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(54) Latch opener for a knitting machine

(57) A latch opener (11) comprises an opening section (1a,1b) for opening the closed latch of a knitting needle (7) and a holding section (2) for holding the opening section. The opening section is pivotally supported on the holding section (2) by means of a pivot pin (5) such that the opening section can move between an operational position (A), in which the latch is opened, and a non-operational position (B) in which the latch is not opened. At least one first magnet is secured to the opening section, and at least two magnets (4a,4b) are secured to the holding section (2). The magnet (4a) is secured to the holding section (2) so as to attract, in the operational position (A), the first magnet (3) secured to the opening section, and the magnet (4b) is secured to the holding section (2) so as to repel, in the non-operational position (B), the first magnet (3) secured to the opening section.

Fig. 2(a)

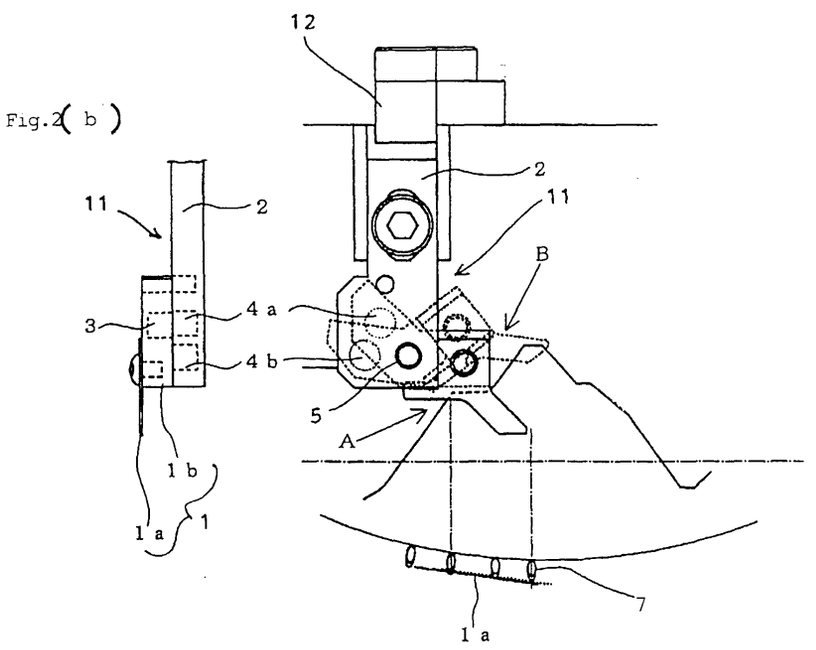

Fig. 2(b)

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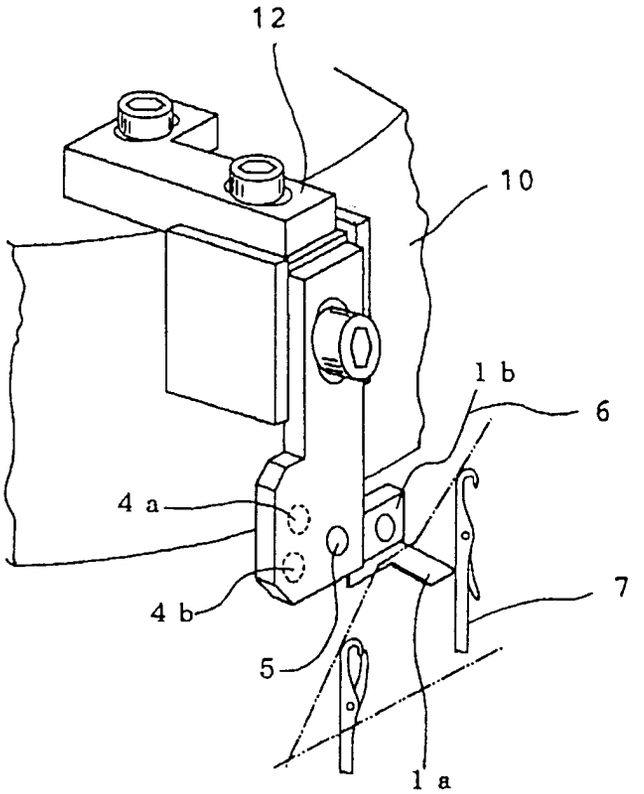
Fig. 3(a)



Description

[0001] The present invention relates to knitting machines and, more particularly, to an apparatus for opening the latches on knitting needles of knitting machines.

[0002] The knitting of fabric on a knitting machine frequently requires that the yarn or yarns being fed to the knitting needles be changed or replaced, such as,when a yarn is cut or when a transferring pattern is being knit. The latches of the knitting needles must be opened to receive the new or transferred yarn and a needle-type or brush-type latch opener is conventionally used for opening a closed latch.

[0003] A typical needle-type latch opener is disclosed in JP-U-4-123281 and includes a pin-like needle-type latch opener rotatably mounted on the knitting machine in position to open a latch on the end of a needle by inclining the latch through a predetermined angle relative to the needle. This latch opener also includes a control ring which is turned through a predetermined arc or angle to turn or rotate the latch opener through a sufficient angle to apply the requisite opening force to the latch, and a latch guard control ring which is turned in the same direction as the latch opener control ring for bringing up a yarn feeder to its proper position.

[0004] Several problems and disadvantages have been encountered in the use of needle-type latch openers, such as that described above. For example, ring yarns or special yarns having significant fuzz thereon are prone to be caught on the tip end of the latch opener which interferes with the knitting operation with unsatisfactory results. Also, such latch openers require a plate-like latch guard to prevent the opened latch from closing again and are maintained in their operational positions by spring mechanisms which increase the size of the latch opening mechanisms making it difficult to install on the knitting machine where space is always limited and at a premium. Further, such latch openers are formed by a three-dimensional bending operation and variations in fabrication precision are prone to occur resulting in frequent difficulty in mounting these needle-type latch openers properly.

[0005] Finally, when the fabric pattern being knit is dense, the loops formed are small and the timing of opening of the latches on the needles by the old loops thereon is prone to be delayed. If this occurs, the latch opener and latch may collide and the latch may be damaged.

[0006] With the foregoing in mind, it is an object of the present invention to provide a plate-type latch opener for a knitting machine which obviates and overcomes the aforementioned problems and disadvantages of needle-type latch openers.

[0007] This object of the present invention is accomplished by providing a latch opener for a knitting machine which includes an opening section for opening a closed latch and a holding section on which the opening section is pivotally mounted by a pivot pin or rotation shaft. The opening section can thereby move between an operational position where the latch is opened and a non-operational position where the latch is not opened. Additionally, a first magnet is mounted on the opening section and at least two additional magnets (second and third magnets) are mounted on the holding section in position whereby the second magnet attracts the first magnet when the opening section is in the operational position and the third magnet repels the first magnet when the opening section is in the non-operational position.

[0008] It is preferable that the opening section of the latch opener of the present invention include a plate-like tip end portion and a magnet-embedded portion. It is also preferable that knitting needles used in knitting machines equipped with the latch opener of the present invention have a polished tip end of the hook and a latch that is about 0.1 mm longer than the latch on a normal or conventional needle. With this design, a V-portion is formed between the latch and the hook on these needles, which improves the latch-opening process. Finally, cleaning and inspection of the knitting needles in a knitting machine equipped with the latch opener of the present invention after a latch opening operation and after the opening section has been moved to the non-operational position is highly recommended. To this end, it is preferred that such knitting machines be equipped with a stop mechanism for stopping the knitting machine so that such cleaning and inspection can be performed.

[0009] In order that the present invention may be more readily understood, reference will now be made to the accompanying drawings, in which:-

Figure 1 is a fragmentary, front elevational view of a latch opener of the present invention shown adjacent to a yarn carrier on a dial of an interlocking circular knitting machine;

Figure 2a is a view similar to figure 1 illustrating the latch opener in operational and non-operational positions;

Figure 2b is a fragmentary side elevational view of the latch opener shown in Figure 2a;

Figure 3a is a fragmentary perspective view of a section of a knitting machine showing the latch opener of the present invention mounted on the dial thereof; and

Figure 3b is an enlarged, fragmentary, somewhat schematic view of a knitting needle and the opening section of the latch opener in position for opening the latch thereof.

[0010] Referring to the accompanying drawings and specifically to Figure 1, a yarn carrier 8 for supplying yarn to a knitting needle 7 is supported by a yarn carrier holder 9 in each of the yarn feed mechanisms of a knitting machine. The yarn carrier holder 9 is mounted on a dial cam holder 10 or on a yam carrier ring (not shown).

[0011] A latch opener, generally indicated at 11, is po-

sitioned adjacent the yarn carrier 8 and is supported by a latch opener holder 12 also mounted on the dial cam holder **10** (Figure 3a) or on a yarn carrier ring (not shown). Latch opener **11** includes an opening section 1 for opening a latch **7a** of the knitting needle **7**, and a holding section **2** for supporting or holding the opening section 1 (Figure 2a, 2b, 3a and 3b). The opening section **1** is positioned such that the opening section **1** is situated between the closed latch **7a** and a hook **7b** when knit or tuck is selected for the knitting needle **7** and the knitting needle **7** is in a predetermined raised position. It is preferred that the opening section **1** comprise a tip end thin plate **1a** and a magnet embedded portion **1b** which are coupled or connected so as to be separable. Preferably, the tip end plate **1a** has a thickness of about 0.2 mm. The holding section **2** is mounted on the latch opener holder **12** such that the position of the holding section **2** can be adjusted vertically. The holding section **2** thus connects the latch opener holder **12** and the opening section **1**.

[0012] If the knitting needle **7** rises with the latch **7a** closed and with the latch opener **11** in the operational position **A** (Figure 3a) the tip end **1a** of the opening section **1** will enter the V-portion between the latch **7a** and the hook **7b** (Figure 3b) and will push upon the latch **7a** as the needle **7** rises and will open the latch **7a** by causing latch **7a** to pivot downwardly about its pivot pin **14**. It is preferable that knitting needle **7** have a polished tip end of the hook **7b** and that latch **7a** be of a length about 0.1 mm longer than the latch on a normal or conventional needle.

[0013] When lint or dust accumulates on pivot pin **14** of latch **7a** and the latch **7a** cannot be smoothly opened or closed, an abnormal load may be applied to the latch 7a by the selecting cam (not shown) and a butt on needle **7** (also not shown) which control the knitting needle. If an attempt is made to open the latch **7a** forcibly, damage to the latch **7a** or to the butt on needle **7** may result. Consequently, the opening section **1** is pivotally mounted or supported on holding section **2** by a pivot pin or rotation shaft **5**, so that opening section **1** can move from operational position **A** to non-operational position **B** to avoid any damage to the needle **7** (Figure 2a). A positioning pin **13** carried by the holding section **2** limits the pivotal movement of the opening section **1** to the operational position **A**, but does not interfere with pivotal movement thereof toward the non-operational position **B**.

[0014] At least one first magnet **3** is embedded in a contact surface of the opening section **1** with respect to the holding section **2** (Figures 1 and 2b). At least one second magnet **4a** is embedded in a contact surface of the holding section **2** in a position slightly out of phase with or off-set from the first magnet **3** when the opening section **1** is in the operational position **A**, but with sufficient overlap to attract the first magnet **3** and stabilize the position of the opening section **1**.

[0015] At least one third magnet **4b** is embedded in the contact surface of the holding section **2** in a position and with a polarity that third magnet **4b** will repel the first magnet **3**. First magnet **3** and third magnet **4b** have such strong magnetic forces that after the opening section **1** moves to the non-operational position **B**, the opening section **1** can be brought swiftly back to the operational position **A**.

[0016] Since it is highly recommended and probably necessary that the knitting needles **7** be cleaned and inspected once the opening section **1** is moved to the non-operational position **B**, it is preferred that suitable stop means (not shown) be provided for stopping the knitting machine when this occurs.

[0017] Although the latch opener **11** is shown as being mounted on a dial cam holder **10** of a double-knit machine for opening the latches **7a** of cylinder needles **7**, it should be understood that the latch opener **11** may be suitably mounted on any type of knitting machine for use in opening the latches of dial needles as well as the needles of single-knit machines.

Claims

1. A latch opener for a knitting machine having a latch needle (7), comprising an opening section (1) for opening a closed latch (7a) and a holding section (2) for holding said opening section (1), characterised in that the opening section (1) is pivotally supported on the holding section (2) by means of a shaft (5) such that the opening section (1) is movable between an operational position (A) in which the latch (7a) is opened and a non-operational position (B) in which the latch (7a) is not opened, at least one first magnet (3) is secured to the opening section (1), and at least two magnets (4a,4b) are secured to the holding section (2), one (4a) of said at least two magnets (4a,4b) being secured to the holding section (2) so as to attract, in said operational position (A), said first magnet (3) secured to the opening section (1), and the other one (4b) of said at least two magnets (4a,4b) being secured to the holding section (2) so as to repel, in said non-operational position (B), the said first magnet (3) secured to the opening section (1).

2. A latch opener according to claim 1, wherein the opening section (1) comprises an opening section tip end (1a) and a magnet-embedded portion (1b).

3. A latch opener according to claim 2, wherein the opening section tip end (1a) is a plate-like shape.

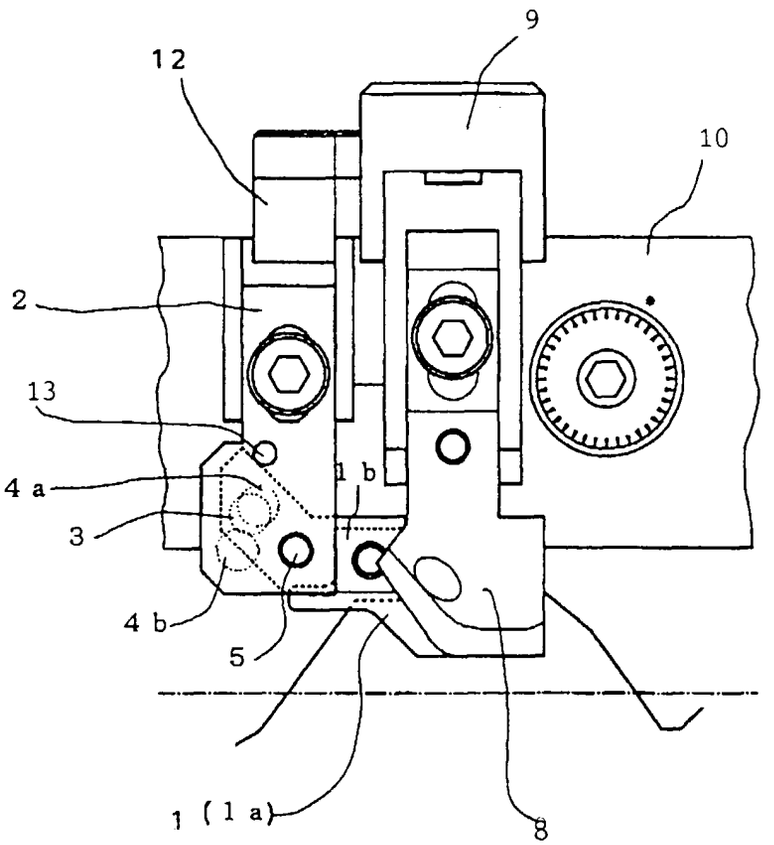


Fig. 1

Fig. 2(a)

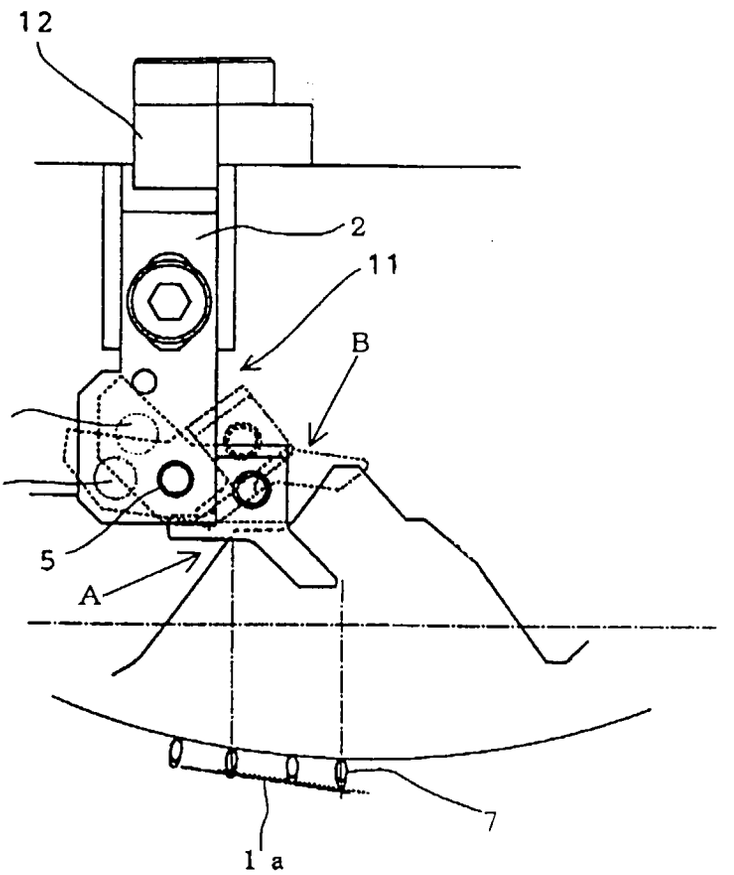


Fig. 2(b)

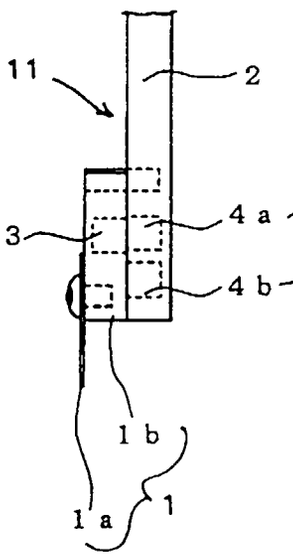


Fig. 3(a)

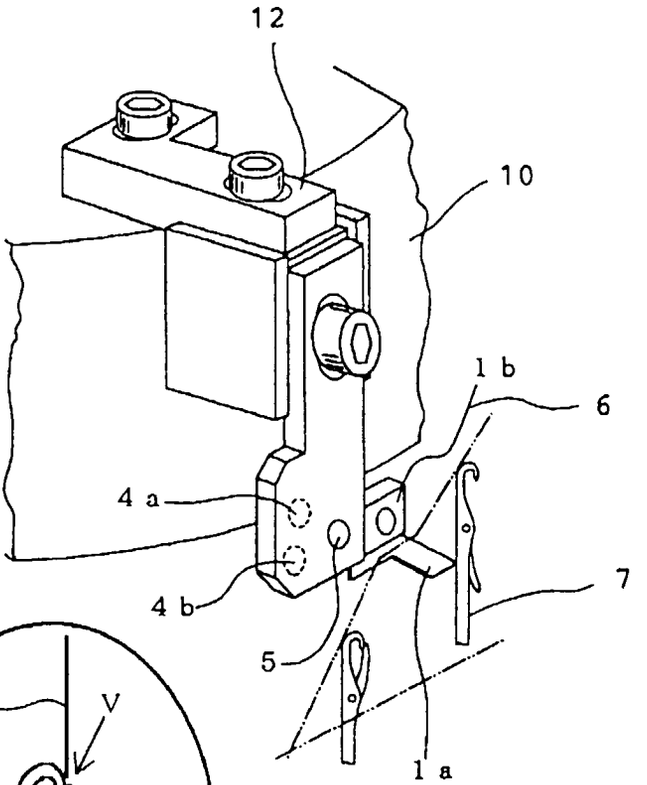


Fig. 3(b)