PETITION

TO THE COMMISSIONER OF PATENTS:

Your petitioner s, William F. Friedman and J. C. Mauborgne citizen s of the United States residing at 5932 Mil. Rd. and #1 Alston Court, in the ~~District~~ Dist. Columbia-County, Monmouth and ~~State~~ of City, Washington, RedBank, N.J and whose post-office address 5932 Mil. Rds. Washington, D. C. and No. 1 Alston Court Red Bank, New Jersey, respectively pray that Letters Patent may be granted to them without payment of fee, pursuant to the provisions of the Act of March 3, 1883, c. 143; U. S. Statutes, XXII, p. 625, as amended by the Act of April 30, 1928, for the improvement in System for Enciphering Facsimile set forth in the annexed Specification.

And they hereby irrevocably give control of their application for Letters Patent to the Secretary of War, and appoint William D. Hall, whose post-office address is care of the Chief Signal Officer, Munitions Building, Washington, D. C., attorney with full power of substitution and revocation to prosecute this application, to make alterations and amendments therein, to sign their name s to the drawings, to receive the Letters Patent, and to transact all business in the United States Patent Office connected therewith.

Signed at _____ in the County of _____ and State of _____ this _____ day of _____ 19 43

(Sign here, _____
(first name in full) _____

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN, That William F. Friedman and J. C. Mauborgne are citizens of the United States residing at 5932 Mil. Rd. & #1 Alston Court in the ~~District~~ of Columbia County Monmouth City ~~State~~ of Washington-Red Bank, New Jersey, have invented certain new and useful improvements in System for Enciphering Facsimile of which the following is a specification:

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.

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

In other words, by means of my 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 heterogeneous manner which renders interception of the transmission by unauthorized persons difficult, if not indeed impossible.

More specifically, it is an object of my 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 my invention reference may be had to the annexed drawings and specification, at the end whereof the novel features of my invention will be specifically pointed out and claimed.

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

In that embodiment of my invention selected from among others for illustration in the drawings and description in the specification, my 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 5 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 5 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, as shown, 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 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 27 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 my 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 The conditions which cause a variation are 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 are 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 25 where they cause corresponding variations in the light emitted by output lamp 4 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 circuits containing third amplifier 47 and fourth amplifier 3 respectively Because the voltages of output circuits 33 and 34 are equal and opposed the light emitted by lamp 36 only varies when two of the four possible conditions 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 happens in the output of output lamp 36. These variations of the output of the light from lamp 36 sensitize 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 receive 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 mounted so as to vary in response to the 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, a third 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 record the variations in intensity of said third light and to thereby receive the message.

8. 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 on which the message is, 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 only emits a signal 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 communication system by means of facsimile transmission, 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 secdnd amplifying circuit controlled by a screen, the outputs of said amplifying circuits being balanced 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 elemant supplying an output varying in response to the output of a third amplifying circuit controlled by a receiver controlled in turn by the receipt of the output from said transmitter and to the output of a fourth amplifying circuit controlled by a duplicate of said screen, the outputs of said third and fourth amplifying circuits, being balanced 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 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.

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REF ID:A105132

IN TESTIMONY WHEREOF they affix their signature[s]

_____

_____
(Sign here, first name in full.)

O A T H

_____)
: ss
_____)

William F. Friedman and J. O. Mauborgne

the above-named petitioner[s], being duly sworn, depose and say that they are citizen[s] of the United States of America and resident[s] of 3932 Military Rd., Washington, D. C. and No. 1 Alston Court, Red Bank, New Jersey. that they verily believe themselves to be the original, first, and joint inventor[s] of the improvement in System for Enciphering Facsimile

described and claimed in the annexed specification; that they do not know and do not believe that the same was ever known or used before their invention or discovery thereof or patented or described in any printed publication in any country before their invention or discovery thereof, or more than one year prior to this application, or in public use or on sale in the United States for more than one year prior to this application; that said invention has not been patented in any country foreign to the United States on an application filed by them or their legal representatives or assigns more than twelve months prior to this application; and that no application for patent or said improvement has been filed by them or their representatives or assigns in any country foreign to the United States, ~~except as follows~~:

_____

_____

_____

_____
(Sign here, first name in full)

SWORN to and subscribed before me this _____ day of _____, 19 45

_____
Notary Public

(Seal here, to be impressed in paper.)

W-3952, AC

LICENSE

WHEREAS, we, William F. Friedman and J. O. Mauborgne, are employees of the Government of the United States of America, and

WHEREAS, in pursuance of said employment the undersigned have invented certain improvements in System for Enchiphering Facsimile

for which the undersigned are about to make application for Letters Patent of the United States; and

WHEREAS, the nature of our employment, and the conditions and circumstances under which said invention was made, are such as to justly and lawfully entitle the Government of the United States of America to have a non-exclusive license and right to make and use said invention, together with any and all improvements thereon and inventions relating thereto that the undersigned have made or may hereafter make while employed and engaged by the United States Government;

NOW, THEREFORE, in consideration of the premises the undersigned do hereby give and grant unto the Government of the United States of America a non-exclusive license to make, to have made, to use and/or to sell, said invention as described in the specification executed by the undersigned on even date herewith, said non-exclusive license to extend to any and all Letters Patent which may be granted for said invention, (including all divisions, reissues, continuations, and extensions thereof) together with any and all improvements thereon and inventions relating thereto made by the undersigned while employed or engaged by the United States Government, or for which the undersigned may hereafter make application for Letters Patent while employed or engaged by the United States Government, reserving to the undersigned in each case the unrestricted possession of all other patent rights not hereby or otherwise licensed to the Government of the United States of America. Said license hereby granted or agreed to be granted shall extend throughout the United States, its territories and dependencies, and all foreign countries and shall continue in force for the full term for which said Letters Patent may be granted.

SIGNED at _____, State of _____

this _____ day of _____, 1945

Witnesses:

Signed:

_____

_____

_____

REF ID:A105122

ASSIGNMENT

WHEREAS, We , William F. Friedman and J. O. Mauborgne , of 4032 Military Road, Washington, D.C., and No. 1 Alston Court, Red Bank, N.J., respectively, have invented certain improvements in System for Enciphering Facsimile, for which the undersigned on even date herewith executed an application for Letters Patent of the United States; and

WHEREAS, the invention was made while the undersigned were in the employ of the War Department, and pertains to a device useful in the National Defense, and

WHEREAS, The Government of the United States is desirous of acquiring the entire right, title, and interest in and to the said invention and in and to any patents that may issue thereon.

NOW, THEREFORE, in consideration of the premises and one dollar ($1.00), the receipt of which is hereby acknowledged, the undersigned have sold, assigned, and transferred, and by these presents do hereby sell, assign and transfer unto the Government of the United States of America, as represented by the Secretary of War, the entire right, title and interest, throughout the United States of America, and the territories and dependencies thereof, and not elsewhere, in and to the said invention and to the invention as described in the specification executed by the undersigned on even date herewith, preparatory to obtaining Letters Patent in the United States therefor, and to all Letters Patent issuing thereon and any continuations, divisions, renewals, and reissues or extensions of such Letters Patent; the said entire right, title and interest as well as the control of the prosecution of the application and all continuations, reissues and divisions thereof to be held by the Government of the United States of America (as represented by the Secretary of War) and all Letters Patent including any divisions, reissues, renewals or extensions thereof as there are or that may be granted, to be held by the Government as fully and entirely as the same would have been held by me had this assignment and sale not been made. The undersigned hereby gives the Government of the United States of America the non-exclusive right to make, use, or sell the invention for governmental purposes in all foreign countries.

Provided, however, that upon any subsequent notice of allowance of said application or of any renewals, substitutions, divisions, continuations, or continuations-in-part being given by the Commissioner of Patents, the entire right, title, and interest in and to said invention and said application or any renewals, substitutions, divisions, continuations, or continuations-in-part, and such patents as may be issued thereon, will thereupon revert to themselves subject to an irrevocable, non-exclusive, and royalty-free right and license remaining vested in the United States of America as represented by the Secretary of War, to make, have made, to use, and to sell the subject matter of said invention for governmental purposes only, to the full end of the term or terms for which any Letters Patent, divisions, reissues, renewals, extensions, continuations or continuations-in-part are or may be granted.

_____ _____

Witness

_____

Before me, a notary public in and for the _____ appeared the above-named _____, personally known to me, who in my presence executed the foregoing assignment and acknowledged that his execution thereof was his free act and deed.

Signed _____ this _____ day of

(Seal) _____

Notary Public

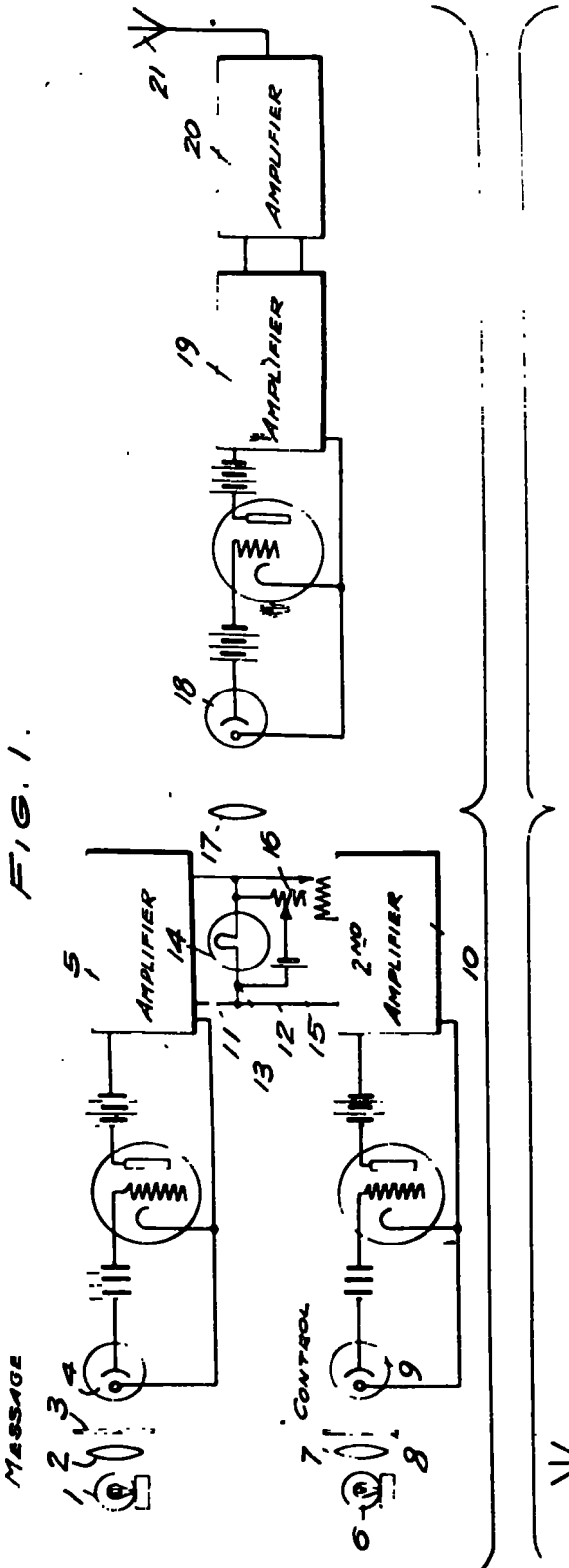

FIG. 1.

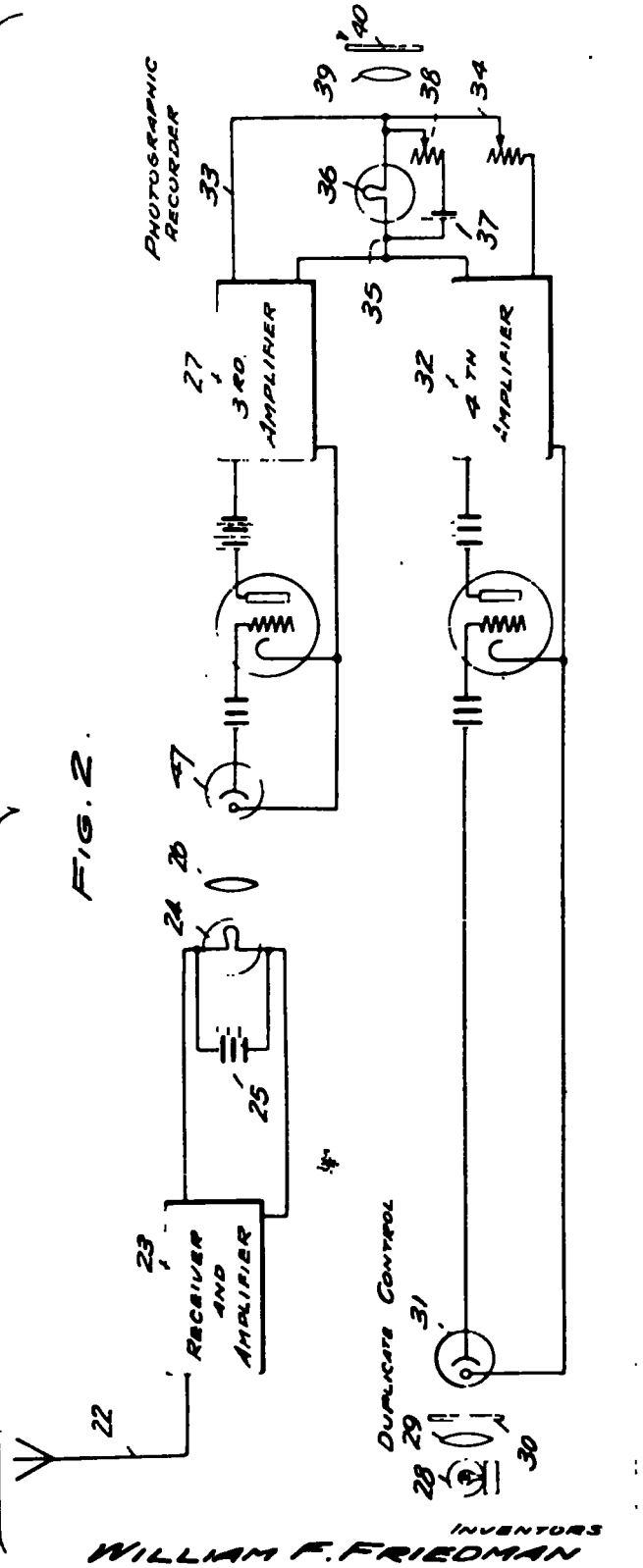

FIG. 2.

INVENTORS
WILLIAM F. FRIEDMAN
JOSEPH O. MAUBORGNE

BY William Y. Hall
ATTORNEY