clockwise direction, with the result that the sheet is offset toward the right. Thus the plate 58 by controlling the position of the needle valve 53 serves to maintain or adjust the positions of the rollers so as to maintain the web in its desired path as it leaves the rollers.

The valve mechanism 49 is bodily adjustable along the bar 48 so as to conform to variations in the normal position of the sheet. This lateral adjustment of the valve

mechanism can also be used to adapt the mechanism for handling sheets of different widths.

I claim:

1. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, the said rollers being arranged with their axes normally in a plane parallel with the planes of the sheet, and supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet.

2. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, the said rollers being arranged with their axes normally in a plane parallel with the planes of the sheet, and supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the plane of the axes of the rollers and located approximately midway between the axes of the rollers.

3. In a sheet straightener, the combination of a swiveled frame member, two parallel cylindrical guides carried by the frame member with their axes normally in a plane perpendicular to the swivel axis, the guides extending transversely of the direction of sheet movement and being so arranged that the travelling sheet can pass over one and under the other, and means whereby relative bodily adjustment may be effected between the two guides in a direction parallel with the swivel axis.

4. In a sheet straightener, the combination of a swiveled frame member, two parallel rotatable rollers carried by the frame member with their axes normally in a plane perpendicular to the swivel axis, the rollers extending transversely of the direction of sheet movement and being so arranged that the travelling sheet can pass over one and under the other, and means whereby relative bodily adjustment may be effected between the two rollers in a direction parallel with the swivel axis.

5. In a sheet straightener, the combination of a swiveled frame member, two parallel rotatable rollers so arranged that the travelling sheet can pass over one and under the other, the said rollers being normally located with their axes in a plane perpendicular to the swivel axis, and supporting yokes for the rollers pivotally mounted on the frame member for adjustment about an axis parallel with the axes of the rollers.

6. In a sheet straightener, the combination of a main frame, a frame member located below the main frame, a swivel connection whereby the frame member is suspended from the main frame and is adapted for movement about a vertical axis, and two horizontal parallel rotatable rollers suspended from the frame member, the said rollers extending transversely of the direction of sheet movement and being so arranged that the travelling sheet can pass over one and under the other.

7. In a sheet straightener, the combination of a main frame, a frame member located below the main frame, a swivel connection whereby the frame member is suspended from the main frame and is adapted for movement about a vertical axis, two horizontal parallel rotatable rollers suspended from the frame member, the said rollers extending transversely of the direction of sheet movement and being so arranged that the travelling sheet can pass over one and under the other, and means whereby relative bodily vertical adjustment may be effected between the two rollers.

8. In a sheet straightener, the combination of a main frame, a frame member located below the main frame, a swivel connection whereby the frame member is suspended from the main frame and is adapted for movement about a vertical axis, two horizontal parallel rotatable rollers so arranged that the travelling sheet can pass over one and under the other, and supporting yokes for the rollers pivotally mounted on the frame member for adjustment about an axis parallel with the axes of the rollers.

9. In a sheet straightener the combination of two connected parallel cylindrical guides extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the guides permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and means dependent on the position of the travelling sheet for causing the adjustment of the guides about the said pivotal axis.

10. In a sheet straightener the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and means dependent on the position of the travelling sheet for causing the adjustment of the rollers about the said pivotal axis.

11. In a sheet straightener, the combination of two connected parallel cylindrical guides extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the guides permitting adjustment thereof about

a pivotal axis transverse of the planes of the sheet, means dependent on the position of the travelling sheet for causing the adjustment of the guides about the said pivotal axis, and means whereby the last said means may be adjusted to correspond to different normal positions of the edge of the sheet.

12. In a sheet straightener, the combination of two connected parallel cylindrical guides extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the guides permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and fluid operated means for adjusting the guides about the said pivotal axis.

13. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and fluid operated means for adjusting the rollers about the said pivotal axis.

14. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, fluid operated means for adjusting the rollers about the said pivotal axis, and spring means tending to hold the rollers in a predetermined position.

15. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and vacuum operated means for adjusting the rollers about the said pivotal axis.

16. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and vacuum operated means including a diaphragm exposed to the atmosphere for adjusting the rollers about the said pivotal axis.

17. In a sheet straightener, the combination of two connected parallel cylindrical guides extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the guides permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and fluid operated means for adjusting the guides about the said pivotal axis, the said means being automatically controlled in accordance with the position of the travelling sheet.

18. In a sheet straightener the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and fluid operated means for adjusting the rollers about the said pivotal axis, the said means being automatically controlled in accordance with the position of the travelling sheet.

19. In a sheet straightener the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, fluid operated means for adjusting the rollers about the said pivotal axis, the said means being automatically controlled in accordance with the position of the travelling sheet, and spring controlled means tending to hold the rollers in a predetermined position.

20. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and vacuum operated means for adjusting the rollers about the said pivotal axis, the said means being automatically controlled in accordance with the position of the travelling sheet.

21. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and vacuum operated means including a diaphragm exposed to the atmosphere for adjusting the rollers about the said pivotal axis, the said means being automatically controlled in accordance with the position of the travelling sheet.

22. In a sheet straightener, the combina-

tion of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and vacuum operated means for adjusting the rollers about the said pivotal axis, and a vacuum regulating means including a tube arranged to contact with the sheet and having at least two closely adjacent holes one of which is normally covered by the edge of the sheet and another of which is not so covered.

23. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, vacuum operated means for adjusting the rollers about the said pivotal axis, vacuum regulating means including a tube arranged to contact with the sheet and having at least two closely adjacent holes one of which is normally covered by the edge of the sheet and another of which is not so covered, and means whereby the tube may be adjusted transversely of the sheet.

24. In a sheet straightener, the combination of two connected parallel cylindrical guides extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the guides permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, and means whereby relative bodily adjustment may be effected between the two guides in a direction perpendicular to the planes of the sheets.

25. In a sheet straightener, the combination of two connected parallel cylindrical guides extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the guides permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, fluid operated means for adjusting the guides about the said pivotal axis, and means whereby relative bodily adjustment may be effected between the two guides in a direction perpendicular to the planes of the sheets.

26. In a sheet straightener, the combination of two connected parallel rotatable rollers extending transversely of the direction of sheet movement and so arranged that the travelling sheet passes over one and under the other, supporting means for the rollers permitting adjustment thereof about a pivotal axis transverse of the planes of the sheet, fluid operated means for adjusting the rollers about the said pivotal axis, the said means being automatically controlled in accordance with the position of the travelling sheet, and means whereby relative bodily adjustment may be effected between the two rollers in a direction perpendicular to the planes of the sheets.

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