

UNITED STATES PATENT OFFICE

2,320,784

SEAM RIPPER

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Application January 1, 1943, Serial No. 470,968

21 Claims. (Cl. 30—272)

This invention relates to a seam ripper, that is to say, a device which is particularly adapted to the ripping of sewed seams, although it is not necessarily restricted to such an operation, because the device has great utility for many other cutting purposes.

Among the principal objects of the invention are those set forth below:

First. To perform a cutting operation by means of a sharp blade that is reciprocated longitudinally in the plane of the blade in such a manner that it becomes possible to keep substantially the entire cutting edge of the blade in contact with a substance or article to be cut.

Second. To cause the blade to swing freely in the plane thereof by eliminating any lateral guide or other structural member likely to come in contact with the moving blade.

Third. To so mount and suspend the blade that its travel in the plane thereof is extremely flexible, but that at the same time the deviation or deflection sidewise of its plane is rigidly prevented.

Fourth. To have the blade disposed for reciprocation electrically, whereby a high cutting speed results.

Fifth. To provide an instrument that consists of few parts, is simple in operation and durable in construction.

Sixth. To provide an instrument in which the cutting member is indefinitely replaceable, that is to say, in which new cutting members are easily substituted for old ones as soon as the latter lose the desired efficiency.

Seventh. To provide an instrument in which ordinary safety razor blades, especially those discarded after shaving, are advantageously utilized.

Other objects too, will become evident after the invention is more fully understood.

Cutting instruments of the class to which the invention belongs, are usually of a construction in which two blades are connected mutually together scissor-fashion, and while such instruments can and are operated electrically, still in each oscillation of the scissor blades, the extent of the cutting action is limited to rather short, cooperative oscillations of the blades.

In the device of the invention, on the contrary, the entire cutting edge of the single blade is in contact, at one and the same time, with the article to be cut, where such article is at least as long as the blade. Therefore, instead of being limited to only the actual length of the stroke in the cutting operation, the effective cutting result in each stroke is virtually equal to the number of times

that the length of the stroke is contained in the length of the cutting edge of the blade. Consequently, for the same length of stroke effective upon the cutting members, the device of the invention produces a much greater shearing action than is the case with scissor blades.

An advantage possessed by the device of the invention is that the material to be cut is exposed to the cutting edge on only one surface instead of being squeezed between two blades, where the two blades operate alongside, but on opposite surfaces, of the article or goods being cut.

In the accompanying drawing, which illustrates one embodiment of the invention,

Fig. 1 represents a front elevation, partly in section, taken on the line 1—1 in Fig. 2;

Fig. 2, a side elevation partly in section, taken on the line 2—2 in Fig. 1;

Fig. 3, a fragmentary portion of Fig. 2, showing an alternate position of certain operative parts;

Fig. 4, a side elevation of another embodiment of the invention, drawn to a reduced scale;

Fig. 5, a front elevation of the embodiment of Fig. 4; and

Fig. 6, a fragmentary vertical section taken through the handle portion of the embodiment of Fig. 4, showing the details of an electrical "trigger" switch for starting and stopping the operation of the device.

Referring to the drawing, the numeral 10 indicates a housing made of any suitable material, such as a molded plastic. Projecting upwardly from the housing 10 is a handle portion 12 which advantageously is integral with the housing. Within a chamber or recess 14 that is enclosed by the housing, there is reciprocally mounted a vibrating element 15 having the movable arm 15—1 and the fixed arm 15—2, the latter being held in place against an abutment 17, by any suitable fastening means, for example, screws 18. The movable arm 15—1 is cantilevered from the stationary arm 15—2 by means of the elbow portion 15—3. Advantageously, the vibrating element 15 is made of extremely resilient material such as spring steel, which gives the elbow portion a high degree of flexibility, owing largely to its cross-sectional proportions. These proportions are so chosen that the width of the material is considerably in excess of its thickness, and lies substantially parallel to the axis of oscillation, thereby imparting stability.

Rigidly attached to the movable arm 15—1 is an armature 19, made for example, of soft iron and having a foot 19—1 integral therewith. The

foot has depending from it a bracket 19—2 lying in a plane that extends at substantially right angles to the axis of oscillation of the resilient elbow portion 15—3. Removably attached to the bracket 19—2 is a cutting blade 20 having its lower or active cutting edge 20—1 extending somewhat below the lower edges 10—1 of the housing 10. The blade 20, in this instance, is advantageously an ordinary double-edge safety razor blade, but a blade of any other suitable kind can be used if desired. The blade is conveniently fastened to the bracket 19—2 by means of screws 21, and the intervening washers 24, through it is obvious that there is nothing restrictive in this method of fastening. Energy for reciprocating the blade 20 is advantageously through an electromagnet comprising for example, a coil 25 wound around a spool 26 and enclosing a core 27, the core being energized electrically, in this instance A. C., by means of the leads 28—1 forming part of an ordinary electric appliance cord 28. Obviously, the use of D. C. electricity can be provided for by making well known changes in some of the minor details herein shown and described.

When the coil 25 is energized, the electromagnetic force set up in the core 27 acts to intermittently attract the armature 19 counter to the potential mechanical energy stored in the spring means 15—3. Since the A. C. electric current varies in each cycle from zero to maximum and back again to zero, the electromagnetic force in the core varies accordingly. Whenever, the electric current is at zero, the tension in the spring element 15—3 becomes effective to return the arm 15—1, and consequently the armature 19 also, to their normal position, indicated in Fig. 2, all in a manner that is well known.

Since the blade 20 is fixed relative to the armature, it is obvious that any reciprocative motion, indicated by the double-pointed arrow 29 in Fig. 2, of the armature imparts to the blade 20 corresponding reciprocative motion indicated by the double-pointed arrow 30. It is to be observed that the exact motion of the blade relative to the motion of the armature depends upon the angle existing between the armature 19 and its foot 19—1. In this instance, the angle is assumed to be as indicated at 31, but of course, this angle can be varied to suit different requirements. The motion at any particular point of the blade is represented by an arc described from the center of oscillation lying in proximity to the bend of the spring means. The motion of the cutting edge 20—1 of the blade is compound in character having both a vertical and a horizontal component. This results in a very effective draw-cut upon material to which the instrument is applied. The ratio between the vertical and horizontal components is determined to a large extent by the magnitude of the angle 31.

The horizontal component causes the blade to be drawn back and forth in material to be cut, while the vertical component causes the blade to alternately sink into the material and to be lifted out again.

The two side walls 10—2 and 10—3, Fig. 1, of the housing are advantageously curved inward so as to at least partially define the guard portions 10—4 on either side of the blade 20, thus facilitating the manipulation of the device in following definite lines of cutting.

As a matter of convenience in assembling the operative parts of the mechanism, the end wall 10—6 may be separable from the remainder of the

housing along planes indicated by the lines 10—5, and may be removably attached thereto by means of screws 32 or other fastening devices, these fastenings being placed wherever most convenient in any particular design of the device.

The spool 26 can be fastened to abutments 34, projecting inwardly from the housing, by means of screws 35.

If desired, a resilient cushion 37, of rubber or other material, may be disposed in a suitable location for taking up the force of the spring impact of the arm 15—1.

Instead of providing an armature as a separate though rigidly attached part of the spring arm, the spring arm itself can constitute the armature. Such a construction is shown at 40 in Fig. 3. In that case, however, the armature would consist of spring steel and this might frequently be objectionable owing to the possibility of the armature "freezing" to the core of the electromagnet. Even so, a thin strip (not shown) of a non-magnetic substance, such as brass, can be attached to the face contacting the core. Since this is a common expedient, it is not here illustrated.

A feature in addition to maximum cutting-edge contact, that makes this device particularly suitable for seam ripping is the downwardly converging disposition of the guards 10—4 whereby it becomes possible to provide the sharply defined hold-down edges 41 closely adjacent the cutting edge on either side thereof. Each hold-down edge is flanked by a side face 42 that slopes rather acutely upward and outward from the respective hold-down edge. Because of this construction, it becomes feasible in operating the instrument of the invention, not only to accurately follow a seam but also to put the stitches of the seam in a condition favorable for severing the thread as the instrument is moved along the seam.

The favorable disposition just described, is visible in Fig. 1, where the numerals 43 and 43—1 designate two portions of an article made for example of a textile fabric, the two respective portions having previously been sewn together by means of a thread at 45. In pressing down upon the instrument, after it is so placed that the blade 20 comes approximately into alignment with the seam, a small depression or channel is formed immediately underneath the cutting edge of the blade. Obviously, this depression or channel follows the seam as the instrument is moved along the latter. The oppositely sloping faces 42 exert horizontal force components in opposite directions and tend to push the article portions apart from each other countering the holding power of the stitches. This of course, tends further to draw the thread in each stitch, taut, directly across the path of the blade when it descends, and so, puts the stitches in advantageous condition for producing a satisfactory severing effect. It is possible that the space as shown at 46 between the portions 43 and 43—1, is somewhat exaggerated, but if so, it is done for the sake of clarity.

The utility of the invention is not restricted to the ripping of seams, but extends to the exerting of an improved cutting effect upon various substances, such as the constituents of most textile fabrics. This follows largely because the mutually opposed, inclined, flanking faces 42 are effective to tense the surface structure of a textile or like material simultaneously with the occurrence of the rapidly repeated, blade-length, draw-cut slashes or strokes that are characteristically produced by the reciprocating blade.

The method of mounting the blade 20 is noteworthy in that it makes possible the novel isolation of the cutting edge from any environing structural parts. This isolation results in great freedom of motion of the cutting edge, because neither the blade nor its flexible mounting are in rubbing or other friction-producing contact with any other structural part. Witness the contrary in scissor-like cutting devices where one blade is in close rubbing contact with another blade.

In the present device, the sole contact or connection between the blade and any associated structural part is by means of a flexing element located remote from the cutting edge. In this instance the flexing element is represented by the spring elbow 15—3. Thus the cutting edge swings free of any inherent retarding influence that might otherwise be exerted upon it.

In the rapidity of its performance in any given cutting operation, the instrument of the invention with its blade-length incision in each cutting stroke, has a considerable advantage over a scissor-like device where each cutting stroke results in only a comparatively short bite.

The disposition of the center of oscillation of the armature in its relation to the cutting edge hereinbefore alluded to, makes possible various characteristic cutting results. This can be seen more particularly in Fig. 1, where it may be assumed the center of oscillation is located approximately at the point 47. By drawing the radii 47—1 to 47—4 through various points in the cutting edge 20—1 and constructing the corresponding right triangles 48—1 to 48—4, the motion effects at the various points are graphically represented. The hypotenuse of each triangle virtually coincides with a short arc at the same point. By constructing the respective right triangles, the altitudes thereof represent vertical motion components, and the bases thereof, horizontal motion components.

In the triangle 48—1 the base is longer than the base in any of the others, while in triangle 48—4 the base is shortest. The draw effect varies accordingly. Again, in triangle 48—1 the altitude is lower than the altitude in any of the others, while in triangle 48—4 the altitude is highest. The incisive cutting effect varies accordingly. As a result, the cutting edge exercises a real draw-cut action from end to end of the blade.

In Fig. 1 the angle 31 is greater than a right angle and the center of oscillation is located outside a perpendicular 50 erected at one end of the cutting edge. These conditions may represent one extreme. Another extreme would be where the angle at 31 is made a right angle, and the perpendicular in which the center of oscillation would be located, is erected at the middle point of the cutting edge, as indicated at 51. Fig. 1 serves to make plain the cutting results at the extremes mentioned, as well as at points intermediate the extremes.

To aid in guiding the device along a seam, and in spreading the seam so that threads thereof will be taut in preparation for the cutting operation, it is preferred that a pilot be provided in advance of the blade. The pilot member 55, clearly illustrated in Figs. 2 and 3, is disposed centrally of the front face of the device, and diverges upwardly and backwardly from a nose 55a. It is preferably formed integral with the housing 10. The nose 55a preferably lies in alignment with the cutting edge of the blade, so

the pilot member will be most effective in the performance of its guiding and spreading function.

It is advantageous to provide a built-in electrical switch in close proximity to the handle of the device, so operation of the cutting blade may be easily and quickly controlled.

To this end, as well as to facilitate manipulation of the device, the handle is desirably formed as a "pistol-grip," and the control-switch actuator as a "trigger." In the embodiment of Fig. 4, the pistol-grip 56 is of conventional formation, advantageously hollow, and is provided with protruding finger bearings 56a. The electrical cord 57, containing the electrical lead wires 58 and 59, preferably enters the device through the free terminus of the pistol-grip 56, an insulating bushing 60 being fitted therein for that purpose. Electrical terminal pieces 61 and 62 are secured within the hollow of the pistol-grip, conveniently by screws, as shown, certain of the screws serving also as binding means to attach the lead wires 58 and 59 to the respective terminal pieces. Spring-contact portions 61a and 62a, extending from the respective terminal pieces 61 and 62 into spaced, mutually adjacent positions, provide switch elements, operable by means of the trigger 63. Thus, it can be seen that energization of the electro-magnet 64 may be easily and quickly controlled by the index-finger of the hand which holds and guides the device.

Whereas this invention is here illustrated and described with respect to preferred specific embodiments thereof, it should be understood that various changes may be made in those specific embodiments and that various other embodiments of the invention may be constructed by those skilled in the art without departing from the spirit and generic scope of the invention as set forth herein and in the claims which here follow.

Having fully described our invention, what we claim is:

1. A seam ripper, including in combination, a free-swinging blade having a longitudinally extending cutting edge; and electromagnetic means operative to impart a reciprocative draw-cut motion to the said blade along a line that is substantially in alignment with the longitudinal dimension of the said cutting edge.

2. A cutting device, including in combination, a blade having a cutting edge; electromagnetic means operative to impart a draw-cut motion to the said blade whereby the blade is reciprocated lengthwise of the cutting edge; and a housing in which the said blade and the said electromagnetic means are mounted, the said housing having mutually converging wall portions that at least partially define guards extending along the said cutting edge in close proximity thereto.

3. A cutting device, including in combination, a housing; an electromagnet mounted within the housing; an armature suspension comprising an armature portion disposed along a magnetic face of the electromagnet; a foot extending from the armature portion substantially parallel to the axial plane of the electromagnet; a stationary arm; a spring member connecting the armature portion to the stationary arm; a blade depending from the said foot, the said blade having a cutting edge lying in a plane substantially parallel to the said axial plane; and means for energizing the said electromagnet.

4. A seam ripper, including in combination, an electromagnet; an armature operatively asso-

ciated therewith; a blade mounting extending rigidly from the armature in the plane of oscillation thereof; and a blade fixed on the said mounting, the said blade having a cutting edge extending lengthwise thereof and disposed for reciprocation in strokes substantially in alignment with the lengthwise dimension of the said cutting edge.

5 5. A seam ripper, including in combination, a blade having a cutting edge, the said blade being structurally mounted to swing the cutting edge in a path wherealong the cutting edge is constantly free of any other structural member, the said path further, extending lengthwise of the cutting edge; and means operative to reciprocate the said blade along the said path.

6. A seam ripper, characterized by having a cutting edge that is isolated from an associated structural environment, including in combination, a blade of which the said cutting edge is a part; a resilient cantilever mounting disposed to oscillate in a plane and to rigidly carry the blade in the plane of oscillation; a structural environment for supporting the resilient mounting; and means operative to reciprocate the said resilient mounting.

7. A seam ripper according to claim 6, wherein the said resilient mounting has the center of oscillation so located that a draw-cut motion is imparted to the said blade along the cutting edge thereof.

8. A seam ripper according to claim 6, wherein the said resilient mounting has a center of oscillation lying in a perpendicular erected between the extremities of the said cutting edge.

9. A seam ripper according to claim 6, wherein the said resilient mounting has a center of oscillation lying in a perpendicular erected at one extremity of the said cutting edge.

10. A seam ripper, including in combination, an electromagnetic system having a vibrating armature; a blade having a cutting edge fixed in relation to the said armature, the said cutting edge being disposed to define an included angle in conjunction with the plane of the armature, and further, the vertex of the said included angle being located within the limits of the oscillating system; and means operative to reciprocate the armature.

11. A seam ripper according to claim 10, wherein the said included angle is at least greater than a right angle.

12. A seam ripper according to claim 10, wherein guards having hold-down edges flanked by means disposed to tense the surface portions of a textile or similar material, are spaced apart from

and disposed longitudinally on both sides of the said cutting edge.

13. A cutting device, including in combination, a reciprocable member having a cutting edge in substantial alignment with the line of reciprocation, guards spaced apart from and extending longitudinally along the cutting edge; means whereby the guards, when in contact with material having a yielding surface, tend mutually to tense such yielding surface during the reciprocation of the cutting edge; and means operative to impart motion to the reciprocable member.

14. A cutting device according to claim 13, wherein means are included to cause the motion imparted to the said reciprocable member to exercise a draw-cut effect upon the said material when the said cutting device is impressed thereon in the operative position.

15. A cutting device, including in combination, a blade having a cutting edge extending along substantially a right line, means operative to restrict the motion of the blade to a path such that the cutting edge in all positions thereof is kept approximately in alignment with the said right line; guards disposed in spaced relation to the cutting edge on both sides thereof; and means operative to reciprocate the blade along its restricted path.

16. A cutting device according to claim 15, wherein the said guards have hold-down edges adjacent the cutting edge, and side faces flanking the hold-down edges, the said side faces being disposed to slope upwardly and away from the respective hold-down edges.

17. A cutting device according to claim 15, wherein the said blade is restricted to motion such that the cutting edge thereof follows a draw-cut path.

18. A cutting device according to claim 15, wherein a pilot is disposed in advance of said guards.

19. A cutting device according to claim 13, wherein a pilot is disposed in advance of the said blade, and has its nose lying substantially in line with the cutting edge of the blade.

20. A cutting device according to claim 13, wherein a pilot is disposed in advance of the said blade, and has its nose lying substantially in line with the cutting edge of the blade, the body of the pilot diverging upwardly and backwardly from the said nose.

21. A cutting device according to claim 2, wherein a pilot is disposed in advance of said guards.

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