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Müller

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[54] **METHOD AND APPARATUS FOR MAKING STACKS OF PRINTED SHEETS FOR A BOOKBINDING MACHINE**

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[52] **U.S. Cl.** **270/43**; 270/21; 270/54

[51] **Int. Cl.**[2] **B41L 43/10**

[58] **Field of Search** 270/5–9, 10, 270/11, 32, 37, 41–49; 83/110

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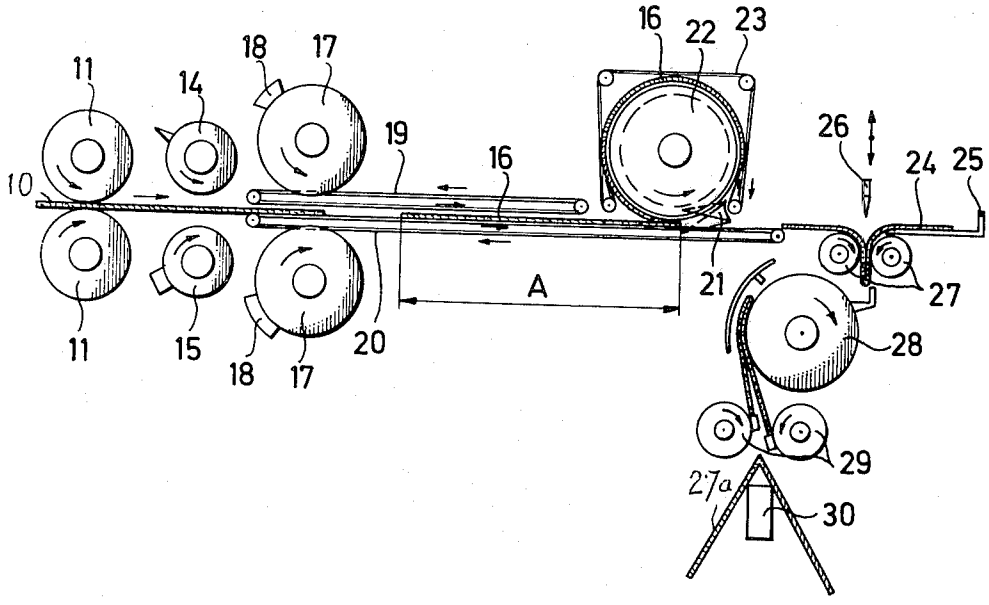
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[57] **ABSTRACT**

A method and apparatus for making folded stacks of printed sheets, and for transporting the stacks to a bookbinding machine. Four superimposed imprinted bands are transported to cutting means which cut off leading portions of the four bands to form stacks of sheets which are transported at an increased speed so as to be separated from the following leading band portions. Two stacks are superimposed to form a double stack with eight sheets, and the double stacks are folded to form booklets having sixteen imprinted sheet portions. The folded booklets are deposited at the bookbinding machine, and bound along the foldline.

9 Claims, 3 Drawing Figures



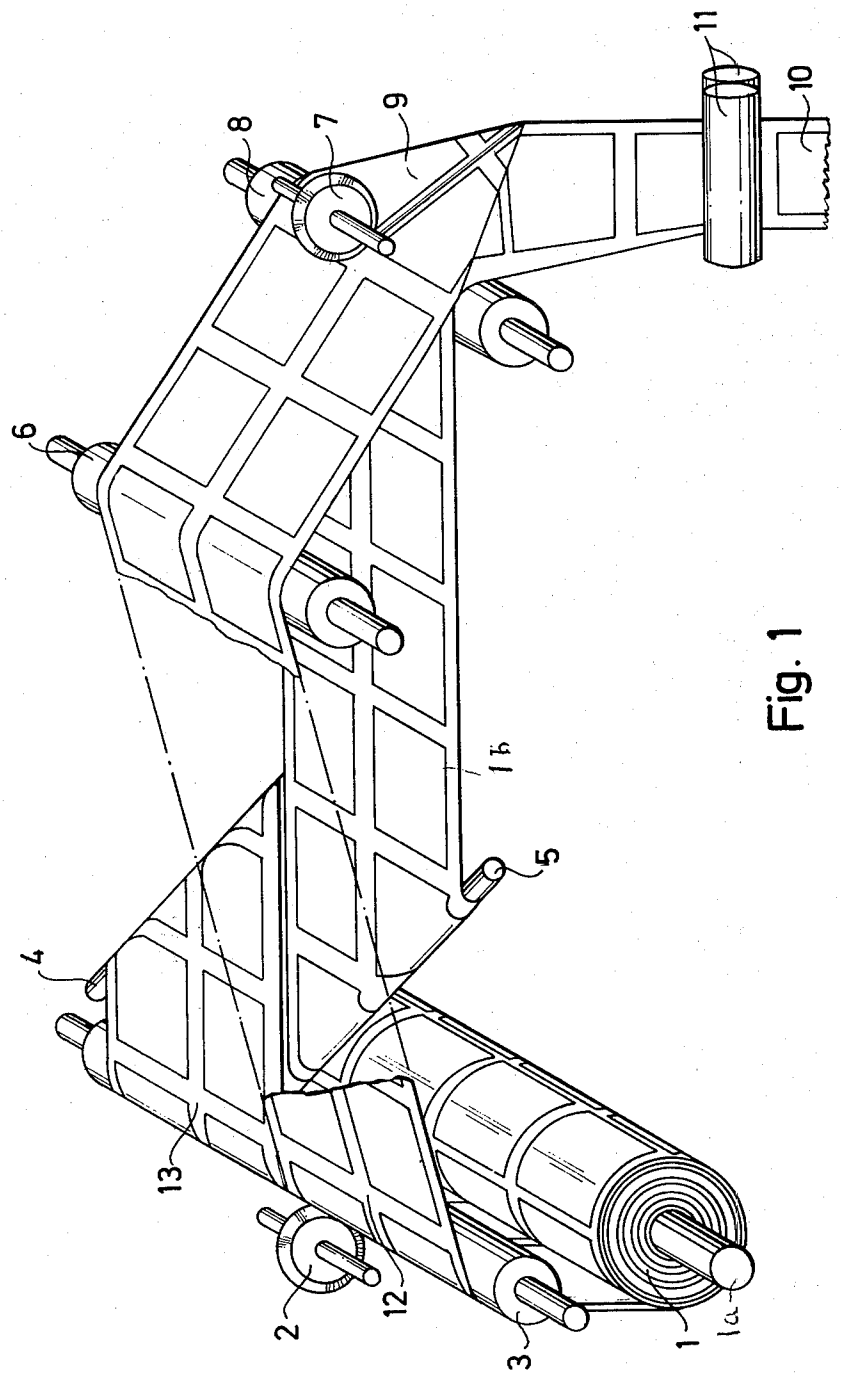


Fig. 1

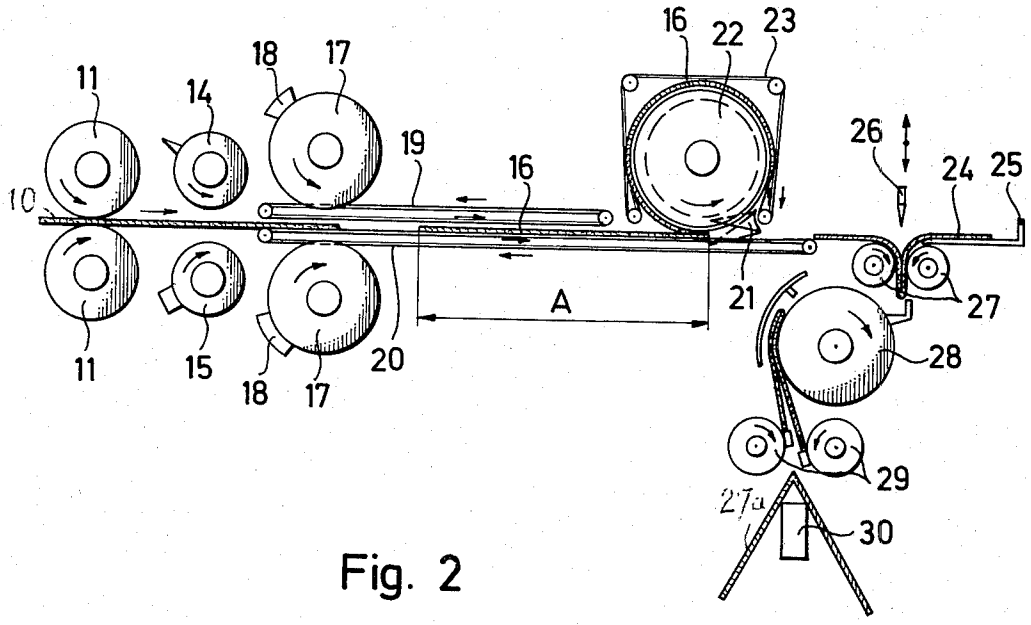

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Fig. 2

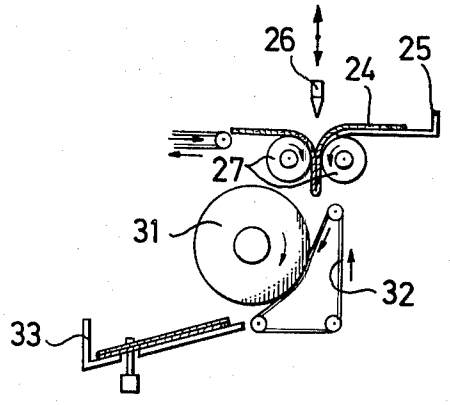

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Fig. 3

METHOD AND APPARATUS FOR MAKING STACKS OF PRINTED SHEETS FOR A BOOKBINDING MACHINE

BACKGROUND OF THE INVENTION

The present invention is concerned with the manufacture of books, brochures and other stacks of folded sheets which are cut off from several superimposed paper bands.

In accordance with the prior art, paper webs are continuously imprinted in printing machines, such as rotary printing machines, and then supplied to folding apparatus in which they are cut and folded. The folded sheets are gathered, manually placed on pallets and transported to the bookbinding machine where the folded sheets are manually arranged in small stacks on a table. The arrangement has the disadvantage that four to five workers are required for carrying out the necessary manual operation following the imprinting of the web at a high speed rotary printing machine.

It is also known to wind up the endless webs imprinted at a rotary printing machine, and to store wound up webs until further use. According to one mode of operation, the paper webs are taken off the storing reel, and transported to a folding and stitching apparatus. This arrangement has the disadvantage that the finished book has a limited number of pages, and it is not possible to glue the back of the book. Another disadvantage is that separately manufactured folded sheets cannot be stitched into the folded stacks.

In another mode of operation, the paper webs stored on reels are cut longitudinally to form narrow paper webs, and these narrow webs are superimposed so that the superimposed webs have as many layers as the printed book to be made has pages. The superimposed webs are glued at the back, whereupon a further web is supplied for forming the cover. Thereupon, the completed encased books are cut off the superimposed webs. The apparatus is expensive and has the disadvantage that stitching or stapling is not possible.

Both arrangements have the disadvantage that faulty portions of the paper webs are necessarily supplied to the folding guide, and cannot be eliminated so that a great percentage of faulty printed books occurs which have to be rejected.

SUMMARY OF THE INVENTION

It is one object of the invention to overcome the disadvantages of the prior art and to provide a simple and efficient apparatus for making folded stacks of sheets which can be encased by the cover in any desired manner.

Another object of the invention is to form stacks of sheets by cutting off the leading portion of a plurality of superimposed imprinted paper bands.

With these objects in view, the method of the invention comprises the steps of transporting in one longitudinal direction at a first speed a plurality of superimposed bands having imprints along predetermined equal longitudinal distances; cutting off successive superimposed leading portions of the superimposed bands at the predetermined distances to form stacks of printed sheets; transporting each cut off stack of printed sheets at a second speed higher than the first speed so that each cut off stack separates from the following uncut superimposed leading portions of the superimposed bands; and depositing the cut off stacks for binding in a book binding machine. Preferably, two successive cut off stacks are stacked for forming a double stack which is folded along a central fold line which may be stitched in a bookbinding machine so that a bound booklet results.

The apparatus of the invention includes first transporting means for transporting the superimposed bands, cutting means for cutting off successive superimposed leading portions of the bands at the predetermined distances to form stacks of printed sheets; and second transporting means for transporting each cut off stack at a second higher speed in the same direction so that each stack separates from the following uncut superimposed leading portions of the superimposed bands.

Preferably, each imprint on the bands has two separate parts, and folding means fold the stacks along a center fold line located between the two separate parts of the imprints.

The first transporting means preferably includes a pair of transporting rollers, the second transporting means include endless conveyor means for transporting the stacks at an increased speed away from the cutting means.

An embodiment of the apparatus of the invention comprises rotary reel means for a wound up web having a four transversely adjacent imprints, a first cutting device for cutting the web along a longitudinal center line into two web portions; first guide means for superimposing the two web portions; a second cutting device for cutting each of the web portions along longitudinal center lines thereof into two pairs of bands; and second guide means for superimposing the two pairs of bands to form four superimposed bands transported by the first transporting means to the cutting means.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary perspective view illustrating a device for transforming a broad web into four superimposed bands;

FIG. 2 is a fragmentary side elevation illustrating one embodiment of the apparatus of the invention with depositing means for a saddle stitching machine; and

FIG. 3 is a fragmentary side elevation illustrating depositing means for a bookbinding machine in which the back of the folded stack of sheets is glued.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A pair of transporting rollers **11** transport a paper web **1** and pull it off a reel shaft **1***a*. The paper web **1** has four imprinted areas or imprints **1***b* across its width. A rotary cutter **2** is positioned at the center of the web and cuts the web into two longitudinal web portions **12** and **13**, each of which has two imprints **1***b* across its width. Guide rods **4** and **5** guide the web portion **13** downward under the web portion **12** which is guided by a guide roller **6** to register with the web portion **13** so

that the two web portions 12 and 13 are exactly superimposed on another guide roller 8. A second cutter 7 cuts longitudinally along the center line of the superimposed web portions 12 and 13 so that four bands are formed which are superimposed by a guide means 9 to form a web 10 consisting of four superimposed bands 10*a*. Each band 10*a* has a width corresponding to the width of one printed area 1*b* which follow each other on each band 10*a* at equal distances, and are separated by free spaces.

As shown in FIG. 2, the two transporting rollers 11 transport the web 10 of four superimposed bands 10*a* in horizontal direction to a pair of endless conveyors 19, 20. A rotary cutter 14, which cooperates with a counter cutter 15, has a peripheral cutting knife, and cuts during each revolution of the cutting means 14 and 15, a transverse cut through the web 10 which is located between two printed portions 1*b*. In this manner, a stack of four superimposed sheets 16 is cut off from the leading portion of the transported web 10. Each stack 16 of four superimposed sheets has the length A which corresponds to the longitudinal extension of two printing areas or imprints 1*b*, so that a cut is made at every second space between two adjacent imprints 1*b*. By adjusting the rotary speed of the transporting rollers 11 in accordance with the rotary speed of the cutting means 14 and 15, the length A of the cut off stacks can be set. Directly after the cut has been made by cutting means 14, 15, two accelerating rollers 17 which carry elastic projections 18, accelerate the cut off stack to a higher speed than the speed of movement of the web 10, and this higher speed is equal to the speed of a pair of conveyors 19 and 20 so that the cut off sheet is quickly moved away from the cut leading end of the web 10.

The acceleration rollers 17 rotate at the same rotary speed as the rotary cutting means 14 and 15.

While the cut off stack 16 is transported at an increased speed, it reaches a mechanical switch 21 which is positioned to guide each stack of four superimposed sheets between a rotary stacking drum 22 and a band 23 guided on rollers to extend around the stacking drum 22. When a stack 16 has passed about the stacking drum 22, it is deposited on the next following stack 16 of four sheets to form a double stack having eight sheets. The thus formed double stack 24 is of greater thickness than the single stack 16, and shifts the mechanical switch 21 so that the double stack 24 is transported by conveyor band 20 until stopped by a stop 25 in a position in which the center thereof is located under a transverse folding knife 26 which is then reciprocated in vertical direction to cooperate with a gap between two folding rollers 27, so that, as shown in FIG. 2, the double stack is folded to form a folded stack of sheets. Since each stack 24 is folded along a fold line which is located between two imprints 1*b*, the folded stack forms a booklet with 16 sheets.

The folding rollers 27 transport the folded stack 24 to a gripper drum 28 of known construction which transports the stacks to positioning rollers 29 which place the two legs of the folded stack 27 in a position straddling the conveyor 30 of a stitching machine which secures the spines of the folded stacks 27*a* on conveyor 30 to each other. In the modification of FIG. 3, stack 24 is transported by transporting rollers 27 into the gap between a drum 31 and a portion of an endless belt 32 so that the folded stack 24 is deposited on the collecting channel 33 of a glue bookbinding machine.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of apparatus for making stacks of printed sheets, differing from the types described above.

While the invention has been illustrated and described as embodied in an apparatus for making folded stacks of imprinted sheets ready to be bound by a bookbinding machine without manual operations, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. Apparatus for continuously transforming superimposed bands into bound booklets, comprising first transporting means for transporting in one longitudinal direction a plurality of superimposed bands at a first speed; cutting means for cyclically cutting off successive superimposed leading portions of said superimposed bands at predetermined equal distances to form stacks of sheets, said cutting means including a rotary cutter cutting said superimposed bands once during each revolution of said rotary cutter; second transporting means adjacent said cutting means for transporting each cut-off stack at a second higher speed so that each stack separates from the following leading portion of said superimposed bands; stacking means for stacking each second cut-off stack on the preceding cut-off stack whereby double stacks are formed having twice the number of sheets than each cut-off stack, said stacking means including a rotary stacking drum, and a mechanical switch for guiding every second cut-off stack onto the preceding cut-off stack, said rotary stacking drum rotating at the same rotary speed as said rotary cutter and having a peripheral speed equal to the speed of said second transporting means; folding means for folding each double stack along a fold line so that a booklet is formed; and third transporting means for placing said folded booklets successively in position for being bound along said fold lines.

2. Apparatus for continuously transforming superimposed bands into booklets, comprising first transporting means including a pair of transporting rollers for transporting in one longitudinal direction a plurality of superimposed bands at a first speed; cutting means for cyclically cutting off superimposed leading portions of said superimposed bands at predetermined equal distances to form stacks of sheets; second transporting means adjacent said cutting means for transporting each cut-off stack at a second higher speed so that each stack separates from the following leading portion of said superimposed bands, said second transporting means including endless conveyor means for transporting said cut-off stacks away from said cutting means

and accelerating roller means for accelerating said cut-off stacks to the speed of said conveyor means; folding means for folding each stack along a fold line so that a booklet is formed; and third transporting means for placing said folded booklets successively in position for being bound along said fold lines.

3. Apparatus for continuously transforming superimposed bands into booklets, comprising first transporting means including a pair of transporting rollers for transporting a plurality of superimposed bands in longitudinal direction at a first speed; cutting means comprising a rotary cutter for cyclically cutting off successive superimposed leading portions of said superimposed bands at predetermined distances to form stacks of sheets; second transporting means adjacent said cutting means for transporting each cut-off stack at a second higher speed so that each stack separates from the following leading portion of said superimposed bands; folding means for folding each stack along a fold line so that a booklet is formed, said folding means including a pair of cooperating folding rollers forming a gap and a reciprocating folding knife moving towards said gap for pressing the center of said stack into said gap whereby said fold line is formed and said stack is folded so that a booklet is formed, said transporting rollers, said rotary cutter and said folding rollers having axes of rotation all of which are parallel to each other; means for opening said folded booklets; and third transporting means for moving said opened folded booklets in the direction of said fold lines and parallel to said axes in a position for being bound along said fold lines.

4. Apparatus as claimed in claim 3 comprising rotary reel means for a wound up web having four transversely adjacent imprints; a first cutting device for cutting said web along a longitudinal center line into two web portions; first guide means for superimposing said two web portions; a second cutting device for cutting each of said web portions along longitudinal center lines thereof into two pairs of bands; and second guide means for superimposing said two pairs of bands to form said plurality of four superimposed bands transported by said first transporting means.

5. Apparatus as claimed in claim 3, wherein said third transporting means include drum means and roller means for spreading said folded booklets, and a conveyor receiving the spread booklets in a straddling position so that booklets can be bound along said foldlines.

6. Apparatus as claimed in claim 3, and including stacking means located between said cutting means and said folding means for stacking each second cut-off stack on the preceding cut-off stack whereby double stacks having twice the number of sheets than each cut-off stack are formed.

7. Apparatus as claimed in claim 6, wherein said second transporting means includes a pair of endless superimposed conveyor belts, the lower one of which extends beneath and beyond said stacking means.

8. A method of continuously transforming a plurality of bands into bound booklets, comprising transporting said bands in the longitudinal direction thereof and at a first speed; cutting successive leading portions of said bands at predetermined equal distances to form sheets; transporting each cut-off sheet in said direction and at a higher speed so that each cut-off sheet separates from the following leading portion of said bands; stacking successive cut-off sheets for forming a stack; folding each stack along a fold line normal to said direction at which said bands and said sheets are transported so that a booklet is formed; opening said folded booklets; and transporting said opened folded booklets in the direction of said fold line and in a position for being bound along said fold line by a book binding machine.

9. Apparatus for continuously transforming a plurality of bands into bound booklets, comprising means for transporting said bands in the longitudinal direction thereof and at a first speed; means for cutting successive leading portions of said bands at predetermined equal distances to form sheets; means for transporting each cutoff sheet in said direction and at a second higher speed so that each cut-off sheet separates from the following leading portion of said bands; means for stacking successive cut-off sheets for forming a stack; means for folding each stack along a fold line normal to said direction at which said bands and said sheets are transported so that a booklet is formed; means for opening said folded booklets; and means for transporting said opened folded booklets in the direction of said fold line and in a position for being bound along said fold line by a book binding machine.

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