May 30, 1967 M. I. SHEPS 3,322,924

TRANSLATORY MECHANICAL MEMBER WITH MOLDED HINGE PORTION FOR USE IN ELECTRIC SWITCHES AND OTHER APPLICATIONS

Filed March 4, 1965

FIG. 3

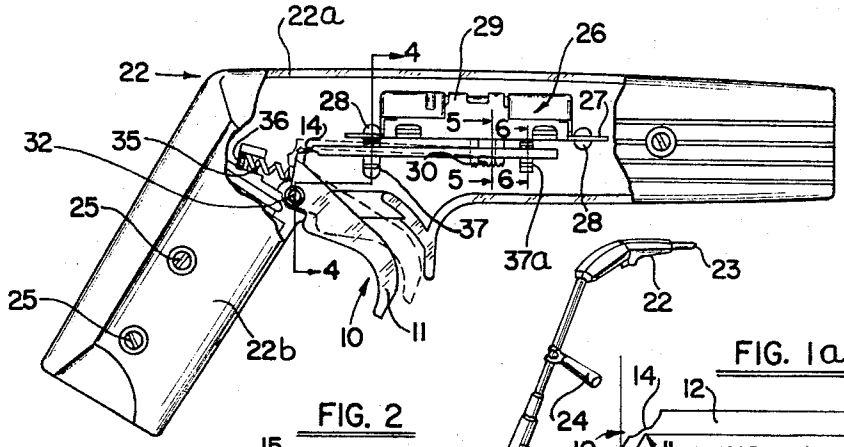


FIG. 2

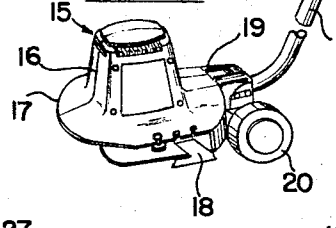


FIG. 1a

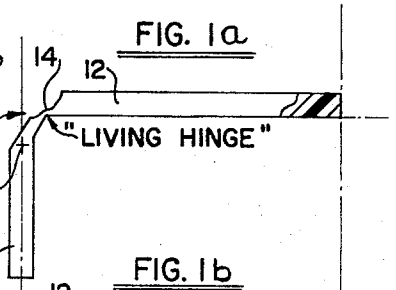


FIG. 1b

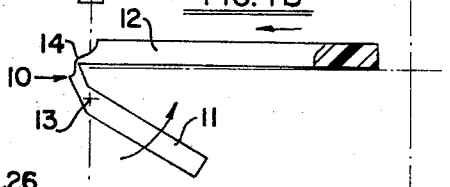


FIG. 4

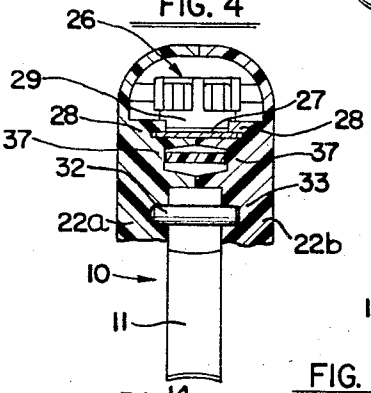


FIG. 5

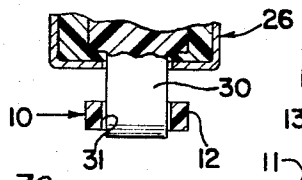


FIG. 1C

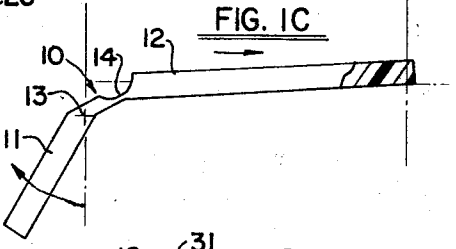


FIG. 7a

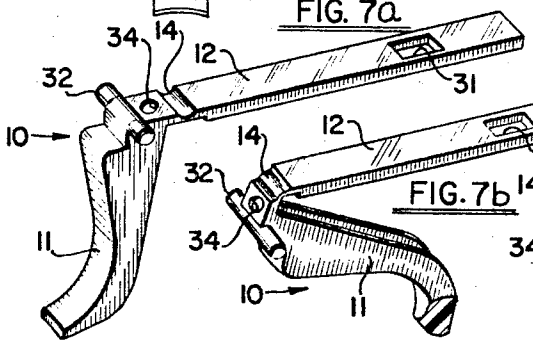


FIG. 7b

FIG. 7C

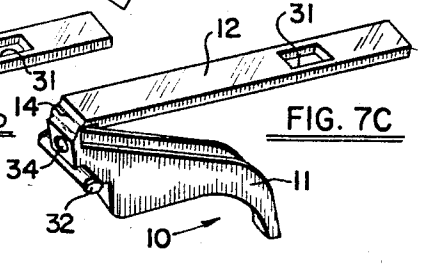


FIG. 6

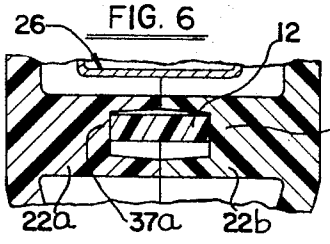
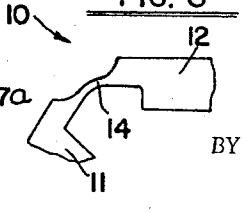


FIG. 8



INVENTOR

MARTIN I. SHEPS

BY Leonard Bloom

ATTORNEY

United States Patent Office 3,322,924 Patented May 30, 1967

3,322,924

TRANSLATORY MECHANICAL MEMBER WITH MOLDED HINGE PORTION FOR USE IN ELECTRIC SWITCHES AND OTHER APPLICATIONS

Martin I. Sheps, Baltimore County, Md., assignor to The Black and Decker Manufacturing Company, Towson, Md., a corporation of Maryland

Filed Mar. 4, 1965, Ser. No. 437,029
5 Claims. (Cl. 200—157)

The present invention relates to a translatory mechanical member which is provided with an integral "living hinge" portion, and more particularly, to a one-piece integrally-formed inherently resilient, yet sufficiently rigid, actuator member whose intermediate "living hinge" portion accommodates a conversion or translation from a limited substantially-pivotal movement into a limited substantially-linear movement. The term "living hinge" is well known in the art to which the invention pertains, and relates to an integrally-molded hinge capable of being flexed through a great number of cycles in the order of 100,000 or so.

Broadly stated, the teachings of the present invention are applicable to a one-piece integrally-formed mechanical member having a degree of inherent resiliency and comprising a translatory first portion, a pivotably-supported actuatable second portion disposed laterally of the first portion and pivoted on a transverse axis, and a "living hinge" portion intermediate the first and second portions, with the intermediate "living hinge" portion being disposed between the pivot point and the translatory first portion of the member, whereby when the second portion is pivoted through an angle in one direction or another about its pivot point, the first portion experiences a limited substantially-linear translation in a general direction which is either towards or away from the pivot point, respectively, with the inherent resiliency of the member, especially in its immediate "living hinge" portion, accommodating the translation of the first portion of the member.

While not necessarily confined thereto, the teachings of the present invention may find more particular utility in the switching means of an electrically-operated device. More specifically, the device is provided with an "on-off" switch, preferably of the sliding-type, and having an actuating element, such as a button, for moving the switch from its "off" position to its "on" position. A one-piece integrally-formed actuator member is provided, and this member is preferably molded and has a degree of inherent resiliency, yet is sufficiently rigid. The member comprises a translatory actuated portion having means engaging the actuated element of the switch, a manually-manipulatable trigger portion integrally formed with the actuator portion of the member, and a "living hinge" portion intermediate the actuator portion and the manually-manipulatable portion. Consequently, when the manually-manipulatable portion of the actuator member is manually engaged, the actuated portion of the member translates substantially linearly and moves the actuated element of the switch into its "on" position; and the inherent resiliency of the actuator member, especially in its intermediate "living hinge" portion, accommodates its translatory movement.

The present invention, therefore, provides an economical conversion of a relatively-inexpensive, yet reliable, standard sliding switch into a trigger switch suitable for use in a wide variety of applications, such as in portable electric tools. The conversion is facilitated by means of the actuator member which may be very economically molded from a suitable plastic material.

In a preferred embodiment, the electrically-operated device has a control handle within which the sliding switch is housed, and the molded actuator member is pivotably supported in the handle adjacent to its intermediate "living hinge" portion. Yieldable means, such as a compression spring, constantly urges the actuator member towards the "off" position of the switch. Preferably, but not necessarily, the handle is split longitudinally into a pair of complementary mating halves which entrap the switch body, and the means to pivotably support the actuator member preferably comprises an integrally-molded pivot pin trapped between the complementary mating halves of the handle. The actuated portion of the member comprises a strap having a recess for receiving the actuated button of the sliding switch. The trigger portion of the actuator member is angularly or transversely disposed in relation to its actuated strap portion; and the trigger portion of the actuator member is bent around in a direction towards the switch, with the handle being formed with a trigger guard portion adjacent to the end of the trigger. Preferably, but not necessarily, the actuator member is integrally molded from polypropylene.

These and other objects of the present invention will become apparent from a reading of the following specification, taken in conjunction with the enclosed drawings, in which:

FIGURE 1*a* is a schematic presentation of the translatory pivotably-supported mechanical member of the present invention with its integral "living hinge" portion formed therein intermediate its actuator portion and its actuated portion;

FIGURE 1*b* corresponds substantially to that of FIGURE 1*a*, but illustrates schematically how a limited substantially pivotal movement of the actuator portion in one direction about the pivot point results in a limited stantially-pivotal movement of the actuator portion in a general direction towards the pivot point as is indicated by the arrows, with the movement of the member being accommodated by means of its inherent resiliency, especially in the formation of its "living hinge" intermediate portion;

FIGURE 1*c* corresponds substantially to FIGURES 1*a* and 1*b*, but illustrates schematically how a limited substantially-pivotal movement of the actuator portion in the opposite direction results in a limited substantially-linear translation of the actuated portion in a general direction away from the pivot point as is indicated by the arrows;

FIGURE 2 is a perspective of a power-operated trimmer-edger for lawns in which the teachings of the present invention may find particular utility;

FIGURE 3 is an enlarged elevation of the control handle of the trimmer-edger shown in FIGURE 2, with part of the housing of the control handle being broken away to illustrate (in elevation) the switching means and the actuator member of the present invention;

FIGURE 4 is a stepped section view, taken along the lines 4—4 of FIGURE 3, and showing the manner in which the actuator member is pivotably supported between the mating halves of the longitudinally-split handle, the manner in which the front of the actuated strap portion of the member is lightly guided between cooperating bosses in the handle, and the manner in which the flanged base portion of the sliding switch is trapped between the mating halves of the split handle;

FIGURE 5 is a detail section view, taken along the lines 5—5 of FIGURE 3, and showing the manner in which the sliding button of the switch is received within an aperture formed in the strap portion of the actuator member;

FIGURE 6 is a detail section view, taken along the lines 6—6 of FIGURE 3, and showing the manner in which the rear of the actuated strap portion is more closely guided or confined by a second pair of cooperating bosses formed in the mating halves of the split handle;

FIGURE 7*a* is a perspective of the molded actuator member of the present invention as it would appear in its finished state;

FIGURE 7*b* is a perspective of the molded actuator member, corresponding substantially to that of FIGURE 6*a*, but showing its approximate position when assembled within the control handle of FIGURE 3;

FIGURE 7*c* is a perspective of the actuator member when it is manually depressed in the "on" position of the switch; and

FIGURE 8 is an enlarged fragmentary elevation of the molded actuator member illustrating the formation of its reduced cross-section intermediate "living hinge" portion.

With reference to FIGURES 1*a*, 1*b*, and 1*c*, there is illustrated an actuator member **10** which preferably is integrally molded from a suitable plastic material, such as polypropylene. The actuator member comprises an actuator portion **11**, an actuated portion **12**, a pivotably-supported portion about a pivot point **13**, and an integrally formed "living hinge" portion **14** of reduced cross-section intermediate the actuator and actuated portions, and preferably, between the pivot point **13** and the actuated portion **12**. As is shown in FIGURE 1*b*, a pivoting of the actuator portion **11** (in a general direction towards the actuated portion **12**) results in a limited substantially-linear translation of the actuated portion **12** in a direction towards the pivot point **13** as is indicated by the arrows. Conversely, as is shown in FIGURE 1*c*, a pivoting of the actuator portion **11** (in generally the opposite direction away from the actuated portion **12**) results in a limited substantially-linear translation of the actuator portion **12** in the opposite direction away from the pivot point **13**. This translatory movement of the actuated portion **12** of the member **10** is accommodated by reason of the degree of inherent resiliency of the member **10**, especially in its reduced intermediate "living hinge" portion **14**; and it will be appreciated that the degree to which the actuated portion **12** is guided or constrained determines, at least in part, the degree to which the translation of the actuated portion becomes substantially linear. The teachings of the present invention, therefore, provide a translatory economically-formed mechanical member having numerous applications; and one such application is illustrated in FIGURES 2 and 3.

With reference to FIGURE 2, there is illustrated a power-operated lawn trimmer-edger machine **15** which generally comprises a motor housing **16**, a peripheral skirt portion **17** which encloses a rotary blade (not shown), a guiding portion **18**, a wheel housing **19** anteriorly of the motor housing, a suitable means (not shown) for pivotably indexing the wheel housing with respect to the motor housing, a pair of wheels carried by the wheel housing, one of the wheels being illustrated as at **20**, an elongated preferably tubular handle extension **21**, an uppermost control handle **22** provided with an electric cord, the cord being shown partially in FIGURE 2 and denoted as at **23**, and an auxiliary handle grip **24** mounted on the handle extension to facilitate the convenient manual control of the machine.

With reference to FIGURE 3, and with further reference to FIGURES 4, 5, and 6, the control handle **22** is preferably formed with a pair of complementary mating halves or portions 22*a* and 22*b* which preferably, but not necessarily, are molded from a suitable plastic material and are secured together by means of a plurality of screws **25**. The control handle **22** houses a sliding-type of electric switch **26**, and the switch **26** is provided with a flanged base portion **27** seated within (and trapped between) a pair of spaced-apart partially-slotted bosses **28**, the cooperating portions of which are molded integrally within the mating halves of the control handle. The electric switch **26** is further provided with a main body portion **29** and an actuated element comprising a sliding button **30**. The electrical connections from the cord **23** to and through the switch **26**, as well as the mechanical details of the switch itself, form no part of the present invention, and hence have been omitted for clarity of understanding.

With further reference to FIGURES 7*a*, 7*b*, and 7*c*, the molded plastic actuator member **10** has its actuator portion **11** formed as a curved trigger for a convenient manually-manipulation thereof, with the trigger preferably having a U-shaped cross-section for reasons of strength and to conserve material. The actuated portion **12** of the member **10** preferably comprises an oblong strap having an aperture **31** which engages, see FIGURES 3 and 5, the button **30** of the switch **26**. Furthermore, the actuator member **10** preferably has an integrally-molded pin **32**, which, see FIGURES 3 and 4, is trapped between cooperating mating bosses **33** formed in the complementary halves of the longitudinally-split control handle, thereby trapping the actuator member **10** within the control handle. The actuator member **10** has a recessed pocket **34**, see FIGURE 7*a*, which seats one end of a compression spring **35**, the opposite end of which is seated within a boss **36** formed in the control handle, thereby urging the actuator member and the switch into the normal "off" position of the switch. The alternate position of the trigger of the actuator member (and of the switch button) are illustrated by the broken lines in FIGURE 3. The strap portion **12** of the actuator member **10** is guided within a pair of spaced-apart U-shaped bosses **37** and **37***a*, the cooperating portions of which are formed in the complementary mating halves **22***a* and **22***b* of the split handle. Preferably, the front U-shaped boss **37** has a wider opening than the rear boss **37***a*, such that the rear portion of the actuated strap is more closely guided or confined than its front portion.

The particular formation of the integral reduced cross-section "living hinge" portion **14** of the preferred embodiment is shown in FIGURE 8. Obviously, other formations of the "living hinge," as well as other means for deriving the required "plastic memory" quality of the hinge, are equally applicable to the teachings of the present invention.

Obviously, many modifications may be made without departing from the basic spirit of the present invention; and accordingly, within the scope of the appended claims, the invention may be practiced other than has been specifically described.

I claim:

1. In an electric tool or appliance, the combination of:

(a) a handle having an aperture formed therein;

(b) an electric switch housed completely within the tool, isolated from exposure externally of the tool, and having alternate "on" and "off" positions; and

(c) a switch actuator member mounted within the handle, the actuator member being molded from a plastic material having a degree of inherent resiliency, and comprising:

(1) trigger portion protruding through the aperture in the handle;

(2) a translatory actuator portion operatively connected with the switch for actuating the same between its alternate positions; and

(3) an intermediate portion joining the trigger and actuator portions;

(d) whereby inward depression of the trigger within the handle causes a responsive movement of the actuator portion within the handle and thereby moves the switch into its "on" position; and

(e) whereby, during said movement, the intermediate portion of the actuator member flexes due to the inherent resiliency of its material;

(f) thereby providing for economical trigger operation of the tool by facilitating the use of a relatively inexpensive switch.

2. The combination of claim **1**, wherein:

(a) said switch has a limited sliding switch movement;

(b) said trigger is pivotably mounted within the handle, adjacent to its intermediate portion, and has a limited rotary movement; and

(c) said intermediate portion of said actuator member is molded integrally with said other portions, constitutes a "living hinge," and converts the limited rotary movement of the pivoted trigger into the limited sliding movement of the switch.

3. The combination of claim 1, wherein:

(a) said handle is split longitudinally and comprises a pair of complementary mating halves molded from a plastic material; and wherein:

(b) said switch and said actuator member are both trapped between said plastic halves.

4. A mechanical member for translating a limited substantially-pivotal movement into a limited substantially-linear movement, which comprises:

(a) a one-piece integrally-formed member having a degree of inherent resiliency and including:

(1) a first portion;

(2) a second portion; and

(3) a "living hinge" portion of reduced cross-section intermediate said first and second portions;

(b) said first portion being pivoted at a fixed point approximately adjacent to said intermediate "living hinge" portion;

(c) whereby, when said first portion is pivoted through an angle in a direction towards said second portion, said second portion experiences a limited substantially-linear translation in a general direction towards said pivot point; and

(d) whereby the inherent resiliency of said member, especially in said intermediate "living hinge" portion thereof, accommodates the translation of said first portion of said member.

5. A mechanical member for translating a limited substantially-pivotal movement into a limited substantially-linear movement, which comprises:

(a) a one-piece integrally-formed member having a degree of inherent resiliency and including:

(1) a translatory first portion;

(2) a pivotably-supported actuatable second portion disposed transversely of said first portion; and

(3) a "living hinge" portion intermediate said first and second portions;

(b) whereby, when said second portion is pivoted through an angle in one direction about its fixed pivot point, said first portion experiences a limited substantially-linear translation in a general direction towards the pivot point; and

(c) whereby, when said second portion is pivoted through an angle in the opposite direction, said first portion experiences a limited substantially-linear translation in a general direction away from the pivot point; and

(d) whereby the inherent resiliency of said member, especially in said intermediate "living hinge" portion thereof, accommodates the translations of said first portion of said member.

References Cited

UNITED STATES PATENTS

1,245,860	11/1917	Black et al.	200—157
1,703,988	3/1929	Cameron	200—157
2,668,456	2/1954	Meistrell	74—503
2,687,157	8/1954	Cowan	150—0.5
2,844,697	1/1956	Emmerson	200—157 X
2,947,840	8/1960	Park et al.	200—160
3,240,077	3/1966	Smith	74—40 X

ROBERT K. SCHAEFER, *Primary Examiner.*

H. HOHAUSER, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,322,924 May 30, 1967

Martin I. Sheps

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 34,for "stantially-pivotal movement of the actuator portion in" read -- substantially-linear translation of the actuated portion in --; column 4, line 57, after "(1)" insert -- A --.

Signed and sealed this 30th day of July 1968.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents