United States Patent

Duffy et al.

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[54] **CUTTING IMPLEMENT OR TOOL WITH BLADE TENSIONING DEVICE**

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[52] **U.S. Cl.**.....**30/228**, 30/268

[51] **Int. Cl.**.....**B26b 15/00**

[58] **Field of Search**.....30/228, 268, 269, 221, 213

[56] **References Cited**

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[57] **ABSTRACT**

A cutting implement or tool, for example, scissors or shears driven by motor means having a stationary cutting blade and a cooperating movable cutting blade and having means for applying pressure to the movable blade for improving the cutting operation and for compensating for spring blade wear. The pressure means preferably consists of a volute spring the lower end of which is located on the shank of the movable blade. The upper end of the spring is preferably held by a screw by which the force of the spring may be adjusted.

7 Claims, 6 Drawing Figures

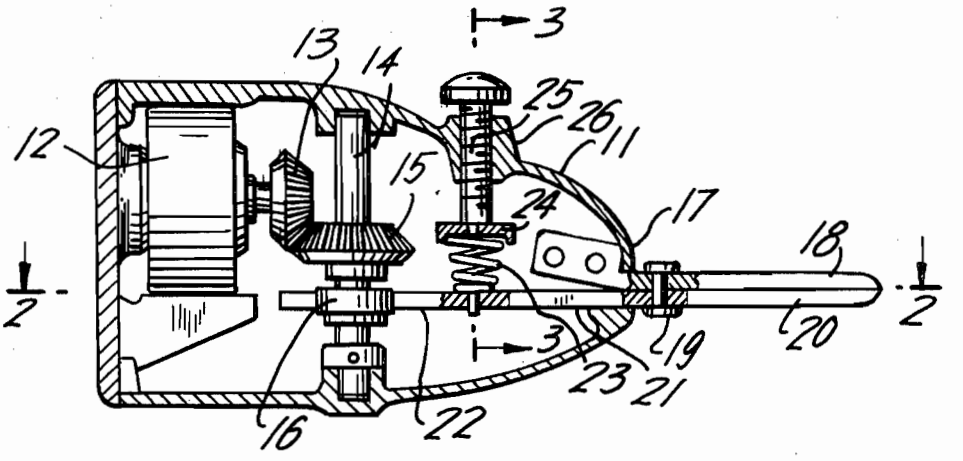


FIG. 1

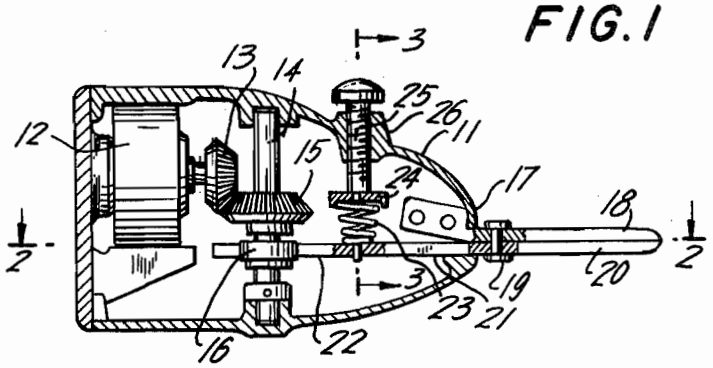


FIG. 3

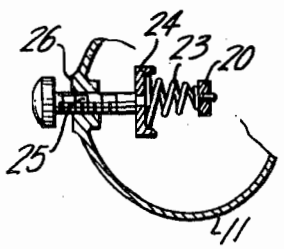


FIG. 2

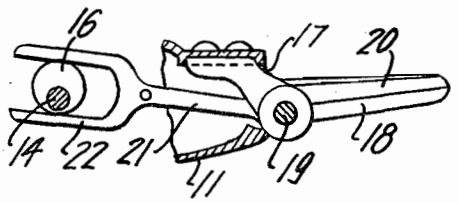


FIG. 5

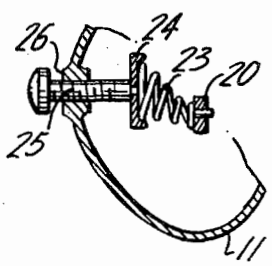
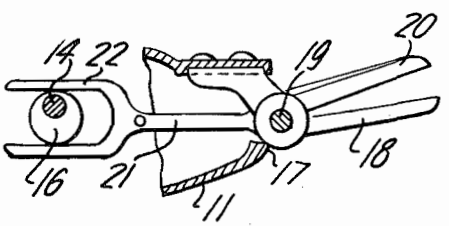


FIG. 4



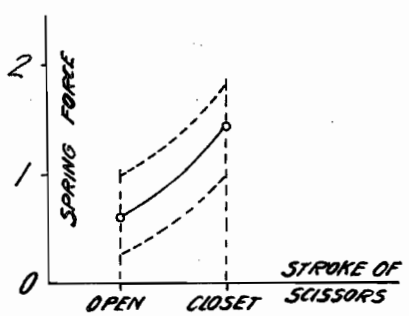


FIG. 6

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CUTTING IMPLEMENT OR TOOL WITH BLADE TENSIONING DEVICE

BACKGROUND OF THE INVENTION

The invention relates to motor-driven cutting tools in general and particularly to electrically driven scissors or shears.

It is obviously feasible to make a pair of scissor blades for electric scissors which have a fixed fulcrum, by carefully fitting the blades together for fairly good operation. Electric scissors are known in which some kind of spring device is used for maintaining constantly proper blade pressure. But all known scissors have springs which apply a constant force which does not vary cyclicly during the operation of the scissors; that is, which applies the same force in the open position of the scissors as in the fully closed position. The blades wear during use and the scissor blades cannot cut properly if their setting is not adjusted from time to time.

It is the purpose of the present invention to improve the foregoing conditions and to provide a cutting implement or tool embodying structural features for achieving these improvements.

SUMMARY

The invention consists in such novel features, construction arrangements, combinations of parts and improvements as may be shown and described in connection with the apparatus herein disclosed by way of example only and as illustrative of a preferred embodiment. The gist of the invention is to position a spring, preferably a volute spring, on the shank of the movable blade in such manner that the center line of the spring is substantially in a 90° relationship to the shank of the blade when the blades are fully closed. In this position the maximum spring force is applied to the movable spring blade when the cutting point of the blades is at the greatest distance from the fulcrum of the blade. When the blades are fully opened, the center of the volute spring is skewed from the 90° position in relation to the shank and thus a minimum spring force is applied to the spring blade, when the cutting point is closest to the fulcrum. The overall force of the spring can be adjusted by compressing the spring more or less by a screw. This is a desirable feature for adjusting the scissors to the various kinds of material to be processed.

Objects and advantages of the invention will be set forth in part hereafter and in part will be obvious herefrom or may be learned by practicing the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

It is an object of this invention to provide an electrically operated scissors which have a spring-loaded movable cutting blade.

Another object of the invention is to provide a spring on the movable blade of a scissors, which is disposed in such manner that a maximum spring force on the movable blade is attained when the cutting point of the blades is farthest away from the fulcrum point of the scissors.

A further object of the invention is to provide a device by which the overall force of the spring can be adjusted.

Various further and more specific purposes, features and advantages will clearly appear from the detailed description given below taken in connection with the accompanying drawing which forms part of this specification and illustrates merely by way of example one embodiment of the device of the invention.

BRIEF DESCRIPTION OF THE DRAWING

In the following description and in the claims, part will be identified by specific names for convenience, but such names are intended to be as generic in their application to similar parts as the art will permit. Like reference characters denote like parts in the figures of the drawing, in which

FIG. **1** shows a vertical section of a motor-driven scissors according to an embodiment of the invention;

FIG. **2** shows, partly broken away, a horizontal section of the scissors, taken along the line **2—2** in FIG. **1**, in the closed position of the scissor blades;

FIG. **3** shows a vertical section of the spring arrangement in the scissors, taken along the line **3—3** in FIG. **1**, in the closed position of the scissor blades as shown in FIG. **2**;

FIG. **4** shows, partly broken away, the horizontal section of the scissors, taken along the line **2—2** in FIG. **1**, in the open position of the scissor blades;

FIG. **5** shows a vertical section of the spring arrangement in the scissors, taken along the line **3—3** in FIG. **1**, in the open position of the scissor blades, as shown in FIG. **4**; and

FIG. **6** shows a graph illustrating the variation of the spring force depending upon the position of the movable blade of the scissors.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in more detail to the drawing illustrating a preferred embodiment by which the invention may be realized, there is shown in FIG. **1** a vertical section of the motor-driven scissors. In the housing **11** of the scissors is an electric motor **12** which has a bevel gear **13** on the shaft of motor **12**. A vertical shaft **14** is journalled in housing **11**. A bevel gear **15** which meshes with bevel gear **13**, is fixed on shaft **14**. An eccentric disk **16** is also fixed on shaft **14**. Near the forward end **17** of housing **11** is a stationary cutting blade **18** firmly attached to housing **11**. A pivot bolt **19** serving as the fulcrum of the movable scissor blade **20** is located on stationary blade **18** near forward end **17**. Movable blade **20** has a rearward extending shank **21** which has a yoke **22** on the end thereof, engaging eccentric disk **16**. Thus, during the rotation of eccentric disk **16** by motor **12** through the intermediate bevel gears **13, 14**, movable blade **20** cooperates with stationary blade **18** for a cutting operation. A helical spring **23**, preferably a volute spring, has one of its ends, positioned on shank **21** and its other end located in a recessed holder or cup **24**. A screw or threaded member **25** is attached to cup **24** and holds it in place. Member **25** threadedly engages threaded bosses **26** on housing **11**. Spring **23** can be compressed or released by tightening or loosening of the screw or threaded member **25**, respectively, for increasing or decreasing, respectively, the spring force acting on movable blade **20**.

When movable blade **20** is oscillated by the action of eccentric disk **16** from the closed position of blades **18, 20** (FIGS. **2, 3**) to the open position thereof (FIGS. **4, 5**), the lower end of spring **23** which engages shank **21** moves therewith, whereas the other end of spring **23** remains fixed or stationary. The center lines of spring **23** and of screw **25** are arranged in such manner that these lines are at right angles with relation to shank **21** when blades **18, 20** are closed. When movable blade **20** is swung to the open position of the shears or scissors, the center line of volute spring **23** becomes inclined with respect to blade **20**. Thus, maximum force of spring **23** is attained at dead center above blade **20**, whereas minimum vertical force of spring **23** is applied to blade **20** when in open position due to the inclination of the spring. Obviously, the cutting force between blades **18, 20** increases as blade **20** is closing on stationary blade **18**, whereas the force decreases toward the fully open position of the blades where a minimum pressure is only required. This may be clearly seen from the characteristic graph in FIG. **6** showing the relationship between force and displacement.

Thus, volute spring **23** is positioned on the movable blade shank **21** so that when the blades **18, 20** are fully closed, the spring (**23**) center is in a 90° relationship with blade shank **21**, and is exercising maximum crossover pressure on the blades at a time when the cutting point is furthest from the blade fulcrum. When the blades are fully opened, the center of volute spring **23** is skewed from the 90° position in relation to the shank, and thus exerts the least crossover pressure on the blades at a time when the cutting point is closest to the blade fulcrum. At intermediate positions, intermediate pressures are applied, because the volute spring **23** is approaching or receding from a 90° relationship with the blade shank.

Whereas, the prior art was directed at achieving a constant spring force on the blades, the present invention by using volute spring means achieves a varying spring force on the blades so that the maximum spring biasing pressure is exerted on the blades when they are approaching the closed position. In this position, the blades have the least leverage since the cutting point is farthest from the blade fulcrum. Conversely, when the blades are at the start of their cut, and the leverage is at its maximum because the fulcrum is quite close to the cutting point, according to the present invention the least biasing force is exerted.

Adjusting screw **25** shown in the drawing permits adjustment of maximum or minimum pressure desired to cut the particular material being processed. This adjusting screw, however, is not necessary for the operation of the cutting tool, (which in the illustrated example, is a pair of shears or scissors), since the compensating feature is automatic, and fixed initial pressure can be built into the device.

While the invention has been described and illustrated with respect to a certain preferred example which gives satisfactory results, it will be understood by those skilled in the art after understanding the principle of the invention, that various other changes and modifications may be made without departing from the spirit of the invention.

What is claimed is:

1. Motor-operated tool comprising a stationary blade member, pivot means on said stationary blade member, a movable blade member swingably disposed on said pivot means, said movable blade member having a shank, motor-driven means for operating said movable blade member from an open position to a close position with relation to said stationary blade member, volute spring means having two end portions, one of said end portions being fixed with relation to said shank and the other of said end portions being connected to said shank in such manner that said spring means is positioned at a right angle to said shank when said movable blade member is in said closed position and is in skew position when said movable blade member is in said open position with relation to said stationary blade member.

2. Motor-operated tool according to claim **1**, and means for holding said one end portion of said spring means in said fixed relation.

3. Motor-operated tool according to claim **2**, said holding mans being adjustable for varying the pressure exerted on said movable blade member.

4. Motor-operated tool according to claim **1**, further comprising a housing, said stationary blade member being connected to said housing, a motor in said housing for said driven means, and means for fixing said one of said end portions of said spring means to said housing.

5. Motor-operated tool comprising a stationary blade member, a movable blade member pivoted with relation to said stationary blade member and cooperable therewith, said movable blade member having a shank, motor-driven means for swinging said movable blade member into successive open and closed positions with respect to said stationery blade member, volute spring means connected between said movable blade member and a fixed position with relation thereto, said spring means being positioned for exerting maximum pressure on said movable blade member against said stationary blade member when said spring is disposed at substantially right angle to said shank when said movable blade member is in closed position, and is in skew position when said movable blade member is in said open position with relation to said stationary blade member.

6. Motor-operated tool according to claim **5**, and means for adjusting the pressure on said movable blade member.

7. Motor-operated tool according to claim **5**, further comprising a housing, said stationary blade member being connected to said housing, a motor in said housing for said driven means, and said fixed position being on said housing.

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