

## Description

The present invention relates to an apparatus for automatically closing a slide fastener into a final product form for delivery to the market.

A typical prior art apparatus of this character is disclosed in Japanese Laid-Open Patent Publication 60-180515 (corresponding to U.S. Patent No. 4,592,135), which apparatus comprises a holder including a presser-foot arranged to hold under pressure a slide fastener, which has been assembled by associated finishing station and partly closed by a slider, temporarily in stationary position on a track of its travel, and a drive means engageable with and moving the slider to close the slide fastener along its entire length. Such apparatus further includes an air-cylinder to drive the holder and another to reciprocate the drive means and is therefore not only bulky in size but also difficult to adjust the operational timing between the two cylinders. It has a further problem in that because the slide fastener is invariably pressed down while the slider is pulled forcibly to run along the rows of fastener coupling elements, there is a fear of impairing the coupling elements, the slider or the drive means.

A further example of relevant prior art apparatus is disclosed in European Patent Application no. 0 109 643 which apparatus comprises a pair of lower feed rollers and a pair of upper feed rollers for driving a slide fastener therebetween, a drive means for driving said pair of feed rollers and control means for controlling the drive means. A system of tilt plates is disclosed for engagement with a slider to act as an arresting means. This apparatus is bulky in size, and incorporates pairs of feed rollers rather than single rollers each having a peripheral groove which is disadvantageous; it also lacks a separate presser means and the advantages therewith.

According to the present invention, there is provided an apparatus for automatically closing a slide fastener having a pair of stringers and a slider, which apparatus comprises:

(a) an upper feed roller and a lower feed roller for driving a slide fastener therebetween and mounted on their respective shafts extending at right angles across a horizontal path of travel of the slide fastener, at least one of said rollers having a peripheral guide groove for unobstructed passage of the slide fastener;

(b) a drive means for driving one of said rollers in either direction

(c) a control means for controlling said drive means for its direction of rotation; and

(d) an arrester means disposed in said path of travel and engageable with the slider for arresting the slider to thereby move the latter relative to the stringers.

The present invention seeks to provide an improved apparatus for automatically closing a slide fastener which will eliminate or alleviate the aforementioned disadvantages of the prior art.

The present invention further seeks to provide an apparatus for automatically closing a slide fastener which essentially comprises a pair of feed rollers rotative both in forward and reverse directions to move a slide fastener, and a slider arrester engageable with and arresting a slider in position to provide continued movement of the fastener there-through, all operating parts being actuated by a power essentially dependent upon moments applied by feed rollers to the slide fastener. The apparatus as a whole is therefore made relatively compact and is free from a fear of damage to the slider, fastener coupling elements or operating parts of the apparatus.

The above and other objects and features of the invention will become clear from the following detailed description taken in conjunction with the accompanying drawings in which like reference numerals prefer to like and corresponding parts.

Figure 1 is a perspective view of an apparatus for automatically closing a slide fastener embodying the invention;

Figures 2A - 2E inclusive are schematic side elevational, partly sectional, views of the apparatus of Figure 1 utilized to depict the sequence of its operation;

Figure 3 is a perspective view of a modified form of apparatus according to the invention;

Figures 4A and 4B are plan views of slide fasteners of a separable type; and

Figures 5A and 5B are plan views of slide fasteners of a standard form.

Referring now to Figure 1, there is shown an apparatus 10 provided in accordance with the invention for automatically closing an individual slide fastener F finished by but partly open and transferred from a fastener assembling or finishing unit not shown. The slide fastener F that may be handled by the present apparatus 10 may be of a standard form shown in Figures 5A and 5B or of a separable type shown in Figures 4A and 4B, each slide fastener commonly including a pair of stringers or tapes T carrying along their inner longitudinal edges rows of coupling elements E which are taken into and out of mutual coupling engagement by a slider S as the latter reciprocates between top and bottom end stops M in a manner well known in the art. When a chain of slide fasteners F is assembled with sliders S and then end stop M, there necessarily occurs a gap G (Figure 4A) or a length of uncoupled or separated rows of fastener elements E between the slider mounted thereon and the end stops, which gap G must be closed to provide an acceptable slide fastener product prior to its shipment. It is to this end that the apparatus 10 of the invention is applied.

Each individual slide fastener F is transported along a horizontal path of travel R - R from the assembling unit to the apparatus 10 by a suitable transporting means which is illustrated in Figure 1 to be in the form of a pair of grippers 11, 12 movable along their guide rods 13, 14.

The apparatus 10 includes an upper feed or drive roller 15 and a lower feed or driven roller 16 dis-

posed in confronting relation to each other across the path of travel R - R of a slide fastener and mounted on their respective shafts 17 and 18 extending at right angles across the path of travel R - R, the rollers 15 and 16 peripherally centrally registering with the path R - R. The upper feed roller 15 has its shaft 17 connected to and driven by a suitable drive such as a reversible motor 19 which is connected via a control circuit 20 to, and controlled for its direction of rotation by, a controller unit 21.

The lower feed roller 16 has its shaft 18 rotatably supported in a bracket 22 for an elevator block 23 secured to a support rod 24 which is hydraulically driven by means not shown to move vertically. Actuation of the rod 24 is electrically controlled by the controller unit 21 which transmits signals via a circuit 25 to cause ascending and descending of the rod 24 to bring the lower feed roller 16 into and out of peripheral engagement with the upper feed roller 15.

In the embodiment of the invention shown in the present drawings, the lower feed roller 16 is provided with a peripheral guide groove 16a dimensioned to allow unobstructed passage of the slider S with its pull tab S1 dependent while the slide fastener F is fed between the upper and lower rollers 15 and 16. In a mode of operation in which the slide fastener F is fed with the slider pull tab S1 face up in contrast to the present showing, the peripheral guide groove may be provided in the upper feed roller 15 for similar purposes. It will be also understood that where a given slider is bulky to protrude on both sides of the fastener F, the guide groove may be provided for each of the two feed rollers 15 and 16.

A slider arrester 26 is pivotally supported on a pin 27 secured to the bracket 22, the pin 27 extending parallel with the shafts 17, 18 of the rollers 15, 16. The slider arrester 26 has an inverted-L shape defined by a vertical arm 28 and a horizontal arm 29. The vertical arm 28 has at its distal end a hook 28a engageable with the slider S to arrest the movement of the latter during the fastener closing operation hereafter described.

A spring 30 is supported between the bracket 22 and the distal end of the horizontal arm 29 to normally urge the slider arrester 26 clockwise in the direction of forward movement of the slide fastener F.

A contact strip 31 extends horizontally from the arrester 26 at an end of the horizontal arm 29 remote from the spring 30 and is normally held in contact with a microswitch 32 on the bracket 22 as the arrester 26 is normally urged clockwise. The contact strip 31 is provided with an adjusting bolt 33 and nut 34 which restrict and adjust the rotary movement of the arrester 26, which takes place as shown in Figures 2A - 2E.

A presser foot 35 is provided in a position registering with the path of travel R - R immediately downstream of the slider arrester 26 and adapted to hold down the slide fastener F, for which purpose the presser foot 35 is connected to and vertically moved by a piston 36 of a hydraulic cylinder 37 mounted on a frame member 38. The amount of downward movement of presser foot 35, or the downward stroke of the piston 36 is limited by a central

nut 39 on the upper end of a bolt 40 inserted through the frame member 38 and secured at the lower end to the presser foot 35 as the control nut 39 is brought into abutting engagement with the upper surface of the frame member 38. The presser foot 35 has in its sole a longitudinal guide groove 35a extending throughout its entire length for receiving and passing the reverse side of the slider S during movement of the slide fastener F. The presser foot 35 is tilted downwardly toward the lower feed roller 16 so that its tilted end 35b alone is disposed for engagement with the stringer tapes T as shown in Figure 2C and further with the rear end of the slider upper flange S2 without interference with the coupling elements E as shown in Figure 2D.

The tilted end 35b of the presser foot 35 is disposed barely out of juxtaposed relation to and spaced a predetermined distance apart from the hook 28a of the arrester 26 when the slider S is arrested so that the tilted end 35b and the hook 26b come into contact precisely with the rear ends of the upper and lower slider flanges S2 and S3 respectively without engaging and impairing the coupling elements E.

With this construction, the apparatus 10 performs the phases of operation illustrated in Figures 2A - 2E. In the initial phase or rest position in which the apparatus 10 is disposed as shown in Figure 1 and Figure 2A, the feed rollers 15 and 16 and the presser foot 35 are all retracted away from the path of travel R - R of the slide fastener F which has been carried by the grippers 11, 12 to a position immediately adjacent the entrance of the apparatus 10.

In the second phase of operation shown in Figure 2B, the slide fastener F has arrived between the upper and lower feed rollers 15 and 16 and the slider S has just passed between the presser foot 35 and the arrester 26, when this is detected by a photoelectric sensor 41 connected to the controller unit 21, whereupon a control signal is transmitted via the circuit 25 to cause actuation of the hydraulic drive means to raise the rod 24 and its associated elevator 23 to bring the lower feed roller 16 up close to the upper feed roller 15. This takes place simultaneously with actuation of the cylinder 37 to lower the presser foot 35 to the position shown in Figure 2C in which the slide fastener F is arrested between the presser foot 35 and the arrester 26. This timing (or the third phase) is detected by suitable means not shown, whereupon the controller unit 21 transmits a signal via a circuit 20 to reverse the direction of rotation of the motor 19 thereby switching the rotation of the upper feed roller 15 from counterclockwise to clockwise. This causes movement of the slide fastener F in the opposite direction (as indicated by the arrow X in Figure 2C) until the slider S is caught by and between the presser foot 35 and the arrester 26 and thereafter brought into engagement with the end stops M, taking the rows of elements E at the gap G or the separated portions of the stringer tapes T into coupling engagement, thus fully closing the slide fastener F as shown in Figure 2D or Figures 4R and 5B. This, the fourth phase of operation, is followed by the final phase in which the slider arrester 26 is urged against the tension of the

spring 30 to pivot counterclockwise under contact pressure from the slider S which has just struck the end stops M and the contact strip 31 disengages from the microswitch 32 whereupon a signal representing the completion of relative movement between the fastener F and the slider S is transmitted from the controller 21 via the circuit 20 to the motor 19 to effect rotation of the upper feed roller 15 counterclockwise so that the fully closed fastener F is now moved back in its forward direction until it is finally hopped out through a discharge chute 42 as shown in Figure 2E. Discharge of the slide fastener F, now fully closed, is detected by suitable means not shown, to send a signal to the controller 21 which will instruct the apparatus 10 to resume its initial position shown in Figure 1 or Figure 2A, thus standing by for the next repetitive cycle of operation.

Figure 3 illustrates a modified form of apparatus 100 in which there is provided an endless belt conveyor 101 in place of the grippers 11, 12 for transporting the slide fastener F to be fully closed, and a plate member 102 is disposed extending between the belt conveyor 101 and the nip of the feed rollers 15 and 16 for relaying the slide fastener F on to the region of the apparatus 100. The lower feed roller 16 in this modification is normally urged by a coil spring 103 upwardly toward the upper feed roller 15 to grip and move the slide fastener F in a manner similar to the operation of the apparatus 10 shown in Figure 1. There is also additionally provided a protective crank arm shield 104 secured at one end to the bracket 22 and received in the guide groove 16a of the lower roller 16, the free end 104a extending over and slightly spaced from the hook 28a of the arrester 26. The crank arm 104 is adapted to protect the guide groove 16a and the arrester 26 against interference with the slider S and its pull tab S1. The modified apparatus 100 of Figure 3 is otherwise identical with the apparatus 10.

Having thus described the invention, it will be understood that various changes or modifications may be made in the apparatus 10 (100) without departing from the scope of the appended claim. For example, the microswitch 32 may be substituted by a photoelectric cell. The pivotal movement of the arrester 26 on the pin 27 can be effected by means of a coil spring spanning between the pin 27 and the bracket 22. It is even conceivable that the pressure foot 35 and its associated parts may be excluded from the slide fastener closing operation if a given slider is heavy enough to keep the fastener down and ensure its engagement with the arrester 26. While the invention has been described as applied to the case where the apparatus 10, (100) is located downstream of and associated with existing slide fastener assembling or finishing units, it may be applied immediately in advance of the packaging of product fasteners.

#### Claims

1. An apparatus (10) for automatically closing a slide fastener (F) having a pair of stringers (T) and a slider (S), which apparatus comprises: an upper feed roller (15) and a lower feed roller (16) for driv-

ing a slide fastener (F) therebetween and mounted on their respective shafts (17), (18) extending at right angles across a horizontal path (R-R) of travel of the slide fastener (F); a drive means for driving one of said rollers (19) in either direction; a control means (21) for controlling said drive means (15) for its direction of rotation; and an arrester means (26) disposed in said path of travel and engageable with said slider (S) to thereby move the latter relative to the stringers (T); characterised in that said apparatus (10) further includes a presser means (35) movable toward and away from said path of travel for holding the slide fastener stringers (T) against said arrester means (26), and at least one of said rollers (16) has a peripheral groove (16a) for unobstructed passage of the slide fastener (F); whereby said slider (S) may be arrested between said arrester means (26) and said presser means (35) when effecting the closure of the slide fastener (F).

2. An apparatus according to Claim 1, characterised in that said arrester means (26) is pivotable and spring-biased normally in the direction of forward travel of the slide fastener (F).

3. An apparatus according to Claim 1 or 2, characterised in that said apparatus further includes a contact strip (31) associated with said arrester (26) and a microswitch (32) engageable with said contact strip (31) to effect forward movement of the slide fastener (F) and disengageable from said strip (31) upon completion of the slide fastener (F) closing operation.

4. An apparatus according to any one of Claims 1 to 3, characterised in that said apparatus further includes an elevator means (23) for moving one of said feed rollers (16) toward and away from the other.

5. An apparatus according to any one of Claims 1 to 3, characterised in that one of said feed rollers (16) is spring-biased normally toward the other (15).

6. An apparatus according to Claim 5, characterised in that said apparatus further includes a protective shield means (104) disposed within said guide groove (16a) and extending over said arrester means (26).

#### Patentansprüche

1. Vorrichtung (10) zum automatischen Schließen eines Reißverschlusses (F), der zwei Reißverschlußbänder (T) und einen Schieber (S) aufweist, welche Vorrichtung umfaßt: eine obere Zuführrolle (15) und eine untere Zuführrolle (16) zum Antreiben eines dazwischen befindlichen Reißverschlusses (F), die auf zugeordneten Wellen (17, 18) gelagert sind, die sich rechtwinklig quer zu einer horizontalen Bewegungsbahn (R-R) des Reißverschlusses (F) erstrecken; eine Antriebseinrichtung zum Antreiben einer der besagten Rollen (16) in jeder Richtung; eine Steuereinrichtung (21) zum Steuern der Drehrichtung der Antriebseinrichtung (19) und eine Anschlageneinrichtung (26), die in der besagten Bewegungsbahn angeordnet und mit dem Schieber (S) in Eingriff bringbar ist, um diesen gegenüber den Reißverschlußbändern (T) zu bewegen; da-



spring 30 to pivot counterclockwise under contact pressure from the slider S which has just struck the end stops M and the contact strip 31 disengages from the microswitch 32 whereupon a signal representing the completion of relative movement between the fastener F and the slider S is transmitted from the controller 21 via the circuit 20 to the motor 19 to effect rotation of the upper feed roller 15 counterclockwise so that the fully closed fastener F is now moved back in its forward direction until it is finally hopped out through a discharge chute 42 as shown in Figure 2E. Discharge of the slide fastener F, now fully closed, is detected by suitable means not shown to send a signal to the controller 21 which will instruct the apparatus 10 to resume its initial position shown in Figure 1 or Figure 2A, thus standing by for the next repetitive cycle of operation.

Figure 3 illustrates a modified form of apparatus 100 in which there is provided an endless belt conveyor 101 in place of the grippers 11, 12 for transporting the slide fastener F to be fully closed, and a plate member 102 is disposed extending between the belt conveyor 101 and the nip of the feed rollers 15 and 16 for relaying the slide fastener F on to the region of the apparatus 100. The lower feed roller 16 in this modification is normally urged by a coil spring 103 upwardly toward the upper feed roller 15 to grip and move the slide fastener F in a manner similar to the operation of the apparatus 10 shown in Figure 1. There is also additionally provided a protective crank arm shield 104 secured at one end to the bracket 22 and received in the guide groove 16a of the lower roller 16, the free end 104a extending over and slightly spaced from the hook 28a of the arrester 26. The crank arm 104 is adapted to protect the guide groove 16a and the arrester 26 against interference with the slider S and its pull tab S1. The modified apparatus 100 of Figure 3 is otherwise identical with the apparatus 10.

Having thus described the invention, it will be understood that various changes or modifications may be made in the apparatus 10 (100) without departing from the scope of the appended claim. For example, the microswitch 32 may be substituted by a photoelectric cell. The pivotal movement of the arrester 26 on the pin 27 can be effected by means of a coil spring spanning between the pin 27 and the bracket 22. It is even conceivable that the pressure foot 35 and its associated parts may be excluded from the slide fastener closing operation if a given slider is heavy enough to keep the fastener down and ensure its engagement with the arrester 26. While the invention has been described as applied to the case where the apparatus 10, (100) is located downstream of and associated with existing slide fastener assembling or finishing units, it may be applied immediately in advance of the packaging of product fasteners.

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2. An apparatus according to Claim 1, characterised in that said arrester means (26) is pivotable and spring-biased normally in the direction of forward travel of the slide fastener (F).

3. An apparatus according to Claim 1 or 2, characterised in that said apparatus further includes a contact strip (31) associated with said arrester (26) and a microswitch (32) engageable with said contact strip (31) to effect forward movement of the slide fastener (F) and disengageable from said strip (31) upon completion of the slide fastener (F) closing operation.

4. An apparatus according to any one of Claims 1 to 3, characterised in that said apparatus further includes an elevator means (23) for moving one of said feed rollers (16) toward and away from the other.

5. An apparatus according to any one of Claims 1 to 3, characterised in that one of said feed rollers (16) is spring-biased normally toward the other (15).

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#### Patentansprüche

1. Vorrichtung (10) zum automatischen Schließen eines Reißverschlusses (F), der zwei Reißverschlusbbänder (T) und einen Schieber (S) aufweist, welche Vorrichtung umfaßt: eine obere Zuführrolle (15) und eine untere Zuführrolle (16) zum Antreiben eines dazwischen befindlichen Reißverschlusses (F), die auf zugeordneten Wellen (17, 18) gelagert sind, die sich rechtwinklig quer zu einer horizontalen Bewegungsbahn (R-R) des Reißverschlusses (F) erstrecken; eine Antriebseinrichtung zum Antreiben einer der besagten Rollen (16) in jeder Richtung; eine Steuereinrichtung (21) zum Steuern der Drehrichtung der Antriebseinrichtung (19); und eine Anschlageneinrichtung (26), die in der besagten Bewegungsbahn angeordnet und mit dem Schieber (S) in Eingriff bringbar ist, um diesen gegenüber den Reißverschlusbbändern (T) zu bewegen; da-



durch gekennzeichnet, daß die Vorrichtung (10) ferner eine Andrückeinrichtung (35) enthält, die zu der bewegten Bewegungsbahn hin und von dieser weg bewegbar ist, um die Reißverschlußbänder (T) an der Anschlageinrichtung (26) in Anlage zu halten, und daß mindestens eine der besagten Rollen (16) eine Umfangsnut (16a) für den unbehinderten Durchgang des Reißverschlusses (F) hat; wodurch der Schieber (S) beim Schließen des Reißverschlusses (F) zwischen der Anschlageinrichtung (26) und der Halteeinrichtung (35) festgelegt werden kann.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Anschlageinrichtung (26) schwenkbar und normalerweise in Richtung der Vorwärtsbewegung des Reißverschlusses (F) federbelastet ist.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Vorrichtung ferner einen der Anschlageinrichtung (26) zugeordneten Kontaktstreifen (31) und einen Mikroschalter (32) enthält, der mit dem Kontaktstreifen (31) in Eingriff bringbar ist, um die Vorwärtsbewegung des Reißverschlusses (F) zu bewirken, und der nach Beendigung des Schließvorganges des Reißverschlusses (F) mit dem besagten Streifen (31) außer Eingriff bringbar ist.

4. Vorrichtung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Vorrichtung ferner eine Hubeinrichtung (23) enthält, um eine der Zuführrollen (16) zu der anderen hin und von dieser weg zu bewegen.

5. Vorrichtung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß eine der Zuführrollen (16) normalerweise gegen die andere (15) federbelastet ist.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß die Vorrichtung ferner einen Schutzschirm (104) enthält, der in der Führungsnut (16a) angeordnet ist und sich über die Anschlageinrichtung (26) erstreckt.

## Revendications

1. Appareil (10) pour fermer automatiquement une fermeture à glissière (F) pourvue d'une paire de bandes (T) et d'un curseur (S), lequel appareil comprend: un galet d'avance supérieur (15) et un galet d'avance inférieur (16) destinés à entraîner entre eux une fermeture à glissière (F) et montés sur des arbres respectifs (17), (18) s'étendant à angle droit par rapport à une trajectoire horizontale de déplacement (R-R) d'une fermeture à glissière (F); un moyen d'entraînement (19) destiné à entraîner l'un (15) desdits galets dans un sens et en sens opposé; un moyen de commande (21) destiné à commander ledit moyen d'entraînement (19) relativement à son sens de rotation; et un moyen formant arrêtoir (26) disposé sur ladite trajectoire de déplacement et pouvant rencontrer le curseur (S) afin de l'arrêter ou le déplacer par rapport aux bandes (T), caractérisé en ce que ledit appareil (10) comporte en outre un moyen de pression (35) pouvant se rapprocher et s'éloigner de ladite trajectoire de déplacement afin de maintenir les bandes de fermeture à glissière (T) contre ledit moyen formant arrêtoir (26), et en

ce qu'au moins l'un (16) desdits galets possède une gorge de guidage périphérique (16a) pour le passage sans encombre de la fermeture à glissière (F); ledit curseur (S) pouvant de ce fait être arrêté entre ledit moyen formant arrêtoir (26) et ledit moyen formant presseur (35) lorsqu'est effectuée la fermeture de la fermeture à glissière (F).

2. Appareil selon la revendication 1, caractérisé en ce que le moyen formant arrêtoir (26) peut pivoter et est sollicité par un ressort normalement dans le sens avant de déplacement de la fermeture à glissière (F).

3. Appareil selon la revendication 1 ou 2, caractérisé en ce que ledit appareil comporte en outre une patte de contact (31) associée audit arrêtoir (26) et un micro-contact (32) pouvant être rencontré par la patte de contact (31) afin de faire avancer la fermeture à glissière (F) et pouvant être dégagé de ladite patte (31) lors de l'achèvement de l'opération de fermeture de la fermeture à glissière (F).

4. Appareil selon l'une quelconque des revendications 1 à 3, caractérisé en ce que ledit appareil comporte en outre un moyen élévateur (23) pour déplacer l'un (16) desdits galets d'avance de manière à le rapprocher et à l'éloigner de l'autre.

5. Appareil selon l'une quelconque des revendications 1 à 3, caractérisé en ce que l'un (16) desdits galets d'avance est normalement sollicité par un ressort vers l'autre (15).

6. Appareil selon la revendication 5, caractérisé en ce que ledit appareil comporte en outre un moyen de protection (104) disposé dans ladite gorge de guidage (16a) et s'étendant au dessus dudit moyen formant arrêtoir (26).