Aug. 29, 1961 J. M. ASHE ET AL 2,997,866

MAGNETIC LATCH OPENER AND DEMAGNETIZER

Filed May 23, 1960

FIG. 1

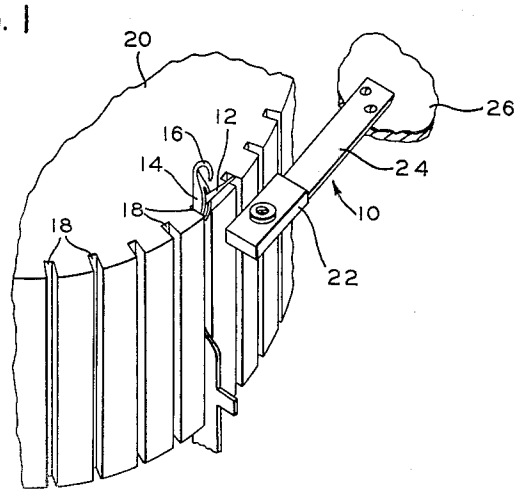


FIG. 5

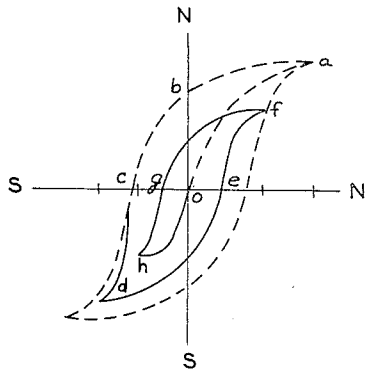


FIG. 2

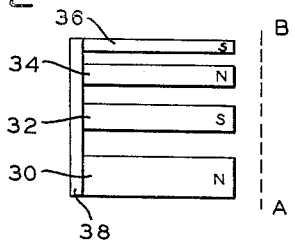


FIG. 3

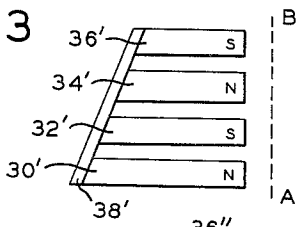
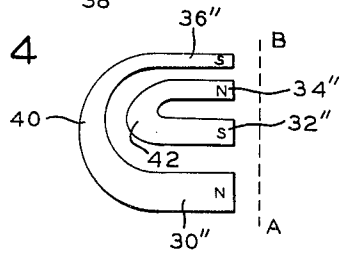


FIG. 4



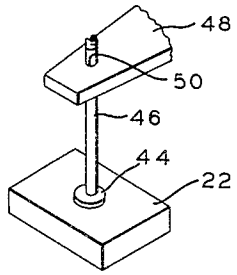


FIG. 6

INVENTORS

JOHN M. ASHE

CLARENCE S. OST

BY Arthur H. Seidel

ATTORNEY

United States Patent Office 2,997,866 Patented Aug. 29, 1961

2,997,866

MAGNETIC LATCH OPENER AND DEMAGNETIZER

John M. Ashe, Philadelphia, Pa., and Clarence S. Ost, Atlantic City, N.J.; said Ost assignor of thirty-five percent to said Ashe

Filed May 23, 1960, Ser. No. 30,945
9 Claims. (Cl. 66—111)

This invention relates to a magnetic latch opener and demagnetizer device. More particularly, this invention relates to a device for magnetically opening the pivotable latches on needles used in textile machinery and immediately thereafter demagnetizing said latches.

Heretofore, many attempts have been made to provide apparatus for mechanically or magnetically opening the latches on needles in textile machinery. These attempts have proved to be unsuccessful for various reasons. Where permanent magnets or electromagnets have been used, the latches and the needles were left in a magnetized condition. Eventually, the latches would not open under the influence of the permanent magnet. In other words, the original means for opening the latches caused the effect that defeated the original means.

Mechanical attempts to open the pivotable latches on needles in textile machinery have included a delicate finger or cam adjusted to mechanically bias the latch open. The normal run out of the cylinder which carries the needles and the vibration of the needles in the cylinder slots caused accidents whereby the delicately adjusted finger or cam would run into or behind the shank of the needle. This resulted in damage to at least one needle, and more often all the needles on the machine, consequently this type of latch opener fell into disuse very quickly.

The advantage of positively opening the latches on the needles in a textile machine prior to the approach of the needles to the yarn feeds is well known in the art. Among the many advantages, the most important is the ease with which the machine can be put into operation by obviating the necessity of brushing latches open. If a yarn end breaks, instead of the knitted material stripping off the needles, the machine continues to knit and when the yarn end is restored, the machine automatically picks up the stitches. The device of the present invention, by its latch opening ability, eliminates the laborious task of picking up dropped cloth.

The use of a magnetic device for attracting the latches to one of their operative positions is most desirable. As pointed out above, these devices leave the latches and needles in a magnetized condition which eventually defeats the purpose of the magnetic means. Thus, there is a definite need in the textile industry to provide a device which magnetically opens the latches on the needles and immediately thereafter demagnetizes the latches and the needles.

It is an object of the present invention to provide a magnetic latch opener and demagnetizer.

It is another object of the present invention to provide a device for magnetically attracting the latches on needles of textile machinery to one of their operative positions and thereafter demagnetize the needle and the latch.

It is still another object of the present invention to provide a device which reduces the possibility of producing textile goods having dropped stitches.

It is a still further object of the present invention to provide a magnetic device for automatically opening the latches on needles in textile machinery and thereafter demagnetizing said needles.

It is a still further object of the present invention to provide a magnetic latch opener and demagnetizer which is simple in construction, low in cost, and completely

devoid of moving mechanical parts or electrical apparatus.

It is a still further object of the present invention to provide a magnetic latch opener and demagnetizer utilizing a plurality of permanent magnets.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a partial perspective view of the magnetic latch opener and demagnetizer of the present invention juxtaposed to a latch of a needle on a textile machine.

FIGURE 2 is a schematic plan view of the magnets in the magnetic latch opener and demagnetizer device of the present invention.

FIGURE 3 is a schematic plan view of the magnets of the magnetic latch opener and demagnetizer of an alternative embodiment of the present invention.

FIGURE 4 is a schematic plan view of the magnets of the magnetic latch opener and demagnetizer of an alternative embodiment of the present invention.

FIGURE 5 is a composite graph showing the induced flux as a function of the inducing flux in dash lines which is the normal hysteresis loop of the needle material, and the induced flux as a function of the inducing flux as the inducing flux decreases from alternating poles in solid lines on the graph.

FIGURE 6 is a perspective view of an alternative embodiment of mounting the magnetic latch opener and demagnetizer of the present invention.

Referring to the drawings, wherein like numerals indicate like elements, there is shown in FIGURE 1 a perspective view of the magnetic latch opener and demagnetizer of the present invention designated generally as **10**. The magnetic latch opener and demagnetizer **10** is shown in FIGURE 1 juxtaposed to the latch **12** on needle **14**. As is well known in the art, the needle **14** is provided with a bight portion **16**. The latch **12** is pivotably secured to the needle **14** and is movable between an open position as shown in FIGURE 1 and a closed position wherein the latch **12** is abutting the bight portion **16**.

As is conventional in the art, the needle **14** is reciprocally mounted in a groove **18** on a rotary cylinder **20**. It will be understood that a needle **14** will be positioned in each of the grooves **18** on the cylinder **20**. The magnetic latch opener and demagnetizer **10** is juxtaposed to the latch **12** at the precise location wherein the latch **12** must be open.

The magnetic latch opener and demagnetizer **10** comprises a housing **22** mounted on a fixed support **26** by the bracket **24**. The housing **22** is made of non-magnetic material. Preferably, the housing **22** is made from plastic or brass.

Mounted within the housing **22**, there is provided a plurality of magnets arranged as shown in FIGURES 2 through 4. Referring to FIGURE 2, it will be seen that the housing **22** contains four permanent bar magnets. The latch **12** as it moves past the housing **22** moves from A to B.

While referring to FIGURE 2, it will be seen that the latch **12** is in its closed position as it approaches the permanent north pole magnet **30**. Adjacent to the permanent north pole magnet **30** and parallel thereto, there is provided a permanent south pole magnet **32**. It will be noted that the permanent south pole magnet **32** is smaller than, and therefore has less strength than the permanent north pole magnet **30**. A permanent north pole magnet **34** is positioned adjacent to and parallel to

the permanent south pole magnet 32. The permanent north pole magnet 34 is smaller than, and therefore has less strength than the permanent south pole magnet 32. A permanent south pole magnet 36 is positioned adjacent to and parallel to the permanent north pole magnet 34. The permanent south pole magnet 36 is smaller than, and therefore of less strength than the permanent north pole magnet 34. Each of the permanent magnets 30 through 36 are connected together by a soft iron core 38.

FIGURE 3 shows an alternative embodiment of the arrangement of the permanent magnets shown in FIGURE 2. In FIGURE 2, the permanent magnets 30 through 36 are of the same length. In FIGURE 3, the permanent magnets 30′ through 36′ are shown having decreasing lengths and connected together by a soft iron core 38′. Thus, permanent north pole magnet 30′ is longer than the permanent south pole magnet 32′. Also, the permanent south pole magnet 32′ is longer than the permanent north pole magnet 34′, etc. By decreasing the lengths of the permanent bar magnets 30′ through 36′, the magnets 30′ through 36′ are arranged in their order of decreasing strength with magnet 30′ being the strongest and magnet 36′ being the weakest.

FIGURE 4 shows an alternative embodiment of the arrangement of the bar magnets mounted within the housing 22. It will be seen that the permanent north pole magnet 30″ is connected to the permanent south pole magnet 36″ by a bight portion 40. Thus, the permanent north pole magnet 30″ and the permanent south pole magnet 36″ cooperate with the bight portion 40 to define a horseshoe magnet.

In FIGURE 4, the permanent south pole magnet 32″ is connected to the permanent north pole magnet 34″ by a bight portion 42. The permanent south pole magnet 32″ and the permanent north pole magnet 34″ cooperate with the bight portion 42 to define a horseshoe magnet.

Referring to FIGURE 6, there is disclosed an alternative manner for supporting the housing 22. The housing 22 is provided on its uppermost surface with a raised boss 44. The raised boss 44 is centrally provided with a threaded blind hole. A rod 46 threaded at both ends supports the housing 22 from a fixed support 48. One threaded end of the rod 46 is threadedly engaged with the threads in the blind hole in the boss 44. The other end of the rod 46 is threadedly engaged with the threads in an aperture 50 in the fixed support 48. The threaded end of the rod 46 need not extend through the aperture 50 in the fixed support 48 as shown in FIGURE 6. For example, the end of the rod 46 may threadedly engage with the threads on a blind hole in the fixed support 48.

It will be seen that the instant invention comprises a plurality of permanent magnets placed side-by-side and spaced from one another with the alternating pole faces north, south, north, and south in line. Each of the magnets decrease in flux density as well as spacing between them, according to a predetermined ratio which will be made clear hereinafter. It is essential for the device of the present invention, that the needles 14 first come in proximity with the strongest magnet, for example permanent north pole magnets 30, 30′ or 30″, and then proceed progressively toward the weakest magnet along the path A—B.

The theory of the present invention is as follows:

The strongest permanent magnet, for example permanent north pole magnet 30, attracts the latch 12 on the needle 14 to one of its operative positions. Preferably, the position is the open position of the latch. The strong magnetic field of the magnet, for example permanent north pole magnet 30, induces magnetism in the latch which would leave the latch permanently magnetized to its residual flux density point if the original inducing flux had saturated the needle material and the needle 14 had been completely removed from the inducing field. However, instead of removing the needle 14 completely from the inducing field, we remove it to another field of opposite magnetic polarity and of less strength than the original saturating flux. For example, the needle 14 moves from the magnetic field of the permanent north pole magnet 30 into the magnetic field of the permanent south pole magnet 32. This reduces the residual flux density of the needle 14 to zero at the instant the inducing flux of the permanent south pole magnet 32 reaches a magnitude equal to the point of coercivity of the material of the needle 14.

It is impossible, except under laboratory conditions, to stop the neutralizing action of the permanent south pole magnet 32 so that the needle 14 would be completely demagnetized. This would require the permanent south pole magnet 32 to be designed and controlled within finite tolerances based on the flux density of the permanent north pole magnet 30 and the residual flux density point of the needle 14. Since the residual flux density point varies from needle to needle, it is not possible as a practical matter to reduce the induced flux down to zero with a single magnet.

In the present invention, the second permanent magnet in the direction of travel of the needle 14, for example permanent bar magnet 32, has a flux density somewhat less than the flux density of the first magnet, for example permanent north pole magnet 30. However, the flux density of the second magnet, for example permanent south pole magnet 32, is greater than the point of coercivity of the material of the needle 14. By repeating the same relationship in succeeding magnets, for example permanent north pole magnet 34 and permanent south pole magnet 36, we produce a hysteresis spiral which eventually, if carried out a sufficient number of times, will reduce the residual flux density of the material of the needle 14 to zero.

In practice, we have found that four alternating poles with decreasing flux density reduces the residual magnetism to a practical zero point.

The operation of the magnetic latch opener and demagnetizer is as follows:

If a demagnetized needle enters the magnetic feel of the permanent north pole magnet 30, the latch 12 will be attracted to an open position. The relative coordinates of the point of inducing and induced flux would follow the curve *o—a* in FIGURE 5. In FIGURE 5, *o* represents the origin or zero residual flux, the vertical N—S line represents the density of the induced magnetic flux measured in units of gauss, and the horizontal N—S line represents the intensity of the inducing flux measured in units or oersted.

As the needle continues along the path A—B, the needle 14 passes out of the influence of the magnetic field of the permanent north pole magnet 30. Thus, the relative coordinates of the point of inducing and induced flux would follow the curve *a—b*, with *b* representing the residual induced flux. Since the needle 14 is moving along the path A—B very quickly, the needle 14 immediately passes into the magnetic field of the permanent south pole magnet 32. Since the permanent south pole magnet 32 has a flux density above the point of coersivity of the material of the needle 14, the polarity of the flux in the needle 14 is reversed and the relative coordinates of the point of inducing and induced flux follow the curve *b—c—d*.

As the needle 14 continues along the path A—B, the needle 14 passes out of the magnetic field of the permanent south pole magnet 32 and into the magnetic field of the permanent north pole magnet 34. At this point, the relative coordinates of the point of inducing and induced flux follow the curve *d—e—f*. At this point, the polarity of the induced flux has been reversed. As the needle 14 continues along the path A—B, the coordinates of the point will trace out the curve *f—g—h*. At this point the polarity of the induced flux is again reversed.

As the needle 14 continues along the path A—B, the coordinates of the inducing and induced flux follow the curve *h—o*. Thus, the needle 14 is demagnetized after

passing out of the magnetic field of the permanent south pole magnet 36. While the above explanation has been explained with relation to the magnets of the embodiment shown in FIGURE 2, it will be appreciated that the explanation is equally aplicable to the embodiments shown in FIGURES 3 and 4.

It should be noted that if the needle **14** was in a magnetized condition prior to entering the magnetic field of the permanent north pole magnet **30**, the same sequence of events described above would take place after the needle **14** passed out of the magnetic field of the permanent north pole magnet **30**.

The housing **22** containing the permanent bar magnets arranged as set forth in FIGURES 2 through 4 may be supported from a bracket **24** as shown in FIGURE 1 or from a depending rod **46** as shown in FIGURE 6.

While the above embodiments include permanent bar magnets, it will be apparent to those skilled in the art that electromagnets having alternating magnetic fields decreasing in magnitude according to a predetermined ratio may be substituted therefor.

Hereinafter, the permanent north pole magnets **30, 30'**, and **30''** may be referred to as a magnetic means for magnetically attracting the latch **12** on the needle **14** to one of its operative positions. Hereinafter, the permanent magnets **32, 34**, and **36**, and their corresponding primed magnets, may be referred to as a means for demagnetizing the latch **12** after it has been attracted to said one operative position.

While the magnetic latch opener and demagnetizer of the present invention has been shown in a position wherein it attracts the latch **12** to an open position, it will be apparent to those skilled in the art that the device of the present invention may be utilized to attract laches to their closed position. While the magnetic latch opener and demagnetizer of the present invention has been shown in combination with a needle **14** reciprocally mounted on the peripheral surface of a rotating cylinder, it will be appreciated that the instant invention is capable of being utilized on all types of textile machinery where there is a need to attract a needle latch to one of its operative positions. Thus, the instant invention could be utilized to attract latches to an open position, wherein said latches are on a horizontally disposed needle.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

We claim:

1. In a textile machine comprising a needle on a moving support, a pivotable latch on said needle, said latch having an open position and a closed position, a magnetic means adjacent said support for magnetically attracting said latch to one of said positions and for demagnetizing said latch after it has been attracted to said one position, said means including a plurality of spaced magnets arranged so that the flux density and spacing of said magnets decreases in the direction of movement of said support.

2. In a textile machine comprising a needle mounted for movement, a pivotable latch on said needle, said latch having an open position and a closed position, a magnetic means for magnetically attracting said latch to said open position, a plurality of magnets of variable strength for demagnetizing said needle, said magnets being supported adjacent the path of movement of said needle and arranged in their order of decreasing magnitude of flux density, the order of decreasing magnitude corresponding to the direction of movement of said latch as it passes said magnets, whereby said needle is demagnetized after said latch has been attracted to said open position.

3. In a textile machine comprising a rotary cylinder, a needle mounted on the periphery of said cylinder, a pivotable latch on said needle, said latch having an open and a closed position, a non-magnetic housing supported on a fixed mounting adjacent the path of movement of said latch, a magnetic means in said housing for attracting said latch to one of said positions, and means in said housing for demagnetizing said latch after it has been attracted to said one position.

4. In a textile machine in accordance with claim 3 wherein said needle is reciprocally mounted in a groove on the outer periphery of said cylinder.

5. In a textile machine in accordance with claim 3 wherein said magnetic means and said demagnetizing means are permanent magnets.

6. In a textile machine comprising a rotary cylinder, a needle mounted in an upright position on said cylinder, a pivotable latch on said needle, said latch having an open and a closed position, a non-magnetic housing supported on a fixed mounting adjacent said latch, a first permanent north pole magnet in said housing for attracting said latch to one of said positions, a first south pole magnet of less flux density than said first north pole magnet, a second permanent north pole magnet of less flux density than said first south pole magnet, and a second permanent south pole magnet of less flux density than said second north pole magnet, said magnets being arranged in the above order which corresponds to the direction of movement of said needle past said housing, whereby said first north pole magnet attracts said latch to its open position and said other magnets demagnetize said latch.

7. In a textile machine in accordance with claim 6 wherein said first north pole magnet and said second south pole magnet form a horseshoe, and said second north pole magnet and said first south pole magnet form a horseshoe.

8. In a textile machine in accordance with claim 6 wherein said magnets are connected together by a soft iron bar.

9. In a textile machine in accordance with claim 6 wherein said magnets are positioned parallel to one another.

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