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COPYING AND REPRODUCING DEVICE

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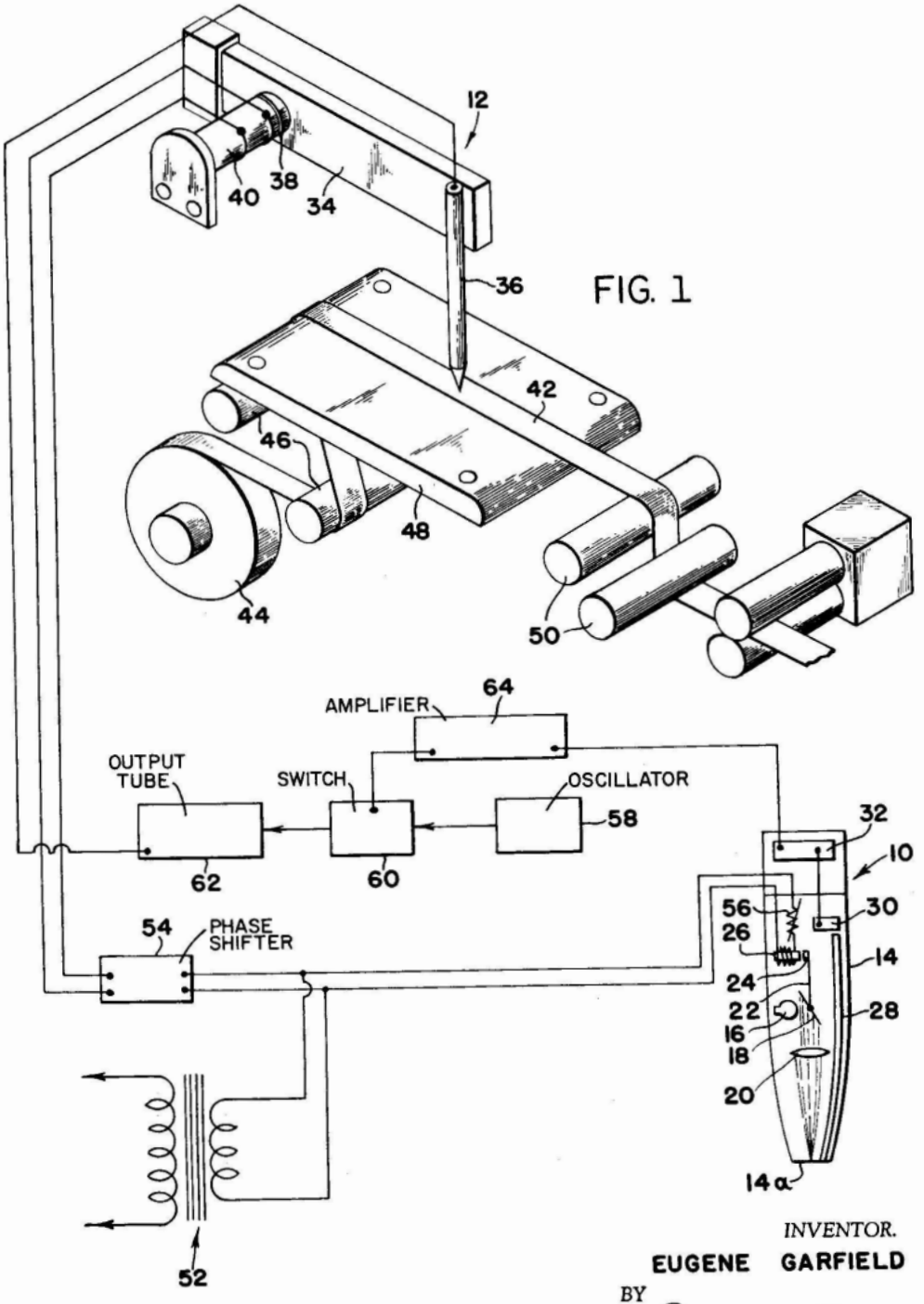

FIG. 1

INVENTOR.

EUGENE GARFIELD

BY Arthur H. Seidel

ATTORNEY

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COPYING AND REPRODUCING DEVICE

Eugene Garfield, Woodbury, N.J.
(1523 Spring Garden St., Philadelphia, Pa.)

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This invention relates to a device for copying and reproducing printed or written matter such as letters, characters, words, phrases, sentences or short paragraphs. More particularly it relates to a device for copying and reproducing printed matter, the copying portion of which is small enough to be manually portable so that it can be used anywhere desired.

It is often desirable to copy and reproduce printed matter from books and the like. This is particularly desirable for such professions as technical or other types of researchers, lawyers and statisticians who review books, files and other literature and must copy pertinent parts thereof, such as words, phrases, sentences or even paragraphs. Copying by hand, particularly if there is any quantity of material to copy, is tedious and time consuming. There are presently available many types of photocopying machines. However, such machines are relatively large. Therefore, the material to be copied must be taken to the machine which takes time so that the material is not available to others who may want to use it. This is particularly troublesome in libraries where considerable amount of research takes place. Furthermore, such machines copy whole pages which is wasteful when many times only small portions of a page are required and many of such machines, especially the smaller and less expensive ones, will copy only loose pages and not pages from a bound volume. In addition such machines being mainly photocopying machines, require special paper to make a negative of the copy and other special paper for the final reproductions so that the operation of the machines becomes relatively expensive.

It is therefore an object of this invention to provide a device for copying and reproducing printed or written matter whether it be only letters, characters, words, phrases, sentences, paragraphs or whole pages.

It is another object of this invention to provide a device for copying and reproducing printed or written matter which permits the copying to be done at one location and the reproduction done at a different location.

It is still another object of this invention to provide a device for copying and reproducing printed or written matter, the copying portion of which is small enough to be manually portable so that it can be used anywhere desired.

It is a further object of this invention to provide a device for copying and reproducing printed or written matter which is fast and relatively inexpensive to operate.

Other of the objects will appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIGURE 1 is a schematic representation of the device of this invention.

Referring to the drawing the copying and reproducing device of this invention comprises in general a scanning or copying instrument, generally designated **10**, a reproducing instrument, generally designated **12**, and an electrical circuit connecting the scanning instrument **10** to the reproducing instrument **12** to operate them and transmit the information from one to the other.

The scanning or copying instrument **10** comprises a substantially rectangular casing **14** having an open end **14***a* and which is small enough to be held in the hand. Within casing **14** is a small light bulb **16** or other source of light operated from a D.C. source of electrical current, such as a dry cell battery, not shown. Light bulb **16** directs the beam of light onto a pivotally mounted mirror **18** which in turn reflects the light through a lens **20** to the open end **14***a* of casing **14**. Lens **20** is shaped to form the beam of light into a fine point at the casing's open end **14***a*. An armature **22** extends from mirror **18** and has a permanent magnet contact **24** attached to its end. An electromagnet **26** is mounted in casing **14** with one end of its core adjacent magnet contact **24**. An elongated clear Lucite rod **28** is mounted in casing **14** and extends from the casing's open end **14***a* to a photoelectric cell, designated at **30**. A single stage amplifier, designated at **32**, is electrically connected to the photoelectric cell to amplify the output of the cell to a usable level.

The reproducing instrument **12** comprises a bar **34** of spring material rigidly supported at one end and dimensioned to resonate at **60** cycles. A stylus **36** of an electrically conductive metal is fastened to but insulated from the other end of bar **34**. A permanent magnet **38** is attached to bar **34** near its fixed end and an electromagnet **40** is fixedly mounted adjacent the permanent magnet **38**. A strip **42** of recording paper is drawn from a supply reel **44** over tensioning guides **46—46** and across a backing plate **48** where it passes beneath stylus **36**. The paper strip **42** then passs over additional tensioning guides **50—50** to a power driven take-up reel, not shown.

Electromagnet **26** of scanning instrument **10** and electromagnet **40** of reproducing instrument **12** are both connected through transformer **52** to a standard 60 cycle power supply. A phase shifter, diagrammatically shown at **54**, is connected between the electromagnet **40** of reproducing instrument **12** and transformer **52**. A rheostat **56** is provided in scanning instrument **10** in the connection between electromagnet **26** and transformer **52**. A 50 kc. oscillator **58** is connected to stylus **36** through an electronic switch circuit **60** and an output tube **62** to provide a high voltage to the stylus **36**. The scanning instrument amplifier **32** is connected to a second amplifier, designated at **64** which is connected to the electronic switch **60**.

The device of this invention operates as follows:

Scanning instrument **10** is held with the open end **14***a* of casing **14** over the printed matter to be copied. The light from bulb **16** is reflected from mirror **18** through lens **20** as a fine point onto the page of the printed matter. If the light shines onto an unprinted portion of the page the light is reflected off of the white page. The Lucite rod **28** picks up the reflected light and transmits it to the photoelectric cell **30**. When the light shines on photoelectric cell **30** a current is produced by the cell which is amplified by amplifiers **32** and **64** to operate electronic switching circuit **60**. The current from photoelectric cell **30** causes the electronic switch **60** to be turned to its off position to prevent any current from passing from oscillator **58** to stylus **36**. When the light from bulb **16** shines on a printed portion of the sheet the light is not reflected from the dark printed matter. In this case there is no current given off by the photoelectric cell **30** to cause switch **60** to be turned off. Thus, the high voltage current will pass from oscillator **58** to stylus **36**. Stylus **36** rides lightly on the paper strip **42** which is an electrosensitive paper, such as teledeltos paper, so that when the high voltage is applied to the stylus **36** a mark

will be made on the paper strip **42**. Thus a printed mark on the page being copied produces a corresponding mark on the paper strip **42**.

The scanning instrument electromagnet **26** being energized by the 60 cycle current causes mirror armature **22** to vibrate at 60 cycles. This in turn oscillates mirror **18** to cause the light beam to swing back and forth across the open end **14***a* of casing **14**. Thus, the beam of light will scan the entire height of a line of printing on the page to be copied. The amplitude of the sweep of the light beam is adjusted by rheostat **56** to accept various size printing. Reproducing instrument bar **34** is similarly vibrated at 60 cycles by electromagnet **40** and magnet **38** so that stylus **36** sweeps across paper strip **42** in synchronism with the scanning instrument light beam. Phase shifter **54** is provided to adjust the phase relation between the movement of stylus **36** and the scanning instrument light beam to account for the time delay between the pick-up of the reflected light from the page being copied and the receiving of a signal by the stylus **36**. Paper strip **42** is pulled under stylus **36** by a power driven take-up, not shown, and scanning instrument **10** is moved by hand along the line of printed matter at the same speed as the paper strip moves. If desired, the motion of the operator's hand can be synchronized with the power drive of the paper strip take-up by use of any well known type solenoid devices. Scanning instrument **10** can be provided with a switch to start and stop the movement of the paper strip. Thus, as the scanning instrument **10** is moved along the line of printed matter, the oscillating mirror **18** moves the beam of light across the height of the printed matter so that the light sweeps across the entire area of the line of the printed matter. Likewise, the stylus **36** moves across the moving strip of paper **42** to cover the same area as the light beam. Therefore, since a high voltage signal is supplied to the stylus **36** when the light beam sweeps across printed matter so as to provide a mark on the paper strip **42**, the marks will take the same shape and configuration as the printed matter being copied. Thus the printed matter will be identically reproduced on the paper strip **42**.

Since scanning instrument **10** is small enough to be carried in the hand and is connected to the reproducing instrument **12** merely by electrical wiring, the reproducing instrument **12** and the electronic circuitry can be located at one place and the scanning instrument **10** carried to a different location to be used. For example, in a library the reproducing instrument **12** and the electronic circuitry can be located at a central position and connected to a plurality of outlet plugs located at various places throughout the library. When a person desires to copy something from a book or magazine or the like, he merely plugs a scanning instrument into the nearest outlet and moves the scanning instrument over the printed matter to be copied. The person can thereby move from place to place throughout the library and copy any desired printed matter at any location. When the person has completed his work he returns to the location of the reproducing instrument **12** and cuts off the strip containing the reproduced printed matter. This strip can be cut into short lengths and attached to a sheet of paper or cards so as to be more easily readable. Thus one can copy any printed matter from a single word to a whole page easily and quickly. Since the scanning instrument can be carried to the matter to be copied, there is no time lost carrying the books to the copying machine and back to the shelves. Also, since the books are not taken away from the shelves they are always available. Furthermore, the reproduction takes place almost simultaneously with the copying so the copying operation is much quicker than with photocopying machines which require some type of chemical development of the reproduction.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A copying and reproducing machine comprising the combination of a portable scanning instrument including a casing open at one end, means in said casing for producing a fine point of light at said open end, means to sweep said light across the open end of said casing, a photoelectric cell in said casing and means to transmit reflections from said light to said photoelectric cell to produce an electric signal; a reproducing instrument including a bar, a stylus attached to said bar, and means to vibrate said bar; means operating said light sweeping means and said bar vibrating means at the same frequency; a source of high voltage electrical current connected to said stylus; and means operated by the electric signal from said photoelectric cell to cut off the current to said stylus.

2. A copying and reproducing machine comprising the combination of a portable scanning instrument including a casing open at one end, a source of light within and fixed with respect to said casing, a pivotable mirror within said casing for reflecting said light through a lens to the open end of the casing, means in said casing for oscillating said mirror to sweep said light as a fine point across the open end of said casing, a photoelectric cell in said casing and means to transmit reflections from said light to said photoelectric cell to produce an electric signal; a reproducing instrument including a bar, a stylus attached to said bar, and means to vibrate said bar; means operating said mirror oscillating means and said bar vibrating means at the same frequency; a source of high voltage electrical current connected to said stylus; and means operated by the electric signal from said photoelectric cell to cut off the current to said stylus.

3. The combination as set forth in claim 2 in which the mirror oscillating means comprises an armature extending from the mirror and an electromagnet adjacent said armature; the bar vibrating means comprises a permanent magnet attached to said bar and an electromagnet adjacent said permanent magnet; and the means for operating said mirror oscillating means and said bar vibrating means comprises a common source of A.C. current connected to both said electromagnets.

4. A copying and reproducing machine comprising the combination of a portable scanning instrument including a casing open at one end, a source of light within and fixed with respect to said casing, a pivotable mirror within said casing for reflecting said light through a lens to the open end of said casing, means in said casing for oscillating said mirror to sweep said light as a fine point across the open end of said casing, a photoelectric cell in said casing and means to transmit reflections from said light to said photoelectric cell to produce an electric signal; a reproducing instrument including a bar fixedly supported at one end, a stylus attached to the other end of said bar, and means to vibrate said bar; means operating said mirror oscillating means and said bar vibrating means at the same frequency; a source of high voltage electrical current connected to said stylus; and means operated by the electric signal from said photoelectric cell to cut off the current to said stylus.

5. The combination as set forth in claim 4 in which the mirror oscillating means comprises an armature extending from the mirror and an electromagnet adjacent said armature; the bar vibrating means comprises a permanent magnet attached to said bar adjacent its magnet; and the means for operating said mirror oscillating means and said bar vibrating means comprises a common source of A.C. current connected to both said electromagnets.

6. The combination as set forth in claim 5 including a phase shifting means connected in the line between said source of A.C. current and the electromagnet for vibrating said bar.

7. The combination as set forth in claim 4 in which the means operated by said photoelectric cell comprises an electronic switch connected between said source of high voltage electrical current and said stylus which is normally in a closed condition and which is switched to open position by the electric signal from said photoelectric cell.

8. The combination as set forth in claim 4 including means for moving a strip of electrosensitive paper across and in contact with an end of the stylus.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 19,575	Finch	May 21, 1935
399,154	O'Neil	Mar. 5, 1889
1,834,330	Brower	Dec. 1, 1931
1,873,926	Centeno	Aug. 23, 1932
2,095,676	Prescott	Oct. 12, 1937
2,225,915	Losier	Dec. 24, 1940
2,457,456	Flory	Dec. 28, 1948
2,895,005	Kock et al.	July 14, 1959
2,921,126	Street	Jan. 12, 1960