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INSPECTION APPARATUS FOR SLIDE FASTENERS

This invention relates to an apparatus for inspecting slide fasteners in the last step of a continuous slide fastener production process and more particularly, to an inspection apparatus which allows a plurality of slide fasteners fed to the inspection apparatus in succession to be visually inspected by an operator while the slide fasteners are suspended in parallel and are being conveyed intermittently in the inspection apparatus.

10 It has been conventional practice that slide fasteners are visually inspected in the final step of a continuous production process for the slide fasteners.

In the conventional inspection procedure, the slide fasteners are fed in succession onto a belt conveyor, and the inspection is effected by an operator viewing the slide fasteners with the naked eye while the belt conveyor is continuously moved.

However, in this conventional inspection procedure, only the surface of the slide fasteners opposite from the surface of the fasteners lying on the belt conveyor is visually inspected and thus, in order to inspect the surfaces of the fasteners in contact with the belt, the

fasteners have to be manually turned over which makes the inspection procedure troublesome. Since the products or slide fasteners are continually moving, the conventional inspection apparatus has the disadvantage that correct and precise inspection cannot be achieved. In addition, since the slide fasteners are laid on the belt conveyor in an extended condition, the belt conveyor has a relatively large width, and thus the conventional inspection apparatus occupies a relatively large space.

According to the present invention there is provided an apparatus for inspecting slide fasteners comprising:

a slide fastener suspension device having a plurality of clips for supporting respective ones of said slide fasteners in a suspended condition, and drive means for intermittently moving said clips one behind another in a closed loop path so that the clips intermittently move spaced apart from each other horizontally from a first position to a second position along said path;

a first gripper which is provided at a first position along said path and which is adapted to feed in succession said slide fasteners to said clips of said suspension device in a suspended condition; and

a second gripper which is provided at a second position along said path and which is adapted to remove said slide fasteners from said clips in succession;

said path between said first position and said second position providing a visual inspection region for said slide fasteners.

It is believed possible by means of the present invention to provide an inspection apparatus for slide fasteners in which both surfaces of the slide fasteners can be inspected by an operator without having to manually turn over the fasteners.

It is further believed possible by means of the present invention to provide an inspection apparatus for slide fasteners in which the inspection can be done easily and positively by intermittently stopping movement of the slide fasteners for inspection.

It is still further believed possible by means of the present invention to provide an inspection apparatus for slide fasteners in which the apparatus can be made relatively compact.

In the suspension device of a preferred form of the inspection apparatus referred to hereinabove, an endless belt or chain is entrained about two opposite and horizontally spaced rotary pulleys, and the clips are provided on the external surface of the belt or chain for supporting the slide fasteners in their suspended condition; each clip comprises a pair of opposing

resilient pinch pieces for resiliently pinching one end of a slide fastener therebetween, the clips being secured to the belt or chain in a spaced relationship to adjacent clips, suitable for visual inspection.

- 5 The drive means adapted to intermittently move the clips may be a ratchet or cam-driven unidirectional driving means which is adapted to intermittently move the clips in one direction at a time through a distance corresponding to the space between adjacent clips.
- 10 Furthermore, the first gripper is adapted to grip one end of each of slide fasteners discharged in succession from a continuous production line for the slide fasteners to hold them in a suspended condition, and feed them in succession to the clips of the slide fastener suspension
- 15 device while the clips are at rest during the intermittent movement. The second gripper is adapted to remove the slide fasteners in succession from the clips which has passed the visual inspection region, and place the slide fasteners in succession into a packing
- 20 station also while the clips are at rest during the intermittent movement thereof.

The invention will be described by way of example with reference to the accompanying drawings, wherein:-

- Fig. 1 is a fragmentary exploded perspective view
- 25 of the principal components of the inspection apparatus

for slide fasteners according to one embodiment of the present invention;

Fig. 2 is a plan view of the suspension device for the slide fasteners in the inspection apparatus;

5 Fig. 3 is an enlarged cross-sectional view of a first gripper in the inspection apparatus; and

Fig. 4 is an enlarged cross-sectional view of a second gripper in the inspection apparatus.

The present invention will be now described by way of
10 one embodiment of the present invention illustrated in the accompanying drawings.

In Fig. 1, reference number 1 denotes a first gripper supported on one end of a piston rod 2 of an air cylinder 3. The piston rod 2 is formed with a spiral cam groove
15 4 around the external surface thereof, and a fixed guide pin 5 is inserted in the cam groove 4. Thus, when the piston rod 2 is extended, the first gripper 1 is reoriented from a horizontal position, shown by solid lines, to a vertical position, shown by broken lines
20 1'. As is more clearly shown in Fig. 3, the first gripper 1 includes a support portion 1a with upper and lower jaws 1b and 1c pivoted about the support portion 1a. These jaws 1b, 1c are normally opened by the action of springs 1d, 1e, respectively, and are closed by the
25 action of a rotary cam 1f which is actuated at a predetermined timing with respect to the action of the

air cylinder 3 by a drive means (not shown).

Thus, when the air cylinder 3 is actuated, the first gripper 1 grips the leading end of a slide fastener F discharged from a continuous production line, to move the slide fastener horizontally in the direction of arrow a while reorienting the slide fastener F from a horizontal position to a vertical position, as shown by the broken line 1' so as to deliver the slide fastener to a slide fastener suspension device 10, of which description will be made hereinafter, then releases its grip from the slide fastener and finally returns to its original, solid-line position (Fig. 1) to ready itself for gripping the next slide fastener from the continuous production line.

The slide fastener suspension device 10 includes an elongated base 11, two horizontal pulleys 12, 13 provided on the base 11, and an endless belt 14 entrained about the pulleys 12, 13 for rotation and the endless belt 14 has a plurality of equally-spaced clips 15 secured to and extending outward from the external surface of the belt 14.

One of the pulleys 13 is adapted to be intermittently rotated in the direction of arrow b by means of a lever 17 which is adapted to be rocked by an air cylinder 16 and a unidirectional clutch 18, whereby the endless

belt 14 is intermittently rotated.

Each of the clips 15 has an opening 19 for receiving an end of a slide fastener F therein and a spring 20 protruding into the opening 19 for resiliently pinching the end of the slide fastener. Thus, the slide fasteners F' delivered to the clips 15 by the first gripper 1 are held in a suspended condition by the clips 15.

Reference number 30 denotes a second gripper adapted to reciprocally move in the directions of arrows c and d to grip the upper portion of each slide fastener F' transferred by the suspension device 10 to remove the slide fastener F' from the clip 15 and displace the slide fastener out of the movement path of the clip 15.

As is more clearly shown in Fig. 4, the second gripper 30 includes a support portion 30a and a pair of jaws 30b and 30c pivoted about the support portion 30a. These jaws 30b and 30c are normally opened by the action of a spring 30d and are closed by the action of a wedge member 30e connected to a piston 30f. The piston 30f is actuated at a predetermined timing with respect of the reciprocal movement of the support portion 30a to operate the second gripper in the manner as stated above.

Reference number 40 denotes a third gripper adapted to

move in the direction of arrow e to grip the upper end of the slide fastener F' transferred by the second gripper 30, and reciprocally move in the directions of arrow f to transfer to slide fastener F' from the second gripper 30 to the third gripper 40 to place the slide fastener F' into a packing station (not shown). When the third gripper 40 is reciprocated in the direction of arrow f, the second gripper 30 is further retracted in the direction of arrow d from the broken-line position so as not to interfere with the movement of the slide fastener F' gripped by the third gripper 40. An opening and closing mechanism of the third gripper 40 is similar to that of the second gripper 30 shown in Fig. 4, so the explanation thereof is omitted.

According to the present invention, it may be also contemplated that the third gripper 40 is omitted, and instead the second gripper 30 directly places the slide fastener F' into the packing station.

The visual inspection of the slide fasteners in the apparatus of the present invention is effected in the following manner while the slide fasteners are conveyed in their suspended condition by the suspension device.

Each slide fastener F discharged horizontally from the continuous production line is first gripped at the leading end thereof by the first gripper 1 and, when the

air cylinder 3 is actuated, the slide fastener F is advanced in the direction of arrow a while it reoriented to a suspended position to be fed to the clip 15 of the suspension device 10, which is at that moment positioned on the pulley 12 and is at rest in its intermittent movement. When the slide fastener F is pushed into the opening 19 of the clip 15, the first gripper 1 releases the slide fastener F' from its grip and immediately returns to its original position ready for receiving and gripping the next slide fastener to be discharged from the continuous production line, and thereafter the air cylinder 16 is actuated to intermittently rotate the pulley 13 to thereby advance the endless belt 14 by a distance corresponding to the pitch of the clips 15.

By repeating the above procedure, a plurality of slide fasteners F' can be held parallel in a suspended condition by the clips 15 on the endless belt 14 in succession, and are intermittently conveyed so that an operator can easily inspect both surfaces of the slide fastener by viewing them from the opposite sides thereof until each of the slide fasteners F' reach the second gripper position. When it is found that a slide fastener or fasteners are unacceptable because of staining and/or a defect, these unacceptable fasteners can be removed from their clips 15 out of the conveying path of the fasteners.

After the inspection, when each slide fastener F' reaches the position of the pulley 12 and it is at rest during the intermittent movement thereof, the second gripper 30 which has remained in the broken-line position 30' in Fig. 1 advances in the direction of arrow c to the solid-line position 30, grips the upper portion of the slide fastener F', and then immediately returns to the broken-line position again to transfer the slide fastener to the third gripper 40. When the third gripper 40 grips the upper end of the slide fastener, the second gripper 30 releases the slide fastener from its grip and retracts further in the direction of arrow d. Thereafter, the third gripper 40 moves in the direction of arrow f to place the slide fastener in the packing station. The third gripper 40 then releases the slide fastener from its grip and thereafter immediately returns to its original position. Meantime, the second gripper 30 in its retracted position also returns to a position 30'.

Therefore, the slide fasteners which have been continuously produced are intermittently transferred by the first gripper 1, slide fastener suspension device 10, and second gripper 30 in succession. The slide fastener suspension device 10 can intermittently transfer a plurality of slide fasteners while holding them in parallel in a suspended condition, and provide a relatively long transfer path thereof for visual

inspection.

Each operational component of the apparatus can be controlled in mutual relationships so that the apparatus can be easily automated.

- 5 As is clear from the foregoing description in connection with one embodiment of the present invention, according to the present invention, since a plurality of slide fasteners supplied in succession from a continuous production line are intermittently transferred by the
- 10 inspection device while being maintained parallel in a suspended condition, the fasteners can be visually inspected from the opposite sides thereof easily and positively, and the apparatus itself can be compactly constructed to occupy a relatively small space.

**CLAIMS:-**

1. An apparatus for inspecting slide fasteners comprising:

5 a slide fastener suspension device having a plurality of clips for supporting respective ones of said slide fasteners in a suspended condition, and drive means for intermittently moving said clips one behind another in a closed loop path so that the clips intermittently move spaced apart from each other
10 horizontally from a first position to a second position along said path;

a first gripper which is provided at a first position along said path and which is adapted to feed in succession said slide fasteners to said clips of said
15 suspension device in a suspended condition; and

a second gripper which is provided at a second position along said path and which is adapted to remove said slide fasteners from said clips in succession;

said path between said first position and said
20 second position providing a visual inspection region for said slide fasteners.

2. An apparatus as claimed in Claim 1, in which said first gripper feeds said slide fasteners discharged from a continuous production line for said slide fasteners to
25 said clips of said suspension device, and said first gripper is so constructed that it reorients each slide



fastener gripped thereby from a horizontal position to a vertical position.

3. An apparatus as claimed in Claim 1 or 2, in which each of said clips has an opening for receiving an end
5 of one of said slide fasteners therein, and spring means protruding into said opening for resiliently pinching said end of said slide fastener thereby.

4. An apparatus as claimed in Claim 1, 2 or 3, further comprising a third gripper which is positioned
10 near said second gripper and which is adapted to grip said slide fasteners removed by said second gripper and place said slide fasteners into a packing station in succession.

5. An apparatus as claimed in any preceding claim
15 wherein the clips are equally spaced apart from each other at least between said first and second positions.

6. An apparatus as claimed in any preceding claim wherein an endless belt or chain is provided with the clips and defines the closed loop path, the belt or
20 chain extending round pulley means.

7. An apparatus as claimed in any preceding clam wherein the closed loop path is entirely horizontal.



8. An apparatus as claimed in Claim 6, in which said pulley means comprises two horizontally-spaced pulleys.

9. An apparatus as claimed in Claim 6 or 8, in which said first and said second grippers are positioned
5 about the periphery of one of said pulleys.

10. An apparatus as claimed in claim 6, 8 or 9, in which said drive means includes a lever which is adapted to be rocked by an air cylinder and which is connected to one of said pulleys by unidirectional clutch.

10 11. An apparatus as claimed in any preceding claim and substantially as described with reference to and as illustrated in the accompanying drawings.
