

July 8, 1952

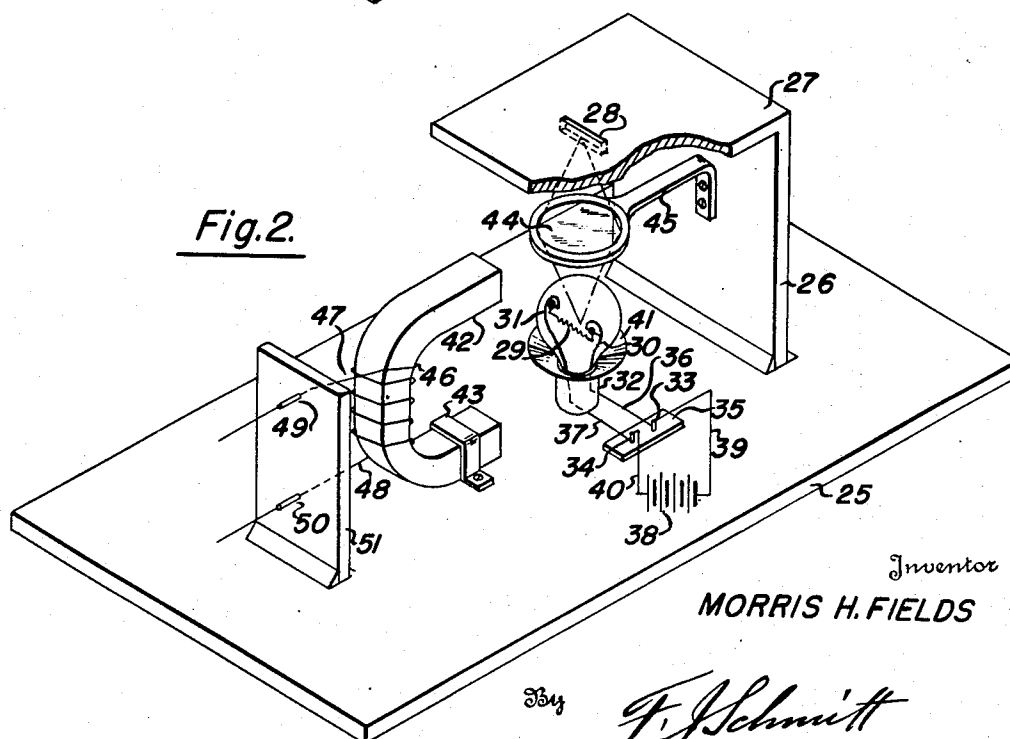
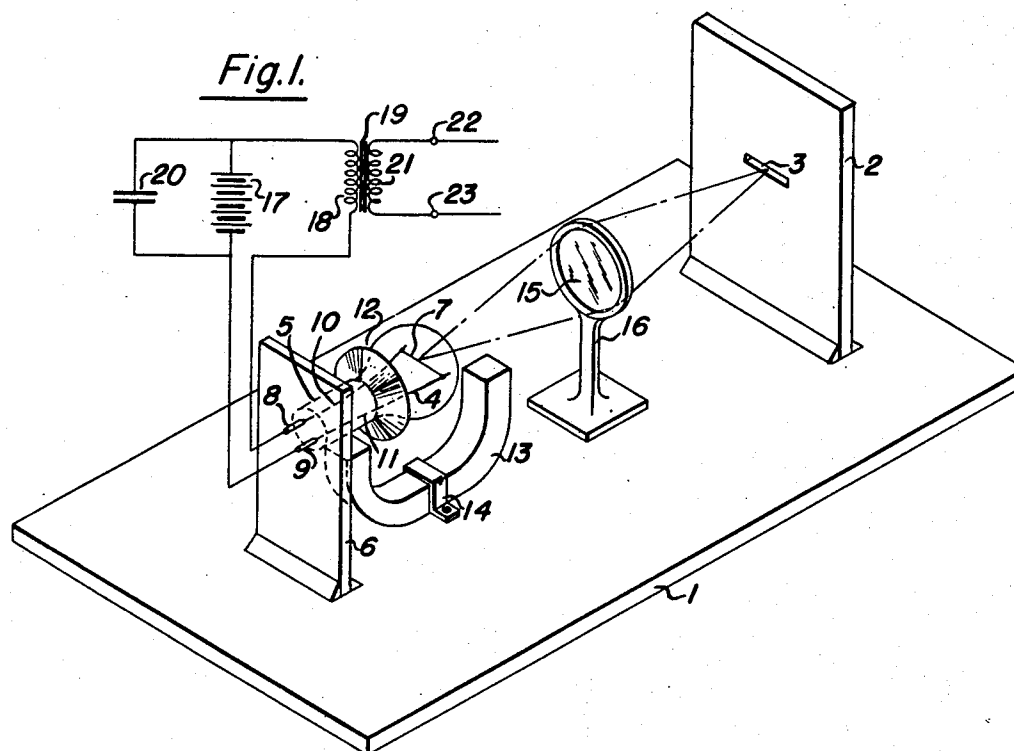
M. H. FIELDS

2,602,886

LIGHT MODULATING DEVICE

Filed March 14, 1946

T2572



Inventor

MORRIS H. FIELDS

By

F. J. Schmitt

Attorney

Patented July 8, 1952

2,602,886

UNITED STATES PATENT OFFICE

2,602,886

LIGHT MODULATING DEVICE

Morris H. Fields, United States Navy

Application March 14, 1946, Serial No. 654,485

10 Claims. (Cl. 250—7)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1 This invention relates to devices for converting electrical variations into light modulations.

The purpose of my invention is to provide modulated light for signal communication. The modulation of a light beam is accomplished by passing a varying signal voltage through an incandescent movable filament which is mounted in a magnetic field. The light beam from the filament is focused on a slit. The filament is movably responsive to flux changes that result from the applied varying signal voltage. As a consequence of a change of position of said filament, the position of the light focus changes in respect to said slit, and the quantity of light passing through the slit therefore varies as the varying signal voltage.

It is an object of my invention to provide a device for signal communications wherein a light beam is modulated in accordance with electrical intelligence.

Further objects and advantages of my invention will be pointed out in the following description, when taken in conjunction with the drawings, in which

Fig. 1 is an isometric view of the device according to a preferred embodiment of my invention; and

Fig. 2 is a modification of Fig. 1 showing a free-swinging filament adapted to be biased by a varying magnetic field.

Referring to Fig. 1, mounting plate 1 has vertically mounted thereon a plate member 2 having a horizontal slit 3 therethrough. Directly opposite said slit is a cantilever mounted flexible filament 4 in a light bulb base which is received by a light bulb socket 5. Said socket 5 is secured in any manner to a supporting post 6 which is vertically mounted on mounting plate 1.

The filament 4 has a straight end portion 7 which is positioned parallel to the longitudinal axis of slit 3 and directly opposite thereof. It is understood that while said straight and parallel end portion is my preferred embodiment, a non-parallel positionment, a curved or other configured end portion may be used. The filament is sufficiently stiff or held under sufficient tension as to cause its resonant frequency to be higher than the highest frequency contained in the varying signal voltage. Terminals 8 and 9 are connected to filament 4 through conductors 10 and 11. Reflector 12 is carried by socket 5 in the usual manner.

A horseshoe magnet 13 is positioned under the filament so that the magnetic lines of force of said magnet are at right angles to straight end

2 portion 7, of filament 4, and in inductive relation with said magnet. Binding strap 14 secures the above positioned magnet 13 to the mounting plate 1.

Double convex lens 15 is supported between filament 4 and slit 3 by means of standard 16.

A battery 17 and the secondary coil 18 of transformer 19 are series connected across terminals 8 and 9. By-pass capacitor 20 is connected across battery 17. Primary 21 of transformer 19 is connected to terminals 22 and 23 which serve as the input terminals for a varying signal voltage.

Operation

Battery 17 furnishes a direct current voltage to the filament to keep it constantly heated to a light-emitting state or incandescence. The incoming varying signal voltage is transformer coupled to the light-emitting filament 4, and is by-passed around the filament heating source 17 by means of capacitor 20. In addition to heating filament 4 to a light-emitting state, the direct current source 17 establishes a fixed electromagnetic field around said filament. The magnetic field of the permanent magnet 13 is positioned so that its flux links with the flux surrounding energized filament 4. A varying signal voltage impressed on filament 4, through transformer coupling 19, establishes an additional electromagnetic field about the filament that varies with the varying signal voltage. As a result of the coaction of the varying magnetic field on the filament with the fixed magnetic field of the permanent magnet 13, a movement of the filament is produced in accordance with recognized principles of motor action. Light from the light-emitting filament 4 is focused on slit 3 through lens 15. At the source light-emitting filament is moved or deflected up or down responsive to the reaction between varying magnetic field and the permanent field of the magnet, said filament position is changed in relation to slit 3, thereby causing the amount of light reaching a fixed point behind the slit to be varied proportionally to electrical intelligence impressed upon the filament. The focal point of light on the slit is moved transversely across the slit opening corresponding to the deflection of the source light-emitting filament. As the focal point of light is moved away from the slit opening, less light is passed through the slit; as the focal point of light is moved fully into the slit, a maximum of light is passed through the slit. Thus, means for modulating a light beam is defined.

Referring to Fig. 2, mounting plate 25 has vertically mounted thereon a supporting plate member 26 carrying a horizontal plate 27 having a slit 28 therethrough. Directly opposite said slit 28 and longitudinally parallel to it is a straight freely swinging filament 29 supported by conducting elements 30 and 31 firmly fixed in a light bulb base received by a socket 32 which is secured in a vertical position by any means to mounting plate 25.

It is understood that while said straight and parallel filament is my preferred embodiment, a curved or other configured filament may be used. The vibratility of said filament 29 is such as to cause its resonant frequency to be lower than the lowest frequency contained in the varying signal voltage. Terminals 33 and 34 of terminal block 35 are connected to conducting elements 30 and 31 through leads 36 and 37. Filament voltage is supplied by battery 38 connected across terminals 31 and 33 through leads 39 and 40, respectively. Reflector 41 is carried by socket 32 in the usual manner.

A horseshoe magnet 42 is positioned opposite the swinging filament 29 in such a manner that the magnetic lines of force are at right angles to the filament and in inductive relation therewith. Binding strap 43 secures the vertically positioned magnet to mounting plate 25.

Double convex lens 44 is supported between filament 29 and slit 28 by means of arm 45 mounted horizontally on supporting plate 26.

Coil 46 encircling the curved portion of horseshoe magnet 42 is attached through conductors 47 and 48 to signal input terminals 49 and 50 mounted on terminal block 51.

Operation

Battery 38 furnishes a direct current voltage to the filament 29 to keep it constantly heated to incandescence and to establish a fixed magnetic field around said filament 29. The magnetic field of the horseshoe magnet 42 is positioned so that its flux links with the flux surrounding the energized filament 29. A varying signal voltage applied to coil 46 establishes an additional magnetic field about the poles of said magnet 42 which varies with the varying signal voltage. As a result of the coaction of the varying magnetic field with the fixed field about filament 29, a movement of filament is produced in accordance with recognized principles of motor action. Light from the light-emitting filament 29 is focused on slit 28 through lens 44. As the source light-emitting filament is deflected up or down responsive to the reaction between the varying magnetic field and the permanent field, said filament position is varied in relation to slit 28, thereby causing the amount of light reaching a fixed point behind the slit to be varied proportionally to electrical intelligence impressed upon the filament. The focal point of light on the slit is moved across the slit opening corresponding to the movement of the source light-emitting filament. As the focal point of light is moved away from the slit opening, less light is passed through the slit; as the focal point of light is moved fully into the slit, a maximum of light is passed through the slit. Thus, means for modulating a light beam is defined.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. A light modulating device, comprising: a member having an opening therethrough; a flexibly mounted filament mounted at one side of said opening; transformer means adapted to be connected to a varying signal voltage, said filament being connected to said transformer means; constant magnetic field means mounted in inductive relation with said filament; and a source of current for heating said filament to incandescence.

2. A light modulating device, comprising: a member having an opening therethrough; a flexible filament mounted at one side of said opening; transformer means adapted to be connected to a varying signal voltage, said filament being connected to said transformer means; a source of current for heating said filament to a light emitting state; and magnetic field means mounted in inductive relation with said filament.

3. A light modulating device, comprising: a member having an opening therethrough; a flexible filament mounted at one side of said opening; transformer means adapted to be connected to a varying signal voltage, said filament being connected to said transformer means; a source of current for heating said filament to incandescence; magnetic field means mounted in inductive relation with said filament; and a lens interposed between said filament and said opening for focusing light from said incandescent filament on said opening.

4. A light modulating device, comprising: a member having an aperture therethrough; a flexibly mounted filament mounted substantially in alignment with said aperture; transformer means adapted to be connected to a varying signal voltage, said filament being connected to said transformer means; a source of direct current for heating said filament to incandescence; constant electromagnetic field means mounted in inductive relation with said filament; and a lens interposed between said filament and said aperture for focusing light from said incandescent filament on said aperture.

5. A light modulating device, comprising: a member having a slit therethrough; a flexible filament mounted substantially in alignment with said slit; transformer means adapted to be connected to a varying signal voltage, said filament being connected to said transformer means; a source of direct current for heating said filament to incandescence; a permanent magnet mounted in inductive relation with said filament; and a lens interposed between said filament and said slit for focusing light from said incandescent filament on said slit.

6. A light modulating device, comprising: a member having a slit therethrough; a flexible filament mounted substantially in alignment with said slit; transformer means adapted to be connected to a varying signal voltage, said filament being connected to said transformer means; an evacuated envelope enclosing said filament; a source of direct current for heating said filament to incandescence; a horseshoe magnet mounted in inductive relation with said filament; a lens interposed between said filament and said slit for focusing light from said incandescent filament on said slit; and a reflector for directing light from said filament to said focusing lens.

7. A light modulating device, comprising: means for producing a constant magnetic field; a filament movably mounted in inductive relation with said field; a source of current for heating said filament to incandescence; and means including a transformer operatively connected to

2,602,886

5

said source and adapted to be energized by a modulating signal for varying the inductive coupling between said constant field means and said energized filament to deflect said filament.

8. A light modulating device comprising a base member, a first supporting member mounted upon said base member and having a slit therein, a lens mounted in predetermined position with respect to said slit, a second supporting member mounted on said base member, an incandescent lamp having a filament and mounted on said second support member in predetermined position thereon whereby said lens focuses light from the filament through said slit, direct current source means for heating the filament to incandescence and setting up a first magnetic field about the filament, modulating means also connected to said filament for altering the field about the filament by a modulating signal, and means disposed in predetermined position with respect to said lamp and filament for setting up a second magnetic field, said lamp and field generating means being so disposed that the first magnetic field and the second magnetic field interact with each other to move the filament in response to the modulating signal and thereby vary the light reaching said slit from said lens.

9. A light modulating device comprising a base member, a first supporting member mounted upon said base member and having a slit therein, a lens mounted in predetermined position with respect to said slit, a second supporting member mounted on said base member, an incandescent lamp having a filament and mounted on said second support member in predetermined position thereon whereby said lens focuses light from the filament through said slit, a source of direct current, a transformer having a primary and secondary, means connecting said secondary and source in series to said filament for energizing the filament, said primary being adapted to have a modulating signal applied thereto, said source providing for heating the filament to incandescence and setting up a first magnetic field about the filament, said transformer providing for varying the strength of said first field in accordance with said modulating signal, and means disposed in predetermined position with respect to said lamp and filament for setting up a second magnetic field, said lamp and field generating means

6

being so disposed that the first magnetic field and the second magnetic field interact with each other to move the filament in response to the modulating signal and thereby vary the light reaching said slit from said lens.

10. A light modulating device comprising a base member, a first supporting member mounted upon said base member and having a slit therein, a lens mounted in predetermined position with respect to said slit, a second supporting member mounted on said base member, an incandescent lamp having a filament and mounted on said second support member in predetermined position thereon whereby said lens focuses light from the filament through said slit, a source of direct current, a capacitor connected in parallel with said source, a transformer having a primary and secondary, means connecting said secondary and source in series to said filament for energizing the filament, said primary being adapted to have a modulating signal applied thereto, said source providing for heating the filament to incandescence and setting up a first magnetic field about the filament, said transformer providing for varying the strength of said first field in accordance with said modulating signal, a permanent magnet mounted on said base member in predetermined position thereon with respect to said lamp for setting up a second magnetic field, said lamp and magnet being so disposed that the first magnetic field and the second magnetic field interact with each other to move the filament in response to the modulating signal and thereby vary the light reaching said slit from said lens.

MORRIS H. FIELDS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,802,441	Morse	Apr. 28, 1931
1,813,681	Sandvick	July 7, 1931
1,937,754	Giesking	Dec. 5, 1933
1,951,578	Peters	Mar. 20, 1934
1,958,696	Digby	May 15, 1934
1,976,120	Francis	Oct. 9, 1934
2,289,075	Ruth	July 7, 1942