G. WALD.

PHOTOTELEGRAPHIC MACHINE.

APPLICATION FILED OCT. 28, 1914.

1,221,780.

Patented Apr. 3, 1917.

2 SHEETS—SHEET 1.

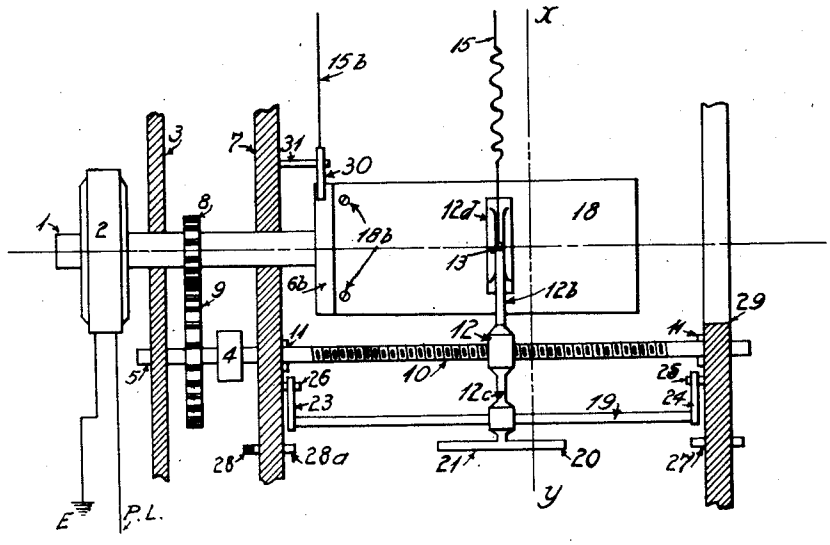


Fig. 1.

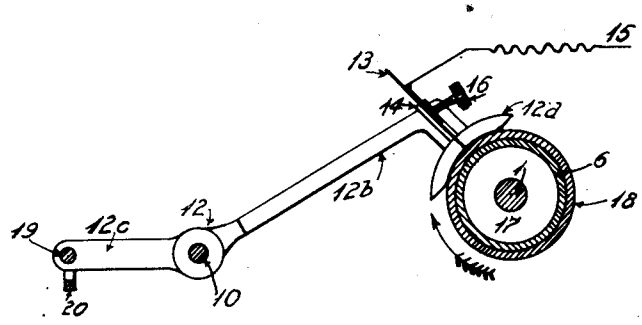


Fig. 2.

Witnesses:

Benjamin Franklin Middleton.

Richard Oscar Mann

Inventor:

George Wald.

G. WALD.

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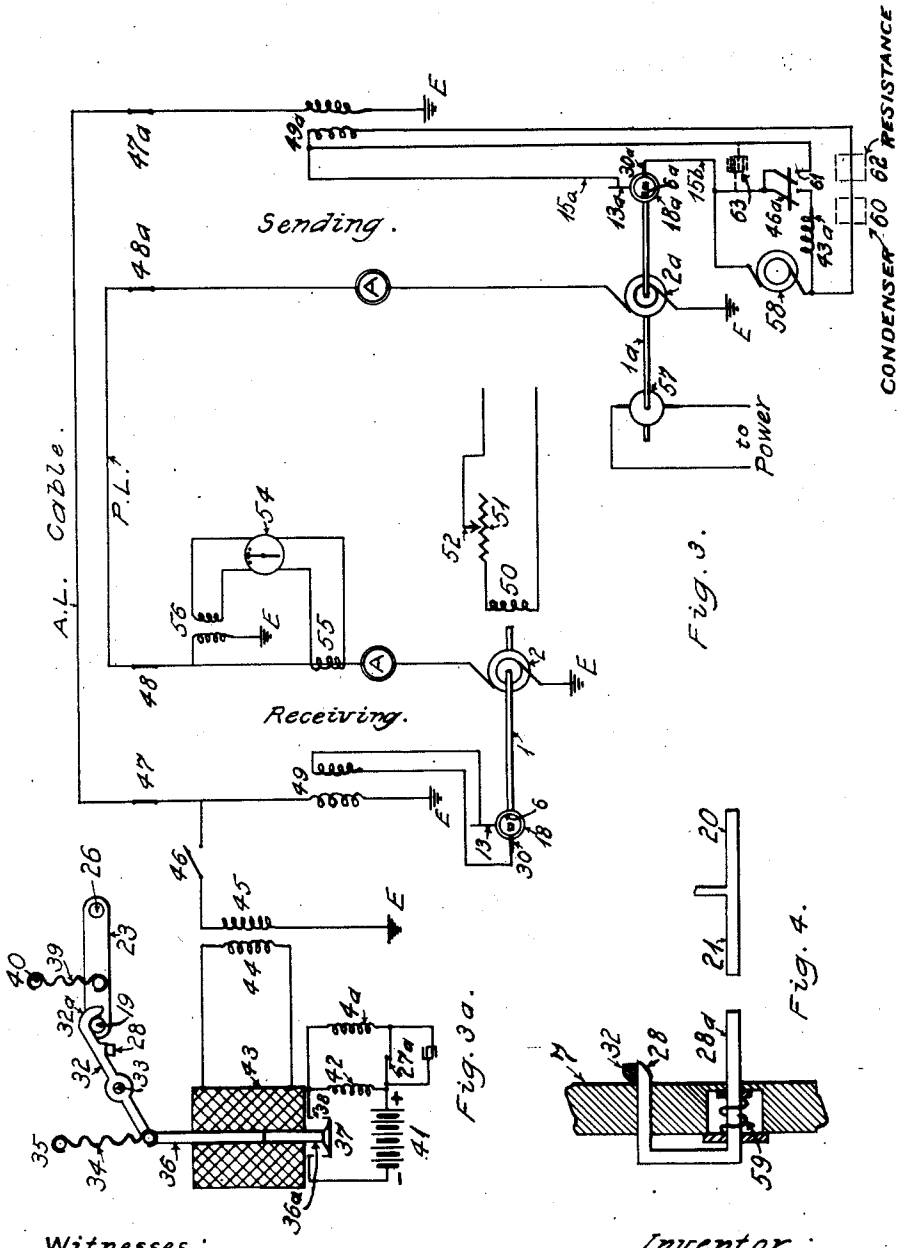


Fig. 3.

Fig. 3a.

Fig. 4.

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Richard Oscar Mann

Inventor:
George Wald.

UNITED STATES PATENT OFFICE.

GEORGE WALD, OF THE UNITED STATES ARMY.

PHOTOTELEGRAPHIC MACHINE.

1,221,780. Specification of Letters Patent. Patented Apr. 3, 1917.

Application filed October 28, 1914. Serial No. 869,038.

To all whom it may concern:

Be it known that I, GEORGE WALD, a citizen of the United States, residing at Fort Adams, city and county of Newport, in the State of Rhode Island, have invented a new and useful Phototelegraphic Machine, of which the following is a specification.

The object of my invention is to provide a method for transmission of photographs, sketches, etc., by wire, at a high rate of speed, locally or at a distance.

Referring to the drawings which illustrate the devices and circuits used to accomplish the above results, Figure 1 is a top-view of the machine, and Fig. 2 is a cross-sectional side-view of the device, taken along the line *x*—*y*, Fig. 1. The same machine is used at the sending station as at the receiving station, but the circuits differ. Fig. 3 represents diagrammatically all the electric circuits employed in the system. Fig. 3ª and Fig. 4 that part of the circuits and devices, which concerns the automatic action of stylus 13.

Similar parts are designated by similar numbers. Similar parts of the sending machine are distinguished from that of the receiving machine by the addition of "a" to the numeral used for the former.

In my method I employ, a photolithographic metallic record 18ª, on which the picture is either etched by the well known process of photolithography, or the picture may be printed on it with some insulated ink. This is traced by a stylus 13ª, that is held rigidly in position by thumb-screw 16 in cell 14 secured in the insulated part 12ᵇ of rocker or bell-crank 12 which moves longwise to the record 18ª, through gears 8 and 9, shaft 5, clutch 4, screw-rod 10 and pins 11, as shown in Figs. 1 and 2. An electric circuit is caused to be made and broken by the record 18ª revolving and the insulated and conducting parts of its surface alternately passing the needle-point of the stylus 13ª, thus electric current impulses are made to travel over line wires and reproduce the picture on the receiving record 18.

The receiving record 18 is made to revolve in synchronism with the transmitting record 18ª by the use of an electric synchronous motor 2, mounted on the shaft 1 and driven by power supplied by the alternator 2ª on shaft 1ª of the transmitting machine (see Fig. 3). Or the synchronism of the sending and receiving machines may be accomplished by any other well known method.

The novel feature of my invention is the method which I employ for receiving the photograph, sketch, etc. on a receiving record 18, by the use of an insulative and protective glue covering a metallic record 18. For each current impulse supplied to the receiving circuit, an electric discharge through this glue occurs in the form of a spark, resulting in a hole burned out in the protective glue covering and revealing the copper surface of the record 18.

These current impulses correspond to depressions or conducting parts, on the surface of the transmitting record 18ª, thus making the burned out holes in the glue covering of the receiving record 18 to correspond to the depressions or conducting parts on the surface of the transmitting record 18ª and thus reproduce a like image. The receiving record 18 is then given an acid bath and the image etched on it as in the regular method of photolithography. The acid will attack only that part of the surface of the record 18 from which the protective glue covering was burned off by the electric discharges.

I will now explain fully my method of transmitting photographs, sketches, etc., by wire.

Referring to Fig. 3, 58 is a high-frequency, low tension, alternator, which supplies power to the primary of the transformer 49ª through the following circuit: Top-brush of alternator 58, lead 15ᵇ, brush 30ª, base-cylinder 6ª, record 18ª,—and when in contact with the stylus,—stylus 13ª, lead 15ª, primary of 49ª, to 62, 60, and back to the alternator 58 through the bottom brush. This circuit is made and broken as the stylus 13ª makes and breaks contact with the record 18ª. A condenser 63 of low-capacity and high voltage may be used to absorb the spark across the stylus 13ª. The alternating current is thus applied across the primary of the transformer 49ª in unison with the stylus 13ª making contact with the conducting parts of the record 18ª. The secondary of 49ª steps up this voltage so as to make the losses of power in the lines negligible. One side of the secondary of 49ª is grounded at E, the other side through switch 47ª and line A. L., to the receiving stations, switch 47, primary

of transformer 49 which is grounded at E to complete the circuit. One side of secondary of 49 is connected to stylus 13 while the other side to brush 30, base-cylinder 6 and receiving record 18. The circuit is thus open at the thin glue-insulating-covering of record 18, across this glue the voltage of the secondary of transformer 49 is applied puncturing same whenever an electric impulse occurs. The transformer 49 rectifies the line voltage of the electric impulses, so that they are just sufficient to puncture the insulating-glue-covering on the record 18. These punctures form burned holes thus revealing the copper or other metallic surface of record 18.

The shaft 1^a is driven by any motive power, such as an electric motor 57. On the shaft 1^a is mounted the alternator 2^a which supplies power through line P. L. and ground E—E to the synchronous motor 2 on shaft 1. Thus shaft 1 is made to revolve in synchronism with shaft 1^a. The insulating cylinder 17, base-cylinder 6 and record 18 are mounted on shaft 1 while 6^a and 18^a on shaft 1^a, thus both records 18 and 18^a pass the stylus 13 and 13^a in synchronism, producing on the record 18 a like image of 18^a.

After the transmission is completed the record 18 is removed from the base cylinder 6, and etched in an acid bath as in the regular process of photolithography. The acid will attack the revealed copper surface of record 18 and etch same to the proper depth, to enable prints to be made from same, as is well known to all familiar in the art.

The stylus 13 and 13^a are raised automatically from the records 18 and 18^a when the picture is completely transmitted and again lowered automatically in position when a picture is again to be transmitted, in the following manner.

The screw-shaft 10 causes bell-crank 12 with stylus 13 to move to the right to wall 29 or to the left to wall 7 of the machine (see Fig. 1), depending on the direction of rotation of the said screw-rod 10, being controlled by the reversing clutch 4. Normally bell-crank 12 moves to the left, to wall 7, but when the electromagnet 4^a (see Fig. 3^a) is energized it causes clutch 4 to reverse the direction of rotation of shaft 10 and move bell-crank 12 to the right, or wall 29.

A rocking-rod 19 pivoted at 25 and 26 through levers 24 and 23, is passed through tail-end-piece 12^c of the bell-crank 12. As the rod 19 is lowered and raised, the stylus 13 is lifted from, and put back on, the record 18 (see Fig. 2), respectively. A hook lever 32 (see Fig. 3^a), pivoted at 33 has its hook 32^a riding upon rod 19. The other end of 32 is pivoted to plunger 36 of the solenoid 43. A spring 34 secured at any point like 35, is pulling on lever 32 in such a direction as to lower 32^a with rod 19, but such motion is prevented by catch lever 28 (see Fig. 4). A spring 39 through lever 23 holds rod 19 against the hook 32^a; however when catch lever 28 is forced inward against spring 59, spring 34, which is much stronger than spring 39, swings lever 32 about its pivot 33, lowering rod 19 and raising the stylus 13 off the record 18. When the solenoid 43 is energized the plunger 36 is pulled downward, turning lever 32 about its pivoted point, passing the catch 28 (see Fig. 4) to the position shown, allowing spring 39 to raise rod 19 and return stylus 13 on the surface of record 18.

The bell-crank 12 terminates in a rod 21 and 20 which is in line with the projections 28^a and 27, when rod 19 is in the upper and lower positions respectively. In the transmission process, the bell-crank 12 is moving to the left. When the transmission is completed rod 21 strikes latch-lever 28^a, releasing lever 32 which turns about 33, lowering rod 19 and lifting the stylus 13 off the surface of record 18. Rod-plunger 36 is also raised closing the local battery circuit at 37 which is as follows: + of battery 41, contact 27^a, reversing-clutch-magnet 4^a, contacts 38, 37 and back to —41. This causes the stylus 13 to rise from record 18. As these devices are alike at the sending and receiving machines, both eventually go through the same process. The clutch 4 reverses the direction of rotation of screw-rod 10, thus moving stylus 13 to the starting position at the right side of the machine. Soon rod 20 strikes projection 27 which opens contact 27^a (see Fig. 3^a) and allows clutch 4 to return to normal. This starts bell-crank 12 again to the left, but contact 27^a is immediately closed, reversing again clutch 4. This keeps bell-crank 12 with stylus 13 at the starting position.

In this position the stylus 13 and 13^a keep the sending as well as the receiving circuits open. In the receiving machine contact 27^a closes another circuit, viz: — + of battery 41, coil 42, 38, 37 and —41 battery. Coil 42 operates and closes the automatic switch 46 into line A. L. This puts primary 45 into the line circuit, while secondary 44, magnetizes solenoid 43 whenever electric current flows through 45. The sending machine, which is just like the receiving machine, has no coil 42, nor any transformer 45—44. Instead, the switch 46^a when closed puts solenoid 43^a (which is exactly like 43) in parallel with the primary 49^a and both are put across the alternator 58. Both blades of the D. P. S. T. switch 46^a are connected together and to the upper-brush of the alternator 58 or, which is the same, to line 15^b. When the machines are ready to be started, switch 46^a is closed, thus closing the follow-

ing circuits: top-brush of alternator 58, left-hand-side-blade of switch 46ª, to lower contact of same, solenoid 43ª and back to generator 58. This lowers stylus 13ª on the surface of record 18ª and also starts it to the left, transmitting the photograph, sketch, etc. Simultaneously 46ª completes another circuit, viz: top-brush of alternator 58, right-side-blade of switch 46ª, to lower right-hand side contact (which is marked 61), up and through primary of 49ª, back through 62 and 60 to the lower brush of the alternator 58 which completes the circuit. The secondary of 49ª sends an electric current through line A. L., 47, 46, 45 and returns by grounds E and E, causing the secondary 44 to actuate solenoid 43 putting stylus 13 on record 18 and starting the former on a transmission stroke. When contact 37 opens, switch 46 opens and remains so till the transmission is completed.

In Fig. 3 means are shown whereby the angle of lead or lag may be caused to remain constant, consisting of an automatic synchronizer or power-factor meter 54 supplied with power by a current-transformer 55 and a potential transformer 56, which will cause the insertion or cutting out of resistance from the field 50 by the pointer 52 shifting on resistance 51.

A condenser 60 may be connected in the primary of transformer 49ª, as shown in Fig. 3, thus resonating the circuit by causing the capacity reactance to balance the inductive reactance. In that case, however, a non-inductive resistance may have to be used in the circuit as shown at 62.

What I claim is:

The method of reproducing sketches and photographs by electric impulses transmitted from a distance and controlled by a transmitting subject by causing the electric impulses to rupture and thereby produce burned holes in an insulating and protecting glue covering a metallic record, thus reproducing the subject in the form of a photolithographical plate as described.

GEORGE WALD.

Witnesses:
BENJAMIN FRANKLIN MIDDLETON,
RICHARD OSCAR MANN.