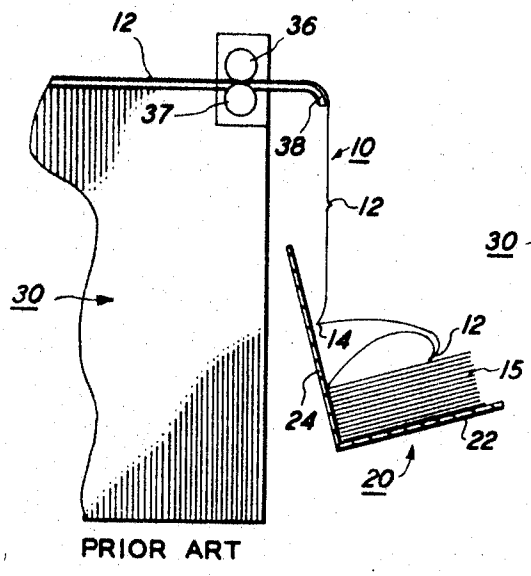
Aug. 12, 1969 F. C. METS ET AL 3,460,825

FAN FOLD STACKING APPARATUS

Filed Dec. 22, 1966



PRIOR ART

FIG. 1

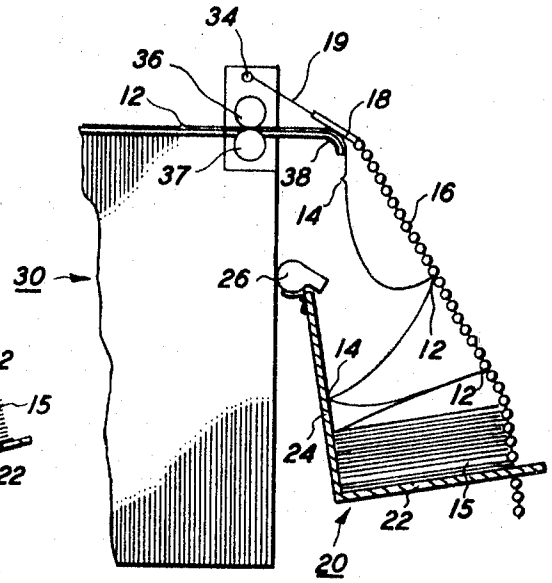


FIG. 3

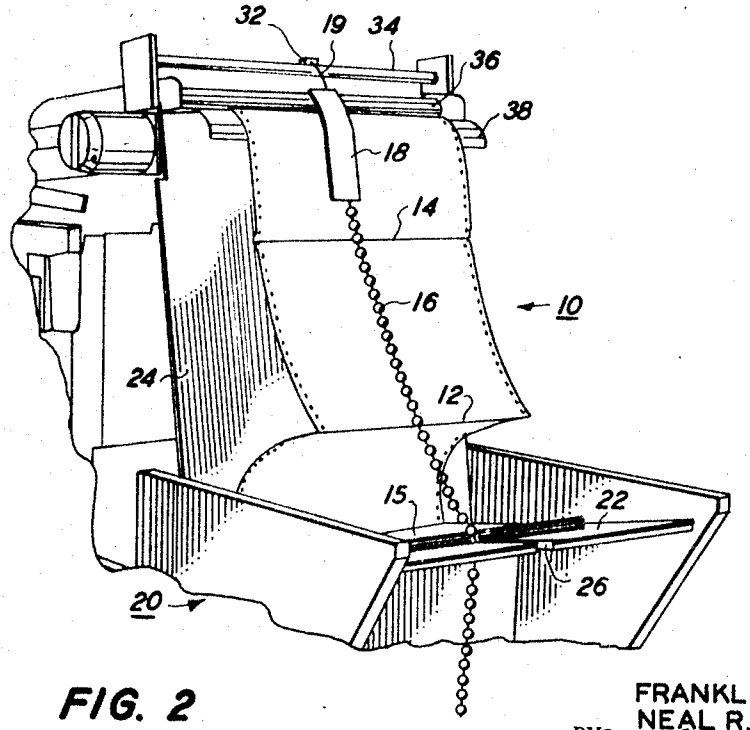


FIG. 2

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FAN FOLD STACKING APPARATUS

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U.S. Cl. 270—61 4 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for folding and stacking web material in a fan folded or zigzag manner having a receptacle located below the discharge end of a path along which web material is advanced, a weighted flexible member having a frictional resistive surface freely suspended across the discharge end and extending into the receptacle for engaging and retarding the movement toward the receptacle of edges formed in the web along alternate transverse weakening lines and a source of pressurized air for positively advancing the edges along the flexible member.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates generally to web handling apparatus and more particularly to apparatus for folding and stacking web material in a fan folded or zigzag manner. Fan folding or zigzag stacking in many applications provides an efficient method of storing web material. In such applications the web is divided into a longitudinal series of uniform lengths by transverse weakening lines which form two opposite edges of the stack. The web is folded along the weakening lines with alternately spaced weakening lines forming one edge of the stack and with other alternatively spaced weakening lines forming an opposite edge.

The stationery used in computers is one application in which web material is stored in a fan folded or zigzag manner. In such applications the paper web is fed into a conveyor unit of the computer from a fan folded stack, printed upon, discharged from the computer, and replaced in a fan folded stack. In most applications, the web is allowed to freely fall from the discharge end of the conveyor to a platform or receptacle for supporting the stack. As the web material falls and engages the platform the weight of the material creates folds along the weakening lines and falls into a fan folded stack.

In machines which have a high discharge rate of the web material, the free fall method has not proven entirely satisfactory. For example, when such web material is discharged at a high rate from a copying machine and allowed to free fall into a stack, a certain amount of misfolding occurs. That is, not all of the edges formed by a fold are aligned with the stack and occasionally edges may curl in the opposite direction to that intended. This is largely due to the fact that at high discharge rates there may be more slack in the web between the platform and discharge tray than at lower speeds. When this occurs the edges formed have a tendency to dive or fall faster than the remainder of the form. When diving occurs, the leading edge will reach the stack faster than the midsection of the form thereby trapping air between the midsection and the stack. Also when diving occurs, the leading edge may curve backwardly creating a hump in the stack, or one corner of the leading edge may be snagged by a sprocket drive hole in an adjacent sheet thereby causing a misfold in the web.

DESCRIPTION OF PRIOR ART

Referring to FIG. 1 a fan fold stacking arrangement is illustrated in which misfolding often occurs. A paper

web generally designated **10** having preformed transverse weakening lines **12** and **14** is conveyed through machine **30** by a pair of pinch rolls **36** and **37** discharged at tray **38**. A receptacle for accepting the discharged material generally designated **20** is located below the discharge tray **38** and includes a flat base member **22** and an edge aligning member **24** extending therefrom at right angles. Upon contact between the base member **22** and the end of the web, slack is formed causing a fold to appear along the first transverse weakening line **12** referred to herein as a leading edge. The leading edge **12** upon continued advancement of the web has a tendency to fall faster toward base member **22** than does the midsection of the form. Upon contact of the base member **22** or an adjacent sheet, the leading edge **12** often has a tendency to curl backwardly or to the left as shown in FIG. 1 causing a misfold. In addition, a corner of leading edge **12** may become entangled with sprocket drive holes in an adjacent sheet causing a misfold.

One attempt to prevent misfolding has been to provide a stop member transverse to the web material for engaging a form as it falls causing the sections to sag downwardly. As the midsection sags and contacts the stack the leading edge then passes over the stop member and falls to the stack. This approach has certain disadvantages in that the stop member to be effective must be spaced a certain distance from the stack. Since the height of the stack is continually changing, the stop member must be periodically moved either manually, or by a complicated linkage arrangement which requires operator attention. Improper positioning of the stop member in relation to the stack, therefore, renders this arrangement ineffective to prevent misfolding. In addition the use of such a stop member is cumbersome and may interfere with the removal of the stack from the platform.

SUMMARY OF THE INVENTION

It is an object of the present invention therefore to provide apparatus for fan folding web material in a zigzag manner, which does not require close operator attention.

Another object of the present invention is to provide apparatus for eliminating misfolds in fan folding web material without periodic adjustment.

Another object of the present invention is to provide apparatus for fan folding web material of various thicknesses and weight without misfolding.

Still a further object of the present invention is to provide apparatus for fan folding web material at various speeds without misfolding.

These and other objects are obtained by means of a receptacle positioned to receive the web material and retarding means positioned to be engaged by successive leading edges of the web material for impeding the movement of the leading edges toward the receptacle.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention as well as other objects and further features thereof reference is had to the following detailed description of the invention to be read in connection with the accompanying drawings wherein:

FIG. 1 is a schematic sectional diagram illustrating the free fall method in which diving of a leading edge occurs.

FIG. 2 is a perspective view of one embodiment of fan fold stacking apparatus which eliminates misfolding.

FIG. 3 is a schematic sectional view of another embodiment of fan fold stacking apparatus in which means are provided for positively advancing a leading edge toward a receptacle.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the embodiments of fan fold stacking apparatus which eliminate misfolding as illustrated in FIGS. 2 and 3, a paper web generally designated **10** having preformed transverse weakening lines **12** and **14** is conveyed through machine **30** by a pair of pinch rolls **36** and **37** and discharged at tray **38** in a generally conventional manner. A receptacle for accepting the discharged material generally designated **20** includes a flat base member **22** and an upstanding edge aligning member **24** extending therefrom substantially at right angles. In practice it has been found that best stacking results are obtained when the intersection between the base member and the upstanding member is substantially in vertical alignment with the discharge tray **38** and the base member **22** is inclined approximately 15 degrees to the horizontal. The receptacle may be comprised of generally solid materials as shown in FIG. 3 with a slot **26** therein or of wire basket construction.

At least one flexible member **16** having a frictional resistive surface is connected to a bar **34** above pinch roll **36** by means of connector link **19** and fastening means **32**. Flexible member **16** is suspended across the discharge tray **38** and extends into the receptacle **20**. Base member **22** of receptacle **20** is preferably constructed so as to allow flexible member **16** to extend beyond the base member. For example, in FIG. 3 slot **26** in base member **22** extends to upstanding member **24** allowing flexible member **16** to freely hang vertically when no material is held in the receptacle.

Flexible member **16** may be comprised of any suitable flexible material which has a frictional resistive surface. A chain commonly referred to as bead chain has been found to work particularly well. That is, chain which is formed by a series of spherical members interconnected by a series of pins extending from within one sphere to within the next adjacent sphere. Chain having spheres with a diameter on the order of 0.125 inch has been found to provide a correct amount of frictional resistance and a correspondingly correct amount of weighting. A flat non-frictional member **18** is affixed to bead chain **16** and connecting link **19** for engaging the web material before it is released from discharge tray **38**, thus eliminating the possibility of prematurely engaging a leading edge.

As an end of web material **10** is advanced into the receptacle, no frictional engagement between the web **10** and the bead chain **16** occurs prior to the end of web **10** contacting base member **22**. Upon contact of base member **22**, slack forms in the web material **10** creating a fold along the next adjacent weakening line **12**. Continued advancement of the web **10** produces a leading edge along line **12** which engages bead chain **16** upwards from base member **22**. As the web is advanced the sheet formed between the end of web **10** and line **12** moves toward base member **22** with leading edge **12** being retarded by engagement with successive spheres along bead chain **16**. Continued retardation of leading edge **12** as it approaches base member **22** again creates slack in the infed web which in turn causes a fold to appear along the next succeeding weakening line **14**. Additional advancement of web **10** creates a trailing edge along line **14** which contacts upstanding member **24**, upstanding member **24** guiding trailing edge **14** to the next adjacent trailing edge in the stack **15**. Successive leading edges which are formed as the web continually advanced become engaged with flexible member **16** retarding the movement thereof toward base member **22** so that the leading edge is the last portion of the form to reach the stack in a sequence. The retardation of the leading edge eliminates the possibility of misfolding. Thus through this simple, yet effective arrangement, it may be seen that a neat uniform stack of fan folded material is obtained at low to high discharge rates without misfolding. The stack obtained may be conveniently removed from the receptacle without interference simply by moving chain **16** to one side.

When paper stock of a very light weight or supple nature is being used the retarding force exerted by the bead chain **16** on leading edges **12** may be greater than desirable, thus causing a greater amount of sag than normally occurs between leading and trailing edges. That is, as a leading edge **12** engages bead chain **16**, the weight of the paper stock itself may be insufficient to advance leading edge **12** along bead chain **16**. The weight of the paper stock, however, in this instance causes the center portion of the form to sag downwardly which sagging action may be of an amount sufficient to cause the leading edge **12** to become disengaged from bead chain **16**. In some lighter weights of paper stock the leading edges **12** may not become disengaged from bead chain **16** due to the sagging action, but nevertheless may not fall completely to the stack thereby remaining in a slightly raised position. For this reason, a source of pressurized air **26** as illustrated in FIG. 3 may be provided to positively advance the leading edges **12** to the next adjacent leading edge in the stack **15**. The source of air serves to advance the leading edges of lighter weight paper stock along bead chain **16** before sagging occurs thereby keeping the leading edge in engagement with bead chain **16**. As illustrated in FIG. 3, the source of air may comprise a fan **26** directed downwardly along chain **16** toward receptacle **20**. The fan may be mounted on machine **30** or on receptacle **20** as illustrated in FIG. 3. Such arrangement provides fan fold stacking apparatus capable of handling nearly all weights of paper stock at low to high discharge rates without misfolding.

While the invention has been described with reference to the structure disclosed herein, it is not confined to the details set forth, and this application is intended to cover such modifications or changes as may come within the purposes of the improvements or the scope of the following claims.

What is claimed is:

1. Apparatus for folding web material in a zigzag stacked manner along transversely extending longitudinally spaced weakening lines comprising:

a receptacle for accepting the web material including a base member, and a guide member extending from said base member to engage and align adjacent trailing edges of individual sheets formed in said web material, said base member including a slot therein extending in a longitudinal direction from said guide member,

means for advancing said web material in an elongated condition and for discharging said web material to said receptacle in a generally vertical descending fashion, said guide member and said base member cooperating to engage and align an initial edge of said web material at the intersection between said guide member and said base member to form a slack in said generally vertically extending length, said slack forming a fold along a first transversely extending weakening line, and

at least one weighted freely suspended flexible member normally extending in a substantially vertical orientation from said discharge means toward the intersection of said base member and said guide member and into said slot, said flexible member being adopted to be contacted by said first formed fold and to be moved thereby to a displaced position as said fold moves toward said base member, said first folded sheet ultimately residing on said base member with one edge engaging said guide member and the other edge engaging said flexible member, successive folds being formed in said web in a generally similar manner along successive transversely extending weakening lines as said web is advanced toward said receptacle, said successive folds alternately forming leading and trailing edges in the stack with trailing edges being

positioned against said guide member and leading edges engaging said flexible member, said flexible member retarding the movement of said engaged leading edges toward said base member to prevent misfolding of the individually formed sheets in the stack.

2. Apparatus according to claim 1 further including:

a source of pressurized air positioned at one side of said web material opposite said flexible member to direct an air stream generally downwardly toward said base member to positively advance leading edges engaged with said flexible member toward said base member.

3. Apparatus for stacking web material in a zigzag manner by folding the web material along transversely extending longitudinally spaced weakening lines comprising:

means for advancing the web material in an elongated condition and for discharging the web material in a generally vertical descending manner,

a receptacle for accepting the web material from said discharge means including a base member having a longitudinally extending slot formed therein and a guide member extending from said base member for aligning adjacent trailing edges of individual sheets over said base member, said receptacle engaging an initial edge of the web material as the web is advanced causing a slack therein, the slack forming a fold of the web along a first transversely extending weakening line, and

at least one weighted freely suspended flexible member normally extending in a substantially vertical orientation from said discharge means into said slot

in said base member, said first formed fold engaging said flexible member and displacing said flexible member in the longitudinal direction within said slot as said first formed fold moves toward said base member, successive folds being formed in the web along successive transversely extending weakening lines as the web is discharged to said receptacle, said successive folds alternately forming leading and trailing edges in the stack with trailing edges being positioned against said guide member and leading edges engaging said flexible member, said flexible member retarding the movement of said leading edges toward said base member to prevent misfolding between individual sheets in the stack.

4. Apparatus according to claim 3 further including:

a source of pressurized air positioned at one side of said web material opposite said flexible member to direct an air stream generally downwardly toward said base member to positively advance leading edges engaged with said flexible member toward said base member.

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U.S. Cl. X.R.

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