

APPARATUS FOR INSPECTING SLIDE FASTENER
SLIDERS

The present invention relates to the production
5 of slide fasteners, and more particularly to an
apparatus for inspecting automatic lock sliders for
slide fasteners.

Automatic lock sliders for slide fasteners
generally include a leaf spring which is supported on
10 an upper wing of a slider body to normally urge a
locking member to project into a coupling-element guide
channel in the slider body for preventing the slider
from moving on a pair of coupling element rows of the
slide fastener. A pull tab is operatively connected to
15 the locking member for retracting the latter from the
guide channel against the bias of the spring. For
smooth and reliable locking and unlocking operation of
the slider, the degree of resilience of the spring must
be within a required range. In assembly, the pull tab,
20 the locking member, the spring and a cover are mounted
on the slider body one after another in this order. The
manufacture of such sliders is often subject to
inferior sliders due to the change of quality of the
individual parts and the change of the assembling
25 condition.

Japanese Patent No. 1,273,103 (Japanese Patent
Publication No. 59-51811) discloses a slider inspecting

apparatus for efficiently detecting and removing inferior sliders at the final stage of the production. In the known apparatus, the amount of resilience of a spring acting on a locking member of the individual slider is sensed in terms of angular movement of a pivoted pointer of a dial gauge as the pull tab is pressed by a pressure pin of the gauge which pin is projectable to a constant stroke. When the pointer is angularly moved to a predetermined extent to touch a fixed contact on a calibrated face of the gauge, an electrical signal for discrimination is issued. This prior apparatus is disadvantageous in that since relatively small movement of the slider is sensed directly by the dial gauge, the apparatus and the slider to be inspected must be kept in precise position or posture during the sensing, which requires meticulous adjustment of various parts. Further, the dial gauge per se is expensive.

According to the present invention, there is provided an apparatus for inspecting automatic lock sliders for slide fasteners, each of the sliders including a slider body and a pull tab pivotally connected to the slider body, said apparatus comprising: a disk-like table intermittently turnable on its vertical axis and having a plurality of recesses in and along a peripheral edge of said table at predetermined distances for receiving the sliders one in each of said recesses; a support block disposed above said table and vertically movable toward and away from said table along a predetermined length in timed relation to the intermittent turning of said table; a retainer member mounted on said support block and vertically movable in response to the vertical movement of said support block for retaining the slider body of one of the sliders received in one of said recesses

of said table; a pressure rod mounted on said support block and vertically movable, in response to the vertical movement of said support block, for pressing the pull tab of the one slider downwardly; a sensor lever pivotally mounted on a lower end portion of said retainer member and extending substantially horizontally therefrom, said sensor lever having a sensing projection extending downwardly therefrom for contacting the pull tab of the slider so that said sensor lever is pivotally movable in response to the pivotal movement of the pull tab; a detecting unit including a pair of upper and lower non-contact -type detectors disposed within a range in which a free end of said sensor lever is vertically movable in response to the pivotal movement of said sensor lever; and a discrimination circuit electrically connected to said detecting units for receiving electrical signals therefrom and for discriminating between normal sliders and inferior sliders based on the electrical signals from said detecting unit.

It is believed possible by means of the present invention to provide a slider inspecting apparatus which enables a stable and accurate inspection without meticulous adjustment of various parts and which is simple in construction and inexpensive to manufacture.

The invention will be described by way of example with reference to the accompanying drawings, wherein like references refer to like parts unless the context requires otherwise and wherein:-

Figure 1 is a perspective view, with parts omitted, of a slider inspecting apparatus embodying the present invention;

Figure 2 is a side elevational view, partly in cross section, of Figure 1;

Figures 3A, 3B and 3C are cross-sectional views of an automatic lock slider, showing various postures of the slider while the latter is inspected;

Figures 4A, 4B, 4C and 4D are views similar to Figure 2,
5 illustrating the manner in which a normal and good slider is inspected;

Figures 5 and 6 respectively illustrate the manner in which differently inferior sliders are inspected;

Figure 7 is a perspective view of a slider of the type different from that of Figures 3A, 3B and 3C; and

Figures 8A and 8B are cross-sectional views of Figure 7, respectively illustrating different postures of the slider.

Figures 1 and 2 show an apparatus for automatically inspecting automatic lock sliders 30 at the final stage of the slider production.

10 The apparatus includes a disk-like table 1 adapted to be intermittently turned on its vertical axis and having a plurality of recesses 10 (only one shown here for clarity) in and along a peripheral edge of the table 1 at predetermined distances for receiving
15 respective sliders 30, a support disk 2 disposed above the table 1 and vertically movable toward and away from the table 1 in response to the intermittent turning of the table 1, and a support block 3 fixed to an edge of the support disk 2.

20 The support block 3 carries a retainer member 4 vertically slidably mounted thereon for retaining a slider body 31 (Figure 1) of one slider 30 received in one of the peripheral recesses 10 of the table 1. A first extension spring 14 is mounted between the
25 support block 3 and the retainer member 4 to normally urge the latter downwardly.

The support block 3 also carries a pressure rod

5 vertically slidably mounted thereon for pressing a pull tab 32 of the slider 30, the pressure rod 5 being disposed outwardly of the retainer member 4. A second extension spring 15, like the first spring 14, is mounted between the support block 3 and the pressure rod 5 to normally urge the latter downwardly.

A sensor lever 6 is pivotally mounted on a lower portion of the retainer member 4 by a horizontal pivot pin 16, normally resting by gravity against a jaw 4a of the retainer member 4 in such an inclined posture that one or free end of the sensor lever 6 is slightly lower than the other or pivoted end thereof, as best shown in Figure 2. The sensor lever 6 has a sensing projection 7 extending substantially downwardly and perpendicularly therefrom. The length of the sensing projection 7 is such that its lower end is slightly lower than a lower end of the retainer member 4 as the sensor lever 6 is in the above-mentioned inclined posture, as best shown in Figure 2.

20 The apparatus also includes a detecting unit 20 composed of a pair of spaced upper and lower detectors 21, 22 supported on a post 23. The upper and lower detectors 21, 22 have a pair of vertically aligned cutouts 21c, 22c, respectively, for the passage of the free end portion of the sensor lever 6. Each of the upper and lower detectors 21, 22 is a photoelectric type switch having a light emitter 21a, 22a disposed at

one side of the respective cutout 21c, 22c, and a light receptor 21b, 22b disposed at the other side thereof, the switch being electrically connected to a discrimination circuit (not shown) via a suitable control means.

In Figures 1 and 2, the slider 30 to be inspected is received in one of the peripheral recesses 10 of the table 1, with the slider body 31 lying horizontally and with the pull tab 32 projecting substantially horizontally from the table 1 in a normal condition.

The lower end surface of the retainer member 4 has a shape complementary to the upper contours of the slider body 31 and a cover 35. The lower end portion of the pressure rod 5 is bifurcated so as to stably contact and press the pull tab 32 without interfering with the sensor lever 6.

Figures 3A and 3B illustrate a typical example of the automatic lock slider 30 to be inspected by the present apparatus. In assembly, a pintle 33 of the pull tab 32, a locking member 36 and a leaf spring 34 are placed on the top of the slider body 31 one over another in this order, and then a cover 35 is mounted on the top of the slider body 31 so as to cover all of the previously placed parts.

In Figure 3A, a claw end of the locking member 36 projects into a coupling-element guide channel 37 in

the slider body 31 under the resilience of the leaf spring 34, while the pintle 33 of the pull tab 32 is urged by the resilience of the leaf spring 34 against the top of the slider body 31 with the pull tab 32 lying substantially horizontally. In Figure 3B, the pull tab 32 is pressed downwardly such that its pintle 33 is raised to retract the claw end of the locking member 36 from the guide channel 37 against the resilience of the leaf spring 34. If this slider 30 is normal and good, when the pull tab 32 is released from being pressed downwardly, the pull tab 32 is returned to its original position (Figure 3A) under the resilience of the leaf spring 34, at which time the locking member 36 also is returned to its projected position.

Figure 3C illustrates an example of inferior slider 30 that has no function of automatic locking, because a leaf spring 34 is failed to be mounted. In this inferior slider 30, the pull tab 32 assumes an inclined posture sloping downwardly toward its free end at a relatively large angle. In other inferior sliders, which are not shown here, the locking member 36 alone may be missing or both the locking member 36 and the leaf spring 34 may be missing. In those other inferior sliders, like in the inferior slider 30 of Figure 3C, the pull tab 32 assumes an inclined posture sloping downwardly toward its free end at a relatively large

angle.

Figures 4A, 4B, 4C and 4D illustrate the manner in which a normal and good slider 30 is inspected. Firstly, with the slider 30 is received in one of the peripheral recesses 10 of the table 1, as shown in Figure 2, as the support disk 2 and hence the support block 3 are lowered together with the retainer member 4 and the pressure rod 5, the lower or free end of the sensing projection 7 of the sensor lever 6 is brought in contact with the pull tab 32 lying horizontally, as shown in Figure 4A, at which time the lower end of the retainer member 4 does not reach the top of the slider 30 and at which time the free end of the sensor lever 6 is disposed in the cutout 22c of the lower detector 22 to shut off the light path between the light emitter 22a and the light receptor 22b.

With continued lowering of the support block 3, the lower end of the retainer member 4 is brought in contact with the top of the slider 30 to resiliently press the slider body 31 by the extension spring 14, during which time the pull tab 32 remains in a horizontal posture under the resilience of the leaf spring 34 to cause the sensor lever, which is relatively light in weight, to pivot counterclockwise about the pivot pin 16 until the free end of the sensor lever 6 enters the cutout 21c of the upper detector 21 to shut off the light path between the light emitter

21a and the light receptor 21b.

Thus, from the fact that both the light paths of the upper and lower detectors 21, 22 have been shut out individually, it has been detected that the pull
5 tab 32, the locking member 36 and the leaf spring 34 have been mounted in the slider 30 in normal condition.

With further continued lowering of the support block 3, the retainer member 4 is kept retaining the slider 30 in the one peripheral recess 10 of the table
10 1 under the resilience of the extension spring 14, and at the same time, the lower end of the pressure rod 5 is brought in contact with the pull tab 32 and pushes the same downwardly as shown in Figure 4C, as the strength of the extension spring 15 is greater than
15 that of the leaf spring 34. As a result, the slider 30 assumes the posture of Figure 3B. This downward pushing causes the sensor lever 6 to pivot clockwise about the pivot pin 16 by gravity until the free end of the sensor lever 6 enters the cutout 22c of the lower
20 detector 22 to shut off the light path between the light emitter 22a and the light receptor 22b. Thus it has been detected that the locking member 36 of the slider 30 has been moved in a normal or correct manner while a predetermined amount of resilient force acts on
25 the locking member 36.

Subsequently, when the pull tab 32 is returned to its original and substantially horizontal posture as

the pressure rod 5 is raised by the upward movement of the support block 3 upon termination of the lowering thereof as shown in Figure 4D, the sensor lever 6 is pivoted clockwise about the pivot pin 16 under the
5 resilience of the leaf spring 34 until the free end of the sensor lever 6 enters the cutout 21c of the upper detector 21 to shut off the light path between the light emitter 21a and the light receptor 21b. Thus it has been detected that the leaf spring 34 of the slider
10 30 has been restored in a normal or correct manner. Then, when the lower end of the retainer member 4 is removed from the top of the slider 30 as the support block 3 is further raised, whereupon the upper and lower detectors 21, 22 are broken out of the
15 non-illustrated discrimination circuit. Finally, a single cycle of the inspection is completed when the support block 3 is returned to the position of Figure 2.

An inferior slider, such as the slider 30 of
20 Figure 3C, can be inspected in the following manner:

In the example of Figure 3C, since the pull tab 32 assumes an inclined posture sloping downwardly toward its free end at a relatively large angle due to the missing of a leaf spring, the lower or free end of
25 the sensing projection 7 of the sensor lever 6 does not engage or at most does slightly engage the pull tab 32, thus leaving the sensor lever 6 not pivoted and hence

keeping the free end thereof in the cutout 22c of the lower detector 22, as shown in Figure 5.

In other examples in which the leaf spring 34 of the inferior slider 30 has an excessive stiffness and hence is too hard and in which the individual parts of the interior slider 30 are assembled in improper postures even though the pull tab 32 is kept lying horizontally, the pull tab 32 is pivotally moved clockwise through only an insufficient angle when it is pressed downwardly by the pressure rod 5, as shown in Figure 6. Consequently, the clockwise pivotal movement of the sensor lever 6 is terminated before its free end enters the cutout 22c of the lower detector 22.

In a further example in which the pull tab 32 of the inferior slider 30 initially remains substantially horizontal and is not returned to such original horizontal posture after the pull tab 32 has been pressed downwardly by the pressure rod 5 and subsequently released therefrom, the counterclockwise pivotal movement of the sensor lever 6 is terminated before its free end enters the cutout 21c of the upper detector 21.

Since electrical signals issued from the detecting unit 20 when an inferior slider is inspected are different from those issued when a normal slider is inspected, it is possible to make a discrimination between normal sliders and inferior sliders based on

the electrical signals and then to sort the inferior sliders from the normal sliders by controlling a slider discharging means in accordance with the electrical signals.

- 5 Figures 7, 8A and 8B illustrate another type of automatic lock slider, in which a cover 35' is pivotally mounted on a slider body 1' by a pin 38 and has a locking claw 36' extending from the cover 35'. A leaf spring 34' fixed at one end to the slider body 1' acts on the cover 35' so as to normally urge the locking claw 36' to project into the guide channel. A pull tab 32' is operatively connected to the cover 35' for retracting the locking claw 36' from the guide channel against the resilience of the leaf spring 34'.
- 10 For inspecting this type of slider, with the slider retained by the retainer member 4 having the lower end surface complementary to such top contour of the slider, the pull tab 32' initially lying horizontally (Figure 8A) is pressed downwardly to its inclined posture (Figure 8B) by the pressure rod 5, and subsequently the pull tab 32' is released from the pressure rod 5 in the manner described above.
- 15 For inspecting this type of slider, with the slider retained by the retainer member 4 having the lower end surface complementary to such top contour of the slider, the pull tab 32' initially lying horizontally (Figure 8A) is pressed downwardly to its inclined posture (Figure 8B) by the pressure rod 5, and subsequently the pull tab 32' is released from the pressure rod 5 in the manner described above.
- 20 For inspecting this type of slider, with the slider retained by the retainer member 4 having the lower end surface complementary to such top contour of the slider, the pull tab 32' initially lying horizontally (Figure 8A) is pressed downwardly to its inclined posture (Figure 8B) by the pressure rod 5, and subsequently the pull tab 32' is released from the pressure rod 5 in the manner described above.

 With this apparatus, partly because the pivotal movement of the slider pull tab is sensed by the sensor lever which is pivotally movable so as to magnify the pivotal movement of the pull tab, and partly because the pivotal movement of the sensor

25 For inspecting this type of slider, with the slider retained by the retainer member 4 having the lower end surface complementary to such top contour of the slider, the pull tab 32' initially lying horizontally (Figure 8A) is pressed downwardly to its inclined posture (Figure 8B) by the pressure rod 5, and subsequently the pull tab 32' is released from the pressure rod 5 in the manner described above.

lever is detected by the non-contact type detecting unit, it is possible to carry out the inspection stably and precisely without meticulous adjustment of various parts. Further, the present inspecting apparatus is
5 simple in construction and easy to maintain and inexpensive to manufacture.

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CLAIMS:

1. An apparatus for inspecting automatic lock
sliders for slide fasteners, each of the sliders
including a slider body and a pull tab pivotally
5 connected to the slider body, said apparatus
comprising:

(a) a disk-like table intermittently turnable
on its vertical axis and having a plurality of recesses
in and along a peripheral edge of said table at
10 predetermined distances for receiving the sliders one
in each of said recesses;

(b) a support block disposed above said table
and vertically movable toward and away from said table
along a predetermined length in timed relation to the
15 intermittent turning of said table;

(c) a retainer member mounted on said support
block and vertically movable in response to the
vertical movement of said support block for retaining
the slider body of one of the sliders received in one
20 of said recesses of said table;

(d) a pressure rod mounted on said support
block and vertically movable, in response to the
vertical movement of said support block, for pressing
the pull tab of the one slider downwardly;

25 (e) a sensor lever pivotally mounted on a lower
end portion of said retainer member and extending
substantially horizontally therefrom, said sensor lever



having a sensing projection extending downwardly therefrom for contacting the pull tab of the slider so that said sensor lever is pivotally movable in response to the pivotal movement of the pull tab;

5 (f) a detecting unit including a pair of upper and lower non-contact-type detectors disposed within a range in which a free end of said sensor lever is vertically movable in response to the pivotal movement of said sensor lever; and

10 (g) a discrimination circuit electrically connected to said detecting unit for receiving electrical signals therefrom and for discriminating between normal sliders and inferior sliders based on the electrical signals from said detecting
15 unit.

2. An apparatus according to claim 1, said retaining member being vertically slidable on said support block and being normally urged downwardly by a first spring.

20 3. An apparatus according to claim 1 or 2, said pressure rod being vertically slidable on said support block and being normally urged downwardly by a second spring.

25 4. An apparatus according to claim 1, 2 or 3, said upper and lower detectors having a pair of vertically aligned cutouts, respectively, for passage of the free end of said sensor lever, each of said upper and lower



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detectors having a light emitter disposed at one side
of the respective cutout and a light receptor disposed
at the other side thereof.

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