

[54] SHEET ALIGNING MECHANISM
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[22] Filed: June 15, 1973
[21] Appl. No.: 371,086

[52] U.S. Cl. 271/227; 271/236; 271/246; 271/251
[51] Int. Cl.².... B65H 9/06; B65H 9/16; B65H 9/18
[58] Field of Search 271/51-53, 271/114, 80, 236, 251, 266, 58-60, 227, 246

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[57] ABSTRACT

A sheet aligning mechanism for aligning varied types and weights of sheets which are hand fed thereto includes a continuously rotating feed roll cooperating with a pinch device for urging sheets into both a leading edge aligner and a side edge aligner for leading edge and side edge registration. The feed roll is eccentrically mounted and its clearance with the pinch device is controlled whereby light weight thin sheets are intermittently driven into the aligners. The intermittent sheet drive force prevents sheet buckling and creasing should the operator fail to properly release the sheet. Further, sheet buckling is prevented by the intermittent drive force once the sheet reaches an aligner since the sheet is allowed to restore during the non-drive portion of the feed roll rotation. Once the sheet is properly aligned against both aligners and the utilization device is ready to receive the sheet, an entry gate is actuated and the feed roll forwards the sheet to a sheet take-up device. Thick sheets are continuously driven by the feed roll since they exhibit little propensity toward buckling.

5 Claims, 6 Drawing Figures

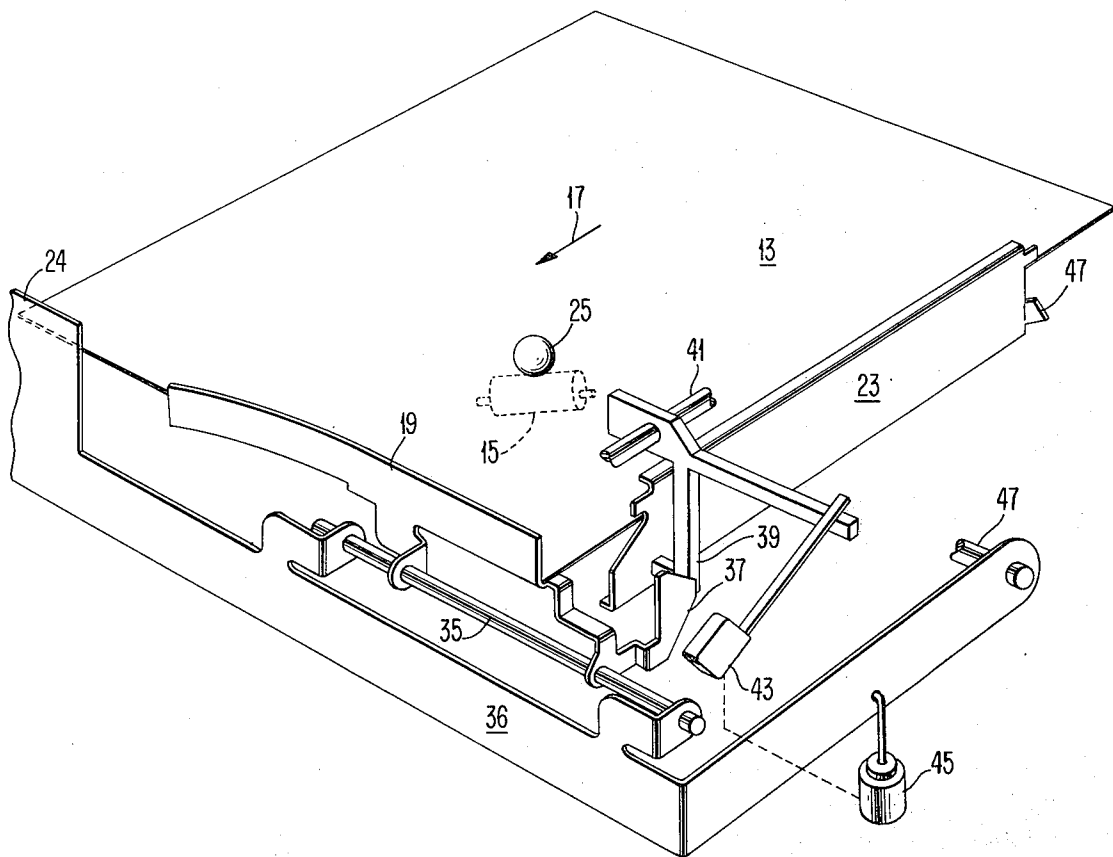


FIG. 4

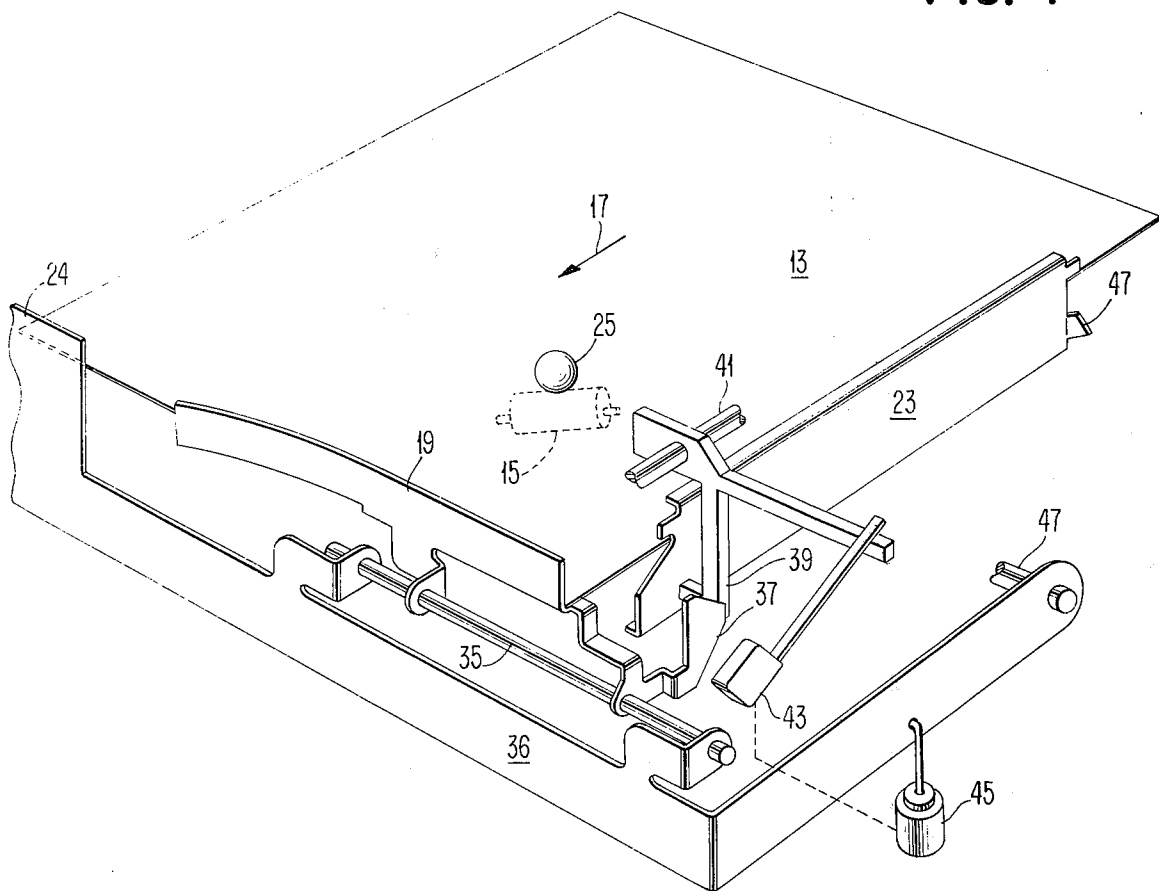
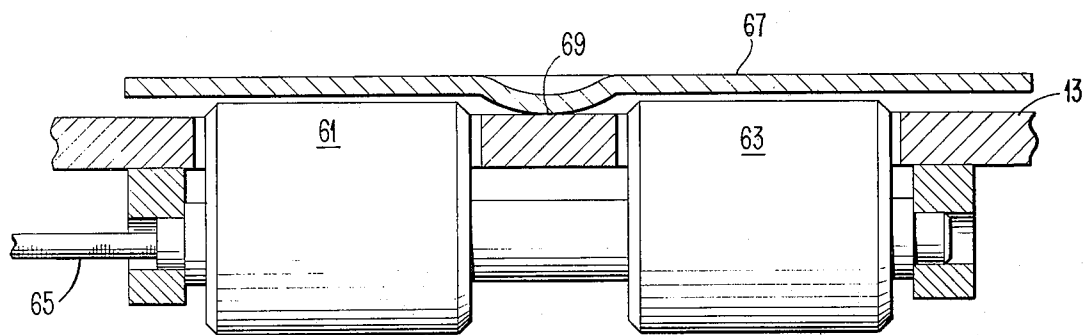


FIG. 6



SHEET ALIGNING MECHANISM

BACKGROUND OF THE INVENTION

1. Field

This invention relates to sheet handling apparatus and, more particularly, to a document feed apparatus for aligning a document prior to its being fed to a utilization device.

2. Description of the Prior Art

Various sheet aligning devices have been constructed in the sheet handling art which conventionally employ an aligning surface, against which a sheet is registered prior to the sheet being forwarded to a utilization device such as a printing press or a document platen. Such devices often incorporate a second aligning surface which is perpendicular to the first aligning surface to effect both front and side registration of the sheet. One such prior approach utilizes a continuously rotating canted roller cooperating with a pinch device to urge the sheet forward and sideways into perpendicular aligner surfaces. While such a device is satisfactory for feeding relatively heavy and thick sheets, it has been found that the device causes wrinkling and buckling of light weight thin sheets as the sheet is urged into the aligner mechanism. Further, wrinkling and buckling of thin sheets is also caused when such a device is utilized with sheets that are hand fed thereto. This is because the reaction time of various operators causes them to hold on to the sheet for an extended period prior to releasing the sheet to the sheet feed device while the roller is continuously urging the sheet away.

Various other prior art devices exist for aligning stacks of sheets within a pocket or the like. Such aligning devices often include sheet joggers operable on the side edges of the sheets in the stack. The joggers often include eccentrically mounted rollers and members for periodically jogging the sheets. However, these devices operate on the side edges of a plurality of sheets in a stack and do not operate on the flat portion of the sheet in co-operation with a pinch device to effect feeding and aligning thereof.

SUMMARY OF THE INVENTION

In order to overcome the foregoing problems of the prior art devices and to provide a sheet aligning mechanism for aligning both light weight and heavy weight paper which has been hand fed to the aligner, an eccentrically mounted continuously rotating feed roll mounted in cooperative relation with a pinch device is utilized to intermittently supply a driving force to light weight sheets causing them to be forwarded into an aligner surface. The intermittent sheet drive prevents sheet buckling since the sheet is intermittently released as the eccentrically mounted roll rotates thereby allowing the sheet to restore to its unstressed condition. Once the sheet has been properly aligned against the aligner surfaces and the utilization device is ready to receive the sheet, an entry gate is actuated and the feed roll-pinch device cooperate to forward the sheet into a sheet take-up device. Additionally, the clearance between the pinch device and the eccentrically mounted feed roll is controlled so that relatively thick and heavy weight sheets are continuously driven into the aligner surfaces thereby facilitating the rapid aligning and feeding of such heavy stock.

Accordingly, it is the principle object of this invention to provide an improved sheet aligning mechanism for aligning varied types and weights of sheets.

A further object of the invention is to provide a sheet aligner which readily aligns light weight sheets which are hand fed thereto.

The foregoing objects, features, and advantages of the invention will be apparent from the following more particular description of the preferred embodiment of the invention as illustrated in the accompanying drawing.

IN THE DRAWING

FIG. 1 is a top view of the sheet aligner of the present invention.

FIG. 2 is a front view of the sheet forwarding device of the sheet aligner of the present invention.

FIG. 3 is a side view of the sheet forwarding device of the sheet aligner of the present invention.

FIG. 4 is a perspective view of the sheet aligner of the present invention.

FIG. 5 is a side view of a portion of the sheet aligner of the present invention and of the sheet take-up device.

FIG. 6 is a cross section view of an alternate sheet forwarding device of the sheet aligner of the present invention.

Referring now to the drawings, and more particularly to FIG. 1 thereof, a top view of the sheet aligner of the present invention is depicted. A sheet 11 is placed by hand upon the sheet guide 13 and placed so that it contacts the feed roll 15 located within an opening of the sheet guide 13. The continuously rotating feed roll 15 is canted causing the sheet to be forwarded in the direction of arrow 17 to a leading edge aligner stop 19 and in the direction of arrow 21 against a side edge aligner stop 23. Once the sheet 11 is squarely positioned against the aligner stops 19 and 23 as depicted, and once the utilization device is ready to receive the sheet, the aligner stop 19 and gate fingers 24 are moved to a position where they no longer intercept the sheet 11. The sheet 11 is then forwarded by the feed roll 15 to a sheet take-up device (not shown).

The feed roll 15 cooperates with a pinch device to forward the sheet 11 in the direction of arrows 17 and 21. The pinch device includes a spherical bearing member 25 which is held by arm 27 above the feed roll 15. As will be described, the feed roll 15 is eccentrically mounted and the clearance between the feed roll 15 and the spherical bearing member 25 is controlled so that the sheet 11 is intermittently driven toward the leading edge aligner stop 19 and the side edge aligner stop 23.

Referring now to FIG. 2 of the drawings, a front view of the sheet forwarding device of the sheet aligner is depicted. The sheet forwarding device comprises the feed roll 15 and the spherical bearing member 25. The feed roll is eccentrically mounted on shaft 29 and is continuously driven by a power source (not shown).

The spherical bearing member 25 rests freely within the conically shaped retainer 31 whereby it is free to move in an upward direction. When a sheet (not shown) is fed between the feed roll 15 and the spherical bearing member 25, the spherical bearing member forms a pressure or pinch point with the flat surfaces of the sheet and with the roll 15 causing the sheet to advance over the surface of the sheet guide 13. As de-

picted, the feed roll has been rotated to its uppermost position with respect to the spherical bearing member 25 and is in contact therewith. The spherical bearing member 25 places about five grams of normal force upon the feed roll 13 or upon a thin sheet fed between the feed roll and the bearing member. Thicker sheets placed therebetween cause the spherical bearing member 25 to be displaced upwards into contact with the spring 32 which supplies an additional normal force through the spherical bearing member 25 to the thick sheet to facilitate the continuous feeding thereof.

Referring now to FIG. 3 of the drawings, a side view of the sheet forwarding device of the sheet aligner is depicted. As depicted, the feed roll 15 has been rotated to its lowermost position with respect to the spherical bearing member 25. The bearing member 25 has fallen to its lowermost position within the retainer 31. Accordingly, a clearance distance d , exists between the uppermost surface of the feed roll 15 and the lowermost surface of the spherical bearing member 25. The clearance distance, d , exceeds the thickness of a thin sheet. Accordingly, as feed roll 15 rotates, a thin sheet located between the feed roll 15 and the spherical bearing member 25 is alternately engaged and disengaged by the sheet forwarding device causing it to be intermittently driven in a sheet forwarding direction.

The surface of the feed roll is made of a material having a coefficient of friction of approximately 0.8 insuring the forwarding of a sheet when the sheet is engaged by the sheet forwarding device. Such a feed roll of approximately 0.625 inches in diameter rotating at approximately 600 revolutions per minute rapidly forwards the sheets fed thereby into the aligner stops. Since the feed roll 15 is relatively small compared to the surface area of a sheet, a sheet such as a sheet of paper can slide freely thereover when there is no pinch point established such as depicted in FIG. 3 of the drawings. That is, the lack of a normal force as applied by the spherical bearing member 25 upon the sheet enables the sheet to move in a restoring direction over the top of the surface of the feed roll 15 without undue interference therefrom. As noted heretofore, the distance d is greater than the thickness of a thin sheet being fed.

Typical thin sheets of paper materials which can be aligned by the sheet aligner vary from 6 pound onion-skin type paper materials having a thickness of approximately 0.002 inches to 20 pound bond paper materials having a thickness of approximately 0.005 inches. Accordingly, the clearance distance, d , between the low point of the feed roll 15 and the upper surface of the spherical bearing member 25 can be adjusted by loosening the screw 33 and moving the arm 27 relative to the sheet guide 13 to be in the range of 0.006 inches to 0.010 inches. Thicker sheets such as card stock having a thickness varying between 0.008 inches to 0.015 inches may then be continuously fed by the sheet forwarding device into the aligner stops of FIG. 1. This material is sufficiently thick so that it does not buckle when continuously fed by the feed device. The additional normal force required to drive such thick sheets is supplied by the spring 32 which is contacted by the upwardly displaced bearing member 25. The spring 32 is adjustable with respect to the arm 27 when the screw 34 is loosened.

Referring now to FIG. 4 of the drawings, a perspective view of the sheet aligner of the present invention

is depicted. As heretofore described, a sheet (not shown) is fed over the sheet guide 13 to the leading edge aligner stop 19 and the side edge aligner stop 23 by the eccentrically mounted, canted positioned feed roll 15 and the spherical bearing member 25. As also described heretofore, once the sheet is properly registered against the aligner stops, the leading edge aligner stop 19 is moved to a position where it no longer interferes with the advancement of the sheet in the direction of arrow 17.

In order to sense that the sheet is properly registered, the leading edge aligner stop 19 is pivotally mounted about a shaft 35 supported by the gate member 36. When the facing surface (not shown) of the leading edge aligner 19 is contacted by the sheet (not shown), it pivots about the shaft 35 causing the stop member 37 to pivot therewith. In its normal position, the stop member 37 prevents the member 39 from pivoting about the shaft 41. Once the stop member 37 pivots away from the member 39, the member 39 is free to pivot about the shaft 41. The member 39 is thusly pivoted when the sheet (not shown) pushes against the side edge aligner stop 23 causing it to push in turn against the member 39. As the member 39 pivots about the shaft 41, it causes the switch 43 to close. The closing of switch 43 enables the energization of the solenoid 45 which pivots the sheet gate 36 about the shaft 47 causing the leading edge aligner stop 19 and the gate fingers 24 to move in a downward direction out of the path of the sheet.

Referring now to FIG. 5 of the drawings, a side view of a portion of the sheet aligner and of the sheet take-up means is depicted. As described heretofore, the sheet 11 is forwarded over the sheet guide 13 to the leading edge aligner stop 19. As also described heretofore, once the sheet is properly registered, the aligner stop 19 and the gate fingers 24 are moved to a position where they no longer interfere with the further advancement of the sheet 11. The thusly aligned sheet is forwarded by the feed roll 15 of FIG. 1 to a feed belt 51 which delivers the sheet 11 to the surface of a document platen 53 or the like.

Referring now to FIG. 6 of the drawings, a cross section view of an alternate sheet forwarding device of the sheet aligner is depicted. The sheet forwarding device comprises a pair of eccentrically mounted feed rolls 61, 63 which are mounted on shaft 65 for rotation. The feed rolls rotate to extend through an opening in the sheet guide 13. A pinch device 67 is resiliently mounted and is located above the feed rolls. The pinch device 67 has a dimple surface 69 formed therein which rests upon the surface 69 when no sheets are located therebetween. As the eccentrically mounted feed rolls rotate and advance to the position depicted, sheets of paper located between the feed roll and the pinch device are drivingly forwarded by the rotating feed roll. As the feed rolls rotate 180° from the position depicted, sufficient clearance exists between the pinch device 67 and the feed rolls so that a thin sheet located therebetween is no longer drivingly engaged thereby even though a normal force is exerted upon the sheet by the pinch device. This is because the normal force is exerted between the drive rolls and does not co-act therewith to provide a sheet forwarding force. Further, since the force supplied by the dimple 69 against the top surface of a thin sheet is small and applied only at a single point when the rolls are at their lowermost position, the

sheet can readily restore. It is noted that the sheet is deflected by the dimple 69 giving the sheet additional column strength in the direction of feed.

Referring once again to FIG. 1 of the drawings, a sheet 11 inserted between the feed roll 15 and the spherical bearing member 25 is forwarded thereby against the side edge aligner stop 23 and the leading edge aligner stop 19. The sheet is forwarded beyond the leading edge aligner stop 19 only after both leading edge and side edge registration have been effected. As most often happens, the sheet arrives at one aligner stop prior to reaching the other aligner stop. Additionally, the utilization device may not be ready to receive a properly registered sheet. Continued drive force supplied by the feed roll 15 then causes thin sheets of paper to tend to buckle against the surface of the aligner stops. As the eccentrically mounted feed roll 15 rotates to a non-driving position, the sheet restores thereby preventing permanent wrinkling of the sheet by the continued application of a drive force.

As noted heretofore, sheets may be hand fed to the eccentrically mounted feed roll 15. Should the operator fail to release the sheet or tend to pull the sheet away from the feed device, the release of the sheet effected upon subsequent rotation of the feed roll 13 enables the sheet to restore to an unstressed condition and/or enables the operator to readily remove the sheet therefrom.

While the invention has been particularly shown and described with reference to the preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A sheet aligner comprising:
 - a sheet guide for supporting a sheet;
 - a first aligner stop positioned adjacent said sheet guide for intercepting a sheet forwarded over the sheet guide;
 - a second aligner stop positioned approximately perpendicular to said first aligner stop in the plane of sheet travel for intercepting a sheet forwarded over the sheet guide;
 - a sheet forwarding device for intermittently forwarding a sheet over the sheet guide to the aligner stops, said sheet forwarding device including an eccentrically mounted roll and a cooperating pinch device, the clearance between the roll and the pinch device allowing alternate engagement and disengagement of a thin sheet fed between the pinch device and roll by the roll and pinch device as the roll rotates, said roll being canted with respect to said first aligner stop and said second aligner stop for simultaneously forwarding a sheet to said aligner stops;
 - sensing means for sensing the registration of a sheet against the first aligner stop and the second aligner stop;
 - actuable sheet gate means connected to said first aligner stop for positioning said first aligner stop in a non-intercepting position with respect to a sheet previously intercepted thereby;

actuator means responsive to the sensing means for actuating the sheet gate means to position the first aligner stop to said non-intercepting position when a sheet is registered;

sheet take-up means located beyond the first aligner stop in the sheet feed path for receiving sheets forwarded thereto by the sheet forwarding device when the first aligner stop is in the non-intercepting position.

2. The sheet aligner set forth in claim 1 wherein said clearance between the pinch device and driving roll allowing continuous engagement of a thick sheet fed between the pinch device and roll by the roll and pinch device as the roll rotates.

3. The sheet aligner set forth in claim 1 wherein the pinch device includes a rotatable spherical bearing movable in a direction perpendicular to the sheet feed direction to facilitate the feeding of sheets of differing thicknesses between the pinch device and the roll.

4. A sheet aligner comprising:

- a sheet guide for supporting a sheet;
- a first aligner stop positioned adjacent said sheet guide for intercepting a sheet forwarded over the sheet guide;
- a second aligner stop positioned approximately perpendicular to said first aligner stop in the plane of sheet travel for intercepting a sheet forwarded over the sheet guide;
- a sheet forwarding device for intermittently forwarding a sheet over the sheet guide to the aligner stops, said sheet forwarding device including an eccentrically mounted roll positioned canted with respect to each of said aligner stops for simultaneously forwarding a sheet toward each of said aligner stops and a cooperating pinch device, the roll and the pinch device providing an intermittent sheet forwarding drive force to be applied to a sheet fed between the pinch device and roll by the roll and pinch device as the roll rotates;

sensing means for sensing the registration of a sheet against the first aligner stop and the second aligner stop;

actuable sheet gate means connected to said first aligner stop for positioning said first aligner stop in a non-intercepting position with respect to a sheet previously intercepted thereby;

actuator means responsive to the sensing means for actuating the sheet gate means to position the first aligner stop to said non-intercepting position when a sheet is registered;

sheet take-up means located beyond the first aligner stop in the sheet feed path for receiving sheets forwarded thereto by the sheet forwarding device when the first aligner stop is in the non-intercepting position.

5. The sheet aligner set forth in claim 4 wherein the pinch device includes a rotatable spherical bearing movable in a direction perpendicular to the sheet feed direction to facilitate the feeding of sheets of differing thicknesses between the pinch device and the roll.

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