United States Patent [19]

Selinder et al.

[11] **3,925,842**

[45] **Dec. 16, 1975**

[54] **POWER ERASER**

[75] Inventors: **Bjorn P. Selinder; Bo Eric Selinder,** both of San Pedro, Calif.

[73] Assignee: **Semo Incorporated,** Fallon, N.Y.

[22] Filed: **Feb. 21, 1975**

[21] Appl. No.: **551,594**

Related U.S. Application Data

[63] Continuation of Ser. No. 403,679, Oct. 4, 1973, abandoned.

[52] **U.S. Cl.** **15/3.53;** 310/30

[51] **Int. Cl.** **H02k 33/02**

[58] **Field of Search** ..... 15/3.53, 22 A, 22 R; 310/17, 19, 30, 32, 34, 35, 33, 23, 24, 29, 20, 28, 26, 27; 51/170 TL, 59 SS

[56] **References Cited**

UNITED STATES PATENTS

1,661,111	2/1928	Coy	51/170 TL
1,718,147	6/1929	Herrmann et al.	310/32 X
1,954,575	4/1934	Pearson	310/35 X
2,343,237	3/1944	McElroy et al.	15/3.53
2,561,355	7/1951	Fish	310/17 X
2,568,757	9/1951	Mesh	310/30
2,734,139	2/1956	Murphy	310/29
2,831,132	4/1958	Jackson	310/26
3,435,300	3/1969	Sato	310/29 X
3,774,255	11/1973	Pao	15/3.53

Primary Examiner—Donovan F. Duggan

Attorney, Agent, or Firm—Christie, Parker & Hale

[57] **ABSTRACT**

An electrical eraser having a linearly reciprocating drive for oscillating an elongated erasing element along its longitudinal axis. This motion of the element provides fast erasing action with minimum abrasion or fraying of paper.

9 Claims, 4 Drawing Figures

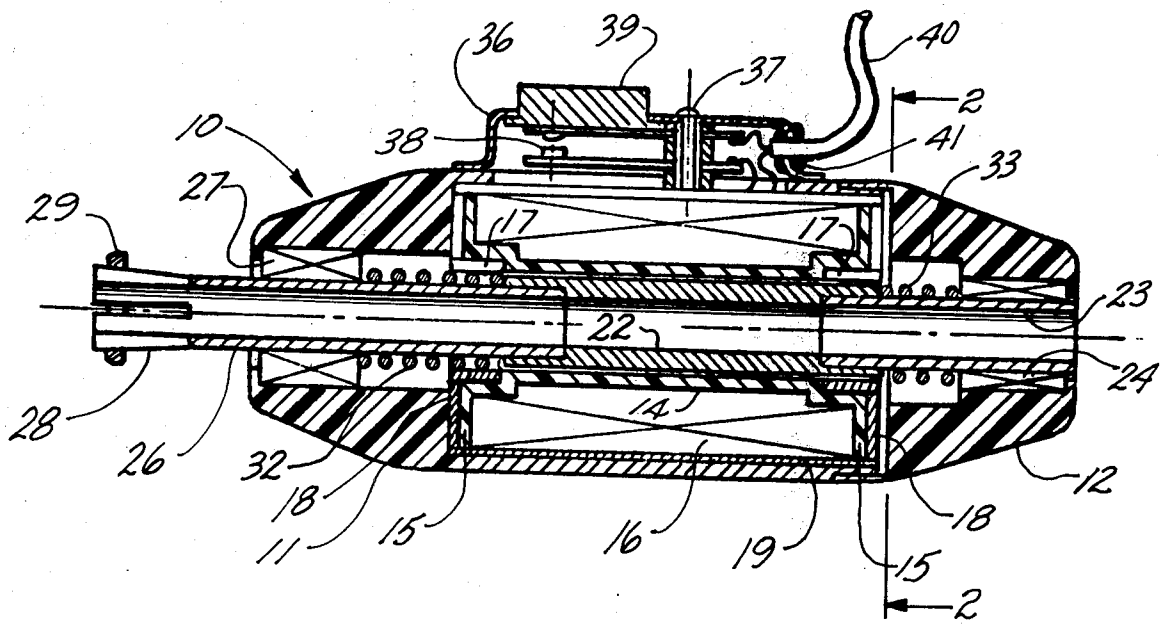


Fig. 1

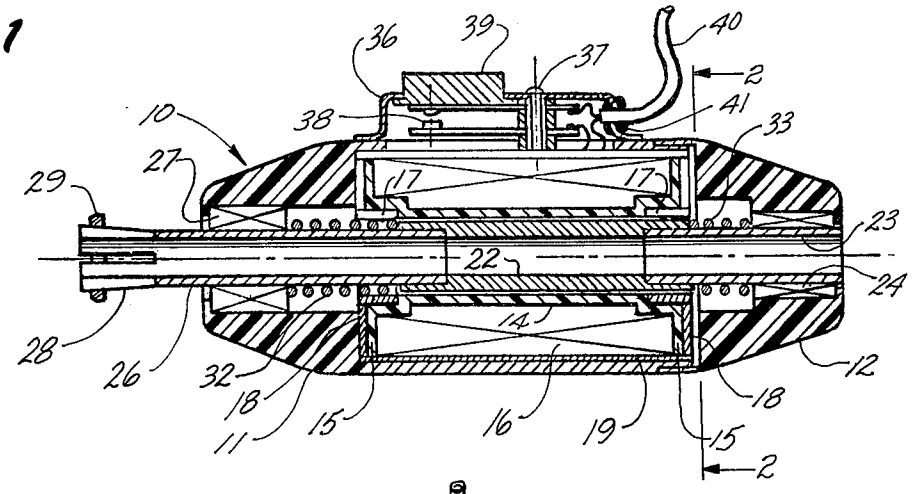


Fig. 2

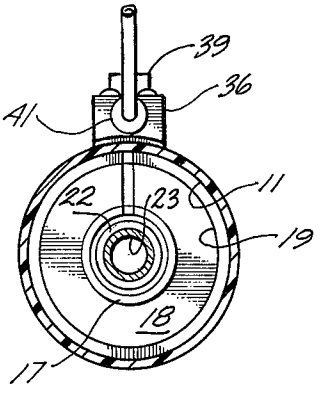


Fig. 3

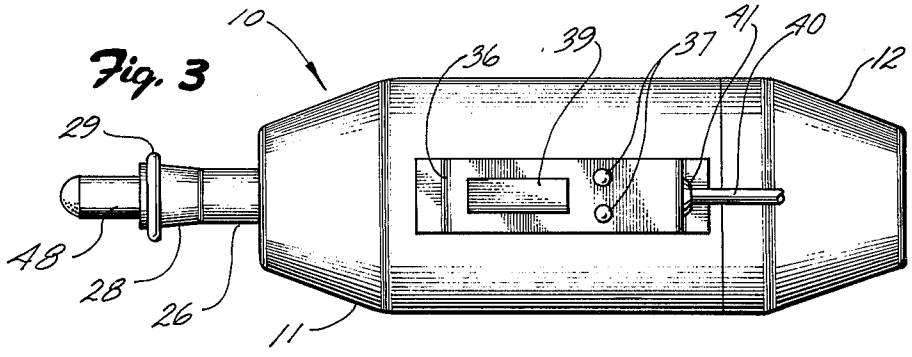
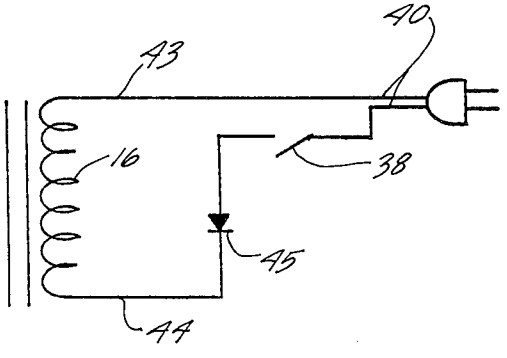


Fig. 4



POWER ERASER

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation of application Ser. No. 403,679, filed Oct. 4, 1973, now abandoned.

BACKGROUND OF THE INVENTION

Conventional electrically operated power erasers use a motor to rotate an erasing element. Another form of a power eraser uses an electromechanical drive which laterally vibrates the tip of an erasing element to simulate the back-and-forth scrubbing action of manual erasing. These known styles of power erasers are satisfactory in some respects, but provide a slow erasing action and must be used with care to avoid burning or tearing of the paper or other material bearing the marks being erased.

We have found that improved erasing action results from driving the erasing element in a linearly reciprocating motion. This motion can be generated by an electromagnetic drive system supported in a compact handheld casing or housing. This unit is simple and economical to construct and maintain, and easier to hold steadily during use than the rotary- or lateral-drive erasers which are awkwardly shaped and impart annoying reaction forces to the user's hand. A high surface speed of the erasing element against the paper provides rapid erasing action which is easily controlled by the user to minimize scuffing or burning of the paper.

SUMMARY OF THE INVENTION

Briefly stated, the power eraser of this invention includes a hollow housing, a chuck means such as a collet for holding an elongated eraser element, and a linearly reciprocating drive means secured within the housing and to the chuck means for oscillating the chuck means and eraser element along the longitudinal axis of the eraser element. In a presently preferred form, the drive means includes a hollow coil supported in the housing, connection means coupled to the coil for electrically energizing the coil, and a magnetic core positioned within the coil to be oscillated thereby, the core being secured to the chuck means.

Preferably, the connection means includes a rectifying diode and a switch connected in series with the coil, and the core is supported within the coil by a pair of springs of unequal spring rate. The housing is preferably formed by a hollow, generally cylindrical casing extending around the coil, and an end closure cap secured to the casing. A field-concentrating ferrous shell extends over outer surfaces of the coil, and a pair of non-ferrous support tubes (one of which carries the eraser chuck) extend from opposite ends of the core to be journaled through bearings mounted in the housing.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side sectional elevation of a power eraser according to the invention;

FIG. 2 is a sectional end view of the power eraser on line 2—2 of FIG. 1;

FIG. 3 is a top view of the eraser; and

FIG. 4 is a schematic diagram showing electrical components in the eraser.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1–3, a power eraser 10 according to the invention includes a hollow, generally cylindrical housing having a main casing 11. An end cap 12 is fitted over and cemented or otherwise secured to the rear end of the casing. The casing and end cap are preferably injection molded from polycarbonate plastic.

A coil assembly makes a press fit within main casing 11, and includes a tubular plastic bobbin 14 with end flanges 15. A coil 16 is wound on bobbin 14 between the end flanges, and is preferably about 4,000 turns of No. 30 enameled copper wire.

A pair of split rings 17 are press-fitted in opposite ends of bobbin 14, and the rings extend slightly beyond end flanges 15. A split washer 18 is brazed to the protruding end of each split ring 17, and the washer fits against and is co-extensive with the adjacent bobbin end flange. A split tubular sleeve 19 is press-fitted over the coil and extends over and between split washers 18 at opposite ends of the coil bobbin.

The purpose of split rings 17, washers 18, and sleeve 19 is to concentrate the magnetic field generated by the coil when it is electrically energized. These components are made of a ferrous material such as Armco magnetic-grade iron. The split portions of these components are radially aligned with each other (in, for example, a 12 o'clock position as shown in FIG. 2) to increase efficiency of the magnetic circuit.

An armature assembly is fitted within the housing of the power eraser, and includes a ferrous tubular core 22 (Armco magnetic-grade iron is a suitable material) which makes a loose slip fit within bobbin 14. A non-ferrous end tube 23 is secured to the rear end of core 22, and extends toward the rear end of cap 12 where it is supported by a sleeve bearing 24.

A tubular non-ferrous collet 26 is secured to the front end of core 22, and extends forwardly through the front end of main casing 11 where it is supported by a second sleeve bearing 27. The collet is of conventional construction, and includes a slotted and outwardly flared forward end 28 with a locking ring 29. End tube 23 and collet 26 are preferably made of aluminum or stainless steel. An acetyl-resin plastic as sold under the trademark Delrin is suitable for sleeve bearings 24 and 27.

A front coil spring 32 is loosely fitted around collet 26, and extends within casing 11 between the rear face of bearing 27 and the front face of core 22. A rear coil spring 33 is similarly fitted around end tube 23 to extend between the rear end of core 22 and the forward end of bearing 24.

As shown in FIG. 1, the front spring has more turns than the rear spring, providing a relatively low spring rate opposing forward motion of the core. The springs position and support the core within the coil assembly, and the unbalance in restoring force generated by the unequal springs produces a somewhat longer vibratory stroke of the armature assembly.

A switch housing 36 is secured by fasteners 37 to the top of casing 11, and a single-pole single-throw switch 38 of conventional construction is mounted within the housing. A knob 39 is secured to one leaf of switch 38 and extends through an opening in the switch housing. A power cord 40 for connection to a conventional 60-cycle A-C source extends through a grommet 41 in the back of switch housing 36.

Referring to the wiring diagram in FIG. 4, one lead 43 from coil 16 is connected directly to power cord 40. A second lead 44 from the coil is connected to the cathode of a diode 45 (a type 1N4004 diode is suitable). The anode of the diode is in turn connected to one side of switch 38, and the other side of the switch is connected to the second lead of power cord 40. The diode is not shown in FIG. 1, but is mounted in switch housing 36 adjacent switch 38.

The use of a rectifying diode in series with the eraser drive coil is preferred because we have found that this circuitry minimizes heat generated by the coil, and keeps the eraser from becoming uncomfortably warm during extended use. The diode also provides a somewhat longer armature stroke for improved erasing performance.

In operation, a rod-shaped eraser element 48 (FIG. 3) is slipped into collet 26, and locked in place by sliding locking ring 29 toward forward end 28 to compress the collet against the element. The inside diameter of the collet and core 22 is slightly more than ¼ inch to accommodate erasing elements of this size commonly sold for use with rotary erasers. It is thus unnecessary to provide a special or non-standard erasing element for eraser 10.

After the erasing element is secured in place, coil 16 is energized by depressing knob 39 to close switch 38. The magnetic field generated by the coil oscillates core 22 and the components secured thereto including eraser element 48. A peak-to-peak vibratory stroke of about ⅛ inch is achieved in a typical unit.

The linearly reciprocating eraser element is then urged against a sheet bearing a mark which is to be erased. Eraser 10 is easy to control because there are no gyroscopic or rotary forces imparted to the user's hand, and it does not tend to skip or jump laterally when pressure is applied. The 3600 stroke per minute oscillatory rate which results from driving the coil with 60-cycle current provides a smooth and effective erasing action, but with much less tendency to burn or abrade the paper surface as compared to conventional rotary erasers.

When the eraser is being used on soft high-friction paper surfaces, a soft rearward kick or thump warns the user if excessive pressure is being applied, and thereby avoids gouging of the sheet. This warning thump is not apparent when the eraser is used with very smooth low-friction sheets where the danger of damaging the surface is minimal.

There has been described a power eraser which is simply constructed from a few inexpensive parts, and yet provides superior erasing action through use of a linear reciprocating drive for the erasing element.

We claim:

1. A power eraser comprising:

a housing;

a chuck means adapted to hold an elongated rod-shaped eraser element;

an elongated eraser element secured in and extending from the chuck means, the eraser element being of a type specifically adapted for removing marks from paper and the like; and

linearly reciprocating drive means secured to the housing and to the chuck means for oscillating the chuck means and eraser element along the longitudinal axis of the eraser element, the chuck means being substantially free of movement lateral to the eraser-element axis.

2. The power eraser defined in claim 1 wherein the drive means includes a hollow coil supported in the housing, connection means coupled to the coil for electrically energizing the coil, and a magnetic core positioned within the coil to be driven by and movable with respect to the coil, the core being secured to the chuck means.

3. The power eraser defined in claim 2 wherein the connection means includes a rectifier connected in series with the coil.

4. The power eraser defined in claim 2 wherein the drive means further includes a pair of springs bearing on opposite ends of the core and supported within the housing.

5. The power eraser defined in claim 4 wherein the springs are coil springs of unequal spring rate, the spring of lower spring rate being positioned between the chuck means and magnetic core.

6. The power eraser defined in claim 2 and further comprising a hollow bobbin supporting the coil and surrounding the core, a pair of split ferrous rings secured in opposite ends of the bobbin, a pair of split ferrous disks secured to the rings and extending over end faces of the bobbin, and a split ferrous sleeve extending between the split disks around the coil, the rings, disks and sleeve having split portions which are radially aligned.

7. The power eraser defined in claim 2 wherein the housing comprises a hollow casing extending around the coil, and an end cap secured to the casing, the casing and end cap each supporting a respective bearing, and further comprising a pair of non-ferrous tubes secured to opposite ends of the core and extending through and supported for linear reciprocating movement by the respective bearings, the chuck means being disposed at the outer end of one of the tubes.

8. The power eraser defined in claim 7 and further comprising a field-concentrating ferrous shell extending around outer surfaces of the coil, a diode, and a switch in series connection with the diode and coil, and wherein the drive means further includes a pair of springs of unequal spring rate positioned within the housing at opposite ends of the core for resiliently supporting the core for longitudinal movement with respect to the coil.

9. The power eraser defined in claim 2 wherein the core and chuck means are coaxially aligned hollow tubes whereby the elongated eraser element can extend through the chuck means into the core.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,925,842

DATED : December 16, 1975

INVENTOR(S) : Bjorn P. Selinder and Bo Eric Selinder

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover page, line [73], "N.Y." should read -- Nevada --.

Signed and Sealed this

sixth Day of *April 1976*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,925,842

DATED : December 16, 1975

INVENTOR(S) : Bjorn P. Selinder and Bo Eric Selinder

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover page, line [73], "N.Y." should read -- Nevada --.

Signed and Sealed this

sixth Day of *April 1976*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks