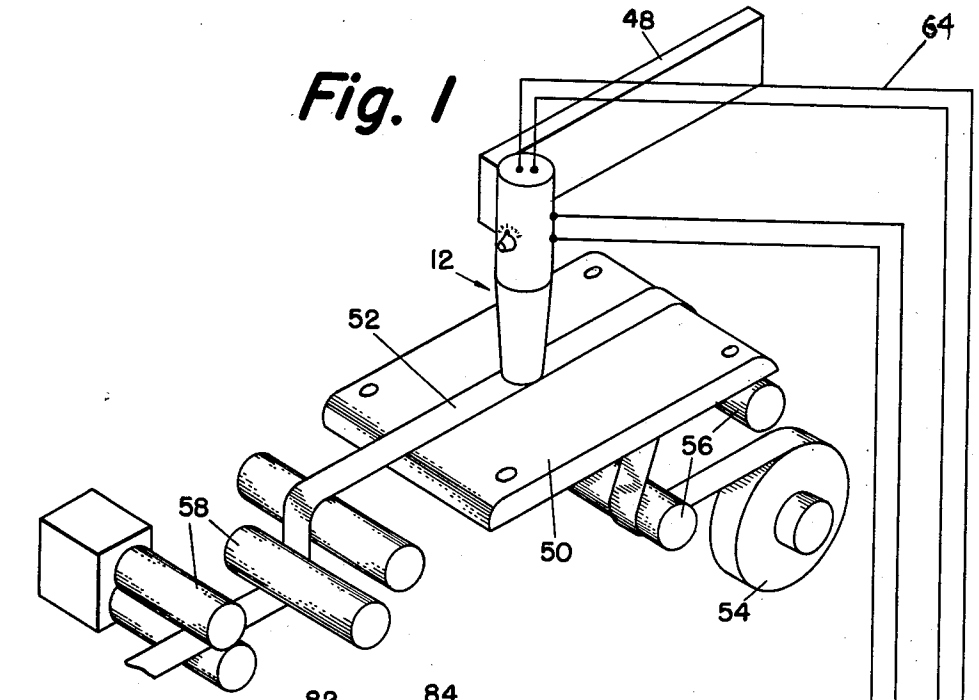
Nov. 13, 1962 E. E. GARFIELD 3,064,078

COPYING AND REPRODUCING DEVICE

Filed May 12, 1959

Fig. 1



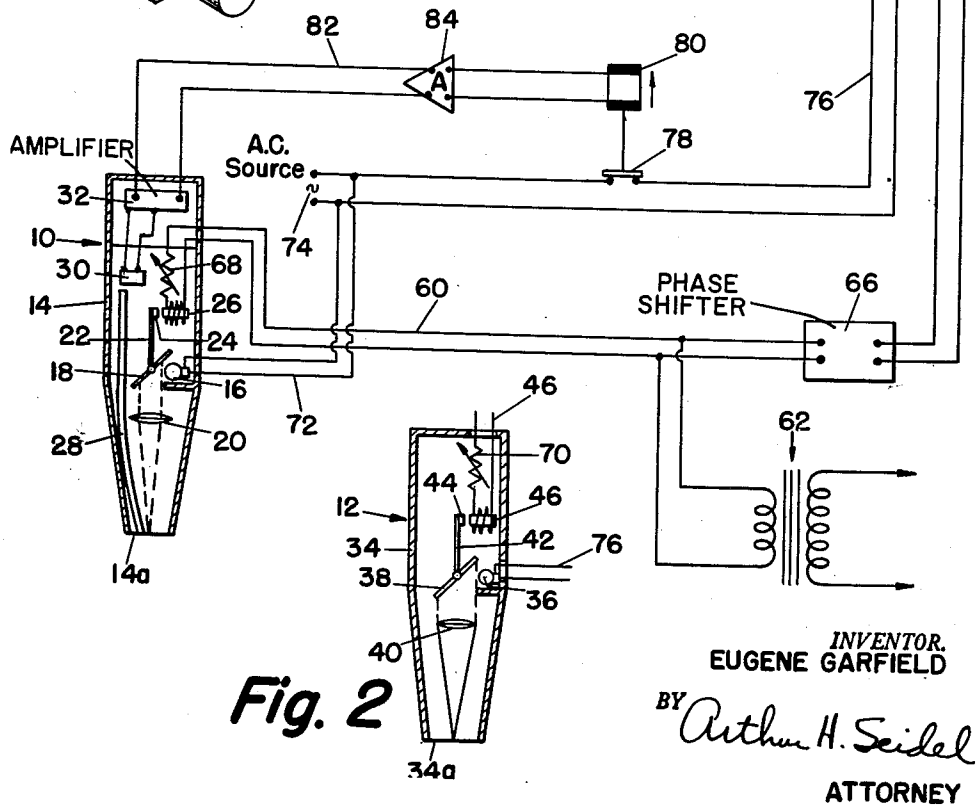


Fig. 2

INVENTOR.
EUGENE GARFIELD

BY Arthur H. Seidel

ATTORNEY

United States Patent Office

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COPYING AND REPRODUCING DEVICE

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

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This invention relates to a copying and reproducing device, and more particularly to a device for copying and reproducing printed or written matter, such as letters, characters, words, phrases, sentences, or short paragraphs. This is a continuation-in-part of my copending application for United States Letters Patent, Serial No. 754,235, filed August 11, 1958, entitled "Copying and Reproducing Device."

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 machines. This 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 full pages which is wasteful when many times only small portions of a page are required. Also, many photocopying 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 only photocopying machines, require special paper to make a negative of the copy, and other special paper for the final reproduction, so that the operation of the machine becomes relatively expensive.

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

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

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a schematic representation of the copying and reproducing device of the present invention, with the casing of the copying instrument being broken away.

FIGURE 2 is a sectional view of the reproducing instrument of the device of the present invention.

Referring initially to FIGURE 1, the copying and reproducing device of the present invention comprises in general a scanning or copying instrument, generally designated as **10**, a reproducing instrument, generally designated as **12**, and an electrical circuit connecting the copying 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 casing **14** having an open end **14***a*. Casing **14** is small enough to be held easily in the hand. Within casing **14** is a small light bulb **16**, or other source of light. Light bulb **16** directs its 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 arm **22** extends upwardly from the mirror **18**, and a permanent magnet contact **24** is attached to the upper end of the arm **22**. An electromagnet **26** is mounted in casing **14** with one end of its core adjacent the contact **24**. An elongated clear Lucite rod **28** is mounted in casing **14** and extends from the open end **14***a* of the casing **14** to a photoelectric cell, designated at **30**. A single stage amplifier, designated at **32**, is electrically connected to the photo-electric cell **30** to amplify the output of the photoelectric cell **30** to a usable level.

Referring to FIGURE 2, the reproducing instrument **12** comprises a casing **34** having an open end **34***a*. A small lightbulb **36**, or other source of light, is mounted within the casing **34**. Lightbulb **36** directs its beam of light onto a pivotably mounted mirror **38** which in turn reflects the light through a lens **40** to the open end **34***a* of the casing **34**. Lens **40** is shaped to form the beam of light into a fine point at the open end **34***a* of the casing **34**. An arm **42** extends upwardly from the mirror **38**, and a permanent magnet contact **44** is attached to the upper end of the arm **42**. An electromagnet **46** is mounted in the casing **34** with one end of the core of the electromagnet **46** being adjacent the contact **44**.

Referring to FIGURE 1, the reproducing instrument **12** is mounted on a supporting rod **48**. Reproducing instrument **12** is positioned with the open end **34***a* of the casing **34** being over and slightly spaced from the top surface of a backing plate **50**. A strip **52** of recording paper is drawn from a supply reel **54** over tensioning guides **56** and across the backing plate **50**. As the strip **52** of recording paper passes over the backing plate **50**, it passes across the open end **34***a* of the casing **34** of the reproducing instrument **12**. The paper strip **52** then passes over additional tensioning guides **58** to a power driven take-up, not shown.

Electromagnet **26** of the copying instrument **10** is connected through wiring **60** to a transformer **62**, which in turn is connected to a standard sixty cycle power supply. The electromagnet **46** of the reproducing instrument **12** is connected through wiring **64** to the transformer **62**. A phase shifter, diagrammatically shown at **66**, is connected in the wiring **64** between the electromagnet **46** of the reproducing instrument **12** and the transformer **62**. A rheostat **68** is provided in the copying instrument **10** in the connection between the electromagnet **26** and the transformer **62**. A rheostat **70** is provided in the reproducing instrument **12** in the connection between the electromagnet **46** and the transformer **62**.

The light bulb **16** of the copying instrument **10** is connected through wiring **72** to a source of electrical current **74**. The light bulb **36** of the reproducing instrument **12** is connected through wiring **76** to the source of electrical current **74**. A switch **78** is provided in the wiring **76** between the light bulb **36** of the reproducing instrument **12** and the source of electrical current **74**. Switch **78** is operated by a solenoid **80** so that when the solenoid **80** is energized the switch **78** is opened, and when the solenoid **80** is not energized the switch **78** is closed. Solenoid **80** is connected through wiring **82** to the amplifier **32** in the copying instrument **10**. A second

amplifier 84 is connected in the wiring 82 between the copying instrument amplifier 32 and the solenoid 80.

The copying and reproducing device of the present invention operates as follows:

Copying instrument 10 is held with the open end 14a of the casing 14 over the printed matter to be copied. The light from the 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 the photoelectric cell 30, a current is produced by the photoelectric cell 30 which is amplified by amplifiers 32 and 84 to energize the solenoid 80. Energizing solenoid 80 opens the switch 78 to prevent any current from passing from the source of electrical current 74 to the light bulb 36 in the reproducing instrument 12.

When the light from the bulb 16 of the copying instrument 10 shines on a printed portion of the page of the printed matter, 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 energize the solenoid 80. Since the solenoid 80 is not energized, switch 78 is closed completing the circuit between the source of electrical current 74 and the bulb 36 of the reproducing instrument 12. The light from the bulb 36 of the reproducing instrument 12 is reflected from mirror 38 through lens 40 as a fine point onto the paper strip 52. Paper strip 52 is a light sensitive paper, such as Electrofax paper manufactured by the Radio Corporation of America, or any of the well known types of photographic emulsion papers. Thus, a printed mark on the page being copied produces a corresponding mark on the paper strip 52.

The copying instrument electromagnet 26 is energized by the sixty cycle current causing the mirror arm 22 to vibrate at sixty cycles. This in turn oscillates the mirror 18 to cause the light beam from the bulb 16 to swing back and forth across the open end 14a of the casing 14. Thus, the beam of light from the light bulb 16 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 68 to accept various size printing. The reproducing instrument electromagnet 46 is similarly vibrated at sixty cycles causing the mirror arm 42 to vibrate at sixty cycles. This in turn oscillates the mirror 38 to cause the light beam from the light bulb 36 to swing back and forth across the open end 34a of the casing 34. The amplitude of the sweep of the light beam from the light bulb 36 is adjusted by rheostat 70 to correspond with the amplitude of the sweep of the light beam of the copying instrument 10. Thus, the light beam from the light bulb 36 of the reproducing instrument 12 sweeps across the paper strip 52 in synchronism with the light beam of the copying instrument 10. Phase shifter 66 is provided to adjust the phase relation between the movement of the mirror 38 of the reproducing instrument 12 and the mirror 18 of the copying instrument 10 to account for the time delay between the pickup of the reflected light from the page being copied and the receiving of the signal by the reproducing instrument 12.

Paper strip 52 is pulled under the reproducing instrument 12 by a power driven take-up, not shown, and copying instrument 10 is moved by hand along the line of printed matter at the same speed as the movement of the paper strip 52. 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. Copying instrument 10 can be provided with a switch to start and stop the movement of the paper strip 52. Thus, as the copying 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 beam of light of the reproducing instrument 12 moves across the moving strip of paper 52 to cover the same area as the light beam of the copying instrument 10. Therefore, since an electrical current is supplied to the light bulb 36 of the reproducing instrument 12 only when the light beam of the copying instrument 10 sweeps across printed matter so as to provide a mark on the paper strip 52, the marks on the paper strip 52 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 52.

Since copying 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 in one place and the copying 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 of the like, he merely plugs a copying instrument into the nearest outlet, and moves the copying instrument over the printed matter to be copied. The person can thereby move from place to place in 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 paper strip 52 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 copying instrument 10 can be carried to the matter being 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 that the copying operation is much quicker than with photocopying machines which require some type of chemical development of the reproduction.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A copying and reproducing device comprising a portable copying instrument, said copying instrument including a casing open at one end, means in said casing for producing a fine point of light at said open end of the casing, means to sweep said light across the open end of the casing, a photoelectric cell in said casing, and means to transmit reflections of said light to said photoelectric cell to produce an electric signal; a reproducing instrument including a casing open at one end, means in said reproducing instrument casing for producing a fine point of light at the open end of the casing, and means to sweep said light across the open end of the reproducing instrument casing; means for operating said light sweeping means of said copying instrument and said reproducing instrument at the same frequency; means for providing an electric current to the light producing means of the copying instrument and the reproducing instrument; and means operated by the signal from the photoelectric cell of the copying instrument to cut off the electric current to the light producing means of the reproducing instrument.

2. A copying and reproducing device comprising a portable copying instrument, said copying instrument in-

cluding 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 the casing, a photoelectric cell in said casing, and means to transmit reflections of said light to said photoelectric cell to produce an electric signal; a reproducing instrument including a casing open at one end, a source of light within and fixed with respect to said reproducing instrument casing, a pivotable mirror within said reproducing instrument casing for reflecting the light through a lens to the open end of the casing, and means for oscillating said mirror to sweep the light as a fine point across the open end of the reproducing instrument casing; means operating said mirror oscillating means of said copying instrument and said reproducing instrument at the same frequency; means for providing an electric current to the source of light in said copying instrument and said reproducing instrument; and means operated by the signal from the photoelectric cell of the copying instrument to cut off the electric current to the source of the light in the reproducing instrument.

3. A copying and reproducing device in accordance with claim 2 in which the means for oscillating the mirror of the copying instrument comprises an arm extending from the mirror, and an electromagnet within the copying instrument casing adjacent said arm, the means for oscillating the mirror of the reproducing instrument comprises an arm extending from the mirror, and an electromagnet within the reproducing instrument casing adjacent the arm, and the means for operating the mirror oscillating means comprises a common source of A.C. current connected to the copying instrument electromagnet and the reproducing instrument electromagnet.

4. A copying and reproducing device in accordance with claim 3 including a phase shifting means connected between the source of A.C. current and the reproducing instrument electromagnet.

5. A copying and reproducing device in accordance with claim 2 in which the means operated by the signal from the photoelectric cell of the copying instrument comprises a switch connected between the source of electric current and the source of light in the reproducing instrument casing, and a solenoid connected to said switch so that when the solenoid is energized the switch is open and when the solenoid is not energized the switch is closed, said solenoid being connected to said photoelectric cell so as to be energized by the electric signal from the photoelectric cell.

6. A copying and reproducing device in accordance with claim 5 including amplifying means connected between the photoelectric cell and the solenoid.

7. A copying and reproducing device in accordance with claim 2 including means for moving a strip of light sensitive paper across the open end of the reproducing instrument casing.

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