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Shuster

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[54] **BUCKLE FOLDER FOLD ROLLER**

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[52] **U.S. Cl.** ..... **270/68 A,** 29/125, 100/176, 226/191, 270/76, 270/83

[51] **Int. Cl.** **B65h 45/14**

[58] **Field of Search** ..... 270/68 R, 68 A, 83–85, 270/76, 77; 29/125; 100/176; 226/186, 191

[56] **References Cited**

UNITED STATES PATENTS

3,160,410	12/1964	Everson	270/83
3,363,816	1/1968	Maddock	226/186
2,645,228	7/1953	Davies	29/125 X
2,168,572	8/1939	Landis	29/125 X
2,926,628	3/1960	Black et al.	29/121 A X

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[57] **ABSTRACT**

An improved buckle folder fold roller comprises a roller body having a series of axially spaced metal bands and alternating resilient collars of greater width than the metal bands. The resilient collars are secured to the roller body in a prescribed manner to have a controllably larger diameter than the metal bands so that they engage the sheet material to be folded prior to the metal bands and thereafter maintain precise control of the sheets as they proceed through a nip comprised of coacting fold rollers arranged in a prescribed manner.

2 Claims, 3 Drawing Figures

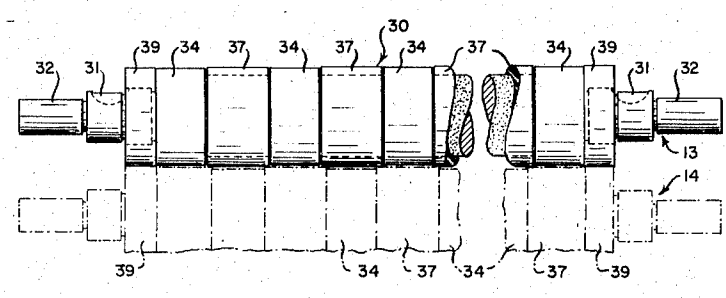


Fig. 1.

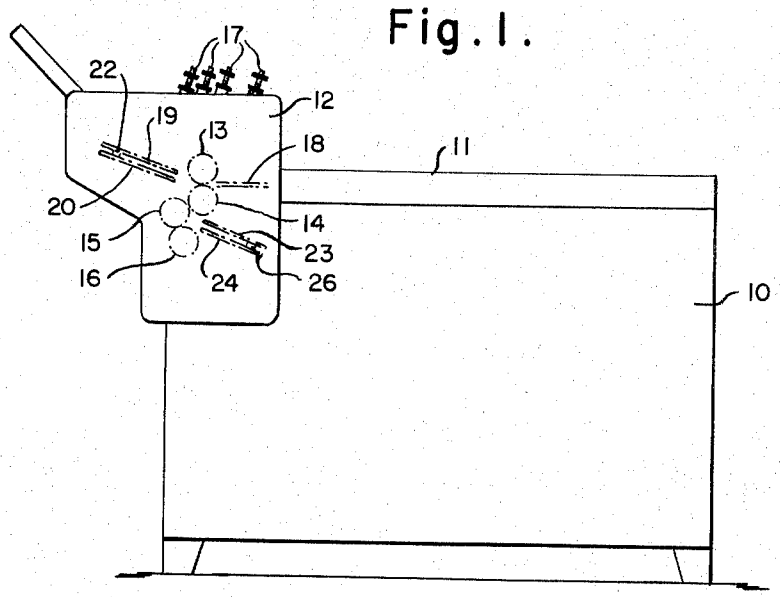


Fig. 2.

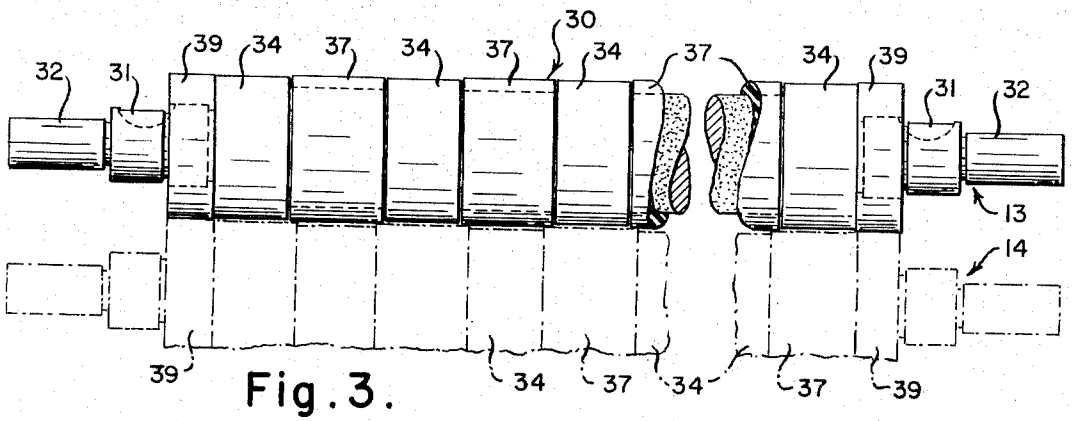
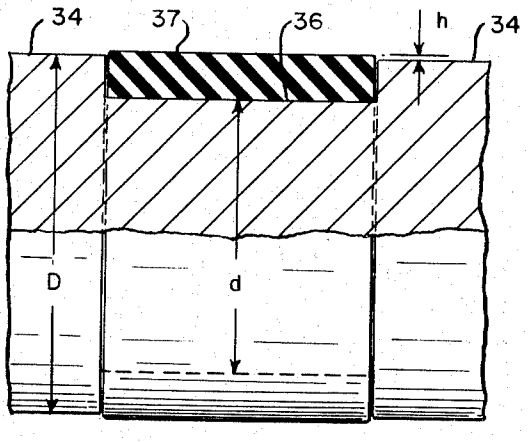


Fig. 3.



BUCKLE FOLDER FOLD ROLLER

SUMMARY OF THE INVENTION

The roller of the present invention has a sheet engaging surface consisting of alternate bands of resilient material and metal with the resilient sections being wider in an axial direction and larger in diameter than the metal bands as achieved in a prescribed manner. The resilient sections initially engage the sheets to be folded between coacting rollers and because of their high coefficient of friction and resiliency they maintain accurate and complete control of the sheets as they pass through the nip of said roller and a coacting roller. The metal bands, however, engage the sheets immediately after the resilient sections and thus supplement the driving force whereby rapid wear of the resilient sections is greatly diminished. A further advantage of the improved fold roller resides in its inherent ability to operate quietly at high speeds as compared to the conventional metal rollers.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevational view of a typical buckle folder to which the present invention applies.

FIG. 2 is an overall view of the improved fold roller and its relation-ship to a coacting like roller; and

FIG. 3 is an enlarged sectional view of a portion of the roller in FIG. 2.

DETAILED DESCRIPTION

With reference now to FIG. 1, a typical buckle folder is illustrated as comprising a base 10 having a feed surface 11 over which the products to be folded are advanced by conventional means not shown to a folder unit 12 wherein the product is folded into the required number of sections. The number of fold rollers in the folder unit obviously will vary with relation to the folding capacity of a particular buckle folder, but for illustrative purposes there is shown a fold unit having four coacting fold rollers 13, 14, 15 and 16 for effecting two sequential folds in the products.

In the arrangement shown, the roller 14 is mounted for rotation about a fixed axis and is positively driven by conventional drive means, not shown. The rollers 13, 15 and 16, in turn, are driven by roller 14 through intermeshing gears on their respective shafts and these rollers are mounted for rotation in pivoted brackets which are biased by resilient spring means associated with adjusting members indicated at 17, to maintain the coacting rollers in contact.

In operation, the sheets to be folded are advanced seriatium over a guide plate 18 mounted on the frame and which serves to direct the leading edge of each sheet into the nip between the rollers 13 and 14. As it passes through said nip, the leading edge of the sheet is directed between fold plates 19 and 20 and continues to travel forward until it engages a stop 22. At this point forward motion of the sheet leading edge ceases and the continuing driving effect of the rollers 13 and 14 causes the trailing portion of the sheet to buckle. The buckled portion of the sheet then advances and is directed into the nip between the rollers 14 and 15 which create the first fold. Upon passing through the nip between rollers 14 and 15, the folded, leading edge is directed between fold plates 23 and 24 wherein it continues to advance until it engages a stop 26. At this point,

continued advancement of the trailing portion of the sheet by the rollers 14 and 15 will create another buckle therein which will be advanced into the nip between the rollers 15 and 16 to effect the second fold. Upon leaving the nip between rollers 15 and 16 the folded product passes to conventional delivery means, not shown.

To perform their function, the respective rollers 13–16 are manufactured to exceedingly close tolerances and the biasing springs are adjusted to maintain sufficient pressure between the respective coacting rollers to drive and control the products and still not emboss them. Accordingly, if the products are properly aligned as they enter the first roller nip, the folds should be properly spaced and parallel to the leading edge. Notwithstanding the accuracy of manufacture and/or the preciseness with which the rollers are set, it frequently happens that control of the sheets is inconsistent and certain products skew as they pass through the nips of the buckle folder resulting in improper, misaligned folds and/or wrinkles in the finished product. The condition seems to be most prevalent with products formed or printed on relatively hard, coated stock. Products printed on web offset presses and which are directed through dryers and chill units subsequent to the printing thereof are particularly troublesome and this is probably due to the hardening effect on the paper of the driers and chill units.

The precise reason for this lack of consistent control is not fully understood but it is believed to be due in large part to local, micro-variations in the surfaces of the rollers or in the gauge of the stock. Because of the hardness of the stock, such local areas will not compress as they pass through the roller nips. Consequently, the coacting rollers are caused to separate slightly against the bias of their control springs and there is a finite period during which contact between the roller surface and the sheet is limited to the local high point thereby relieving the remainder of the sheet from adequate contact with the rollers and allowing it to skew out of position. This condition seems to prevail regardless of whether the peripheral surface of the rollers is smooth, knurled or metal sprayed. Because of their resilient nature, rubber or composition covered rollers function efficiently with virtually all types of stock, but as mentioned previously, they are subject to rapid wear in operation, resulting in high maintenance and/or replacement costs and therefore, are used to only limited extent.

In accordance with this invention an improved roller is provided having a peripheral surface comprised of alternating resilient and metal bands which coact to provide the effective sheet control normally attainable only with rubber or composition coated rollers while providing a life expectancy not substantially less than that of metal rollers.

With reference now to FIGS. 2 and 3, a preferred embodiment of the fold roller essentially consists of a main body portion 30 of metal which is provided with reduced diameter shoulders 31 and stub shafts 32 at each end thereof. The shoulders 31 provide support surfaces for drive gears, not shown, which are keyed to the roller and serve to drive it in unison with the adjacent coacting rollers and the stub shafts 32 serve to support each end of the roller for rotation in bearings carried by brackets that are pivotally mounted on the folder side frames as is well known in the art.

The surface of the roller body **30** is machined to provide a series of axially spaced, annular metal bands **34** having a uniform overall diameter D and these metal bands are separated by a corresponding series of grooves **36** having a reduced diameter *d*. In each groove **36** there is provided a collar **37** of resilient material which is securely bonded in position and which has a radial thickness such that its peripheral surface projects a small distance *h* beyond the surfaces of the adjacent metal bands **34.** The resilient collars **37** may be fabricated from natural rubber or any of various synthetic compositions such as, for example, polyurethane and they preferably have a hardness of 65 to 90 durometer. The difference in height between the peripheral surfaces of the metal bands **34** and resilient collars **37** also may vary to some extent depending upon the material used and the hardness thereof. In actual tests, however, differences in height ranging between 0.001 and 0.007 inch have produced satisfactory results but a height differential of 0.003 inch is preferred. The desired height differential is normally obtained by finish grinding the roller body outer diameter and the resilient collars **37** in one continuous operation after the collars (with surplus material) have been bonded to the surfaces of grooves **36.**

It will be noted that grooves **36** and thus the collars **37** are somewhat wider then the metal bands **34** so that there is a greater surface area of resilient material. Although the ratio of surface areas is not critical, it is preferred that the surface area of the resilient material be not less than 20 percent greater than the metal surface area to assure maximum control of the paper.

Adjacent each end thereof the roller body **30** also is provided with a bearer ring **39** having a radius that is about 0.0005 inch larger than the radius of the metal bands **34.** These bearers are adapted to run in contact with corresponding bearers on the coacting rollers to thereby maintain the axes of the rollers precisely parallel and to maintain a clearance of about 0.001 inch between the surfaces of the respective metal bands **34.**

In a buckle folder as illustrated in FIG. **1,** it is preferred that all of the rollers **13–16** be constructed in accordance with this invention. However, good results can be obtained if the rollers **13** and **15** are of the improved type and are mounted for coaction with conventional metal rollers in the positions of **14** and **16.**

In operation it will be understood that the tension of the springs which bias the respective rollers against each other will be set so that the respective coacting bearer rings **39** will be in contact. Since the collars **37** are slightly larger in diameter than the bearer rings they obviously will be slightly compressed under these circumstances and therefore will have increased surface contact with the sheets as they pass through the nips as compared to the line contact between the metal bands **34** and the sheets.

It also will be apparent that due to their slightly greater radii, the collars **37** will engage the leading edge of the sheets prior to the metal bands **34.** Consequently they are able to assume initial control and thereafter maintain control of the sheets as they pass through a given nip. However, the metal bands **34** contact the sheets immediately after the resilient collars **37** so that they immediately supplement the driving effect upon the sheets and thereby prevent premature wear of the collars **37.**

It is believed that the improved sheet control provided by this roller is attributable to the fact that if the sheets have local variations in the gauge thereof and if the high spots coincide with a collar **37** as they pass through a nip, the collar will merely compress to a slightly greater extent to accommodate the variation in thickness without disturbing the overall contact between the rollers and the sheet. On the other hand, if the high spot in the sheet coincides with a metal band **34** or if there should be a high spot on the surface of a metal band, it may cause a slight, momentary increase in the separation of the coacting rollers. In such case, however, the respective collars **37** will simply expand an equivalent amount and thereby continue to maintain positive control of the sheet.

Furthermore, while the roller is shown in FIG. **2** as being symmetrical on either side of the center thereof, this is not essential. In some instances, it may be desirable to have the roller surface start with a resilient collar at one end and a metal band at the other. In such case, when mounted in the folder, the rollers would be reversed relative to one another such that a resilient collar on one roller would be opposite a metal band on the coacting roller. This would have the advantage in that the wider resilient collars would tend to overlap one another thereby increasing the control of the sheet and reducing the possibility of embossing the products.

While there has been illustrated a preferred embodiment of the invention, it will be understood that modifications will become apparent to those skilled in the art. For example, it is preferred that the peripheral surfaces of the metal bands be smooth so that, when necessary, the sheets may shift slightly relative thereto under control of the resilient collars and thereby avoid introducing wrinkles into the folded product. However, these surfaces may be knurled or otherwise modified to increase their coefficient of friction if desired without departing from the spirit of the invention.

I claim:

1. In a buckle folder wherein the buckled portion of a sheet is directed into the nip between adjacent buckle fold rollers, an improved buckle fold roller comprising an elongated, cylindrical body member having journalling means at each end thereof for rotatably mounting said roller:

a plurality of spaced apart, cylindrical band portions formed on said body member and having metallic, peripheral drive surfaces;

a series of spaced apart, annular recesses alternating with said band portions, said recesses being wider axially of said body member and having a predetermined radius less than said band portion drive surfaces;

a resilient, annular collar secured in each said recess for rotation with said body member and presenting a peripheral drive surface having a radius 0.001 to 0.007 inch greater than the radius of said band portion drive surfaces; and

annular bearer means at each end of said body member, said bearer means having a radius less than the radius of said resilient annular collar peripheral drive surfaces but greater than the radius of said band portion peripheral drive surfaces whereby a predetermined minimum clearance is maintained between the band portion peripheral drive surfaces of said roller and corresponding band portion peripheral drive surfaces of a coacting roller.

2. In a buckle folder as set forth in claim **7** wherein the resilient annular collars have a durometer hardness value in the range of 65–90.

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