

Description

This invention relates generally to the manufacture of slide fasteners from an elongate stringer chain and more particularly to an apparatus for metering an elongate stringer chain having rows of coupling elements which comprises a feed-in unit including a feed roller and a pressure roller for feeding said stringer chain; a guide unit including a pulley; a metering unit for metering said stringer chain by counting the number of coupling elements thereon; a drive means adapted to provide a relative movement between said guide unit and said meter unit; and a feed-out including a feed roller and pressure roller.

Means have been proposed to mechanically meter an elongate continuous stringer chain to give selected individual lot lengths which are to be finished into slide fastener products. Such known metering means essentially comprises an encoder operatively associated with a feed roller unit in the path of feed of the stringer chain, the output of the encoder being computed to control the length of the stringer chain. This prior art has a drawback in that it is difficult to make accurate metering of the stringer chain in motion due to slippage between the feed rollers and the stringer chain and further due to elongation of the stringer chain while in transit.

US-A-3,987,533 which forms the basis of the preamble of claim 1 discloses an apparatus of the type mentioned above. In this conventional apparatus the means of advancing and stopping a stringer chain at a predetermined position relies on counting the number of coupling elements on the stringer chain. Such positioning means, however, fails to account for discrepancies in an element-to-element pitch of spacing between adjacent coupling elements which may arise out of the switching between different manufacturing apparatus or between different stringer chain lots and further out of elongation of the stringer chain during feed movement, and therefore poses a problem in accurate and uniform metering function.

DE-C-31 16 497 discloses an apparatus for metering an elongate stringer chain, which apparatus comprises an operating computer control unit. This prior art apparatus does not comprise a drive means, however, to provide a relative movement between a guide unit and a meter unit.

The present invention seeks to provide an apparatus for metering an elongate stringer chain for slide fasteners with utmost accuracy and efficiency even in the event there are discrepancies or errors in the pitch of adjacent coupling elements on the stringer chain.

According to the invention there is provided an apparatus of the type mentioned above, character-

ized in that said guide unit includes an upper pulley and a lower pulley disposed in vertically spaced relation holding a portion of said stringer chain therebetween, said drive means is adapted to provide a relative movement between said guide unit and said meter unit for a distance defining a metering length L of said stringer chain, the feed roller and the pressure roller of said feed-out unit are disposed downstream of said guide unit for delivering said stringer chain and that said apparatus further comprises a computer control unit comprising a logical operation circuit operatively connected to said metering unit and said drive means for computing an element pitch and a control circuit operatively connected to said metering unit and said logical operation circuit for determining a working length of said stringer chain.

Particular embodiments of the invention are set out in dependent claims 2 to 6.

The above and other objects and advantages of the invention will be better understood from the following detailed description taken in conjunction with the accompanying drawings.

The term "element pitch" as used herein represents an interspace between adjacent coupling elements on a given stringer chain to be finished into a product slide fastener.

By the term "working length" is meant a total length of a given lot of stringer chain which may be for example 120 meters encompassing a prospective product number of 500 slide fasteners each measuring 24 centimeters long.

Figure 1 is a perspective elevational view of an apparatus for metering a stringer chain according to the invention;

Figure 2 is a segmentary perspective view on enlarged scale of a stringer chain having rows of metallic coupling elements;

Figure 3 is a view similar to Figure 2 but showing a stringer chain having rows of plastics coupling elements;

Figure 4 is a diagrammatic side elevational view of part of the apparatus of Figure 1 shown in one operative position;

Figure 5 is a view similar to Figure 4 but showing the apparatus in another operative position; and

Figure 6 is a diagrammatic side elevational view of a modified form of apparatus embodying the invention.

Referring now to the drawings and Figure 1 in particular, there is shown an apparatus 10 which broadly comprises a feed-in unit 11, a guide unit 12, a metering unit 13, a feed-out unit 14 and a computer control unit 15.

The feed-in unit 11 comprises a feed roller 16 and a pressure roller 17 rotatably mounted on respective horizontally extending shafts 16' and 17'

journalled in a support frame 18. The pressure roller 17 is brought into and out of nipping engagement with the feed roller 16 by a suitable lever means not shown.

The feed-out unit 14 is located downstream of the guide unit 12 with respect to the flow of a stringer chain C and comprises a feed roller 19 and a pressure roller 20 for delivering the stringer chain C and rotatably mounted on respective horizontal shafts 19' and 20' journalled in the frame 18. The rollers 19 and 20 are brought into and out of nipping engagement in a manner similar to the unit 11.

The guide unit 12 is interposed between the feed-in unit 11 and the feed-out unit 14 and comprises an upper pulley 21 and a lower pulley 22 rotatably mounted on an upper support bridge 23 and a lower support bridge 24, respectively. The upper and lower bridges 23, 24 are interconnected by a pair of vertically extending guide rods 25, 26.

A drive means D is adapted to provide relative movement between the guide unit 12 and the metering unit 13 and includes a fluid operated cylinder 27 having a piston rod 28 and secured by bracket members 29, 30 to a lower support block 31. The lower bridge 24 is connected to the piston rod 28 which causes the bridges 23, 24 to ascend and descend together with the rods 25, 26 which move vertically through an upper support block 32 secured to the frame 18. A guide pulley 33 is rotatably mounted on the upper support block 32.

The feed rollers 16, 19, the upper and lower pulleys 21, 22 and the guide pulley 33 are all rotatable in a common vertical plane, having their respective peripheral centers disposed in alignment.

As shown in Figure 1 the stringer chain C is passed downwardly between the feed roller 16 and the pressure roller 17 in the feed-in unit 11, trained up around guide rollers 34, 35, 36, then around the guide pulley 33, downwardly toward and up around the lower pulley 22, upwardly toward and around the upper pulley 21 until the stringer chain C is nipped between the feed roller 19 and the pressure roller 20 in the feed-out unit 14.

According to one or first embodiment of the invention, a first span of the stringer chain C between the guide pulley 33 and the lower pulley 22 and a second span of the stringer chain C between the lower pulley 22 and the metering unit 13 add up to define a metering length L of the stringer chain which can be metered at a maximum. Importantly, the metering length L of the stringer chain is held substantially in tensionless suspension except for a tension applied by the weight of the first and second spans of the stringer chain C and a tension applied by frictional engagement of the stringer chain C with the guide rollers and the pulleys

disposed upstream of the metering unit 13. This tensionless suspension of the stringer chain C is maintained by establishing a U-shaped loop Cu of the stringer chain C between the feed-in unit 11 and the guide pulley 33.

To ensure that the U-shaped loop Cu of the stringer chain C be maintained during operation of the apparatus 10, there are provided a pair of photoelectric sensors 37, 37 located on opposite ends of the U-shaped loop Cu for monitoring the presence of this loop and having their respective output signals connected to a drive (not shown) for the feed-in unit 11 so that when the U-shaped loop Cu has moved upwardly beyond the sensors 37, 37; that is, when the rate of feed of the stringer chain C by the feed-out unit 14 becomes greater than that by the feed-in unit 11 for some reason, the speed of the feed roller 16 in the feed-in unit 11 is increased thereby resuming and maintaining the U-shaped loop Cu in the proper position.

The metering unit 13 is provided at the upper support block 32 adjacent to the guide pulley 33 for metering the stringer chain C by counting the number of coupling elements E on a given length thereof. The unit 13 comprises a sensor 38 for detecting the coupling elements E which are made of a metallic material as shown in Figure 2, or a toothed rotor 39 connected to an encoder (not shown) and having a plurality of equally spaced teeth 40 engageable between adjacent coupling elements E which are made of a plastics material as shown in Figure 3.

The computer control unit 15 comprises a logical operation circuit 41 operatively connected through an output circuit 42 to the metering unit 13 and through an output circuit 43 to the piston rod 28 of the cylinder 27, and a control circuit 44 operatively connected to the output circuit 42 and through an output circuit 45 to the logical operation circuit 41. The logical operation or arithmetic circuit 41 receives from the output circuit 42 of the metering unit 13 a signal representing the number of the coupling elements Ea which have been counted and from the output circuit 43 of the piston rod 28 a signal representing a metering length L of the stringer chain, which length L is an equivalent of a stroke length of the piston rod 28 measuring for instance from the stroke end positioned as shown in Figure 4 to the approach end positioned as shown in Figure 5. The logical operation circuit 41 computes an element pitch P from the two signals and transmits the computed signal to the control circuit 44 which stores a signal representing a prospective working length L' of the stringer chain C to be fed to and processed at a subsequent finishing station and which receives the output signal from the metering unit 13 through the output circuit 42.

The control circuit 44 functions to compare the signal representative of the element pitch P from the logical operation circuit 41 against the signal representative of a prospective number of coupling

elements Eb corresponding to the working length L' stored in the control circuit 44 and thus decides and detects a condition that the stringer chain C has been metered over the metering length L or over the working length L'. An output 46 from the control circuit 44 is utilized as a control signal at least to discontinue the operation of the metering unit 13, or to stop the operation of the whole apparatus 10, or alternatively to cut the stringer chain C immediately upstream of the metering unit 13.

Preparatory to the operation the apparatus 10 with the piston rod 28 retracted to the stroke end position shown in Figure 4, the stringer chain C is introduced through the feed-in unit 11 and the guide unit 12 and past the metering unit 13 over the feed-out unit 14 until its leading end Ce is nipped between the feed roller 19 and the pressure roller 20. In this instance, it is important to establish or form the U-shaped loop Cu adjacent the sensors 37, 37 as already described. Then, the cylinder 27 is actuated to make an approach end stroke of the piston rod 28 to the position of Figure 5 thereby taking the stringer chain C up past the metering unit 13 for a distance corresponding to a metering length L which is an equivalent of the sum of the first span (between the guide pulley 33 and the lower pulley 22) and the second span (between the lower pulley 22 and the metering unit 13), or much longer than a full stroke of the piston rod 28 and which is therefore sufficient to hold metering errors to an absolute minimum.

An excess length of the stringer chain C extending between the leading end Ce thereof and the metering unit 13 can be held generally constant and hence striken out from the predetermined metering length L without affecting the computation of the element pitch P.

Upon completion of a cycle of metering operation, the piston rod 28 is retracted to the position of Figure 4, followed by the operation of the feed-in unit 11 and the feed-out unit 14 to advance the stringer chain C while the number of coupling elements E thereon is counted by the metering unit 13 and the output therefrom is incessantly transmitted to the control circuit 44 which determines the completion of feed of the working length L' of the stringer chain C in a manner already described.

When metering the same type and size of a stringer chain C as previously used for a different lot or a different working length L', it is not necessary to repeat the cycle of metering operation, but the previously computed element pitch P can be used per se.

A modified form of metering apparatus 10 is shown in Figure 6, in which the metering unit 13 is fixedly mounted on a bracket 50 secured to and movable with the piston rod 28 through or along the guide rods 25, 26 and the guide pulley 33 is rotatably mounted on the frame 18 adjacent to the cylinder 27.

According to this modified embodiment of the invention, the metering unit 13 is arranged to move relative to the stringer chain C spanning between the upper pulley 21 and the lower pulley 22, in contrast to the first embodiment previously described in which the stringer chain C is arranged to move relative to the metering unit 13 which is held stationary on the upper support block 32.

Claims

1. An apparatus (10) for metering an elongate stringer chain (C) having rows of coupling elements (E) which comprises:
 - a feed-in unit (11) including a feed roller (16) and a pressure roller (17) for feeding said stringer chain (C);
 - a guide unit (12) including a pulley;
 - a metering unit (13) for metering said stringer chain (C) by counting the number of coupling elements (E) thereon;
 - a drive means (27, 28) adapted to provide a relative movement between said guide unit (12) and said meter unit (13); and
 - a feed-out (14) including a feed roller (19) and pressure roller (20),

characterized in that said guide unit (12) includes an upper pulley (21) and a lower pulley (22) disposed in vertically spaced relation holding a portion of said stringer chain therebetween, said drive means (27, 28) is adapted to provide a relative movement between said guide unit (12) and said meter unit (13) for a distance defining a metering length L of said stringer chain (C), the feed roller (19) and the pressure roller (20) of said feed-out unit (14) are disposed downstream of said guide unit (12) for delivering said stringer chain (C) and that said apparatus further comprises

 - a computer control unit (15) comprising a logical operation circuit (41) operatively connected to said metering unit (13) and said drive means (27, 28) for computing an element pitch P and a control circuit (44) operatively connected to said metering unit (13) and said logical operation circuit (41) for determining a working length L' of said stringer chain.
2. An apparatus (10) according to claim 1 characterized by further comprising means for forming a U-shaped loop (Cu) of said stringer



The control circuit 44 functions to compare the signal representative of the element pitch P from the logical operation circuit 41 against the signal representative of a prospective number of coupling elements Eb corresponding to the working length L' stored in the control circuit 44 and thus decides and detects a condition that the stringer chain C has been metered over the metering length L or over the working length L'. An output 46 from the control circuit 44 is utilized as a control signal at least to discontinue the operation of the metering unit 13, or to stop the operation of the whole apparatus 10, or alternatively to cut the stringer chain C immediately upstream of the metering unit 13.

Preparatory to the operation the apparatus 10 with the piston rod 28 retracted to the stroke end position shown in Figure 4, the stringer chain C is introduced through the feed-in unit 11 and the guide unit 12 and past the metering unit 13 over the feed-out unit 14 until its leading end Ce is nipped between the feed roller 19 and the pressure roller 20. In this instance, it is important to establish or form the U-shaped loop Cu adjacent the sensors 37, 37 as already described. Then, the cylinder 27 is actuated to make an approach end stroke of the piston rod 28 to the position of Figure 5 thereby taking the stringer chain C up past the metering unit 13 for a distance corresponding to a metering length L which is an equivalent of the sum of the first span (between the guide pulley 33 and the lower pulley 22) and the second span (between the lower pulley 22 and the metering unit 13), or much longer than a full stroke of the piston rod 28 and which is therefore sufficient to hold metering errors to an absolute minimum.

An excess length of the stringer chain C extending between the leading end Ce thereof and the metering unit 13 can be held generally constant and hence stricken out from the predetermined metering length L without affecting the computation of the element pitch P.

Upon completion of a cycle of metering operation, the piston rod 28 is retracted to the position of Figure 4, followed by the operation of the feed-in unit 11 and the feed-out unit 14 to advance the stringer chain C while the number of coupling elements E thereon is counted by the metering unit 13 and the output therefrom is incessantly transmitted to the control circuit 44 which determines the completion of feed of the working length L' of the stringer chain C in a manner already described.

When metering the same type and size of a stringer chain C as previously used for a different lot or a different working length L', it is not necessary to repeat the cycle of metering operation, but the previously computed element pitch P can be used per se.

A modified form of metering apparatus 10 is shown in Figure 6, in which the metering unit 13 is fixedly mounted on a bracket 50 secured to and movable with the piston rod 28 through or along the guide rods 25, 26 and the guide pulley 33 is rotatably mounted on the frame 18 adjacent to the cylinder 27.

According to this modified embodiment of the invention, the metering unit 13 is arranged to move relative to the stringer chain C spanning between the upper pulley 21 and the lower pulley 22, in contrast to the first embodiment previously described in which the stringer chain C is arranged to move relative to the metering unit 13 which is held stationary on the upper support block 32.

Claims

1. An apparatus (10) for metering an elongate stringer chain (C) having rows of coupling elements (E) which comprises:

a feed-in unit (11) including a feed roller (16) and a pressure roller (17) for feeding said stringer chain (C);

a guide unit (12) including a pulley;

a metering unit (13) for metering said stringer chain (C) by counting the number of coupling elements (E) thereon;

a drive means (27, 28) adapted to provide a relative movement between said guide unit (12) and said meter unit (13); and

a feed-out (14) including a feed roller (19) and pressure roller (20),

characterized in that said guide unit (12) includes an upper pulley (21) and a lower pulley (22) disposed in vertically spaced relation holding a portion of said stringer chain therebetween, said drive means (27, 28) is adapted to provide a relative movement between said guide unit (12) and said meter unit (13) for a distance defining a metering length L of said stringer chain (C), the feed roller (19) and the pressure roller (20) of said feed-out unit (14) are disposed downstream of said guide unit (12) for delivering said stringer chain (C) and that said apparatus further comprises

a computer control unit (15) comprising a logical operation circuit (41) operatively connected to said metering unit (13) and said drive means (27, 28) for computing an element pitch P and a control circuit (44) operatively connected to said metering unit (13) and said logical operation circuit (41) for determining a working length L' of said stringer chain.

2. An apparatus (10) according to claim 1 characterized by further comprising means for forming a U-shaped loop (Cu) of said stringer



chain (C) between said feed-in unit (11) and said guide unit (12) and means (37, 37) for monitoring the presence of said loop (Cu).

3. An apparatus (10) according to claim 1 or 2 characterized by further comprising a guide pulley (33) which forms with said lower pulley (22) a first span of said stringer chain (C), while said lower pulley (22) forms with said metering unit (13) a second span of said stringer chain (C), said first and second spans together defining a maximum of said metering length L.
4. An apparatus (10) according to any of claims 1 to 3 characterized in that said upper and lower pulleys (21, 22) are movable vertically together relative to said metering unit (13).
5. An apparatus (10) according to any of claims 1 to 3 characterized in that said metering unit (13) is movable vertically relative to and between said upper and lower pulleys (21, 22).
6. An apparatus (10) according to any of claims 1 to 5 characterized in that the metering length L of said stringer chain (C) is held vertically between said guide unit (12) and said metering unit (13).

Patentansprüche

1. Vorrichtung (10) zum Abmessen einer langgestreckten Reißverschlußkette (C) mit Reihen von Kuppelgliedern (E), umfassend:
 - eine Zuführeinheit (11) mit einer Förderwalze (16) und einer Andrückwalze (17) zum Zuführen der Reißverschlußkette (C);
 - eine Führungseinheit (12) mit einer Riemenscheibe;
 - eine Abmeßeinheit (13) zum Abmessen der Reißverschlußkette (C) durch Zählen der Kuppelglieder (E) an derselben;
 - eine Antriebseinrichtung (27, 28), die eine Relativbewegung zwischen der Führungseinheit (12) und der Abmeßeinheit (13) bewirken kann; und
 - eine Abführeinheit (14) mit einer Förderwalze (19) und einer Andrückwalze (20), dadurch gekennzeichnet, daß die Führungseinheit (12) eine obere Riemenscheibe (21) und eine untere Riemenscheibe (22) aufweist, die im vertikalen Abstand angeordnet sind und dazwischen einen Bereich der Reißverschlußkette halten, wobei die Antriebseinrichtung (27, 28) eine Relativbewegung zwischen der Führungseinheit (12) und der Abmeßeinheit (13) über eine Entfernung bewirken kann, die eine

Abmeßlänge L der Reißverschlußkette (C) bestimmt, wobei die Förderwalze (19) und die Andrückwalze (20) der Abführeinheit (14) stromabwärts von der Führungseinheit (12) angeordnet sind, um die Reißverschlußkette (C) abzuführen, und daß die Vorrichtung ferner eine Steuerrechneereinheit (15) umfaßt, die einen logischen Betriebskreis (41) aufweist, der mit der Abmeßeinheit (13) und der Antriebseinrichtung (27, 28) betrieblich verbunden ist, um eine Kuppelgliederteilung P zu berechnen, und einen Steuerkreis (44) aufweist, der mit der Abmeßeinheit (13) und dem logischen Betriebskreis (41) betrieblich verbunden ist, um eine Bearbeitungslänge L' der Reißverschlußkette zu bestimmen.

2. Vorrichtung (10) nach Anspruch 1, gekennzeichnet durch Mittel, um zwischen der Zuführeinheit (11) und der Führungseinheit (12) eine U-förmige Schlinge (Cu) der Reißverschlußkette (C) zu bilden, und Mittel (37, 37) zur Überwachung des Vorhandenseins der Schlinge (Cu).
3. Vorrichtung (10) nach Anspruch 1 oder 2, gekennzeichnet durch eine Führungsriemenscheibe (33), die mit der unteren Riemenscheibe (22) einen ersten Abschnitt der Reißverschlußkette (C) bildet, während die untere Riemenscheibe (22) mit der Abmeßeinheit (13) einen zweiten Abschnitt der Reißverschlußkette (C) bildet, wobei der erste und der zweite Abschnitt gemeinsam das Maximum der Abmeßlänge L bestimmen.
4. Vorrichtung (10) nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die obere und die untere Riemenscheibe (21, 22) gegenüber der Abmeßeinheit (13) gemeinsam vertikal bewegbar sind.
5. Vorrichtung (10) nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Abmeßeinheit (13) zwischen der oberen und der unteren Riemenscheibe (21, 22) und relativ zu diesen vertikal bewegbar ist.
6. Vorrichtung (10) nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Abmeßlänge L der Reißverschlußkette (C) zwischen der Führungseinheit (12) und der Abmeßeinheit (13) vertikal gehalten ist.

Revendications

1. Appareil (10) pour mesurer une chaîne allongée (C) de bande d'accrochage portant des



rangées d'éléments d'accouplement (E), qui comprend :

- un ensemble d'amenée (11) incluant un rouleau d'alimentation (16) et un rouleau de pression (17) pour amener ladite chaîne (C) de bande d'accrochage,
- un ensemble de guidage (12) incluant une poulie,
- un ensemble de mesure (13) pour mesurer ladite chaîne (C) de bande d'accrochage par comptage du nombre d'éléments d'accouplements (E) qu'elle porte,
- un moyen d'entraînement (28) apte à fournir un mouvement relatif entre ledit ensemble de guidage (12) et ledit ensemble de mesure (13), et
- un ensemble de sortie (14) incluant un rouleau d'alimentation (19) un rouleau de pression (20),

caractérisé en ce que ledit ensemble de guidage (12) inclut une poulie supérieure (21) et une poulie inférieure (22) disposées en étant espacées verticalement et maintenant une partie de ladite chaîne de bande d'accrochage entre elles, ledit moyen d'entraînement (27,28) est apte à fournir un mouvement relatif entre ledit ensemble de guidage (12) et ledit ensemble de mesure (13) sur une distance qui définit une longueur de mesure L de ladite chaîne (C) de bande d'accrochage, le rouleau d'alimentation (19) et le rouleau de pression (20) dudit ensemble de sortie (14) sont placés en aval dudit ensemble de guidage (12) pour libérer ladite chaîne (C) de bande d'accrochage, et en ce que ledit appareil comprend en outre un ensemble de commande par ordinateur (15) comprenant un circuit d'opération logique (41) relié de façon fonctionnelle audit ensemble de mesure (13) et audit moyen d'entraînement (27,28) pour calculer un pas d'élément P et un circuit de commande (44) relié de façon fonctionnelle audit ensemble de mesure (13) et audit circuit d'opération logique (41) pour déterminer une longueur de travail L' de ladite chaîne de bande d'accrochage.

2. Appareil (10) selon la revendication 1, caractérisé par le fait qu'il comprend en outre un moyen pour former une boucle (Cu) en forme de U avec ladite chaîne (C) de bande d'accrochage entre ledit ensemble d'amenée (11) et ledit ensemble de guidage (12) et un moyen (37,37) pour surveiller la présence de ladite boucle (Cu).
3. Appareil (10) selon la revendication 1 ou 2, caractérisé par le fait qu'il comprend en outre une poulie de guidage (33) qui forme avec

ladite poulie inférieure (22) une première étendue de ladite chaîne (C) de bande d'accrochage tandis que ladite poulie inférieure (22) forme avec ledit ensemble de mesure (13) une seconde étendue de ladite chaîne (C) de bande d'accrochage, lesdites première et seconde étendues définissant ensemble un maximum de ladite longueur de mesure L.

4. Appareil (10) selon l'une quelconque des revendications 1 à 3, caractérisé en ce que lesdites poulies supérieure et inférieure (21, 22) sont déplaçables ensemble verticalement par rapport audit ensemble de mesure (13).
5. Appareil (10) selon l'une quelconque des revendications 1 à 3, caractérisé en ce que ledit ensemble de mesure (13) est mobile verticalement entre lesdites poulies supérieure et inférieure (21,22) et par rapport à elles.
6. Appareil (10) selon l'une quelconque des revendications 1 à 5, caractérisé en ce que la longueur de mesure L de ladite chaîne (C) de bande d'accrochage est conservée verticalement entre ledit ensemble de guidage (12) et ledit ensemble de mesure (13).