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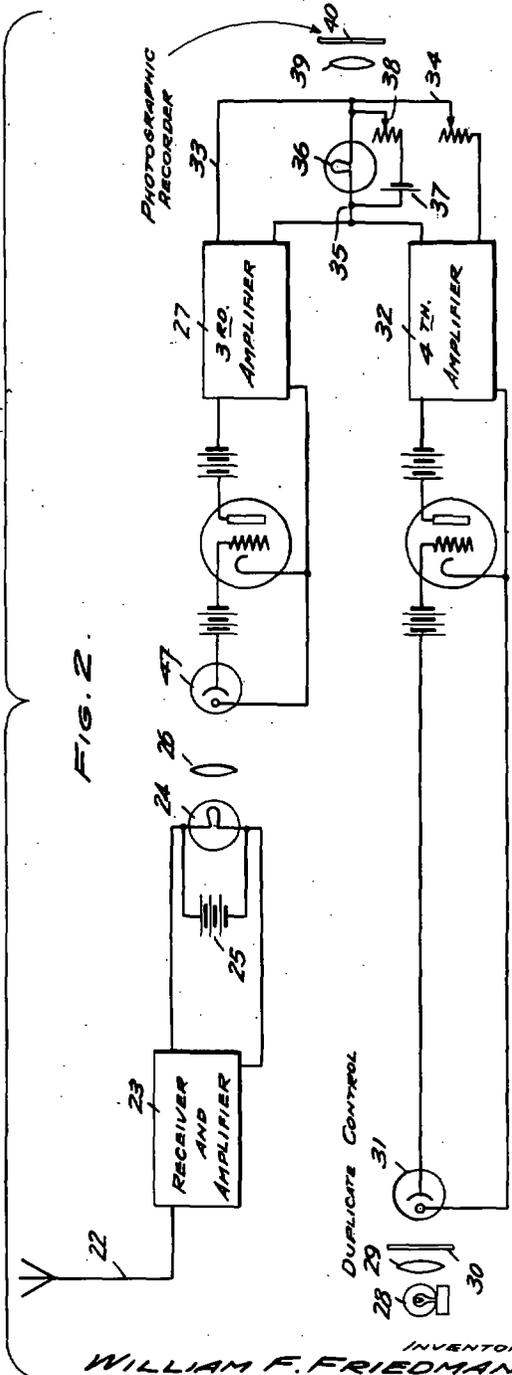
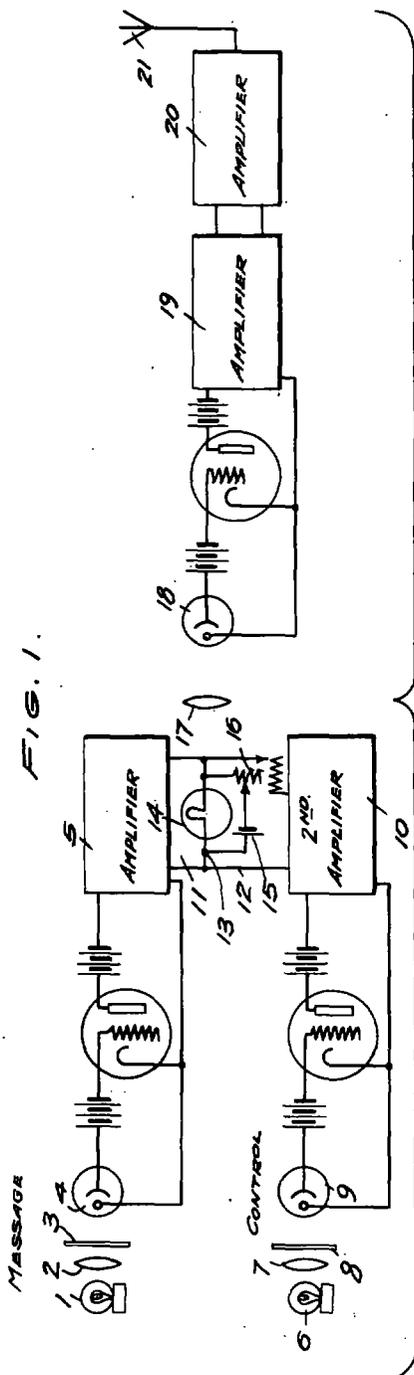
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SYSTEM FOR ENCIPHERING FACSIMILES

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## SYSTEM FOR ENCIPHERING FACSIMILES

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1

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to a system for secretly communicating by means of facsimile transmission.

In other words, by means of our invention, a message in written, printed or picture form is transmitted, under the control of a screen or camouflage element, to another station at which the transmission is received and reproduced under the control of a duplicate of said screen or camouflage element. These screens or camouflage elements interrupt the transmission in an irregular or unpredictable manner which renders derivation of the intelligence contained in the transmission by unauthorized persons difficult, if not indeed impossible.

More specifically, it is an object of our invention to provide a facsimile transmission system having a transmitting means provided with a balanced bridge circuit. The message to be transmitted causes variations in the flow of electricity in one branch of this bridge circuit. Any arbitrarily selected screen or control element causes variations in another branch of this bridge circuit. These two branches are connected together so that equal and opposite potentials are established across the circuit of an electric lamp whose output therefore varies whenever the voltages of these two branches are not substantially equal. A transmitter is mounted under the control of the output from said lamp. At the place to which it is desired to transmit the intelligence, a reception means is located, provided with a second balanced bridge circuit. A receiver in communication with said transmitter causes variations in the flow of electricity in one branch of the second bridge circuit. A duplicate of said screen or control element causes variations in another branch of this second bridge circuit. These two branches of this second bridge circuit are connected together so that equal and opposite potentials are established across the circuits of an output electric lamp whose output therefore varies whenever the output voltages of these branches of this second bridge circuit are not substantially equal. A light-sensitive element, such as a photographic film or the like, is located so as to receive and record the variations in the output of said output electric lamp in the form of a facsimile of the original message.

For a further description of our invention reference may be had to the annexed drawings and specification, at the end whereof the novel features of our invention will be specifically pointed out and claimed.

2

In the drawings, Figures 1 and 2 are circuit diagrams with parts shown as blocks and designated with appropriate labels.

In that embodiment of our invention selected from among others for illustration in the drawings and description in the specification, our device is shown as comprising an electric lamp 1 which serves as a source of light, the light being concentrated by means of lens 2 upon the message sheet 3, which is to be transmitted. This message may be in an opaque form, such as on a sheet of paper, to reflect the light falling thereon, or in a transparent form, such as a film, to allow the light to pass therethrough. In either event, the reflected or transmitted beam of light, varied in accordance with the white and black portions of the message, falls on a light-sensitive cell 4, such as a photo-electric cell. Cell 4 is connected as part of an amplifying circuit, generally indicated by block 5 since any well-known type of amplifying circuit may be employed.

A second electric lamp 6 forms a second source of light formed by a lens 7 into a beam directed upon a screen or control sheet or element 8, which may be any arbitrarily selected pattern having relatively light and dark portions, such as a writing, print, drawing or random arrangement of dots.

Relative motion is provided between lamp 1 and message 3 and between lamp 6 and control 8 so that the beam emitted by each of said lamps falls upon and scans the message and the control, respectively, in a manner well known in the art of facsimile transmission.

The beam of light varied by control element 8 falls on a second light-sensitive cell connected as part of an amplifying circuit identified by the general reference character 10.

The outputs of the amplifying circuits 5 and 10 are oppositely connected as the arms or branches 11 and 12 of a balanced bridge circuit having a diagonal or cross wire 13 connected to the terminals of a third electric lamp 14. Amplifying circuits 5 and 10 have as their output a pulsating direct current of constant polarity and are connected so that equal and opposite potentials are established across lamp 14 by the signals transmitted under the control of message 3 and control 8. Lamp 14 is sensitized by a local battery 15 regulated by adjustable resistor 16.

Lens 17 concentrates the light from lamp 14 into a beam directed upon a third light-sensitive cell 18 forming part of a circuit including an amplifier 19, a transmitter 20, and an output element, such as an antenna 21, or the terminals of a wire transmission system.

At the location or place at which the message is to be received, there is provided a receiving

2,465,367

3

member, such as antenna 22, as shown, or the opposite terminals of the wire transmission system. A receiver 23 with an amplifier has its output connected to a lamp 24 which is energized by a local battery 25. Lens 26 concentrates the light from lamp 24 upon light-sensitive cell 47 forming part of a circuit including a third amplifier 27.

An electric lamp 28 emits light which is beamed by lens 29 onto a screen or control element 30 which is a duplicate of control 8. Relative movement is provided between lamp 28 and duplicate control 30 so that exact synchronism is maintained between the scanning of controls 8 and 30. The light from source 28, reflected or transmitted by duplicate control 30, is passed to light-sensitive cell 31 forming a part of a circuit which also includes an amplifier 32. The output circuits 33 and 34 of amplifier circuits 27 and 32 are connected as arms or branches of a second balanced bridge circuit having a diagonal or cross-wire 35 which connects to the terminals of a third output electric lamp 36 energized by local battery 37 under the control of adjustable resistor 38. The light output of lamp 36 is collected by lens 39 and falls in a beam on recorder 40 which may be any light-sensitive device such as a photographic plate or film. Relative movement is maintained between lamp 36 and recorder 40 in exact synchronism with the relative movement between lamp 1 and message 3 so that recorder 40 reproduces identically the message 3 as varied by controls 8 and 30.

The operation of our device is as follows: Message 3 is scanned by the beam of light from lamp 1 and produces variations in this beam depending upon whether or not the portion of the message which intercepts the beam is black or white. These variations are transmitted by cell 4 and amplified in circuit 5. Control 8 varies the beam of light from source 6 and affects cell 9 and circuit 10 in the same way. Since the output voltages of circuits 5 and 10 are balanced against each other there is no change in the output of lamp 14 unless there is a difference between these output voltages in the arm or branch circuits 11 and 12. In other words, of the four possible conditions of message 3 and control 8, two conditions cause a variation in the output of lamp 14 and two conditions cause no variation in the output of lamp 14. These conditions which cause a variation occur when the spot of message 3 on which the beam of light falls is black or white and the simultaneously exposed spot of control 8 is the reverse. The conditions which cause no variation occur when the simultaneously exposed spots of message 3 and control 8 are of the same hue. The variations in the intensity of the light emitted by lamp 14 cause pulses or oscillations in the circuit containing amplifier 19 and transmitter 20. These pulses or oscillations are sent to receiver 23, where they cause corresponding variations in the light emitted by output lamp 24 and, therefore, in the output of the circuit containing the third amplifier 27. Simultaneously with the scanning of control 8, duplicate control 30 causes variations of the beam of light from source 28, which variations actuate cell 31 and appear in the output circuit 34 of the circuit containing the fourth amplifier 32. Lamp 36 is mounted across the output circuits 33 and 34 of the circuit containing third amplifier 47 and fourth amplifier 32 respectively. Because the voltages of output circuits 33 and 34 are equal and opposed, the light emitted by lamp 36 varies only when two of the four possible conditions

4

exist. That is to say, when there is present in output circuit 33 a pulse corresponding to either a black or a white spot in the original message 3 and there is simultaneously present in output circuit 34 a pulse corresponding to a spot of the opposite hue in the duplicate control 30, a variation in the light output of lamp 36 occurs. Conversely when the simultaneous impulses present in the output circuits 33 and 34 correspond to spots of like hue in message 3 and duplicate control 30, no variation takes place in the output of output lamp 36. These variations of the output of the light from lamp 36 expose the photographic element 40, spot by spot as the element is scanned, and thus reproduce the original message 3.

We do not intend to be limited save as the scope of the attached claims may require.

We claim:

1. Means for secretly transmitting pictorial information, said means comprising, a scanner arranged to scan and reproduce a pictorial message as a series of electric impulses of varying intensity, a screen having varying portions, a second scanner arranged to scan and reproduce the variations of said screen as a second series of electric impulses of varying intensity, an electric light connected across the output circuits of said scanners so that its output varies in intensity when the potentials across said output circuits are not equal, a photo-electric cell mounted so as to vary in response to the output of said light, a transmitter connected to emit signals in accordance with the variations of said photo-electric cell, a receiver arranged to receive the signals emitted by said transmitter and having an output potential varying in accordance with said signals, a second screen duplicating said first mentioned screen, a second receiver having an output potential varying under the control of said second screen, another electric light connected across the output circuits of said receivers so that its output varies in intensity when the potentials across said output circuits are not equal, and a light-sensitive element mounted so as to be scanned and to record the variations in intensity of said other light and to thereby record the message.

2. Means for secretly transmitting pictorial information, said means comprising, a scanner arranged to scan and reproduce a pictorial message as a series of electric impulses of varying intensity, a screen having varying portions, a second scanner arranged to scan and reproduce the variations of said screen as a second series of electric impulses of varying intensity, an electric light connected across the output circuits of said scanners so that its output varies in intensity when the potentials across said output circuits are not equal, a photo-electric cell mounted so as to vary in response to the output of said light, a transmitter connected to emit signals in accordance with the variations of said photo-electric cell, a receiver arranged to receive the signals emitted by said transmitter, a second electric light connected to said receiver so that its output varies in intensity in accordance with the signals received by said receiver, an amplifier circuit including a second photo-electric cell responsive to variations in the intensity of the output of said second electric light, a second screen duplicating said first mentioned screen, a second receiver having an output potential varying under the control of said second screen, a third electric light connected across the output circuits of said re-

2,465,367

5

ceivers so that its output varies in intensity when the potentials across said output circuits are not equal, and a light-sensitive element mounted so as to record the variations in intensity of said third light and to thereby receive the message.

3. A transmitting and receiving system for secretly communicating messages in pictured form in which there is provided, a first electric circuit constructed so as to emit a direct current voltage which varies in response to the variations in light transmission of a sheet bearing a message, a control element having portions of varying light transmitting characteristics, a second electric circuit constructed so as to emit a direct current voltage which varies in response to the variations in light transmission of said control element, a transmitter mounted under the control of said circuits so that the transmitter emits a signal only when the output voltage of one of said circuits differs from that of the other, a receiver tuned to respond to signals emitted by said transmitter and to provide an output varying with said signals, a second control element substantially identical to the first mentioned control element, a third electric circuit constructed so as to emit a direct current voltage which varies in response to the variations in light transmission of said second control element, a light emitter mounted under the control of said receiver and of said third electric circuit and arranged so that the light emitted thereby varies only when the voltage output of said receiver differs from that of said third circuit, and a recording device located so as to record the variations of the light emitted by said emitter and thus to reproduce the message.

4. In a secret facsimile communication system, a balanced bridge circuit having an output element supplying an output varying in response to the output of an amplifying circuit controlled by the message to be sent and to the output of a second amplifying circuit controlled by a screen, means for balancing the outputs of said amplifying circuit against each other so that there is no output from said bridge circuit except when there is a difference between the outputs of said amplifying circuits, a transmitter having an output element supplying an output varying in response to the output from said bridge circuit, a second balanced bridge circuit having an output element supplying an output varying in response to the output of a third amplifying circuit controlled by a receiver controlled in turn by the output from said transmitter and to the output of a fourth amplifying circuit controlled by a duplicate of said screen, means for balancing the outputs of said third and fourth amplifying circuits against each other so that there is no output from said second bridge circuit except when there is a difference between the outputs of said third and fourth amplifying circuits, and a recorder responsive to the output of said second bridge circuit to furnish a facsimile of said message.

5. A system for secret communication comprising, a source arranged to emit a beam of light, a message located so as to vary said beam of light from said source, a light-sensitive cell arranged to receive said beam of light from said source as varied by said message, an amplifying circuit including said cell, a second source arranged to emit a beam of light, a screen located so as to vary said beam of light from said second source, a second light-sensitive cell arranged to receive said beam of light from said second source as varied by said

6

screen, a second amplifying circuit including said second cell, a lamp connected across the outputs of said amplifying circuits so that the light emitted thereby varies when there is a difference between the outputs of said amplifying circuits, a third light-sensitive cell arranged to receive light from said lamp and to cause variations in consonance with the variations in said light, a transmitter connected in circuit under the control of said third cell so as to vary its transmission in consonance with the variations effected by said third cell, a receiver in communication with said transmitter, a second lamp connected to vary in consonance with the variations in output of said receiver, a fourth light-sensitive cell arranged to receive light from said second lamp, a third amplifying circuit including said fourth cell, a third source arranged to emit a beam of light, a duplicate screen located so as to vary said beam of light from said third source as varied by said duplicate screen, a fourth amplifying circuit including said fourth cell, a third lamp connected across the outputs of said third and fourth amplifying circuits so that the light emitted thereby varies when there is a difference between the outputs of said third and fourth amplifying circuits, and a light-sensitive device arranged to receive light from said third lamp and to record the variations of said light in the form of the original message.

6. In a facsimile privacy apparatus, a first device for scanning a subject, a lamp associated with said device the intensity of its illumination being varied responsive to the output of said device, a second device for scanning a subject concurrently with the first device the output of said second device acting on said lamp to vary the intensity of illumination thereof, and light sensitive means for providing a signal responsive to the illumination of said lamp.

7. In a facsimile privacy apparatus, a first device for scanning a subject, a lamp associated with said device the intensity of its illumination being varied responsive to the output of said device, a second device for scanning a subject concurrently with the first device the output of said second device acting on said lamp to vary the intensity of illumination thereof, light sensitive means for providing a signal responsive to the illumination of said lamp, another lamp and means for varying the intensity of its illumination in response to the output of said light sensitive means, another light sensitive means responsive to said other lamp, means for effectively subtracting from the output of said other light sensitive means a signal equivalent to the output of said other device, and means for graphically recording the result.

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