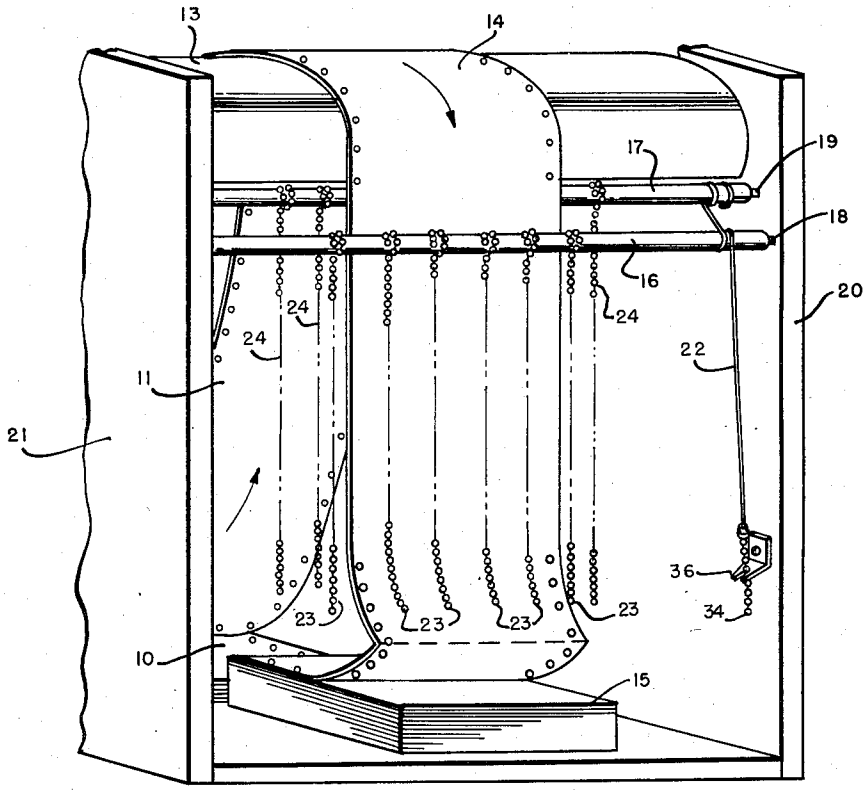
Sept. 29, 1959 A. BLAIN 2,906,527

PAPER STACKING GUIDES

Filed Nov. 18, 1955 2 Sheets-Sheet 1

FIG. 1.



INVENTOR.
ALBERT BLAIN

BY

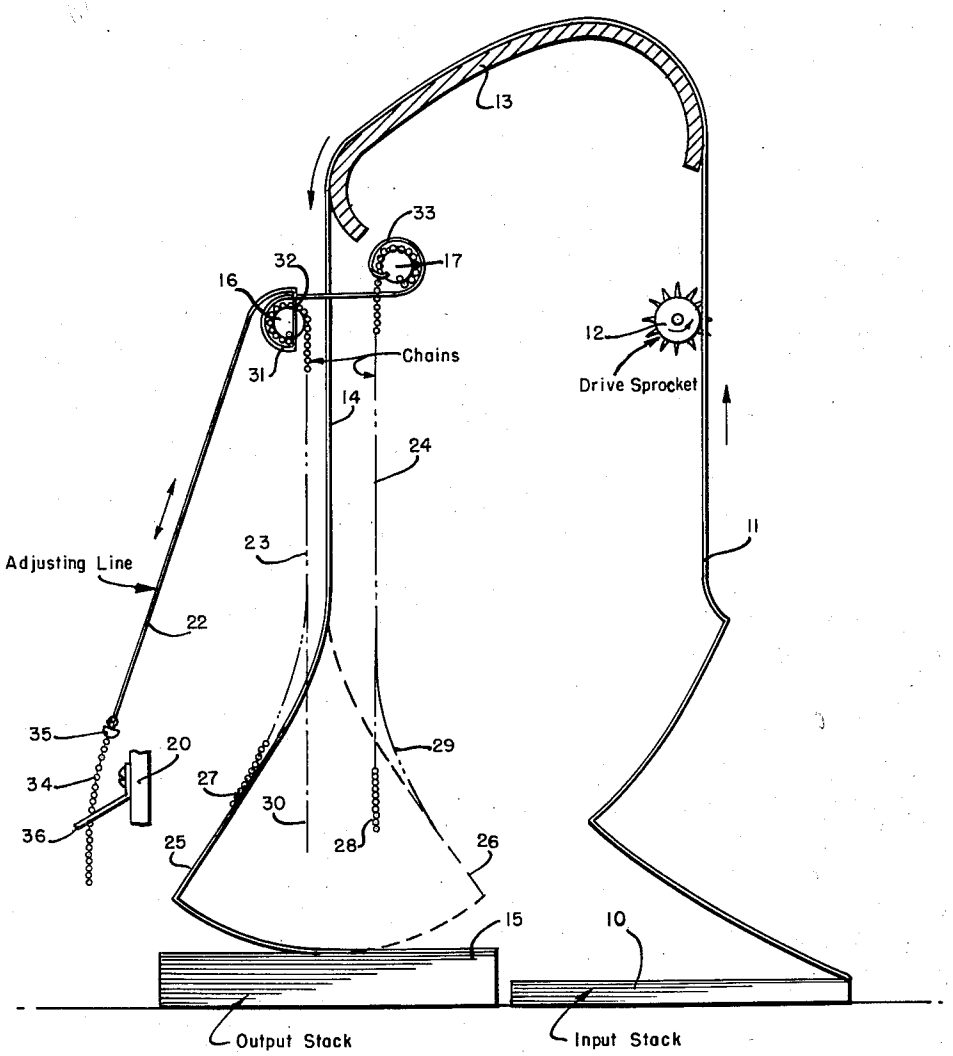
Charles A. English
AGENT

Sept. 29, 1959 A. BLAIN 2,906,527

PAPER STACKING GUIDES

Filed Nov. 18, 1955 2 Sheets-Sheet 2

FIG. 2.



INVENTOR.
ALBERT BLAIN
BY
Charles C. English
AGENT

United States Patent Office 2,906,527 Patented Sept. 29, 1959

2,906,527

PAPER STACKING GUIDES

Albert Blain, Philadelphia, Pa., assignor to Sperry Rand Corporation, New York, N.Y., a corporation of Delaware

Application November 18, 1955, Serial No. 547,792

15 Claims. (Cl. 270—61)

The present invention relates to paper driving systems, and to guide means for use in such systems, and is more particularly concerned with improved apparatus for use in high speed printer applications employing fan-folded record material for guiding such record material thereby to assure proper stacking thereof subsequent to a printing step.

Many paper driving systems and printing devices known at the present time employ fan-folded record material such as paper. In general, these devices are characterized by driving means such as a drive sprocket adapted to move such paper from an input stack, past a printing location, to an output stack. As the paper is so moved, the paper is caused to fan-fold into the output stack, and known apparatuses of the type described ordinarily employ an immovable guide plate disposed adjacent one side of the paper stack to guide the folding of paper into that output stack.

Guide plates of this type, namely those adjacent one side of the output paper stack, are generally adequate in those installations wherein the fan-folded paper moves at a constant speed. In various applications, however, and particularly in high speed printing applications of the type employed in digital or other computing devices, the paper or other record medium is caused to move at a continuously varying speed. Thus, in high speed printers, it has been required that the paper pass the printing station at a speed which is constantly being changed from single spacing of six lines per inch, for instance, to double or triple spacing, or to various combinations thereof; or, in the alternative, the paper may be required to move past the printing station rapidly thereby to provide relatively large spacing between adjacent printed sections. Thus, in practice, the paper which acts as the recording medium may be fed to an output stack at a speed of, for instance, 100 inches per minute for single spacing, and may then be rapidly accelerated to a speed, for instance, of 1200 inches per minute, and/or vice versa.

This wide possible variation in paper speed causes the paper to fall toward the output stack in an erratic manner. The immovable guide plate mentioned above, which has been utilized in the past, is ordinarily designed to abut a creased edge of the stack so as to guide the paper, in fan-folding, into the output stack and this guiding method is, in fact, satisfactory only where a rhythmic action, induced by the rate of fall and the spacing of the creases in the paper, is set up in the paper to aid in its stacking. It has been found, however, that when these known types of paper stacking guides are employed in a variable speed paper drive system of the type described, the paper tends to misfold and pile up in a disorderly fashion.

The present invention serves to obviate this difficulty and utilizes an improved paper stacking means, taking the form of a plurality of elongated flexible restraining members, such as free-hanging chains, serving to prevent the misfolding of fan-folded paper into an output stack, regardless of changes in speed of the paper. In this

respect it should be noted that the terms "chain," or "chain means," to be discussed subsequently and included in the appended claims, are meant to generically include various forms of elongated resilient members having a weight distribution sufficient to assist in the folding of the paper, as will be described. Various alternative constructions will be suggested to those skilled in the art, such as weighted, depending wires or cord, and the like.

It is accordingly an object of the present invention to provide an improved stacking means for fan-folded paper.

A further object of the present invention resides in the provision of improved guides for use in paper driving systems wherein the paper moves at discontinuous speeds.

A still further object of the present invention resides in the provision of an improved stacking means in paper driving systems for preventing misfolding and disorderly piling of paper utilized in such systems.

Another object of the present invention resides in the provision of improved guide means for assuring correct piling of record material in high speed printer applications.

Still another object of the present invention resides in the provision of guide means cooperating with an elongated run of paper leading to an output stack of such paper, which guide means assures proper folding of the paper into the output stack in both directions of possible folding.

In providing for the foregoing objects and advantages, the present invention contemplates the provision of a paper driving or printing system utilizing fan-folded paper wherein the paper is caused to move, subsequent to a printing or other utilization step, in a substantially vertical run to an output stack of said paper. Stacking guides, taking the form of a plurality of free-hanging chain members are disposed adjacent the vertical run, and in a preferred embodiment, a pair of chain guides are used, these chain guides being located respectively adjacent opposing sides of said vertical run. The chain guides are preferably free-hanging from a position above the output stack toward the output stack itself; and, as the fan-folded paper tends to fold in a first direction into the output stack, a first group of the chain members is caused to bear upon the paper whereby the weight of this first group of chain members restrains movement of the paper and assists in the folding thereof into the said stack. Similarly, when the fan-folded paper tends to fold in a second direction opposite to said first direction, a second group of chain members is caused to bear on the opposite side of the paper whereby once more the weight of this second group of chain members assists in the folding of the paper into the stack.

In a preferred form of the invention, the aforementioned chain members depend from a pair of rotatable rods disposed adjacent opposite sides of the vertical run of paper, and means are provided for selectively rotating these rods, thereby to change the effective length of the chain members adjacent the paper, whereby an optimum length of chain may be selected for any particular installation, length of paper sheet, and/or height of output stack in order to assure proper operation of the system.

The foregoing objects, advantages, construction and operation of the present invention will become more readily apparent from the following description and accompanying drawings, in which:

Figure 1 illustrates a fan-folded paper driving system utilizing the improved stacking guides of the present invention; and

Figure 2 diagrammatically illustrates the operation of the stacking guides, and of the chain length adjustment means in accordance with the present invention.

Referring now to Figure 1, it will be seen that in accordance with the present invention, a fan-folded paper system may comprise an input stack of fan-folded paper **10**, and paper from the stack **10** is initially driven in an upward direction, as at **11**, by a drive sprocket **12** (see Figure 2). The paper **11** is then caused to pass across a utilization station **13**, represented in the figures symbolically as an arcuate plate, whereby printing operations may be effected upon the paper, or other utilization made thereof. The paper is then caused to move downwardly, as at **14**, to an output stack **15**. The operation of systems, generally of the type described, are well known in the art; and in practice the paper, after passing in its downward traverse **14**, is caused to fan-fold into the output stack **15**.

As mentioned above, it has been the custom in the past the provide a stacking guide adjacent one side of the output stack **15** to assure that the fan-folded paper will not misfold in said output stack. Such known guide means do not operate effectively, however, when the fan-folded paper moves at continuously varying speeds; and in order to obviate the resulting difficulties from such ineffective operation, the present invention contemplates the provision of improved stacking guide means comprising a plurality of elongated chain members disposed adjacent opposite sides of the vertical run **14**, and adapted to selectively bear on opposite sides of the paper, within an area between the creases of a sheet about to be laid into the output stack, thereby to assist in the folding of the paper into the output stack **15**. As will become apparent from the subsequent description, the pressure applied by the elongated chain members in fact causes the paper to properly roll onto the stack by preventing the folding edge of the said paper from reaching the stack prematurely.

Thus, referring to the figures, it will be seen that a pair of elongated rods **16** and **17** may be disposed, as illustrated, in a direction substantially transverse to the direction of movement of the fan-fold paper during its vertical downward traverse **14**. The rods **16** and **17** are pivotally mounted, for instance as at **18** and **19**, in a pair of structural frame members **20** and **21**. By this arrangement, therefore, the rods **18** and **19** may be selectively rotated, and a system utilizing an adjusting line **22**, which will be described more particularly in reference to Figure 2, may be employed for effecting this rotation of the rods **16** and **17**, thereby to change the effective length of the chain members to be described. It should further be noted that the rods **18** and **19** preferably include some means, such as spring members internal thereof, for providing an opposing force in opposition to the action of adjusting line **22**, whereby the chain members, to be described, may be adjusted both upward and downward.

Examining Figure 1 in greater detail, it will be seen that the rotatable rod **16** carries a first plurality of depending chain members **23** spaced from one another and hanging from the rod **16** toward the output stack **15** adjacent one side of the vertical downward traverse **14** of the fan-fold paper. Similarly, the rotatable rod **17** carries a further plurality of free-hanging chain members **24** which depend from said rod **17** in free-hanging relation toward the output stack **15** adjacent the opposite side of the vertical traverse **14** of the fan-fold paper. Inasmuch as various applications, such as high speed printers, require that any width or length of paper sheet may be used, and since it is also ordinarily required that the paper be permitted to feed at any position within the limits of the machine frame (i.e. the paper may have one edge adjacent either the left or right frame of the machine, or the paper may be spaced anywhere between those frames), the chains **23** and **24** are hung at uniform intervals across the full distance between the frame members **20** and **21** so that, no matter where the paper is in the printer, a group of chains are always adjacent said paper. As the paper is driven in its vertical traverse **14** toward the output stack **15**, by operation of drive sprocket **12**, the said fan-fold paper will be caused to alternately fold into the stack **15** in opposite directions; and during each of these alternate folding steps, one of the pluralities of chains **23** or **24** will be caused to bear upon the appropriate side of the fan-fold paper, whereby the weight of the operative plurality of chains applies enough pressure force to its respective side of the paper thereby to prevent the paper from misfolding, regardless of changes in speed of the paper.

This operation will become more readily apparent from an examination of Figure 2. For ease in identification, like numerals have been employed to designate like parts in both Figures 1 and 2. Thus, referring to Figure 2, it will be seen that, as the fan-fold paper is caused to move in its downward substantially vertical traverse **14** toward the output stack **15**, the paper will be caused to alternately fold between positions **25** (shown in full line) and **26** (shown in dotted line). When the paper is folding in its direction **25**, the plurality of chains **23** adjacent the appropriate side of the fan-fold paper will be caused to bear upon the paper, as at **27**; while the chains **24** will continue to be free-hanging, as at **28**. Similarly, when the fan-fold paper is to be folded in its direction **26** into the output stack **15**, the chains **24** will assume the position shown at **29**, thereby bearing on the opposite side of the fan-fold paper, while the chains **23** will be free-hanging, as at **30**. Thus, in each direction of folding, one of the pluralities of chains **23** or **24** is caused to bear on a given side of the paper, assisting in the folding of the paper in each of the fan-fold directions by causing the folding sheet of paper to be "rolled" onto the output stack.

As mentioned previously, it may be advisable under some circumstances, to change the effective lengths of chain members **23** and **24** (which have been illustrated as bead chains). Thus, the location of the bottom ends of the chains with respect to the top of the output paper stack affects the reliability of the chains in fan-folding the paper. It has been determined that fan-folding occurs satisfactorily if the free-hanging chains terminate at a location within an area bounded by the top of the output paper stack (as a lower limit), and a distance less than the height of one sheet of paper above the output stack (as an upper limit). Since the height of the output stack increases as paper is folded into that stack, the bottoms of the several chains should be raised as the stack height increases. Such adjusting means may be provided by an adjusting line **22**, and this particular form of adjusting means is illustrated in Figure 2. Thus, it will be seen that the line **22** is caused to be wrapped about the rotatable rod **16**, as at **31**, and is also caused to pass through said rod **16**, as at **32**, thereby to prevent slippage of the line **22** with respect to rod **16**. The line **22** is then extended from its wrapped position about rod **16** to rod **17**, is then wrapped about the said rod **17** in a plurality of turns, as at **33**, and is finally secured to rod **17**.

While only a single turn has been shown with respect to the line **22**, as wrapped about each of rods **16** and **17**, it will be appreciated that in a preferred embodiment of the present invention, a plurality of such wraps are provided, for example, five turns. The chain members **23** and **24** are also wrapped about their respective supporting rods **16** and **17** in the manner illustrated in Figures 1 and 2, and the chain members are secured to their respective rods **16** and **17** at one end.

It will be appreciated from the foregoing discussion, as well as from an examination of Figure 2, therefore, that when the adjusting line **22** is pulled in a downward direction, the rod **16** will rotate in a counter-clockwise direction and the rod **17** will rotate in a clockwise direction, thereby shortening th effective lengths of chains **23** and **24**. Similarly, if the adjusting line **22** is permitted to move in an upward direction, for instance under the

impetus of spring members (not shown), coupled to the rotatable rods 16 and 17, or to rod 17 alone, the rod 16 will be caused to rotate in a clockwise direction, while rod 17 will rotate in a counter-clockwise direction, thereby lengthening each of chains 23 and 24. Through the line 22, therefore, an optimum length of chain member may be selected for any particular application, and this optimum length may then be fixed by a further bead chain 34 coupled to adjusting line 22 by a coupling means 35, and cooperating with a restraining bracket 36 affixed to a stable structure, such as member 20.

While I have described a preferred embodiment of the present invention, many variations will be suggested to those skilled in the art, and certain of these variations have already been discussed. It must therefore be stressed that the foregoing discussion is meant to be illustrative only and should not be considered limitative of my invention. All such variations as are in accord with the principles described are meant to fall within the scope of the appended claims.

Having thus described my invention, I claim:

1. In a paper driving system of the type wherein an elongated length of paper is caused to move in translation in a substantially vertically extending run whereafter said paper is folded into a stack at one end of said run, the improvement which comprises a support member adjacent said paper, and a plurality of flexible elongated guide members comprising free-hanging chain means depending from said support member adjacent opposing sides of said substantially vertical run of said paper, said chain means having a certain mass and inertia so that said free-hanging chain means bear upon said paper to assure the proper folding thereof into said stack.

2. The system of claim 1 wherein said support member comprises a pair of elongated rods disposed substantially parallel to one another adjacent opposing sides of said paper, each of said rods being substantially transverse to the direction of elongation of said paper, and means for selectively rotating said rods thereby to change the effective length of said chain means.

3. In a paper driving system of the type wherein an elongated length of paper is fed from a supply stack of fan-folded paper to an output stack of paper with said paper being fan-folded into said output stack during the feeding thereof, the improvement which comprises guide means adjacent said output stack comprising a plurality of free-hanging restraining members disposed above said output stack in selective contiguity with the opposed sides of said paper, said restraining members having a substantially distributed mass such that said restraining members may selectively move or be moved by said paper when folding whereby said restraining members cause said folding paper to follow its natural tendency toward proper folding into said output stack during said feeding thereof.

4. The system of claim 3 wherein each of said restraining members comprises a chain member.

5. The combination of claim 4 wherein said paper includes a plurality of spaced creases defining paper sheets therebetween, the free ends of said chain members being located to bear on said paper between two such creases adjacent said output stack.

6. The system of claim 4 wherein said paper describes an elongated substantially vertical run prior to being fan-folded into said output stack, said plurality of chain members being disposed in two groups of chain members located respectively adjacent opposing sides of said vertical run, whereby one of said groups is contiguous with one side of said vertical run of paper when said paper is being folded in one direction, and the other of said groups is contiguous with the other side of said vertical run of paper when said paper is being folded in the opposite direction.

7. The system of claim 6 including means for simultaneously altering the effective length of chain members in both of said groups.

8. In a printing device of the type wherein elongated record material is fed from a supply stack of fan-folded record material past a printing station whereafter said record material is fed in a substantially vertical run from said printing station and is fan-folded into an output stack, the improvement which comprises stacking guide means disposed adjacent opposed sides of said vertical run, said stacking guide means including support means adjacent said vertical run above said output stack, and a plurality of elongated restraining members free-hanging from said support means, said free-hanging restraining members being vertically disposed substantially parallel to one another closely adjacent opposing sides of said vertical run and having a small distributed mass such that said free-hanging restraining members are capable of moving and being moved by said record material whereby said record material is caused to fall upon said output stack in an orderly fan-folding fashion.

9. The device of claim 8 wherein said support means comprises a pair of rotatable rod members disposed adjacent opposing sides of said record material, said restraining members comprising a plurality of flexible chain members each having a portion wrapped about one of said rod members, and means for selectively rotating said rod members thereby to change the effective length of said chain members adjacent said vertical run.

10. In a paper driving system of the type wherein paper is fed from a supply stock of fan-folded paper initially in an upward direction and thereafter in a downward direction to a fan-folded output stack of said paper, the combination comprising a supporting member adjacent the downwardly extending portion of said paper, said supporting member being spaced upwardly from said output stack, and a plurality of free-hanging chain members having substantially uniformly distributed weight depending from said supporting member toward said output stack adjacent to and in selective contiguity with the opposed sides of the downwardly extending portion of said paper whereby said chain members have suitable mass and tend to be in a position to move and be moved by said paper to control said paper movement in order to assume the proper fan-folding thereof into said output stack.

11. The system of claim 10 wherein said paper comprises a plurality of contiguous sheets spaced from one another by creases, the free ends of said chain members being located to bear on a sheet of said paper immediately above said output stack at locations between the creases bounding said sheet.

12. The system of claim 11 including means for changing the free-end position of said chain members with changes in height of said output stack.

13. A fan-fold-web feeding and stacking apparatus including a utilization station and a web-receiving station, driving means for moving a web to said utilization station and then to said web-receiving station, free-hanging flexible guide means having mass characteristics such that said guide mean can move and be moved by a web of a type suitable for use with said apparatus, means for supporting said guide means to hang at locations between said utilization and web-receiving stations and to bear against said web as it passes between said stations in order to move and to be moved by said web so that said web fan-folds into a stack at said web-receiving station in the proper manner.

14. A fan-fold-web feeding and stacking apparatus for use with a fan-fold-web having a certain distance between consecutive folds, said apparatus including a web input means, a utilization station, an output stack receiving station, driving means for moving said web from said input means to said output stack receiving station via said utilization station, a plurality of support means positioned to receive said web therebetween as it passes from said

utilization station to said output station, and guide means having a distributed mass and hanging freely from said support means to bear upon opposing faces of said web means at predetermined locations, said predetermined locations being located above said output station at a distance less than said certain distance between two consecutive folds of said web, said distributed mass of said guide means being sufficiently small to be movable by said web and sufficiently large to force said web to follow its natural tendency to fan-fold onto said output stack.

15. A fan-folding-web feeding and stacking apparatus including rotatable support means, free-hanging bead-chains pendant from said support means, means for moving a web from an input source to an output stack via a utilization station with said web passing between said support means whereby said chains are adjacent the opposing faces of said web, said chains bearing upon the

opposing faces of said web a predetermined distance above said output stack, said bead-chains having a substantially uniformly distributed mass, said mass of said chains being sufficiently small that said chains may be moved by said web whereby the resultant reaction will cause said web to fan-fold in an orderly manner onto said output stack, and means for rotating said support means to adjust said chains to said predetermined distance, said rotating means comprising an adjusting line wrapped around said support means whereby said support means may be rotated and the length of said chains adjusted thereby.

References Cited in the file of this patent

UNITED STATES PATENTS

2,334,283 Pfeiffer ---------- Nov. 16, 1943

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,906,527 September 29, 1959

Albert Blain

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

Column 3, line 17, for "the provide" read -- to provide --; column 4, line 73, for "th" read -- the --; column 6, line 44, for "assume" read -- assure --; line 59, for "guide mean" read -- guide means --.

Signed and sealed this 3rd day of May 1960.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents