

Aug. 9, 1932.

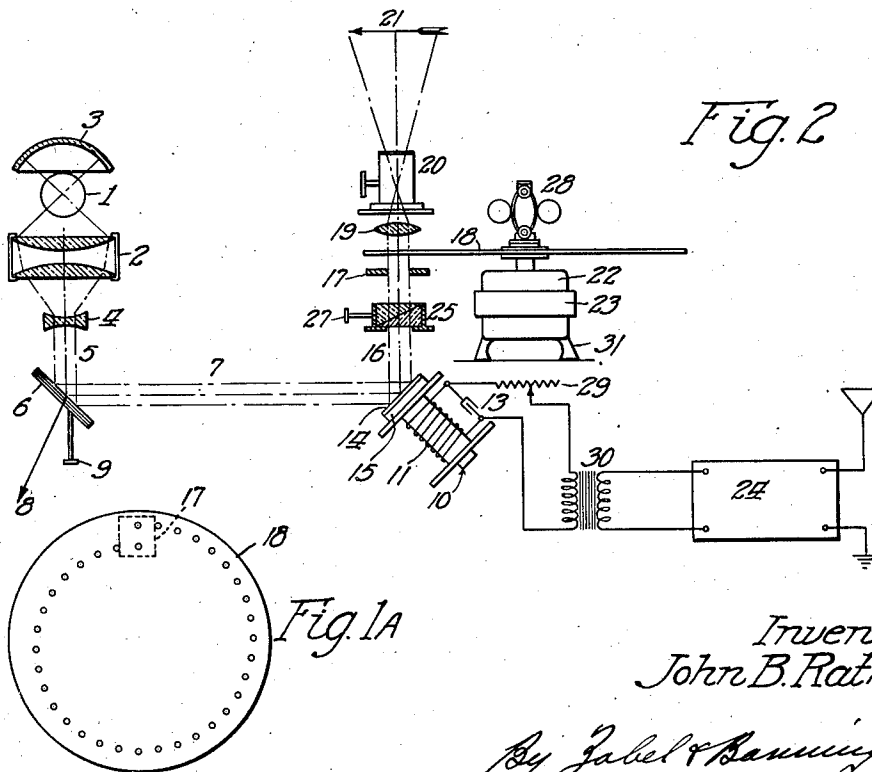
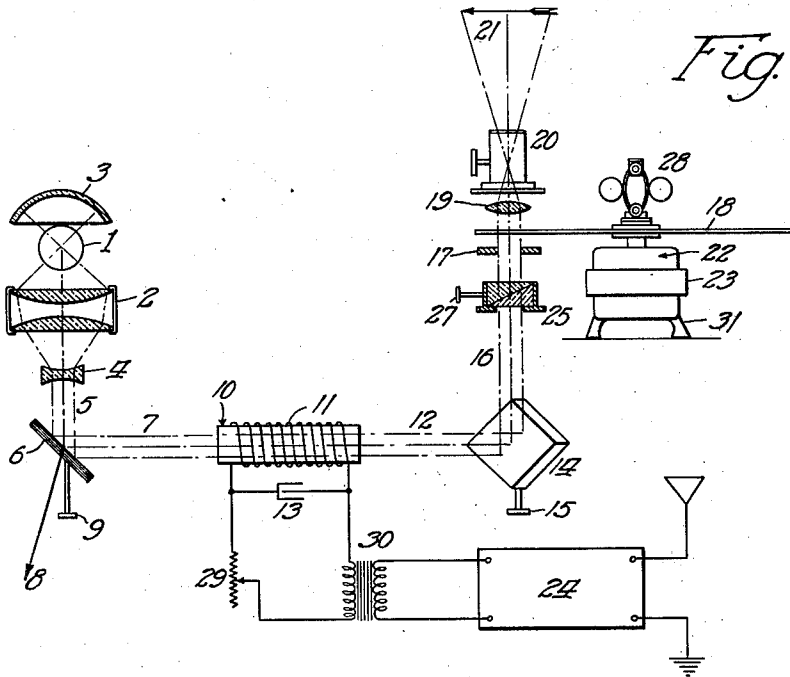
J. B. RATHBUN

1,870,465

SYSTEM OF TELEVISION

Filed Aug. 4, 1930

4 Sheets-Sheet 1



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By *Jabel & Manning* Attys.

Aug. 9, 1932.

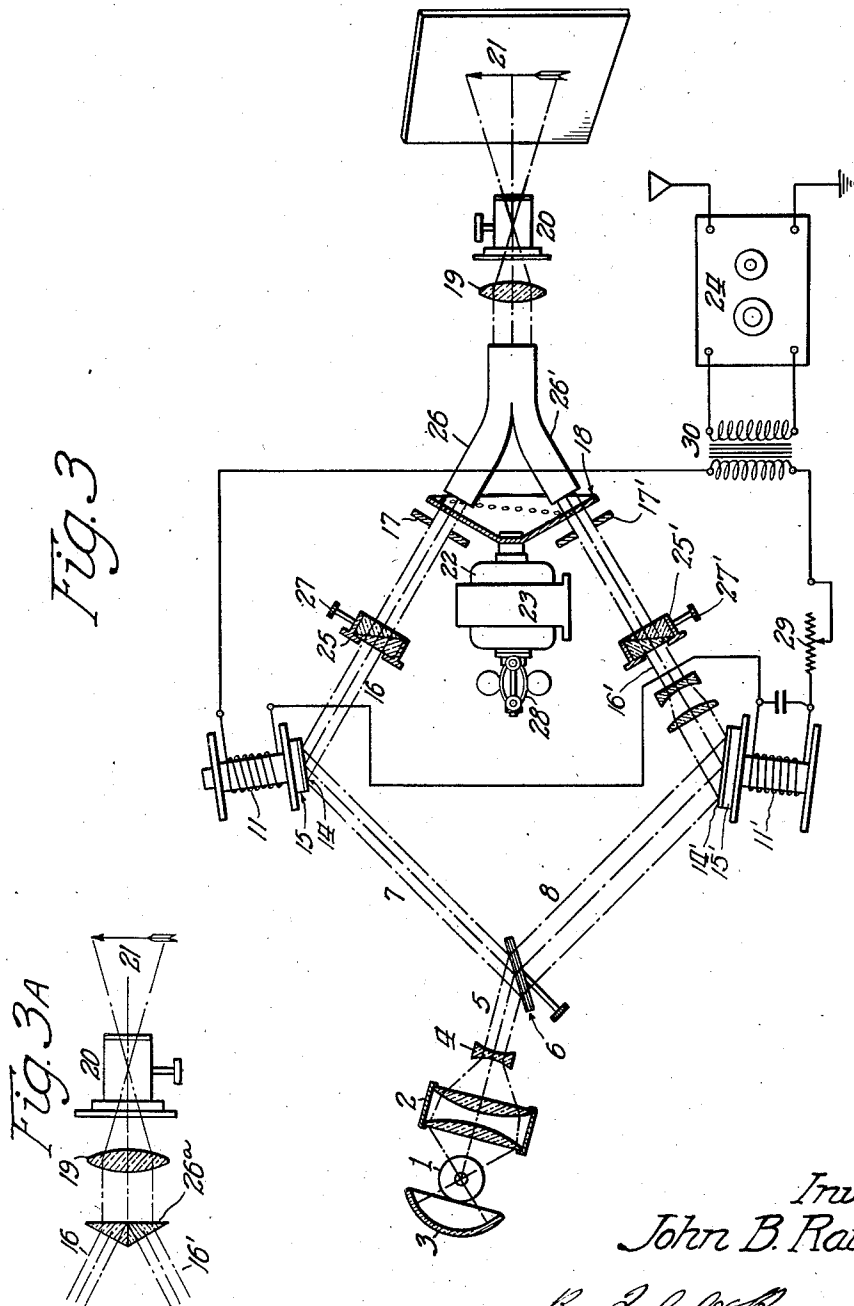
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SYSTEM OF TELEVISION

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4 Sheets-Sheet 2



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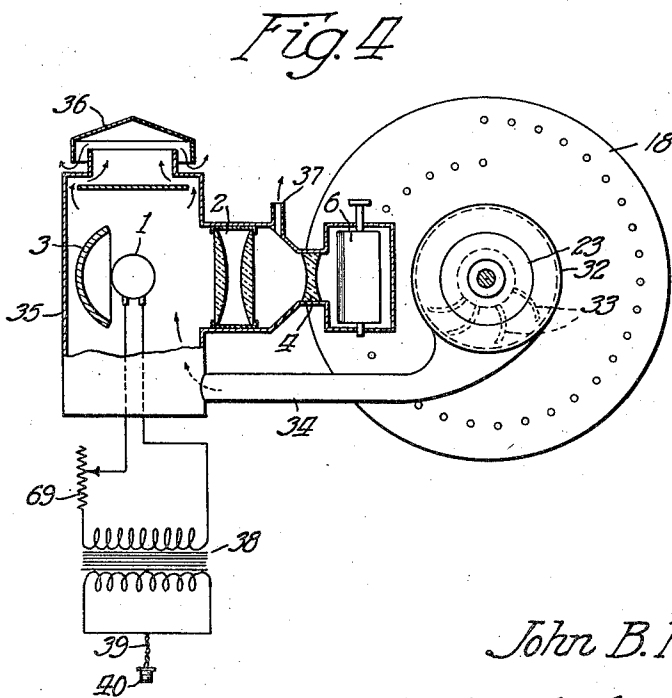
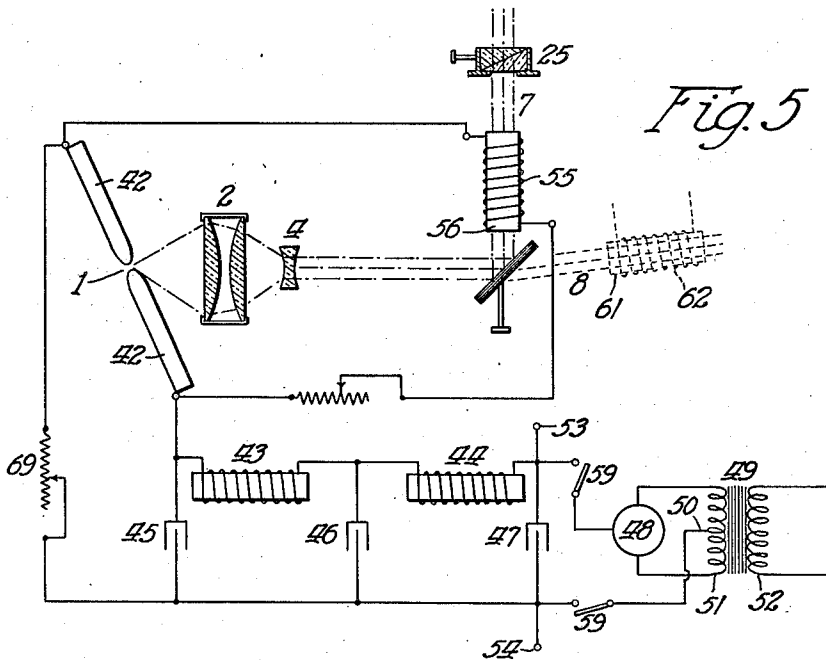
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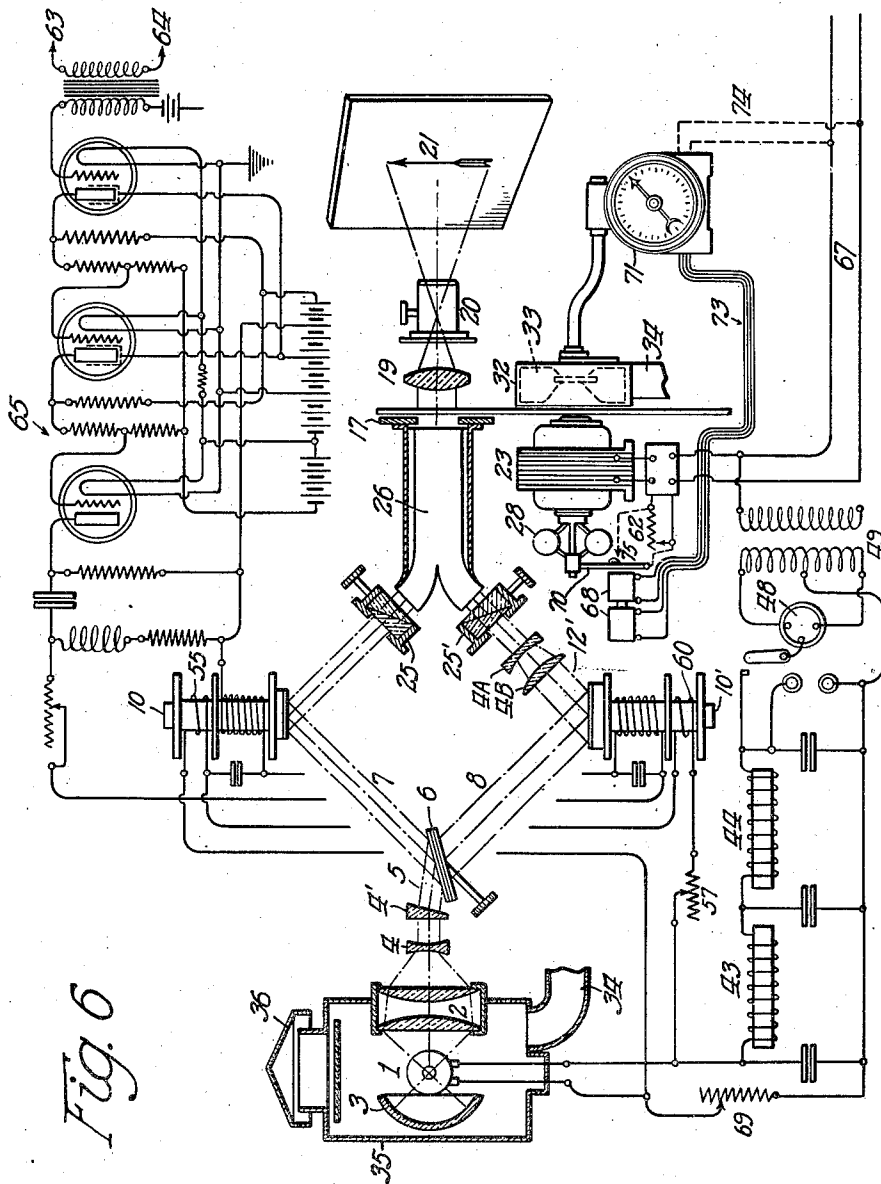


Fig. 6

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UNITED STATES PATENT OFFICE

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SYSTEM OF TELEVISION

Application filed August 4, 1930. Serial No. 473,049.

My invention relates to improvements in apparatus for reproducing or recreating images of distant views, either stationary or in motion; the reproduction of photographic views or writings, either still or in motion; printed or written matter, documents, messages and the like, either directly visible to the eye or photographically recorded by invisible light rays, the operation of this television receiver being controlled by impulses transmitted to the receiver from the distant point through electrical conductors or by radiated energy as by radio waves.

My invention particularly relates to the projection of such reproduced or recreated images in a plane external to the emission plane of a constant unvarying source of light, such as an incandescent or arc lamp, and so that a suitable illumination intensity can be maintained in this visual or picture plane on which the reproduced image is projected. In the direct vision version of the apparatus, the modulated light beam is projected directly upon the retina of the eye. Where large reproductions are to be employed in assembly or public halls, the reproduced image is to be projected upon a screen or equivalent so that it can be viewed simultaneously by a number of people by light reflected from the screen.

My object in this invention is twofold: First to control the beam of light emitted from an unvarying source so that the intensity of the final projected beam will vary in accordance with the intensity of the received electrical or radio impulses, thus producing varying degrees of light and shade that are in synchronism with the varying lights or shades on the original object at the transmitting station while the latter is being progressively scanned or examined along a predetermined path. Second, to allocate this beam of controlled or modulated light on the visual or picture plane so that the intensity variations take place at definite points in accordance with the allocation of the tracer beam at the transmitting station. The modulating device determines the degree of light or shade in the creation of the reproduced image, while the exploring or scanning device determines that particular point within the boundaries of the picture at which the variations of the light are to take place at any given instant. The total effect is that of a traveling or tracing beam of fluctuating light traversing the picture plane along definite lines.

Specifically, the light intensity control is attained by novel applications of the principles involved in the electromagnetic rotation of polarized light, the light from the constant source first being plane polarized and then rotated back and forth by fluctuating electrical and magnetic impulses so that the free passage of the vibrating light beam past an optical analyzer is more or less obstructed in proportion to its momentary angular position in regard to the optical plane or axis of the analyzer. When the plane of the polarized light beam is at right angles to the optical plane of the analyzer, the passage of the light is entirely obstructed and no light will pass the analyzer. When the beam is more or less rotated from this position by the modulating magnet or magnets, then more light will pass the analyzer, the amount depending upon the angle that the plane of the polarized beam makes with the optical plane of the polarizer. Since the modulating magnet or magnets are acted upon directly by electrical impulses received from the transmitting station, it is evident that the intensity of the modulated beam will vary accordingly.

In one form of the invention, I attain this object or objects, by optical systems combined with electrical circuits and mechanical parts illustrated in the accompanying drawings, of which,—

Fig. 1 is a simple schematic diagram showing the simplest application of the invention, and also the optical and electrical relations existing between the major elements;

Fig. 1A is a fragmentary view illustrating the scanning disc;

Fig. 2 and Fig. 3 show progressively further developments in the same system or invention superimposed upon the elements of Fig. 1;

Fig. 3A is a detail of a part of the optical apparatus;

Fig. 4 is a fragmentary view setting forth features of construction;

Fig. 5 is a diagrammatic view showing the use of desirable corrective features; and

Fig. 6 is a diagrammatic view illustrating the combination of various features in one complete device.

Fig. 1 is a schematic diagram of the single beam type of television receiver covered by this invention. At 1 is the source of constant light, such as an incandescent or arc lamp. Light from the lamp is concentrated or intensified by the condenser lens cell 2, and this light can be further increased by light reflected from the back of the lamp through the reflector 3. A lens 4 straightens out the converging rays into a parallel beam of rays as at 5 so that all rays will be equally incident and reflected or refracted from the mirror polarizer 6.

Polarizer 6 reduces the reflected ray 7 into what is understood as a beam of plane polarized light with all its vibrations confined to a single plane, and it is this beam that is eventually used for the projection. The remainder of the light containing polarized rays in a perpendicular plane, is refracted and rejected at 8. The polarizer 6 consists of one or more flat glass plates packed together, the number of plates depending upon the index of refraction of the glass employed. At 9 is an adjustment for the angle of the polarizer. When a single beam of reflected polarized light is employed, a black or colored mirror 6 can be used so that the rejected ray 8 is absorbed.

The modulating cell 10 is a tube or rod of transparent material having a high index of rotation and may consist of a glass rod, a tube filled with carbon disulphide, a quartz rod, etc., and is surrounded by the magnetizing coil 11, the terminals of the coil being connected to the output of the radio receiver and amplifier 24. Current pulsations in the coil, corresponding to the incoming signal impulses, twist the beam of polarized light 7 through an angle proportional to the momentary magnetic intensity so that the plane of the issuing beam 12 is at an angle with the plane of the beam 7. An electrical condenser 13 modifies the inductive effect of the coil 11.

The analyzer 14, shown here, is a reflecting surface with its optical plane so adjusted that the beam of light 12 will be totally obstructed when the coil 11 is demagnetized, but which will reflect the polarized beam along 16 in volume proportional to the rotation of the beam. In short, the optical axis of the analyzer 14 is normally crossed with the axis of polarizer 6 with the coil demagnetized, and the light intensity along 16 is therefore proportional to the rotation of 12,

the strength of the current in 11, and the strength of the impulses received by the amplifier 24. It should be understood that 24 can also be an amplifier for intensifying the impulses sent over wires as well as for amplifying radio signals. It is generally advisable to isolate the amplifier and modulator circuits by a transformer 30.

The polarized beam at 16 is now modulated or controlled by the combined rotation and analysis at 14. Its intensity varies in proportion to the incoming signals from the transmitter. To assist the analyzer mirror 14, it may be necessary to obtain further analysis by the addition of a Nicols or similar prism at 25 when the light is exceptionally intense, the combination of the prism 25 with the reflecting analyzer 14 giving more complete control of the modulation than is possible with either element alone. The adjustment 15 permits the angle of 14 to be changed while 9 is the adjustment of the polarizer.

The modulated or pulsating light beam now passes through the aperture plate 17, which defines the boundaries of the picture. At 18 is a rotating exploring or scanning disc, provided with a spiral of holes that traverse the beam section issuing at 17 along a series of strips or consecutive areas from left to right and from top to bottom across the section. It is this disc that determines the instantaneous light position on the picture plane. A detail of this disc is shown by Fig. 1A. The disc is driven in synchronism with a corresponding disc at the transmitting station so that the location of the light spot on the receiver picture plane will exactly correspond to the location of the spot of light on the object being explored at the transmitting station. This disc is driven by the motor 23 which may be provided with a reduction gear 22 when a synchronous motor is employed. Mechanisms for the synchronization of the receiver motor with the transmitting disc will be described later. Rheostat 29 controls the modulation and intensity.

Light passing the exploring or scanning disc 18 then goes to a secondary condenser or converging lens 19 that converges the rays in the proper relation to the objective or projecting lens 20, forming the image at 21. It should be understood that various combinations of lenses may be employed to meet certain conditions as now employed in the art of projection. For example, the condenser cell 2 may be a double convex lens or a corrugated lens, depending upon the type of lamp employed.

Fig. 2 is a rearrangement of the elements, the parts being given the same reference numbers as in Fig. 1. Here we have the lamp 1, the primary condenser cell 2, the reflector 3, parallel ray lens 4, parallel beam 5, polarizer 6, adjustment 9, polarized beam 7, and refracted and diverted ray 8, as before

Electromagnetic modulation is by the iron or steel magnet core 10 carrying the magnetizing coil 11, the plane polarized light beam 7 being rotated by the polished or mirrored magnet pole 15. The terminals of the magnet coil are connected to the amplified output of the receiver 24 with an electrical condenser 13, as before. At 14 I represent the reflecting surface, which may be separate or an integral part of the pole 15.

Polarized beam 16 is rotated back and forth in step with the current fluctuations in the coil 11, as before, and is partly analyzed by a Nicols or similar prism 25, the preliminary or partial analysis being by the polished mirror face 14 on the pole 15 of the modulating magnet as in the preceding case. The intensity of the beam 16 fluctuates with the incoming signals as before, and is explored by the same rotating disc 18 driven by motor 23. The secondary condenser lens 18 now concentrates the light rays in the objective lens 20, forming the image at 21.

Where light is to be conserved from a limited source, or where more light is to be projected upon the picture plane, use is made of both the reflected and refracted rays diverted by the polarizer 6 (see Fig. 3). This not only materially increases the illumination of the image, but also corrects any color distortion that might be produced by the use of the reflected ray alone. Both beams 7 and 8 are polarized, but in a plane perpendicular to the other. The reflected ray 7 is inclined toward a bluish tinge, while the refracted ray 8 is inclined toward red, hence the eventual recombination of these rays will restore the original white color of the light source to the image.

Fig. 3 shows the employment of both beams with the preceding devices by which the refracted ray 8 and the reflected ray 7 are combined to form a more intense light at the image 21. The various parts in Fig. 3 are given the same reference numbers as the corresponding parts in Figs. 1-2, their functions being the same in all three figures.

In Fig. 3, the constant light source is at 1, the condenser lens cell is 2, the reflector is 3 and the parallel ray lens is at 4. The parallel beam of common light 5 falls incident on the polarizer 6 which reflects a polarized beam 7 and refracts a second polarized ray 8, just as before. Both rays are electromagnetically modulated simultaneously, the beam 7 by the magnet pole 15 and polished mirror face 14, while the beam 8 is modulated by the magnet pole 15' and its mirror face 14'. The magnets carry the respective coils 11 and 11', connected in series and to the amplified output of the receiver 24 or the line amplifier of a wire transmission. The current impulses thereby rotate both beams simultaneously and are analyzed respectively by the prisms 25

and 25'. Adjustments 27 and 27' are provided for the adjustment of the analyzer prisms.

The rotated light beams 16 and 16' pass through the analyzer prisms 25 and 25', respectively, and finally become pulsating beams of modulated light as before. The aperture diaphragms 17 and 17' define the shape of the picture or image and to the right of the apertures is the conical shaped exploring or scanning disc 18 provided with a double spiral of perforations. The single disc serves both beams of light through double spirals of perforations, one spiral for each beam.

At 26 and 26' are two light conductors of some transparent material, such as glass or quartz, used for combining and bringing the two convergent beams into a common direction. At 19 is the secondary condenser lens, used for converging the light rays in the objective lens 20, the latter throwing the image on the picture plane at 21. Both beams of polarized light are used, and with the exception of minor losses by absorption and reflection, all of the light issuing from 1 is available at the screen and of practically the same color as the incident beam of common light at 5.

Because of its superior transparency, refractive index and rotative index, as much of the light is carried through carbon disulphide as possible. The entire optical system, so far as practicable, is immersed in this fluid at open points in the paths of the beams where the light is not traversing glass or other solid substances.

While the radio receiver and amplifier have been illustrated as the means of receiving and amplifying the transmitted impulses in the form of radio waves, for simplicity in explanation, yet the system can also be employed with wired transmission in which the line wires replace the antenna and ground wires of the radio receiver 24. A variable resistance 29 in both figures gives control of the modulating current and hence controls the degree of modulation and illumination.

Since the disc 18 must rotate in synchronism with the mechanism at the transmitting station, so that corresponding portions of the visual plane 21 are illuminated in exact accordance with the same relative position of the real object at the transmitter, it is evident that the motor 23 must be adjusted so that it will operate in synchronism with the transmitter motor or equivalent. This is attained by the employment of some sort of speed control 31 or synchronizing device, either automatic or manually controlled, and also a centrifugal governor 28 that smooths down any momentary variations or pulsations in speed. This governor may be of the friction type, mechanically controlling the load on the motor and hence its speed, or it may be a fan type employing

the air friction of a number of fan blades, or both methods in combination.

As a synchronous motor may be desirable under certain conditions, and as such synchronous motors are commonly built for running at higher speeds than the proper synchronous speed of the disc 18, it may be necessary under such conditions to insert reduction gears at 22 between the motor 23 and the disc 18. Thus, with the disc running at the now common speed of 900 R. P. M., and the standard motor speed of 1,800 R. P. M. now common with stock motors, this may call for a gear reduction of 1 to 2.

Fig. 4 shows certain features desirable in connection with the operation of the television receiver, this view being taken in such a direction that we are looking toward the disc 18 instead of its edge. This view illustrates essentially a means for ventilating the source of illumination 1 and a means of obtaining a steadier illumination without flicker. Except for the new parts about to be described, the parts bear the same numbers as in the other two diagrams.

In Fig. 4, fan blades 33 rotate with the scanning disc 18 or motor 23 within the fan housing 32, drawing air in at the center and discharging the air under pressure through the pipe or port 34 into the lamp-house 35. This current of air then removes heat from the lamp 1 and passes out through the light tight ventilating hood 36, the circulation being indicated by the arrows. Some of the air also escapes through the port 37 so that the condenser lens 2, the parallel beam lens 4 and the polarizer 6 are also cooled.

This ventilation becomes a necessity when the lamps exceed a certain size in order to avoid cracked lenses and mirrors.

To avoid interference with the projection, the light emitted from the source 1 must be as steady and constant as possible, for a flickering lamp will create false shadows and high lights on the screen. One method of minimizing flicker on the smaller machines, using incandescent lamps for the source 1, is to employ a low voltage lamp with a very heavy thick filament so that its mass will prevent appreciable momentary cooling or heating with fluctuations in the voltage of the supply current. As such heavy filaments require voltages considerably below those ordinarily supplied, it will be then necessary to employ a step-down transformer with A. C. current supply, as shown at 38. The primary of this transformer is supplied through the conductor 39 and connection plug 40. A rheostat 69 permits of voltage adjustment at the lamp.

When an arc lamp or similar unstable light of any sort is employed, either with the arc in air or under a diminished pressure as with the mercury arc lamp, the light pulsates in step with the voltage fluctuations so that

such lamps flicker in step with the frequency of an A. C. current or with voltage variations on either A. C. or D. C. lines. Such lamps in their simple form are undesirable unless means is found for maintaining an unvarying voltage at their terminals. It is evident that only D. C. is permissible with such arc lamps and that even this current must be filtered and smoothed out free from any pulsations that might cause flicker. Where the size demands heavy current, a motor generator or converter can be employed for the supply of D. C. from A. C. lines.

Fig. 5 shows a corrective system for use with arc lamps or other unstable lamps employed with either A. C. or D. C. supply current of large size, but arranged so that only smooth D. C. current reaches the terminals of the lamp. In this particular case, I show the source of light 1 consisting of an ordinary carbon arc lamp with the carbon or metallic electrodes 42. The filter system employed with this lamp is of the conventional type, in this case consisting of the two chokes or inductances 43 and 44, and the condensers or capacities 45, 46 and 47, the latter being replaceable with resistances connected in the same way or by similar methods now known to the electrical art. The inductances and the condensers absorb pulsations in the D. C. current supply before they reach the lamp.

When an A. C. supply is employed, it is obvious that it must first be rectified or converted into D. C. by means of a rectifier such as 48, this rectifier being supplied with A. C. by the secondary coil 51 of the transformer 49. The ratio of the secondary 51 to the primary coil 52 is such that the proper lamp voltage is applied at the terminals of the lamp. This voltage is adjustable through certain limits by the rheostat 29 or by voltage adjustments on the transformer. A mid-tap at 50 in the secondary 51 forms one side of the D. C. line.

The rectifier 48 can be any commercial form of rectifier, an electronic tube, mercury arc type, electrolytic, rotary converter, etc., but should preferably be of the double-wave class in which both positive and negative waves of the A. C. are utilized. The variable resistance 69, or any sort of control incorporated within the transformer, is employed for the regulation of the arc at 1 as with all lamps.

When D. C. is supplied instead of A. C. lighting current, then there is no necessity for the transformer 49 nor the rectifier 48, and these parts are entirely removed from the apparatus or disconnected from the filter circuit by the switches 59, the D. C. source of lighting current now being connected to the filter terminals 53 and 54. In the event that the D. C. current supplied is sufficiently smooth, then the filter system can be removed altogether, as will be obvious.

Since practical commercial rectifiers cannot always be depended upon to supply a perfectly smooth current, and for the reason that certain adjustments of the electrodes 42 may cause flicker, a direct acting correction may be necessary, either in addition to the filter or alone, to overcome the pulsations in the projection. In this system, the correction is applied directly to the beam of polarized light issuing from the polarizer or after, turning the beam in proportion to the voltage variations so that it is in greater or lesser agreement with the optical plane of the analyzer, depending upon whether the voltage is diminishing and reducing the emission of light at 1, or whether it is increasing the intensity of the light issuing from 1.

Thus, when an increasing voltage at the lamp tends to increase the intensity of the emitted light, then the corrector coil will turn the beam of polarized light through a corresponding greater angle so that it tends to diminish the light passing the analyzer, thus maintaining a constant total image illumination.

This is attained as shown in Fig. 5 by a transparent body 56 having a high index of rotation, transmitting the beam of polarized light 7 and surrounded by the magnetizing coil 55. The ends of the coil are connected across the lamp electrodes 42 in such a way that a varying voltage drop across the electrodes will cause corresponding variations in the magnetic strength of 55 and thus will turn the beam 7 back or forth in greater or lesser agreement with the optical axis of the analyzer 25. This compensates, therefore, for any variation of the light issuing from 1, whether it be due to line current variations or pulsations, or to imperfect adjustment of the electrodes 42. When both the reflected and refracted rays of polarized light are employed, then a similar corrector, indicated by body 61 and coil 60, is applied to the refracted ray 8 in the same way, both coils then being connected in series or parallel with each other. The coils 55 or 60 may be wound alone on the bodies as shown, or they may be wound on the same coil as the modulating magnet coils, to save room.

In Fig. 6, all of these details are coordinated and assembled to form a complete projector of a large size employing an arc lamp. To the inventions already mentioned, are added a synchronizing device for automatically keeping the scanning disc in step with the transmitter scanning device, and also, one or two optical improvements that may be desirable under certain conditions. With the exception of the additions, all parts bear the same reference numbers as those in the preceding diagrams.

In cases where it is desirable to project the light along the same general line, so that the

optical center of the lamp, condenser and lamp-house are parallel to the optical center of the objective lens 20, it may be required to insert a prism 4' into the incident beam, the lamp house now standing vertical as shown, instead of inclined along the incidence line 5, as in previous diagrams.

Again, it will be noted that the refracted beam of polarized light 8 is of larger diameter than the reflected beam of polarized light 7, hence the unit intensity of 8 is less than that of 7. As it is usually desirable to have both the reflected and refracted beams of equal intensity for the equal illumination of the screen, the lens group 4A and 4B has been placed for the concentration of the refracted beam 12' so that it is of equal intensity at the aperture of the analyzer 25'.

At 65, I have a suggested resistance-coupled three-stage amplifier for amplifying the incoming signals, the amplifier shown herewith being shown in more detail than in preceding figures, although it serves the same purpose. When the signals are transmitted by wire, then the line is connected to the terminals 63 and 64 of the amplifier, or the output of a radio set may be connected in the same way if the amplifier of that radio receiver is not sufficient to properly amplify the signals within itself. No claim is made for the particular amplifier shown, this being a representative type giving "straight line" amplification.

As Fig. 6 represents a television employing some sort of arc lamp or similar lamp having a strong tendency toward flickering with a varying voltage, I show a filter circuit in series with the light, as before explained, the rectifier being cut in with A. C. supply from the wires 67, or cut out with D. C. current. This filter and rectifier is seldom necessary with incandescent lamps.

It will be noted that the corrective coils 55 and 60, for the correction of varying voltage, are wound directly on the core 10 of the modulating magnets instead of being wound around a transparent body, as shown in Fig. 5, but the purpose and effect is the same in both cases.

The ventilation system for the lamp-house consists of the blower housing 32 and rotating fan blades 33, as before described, drawing in air through holes in the front plate and discharging the air through the duct 34 that connects at the other end with the lamp-house, a part of the duct being broken away in the drawing for the sake of simplicity. The warm air exit is at 36.

Fig. 6 also shows the attachment of a proposed automatic synchronizing device which includes the stabilizing centrifugal governor 28 already mentioned, together with a circuit control 62 comprising a variable resistance or rheostat. The centrifugal governor 28 is of the phonograph type, plac-

ing an additional friction load on the motor when it tends to speed up, or releasing the friction load when the motor speed falls off, thus tending to maintain a constant speed within narrow limits. This, however, is simply for the purpose of stabilizing the motor and is not necessarily a means of synchronous operation within itself.

Primarily, synchronism is attained by means of an accurate clock 71, acting in connection with the motor in such a way that motor speed variations are checked up with the clock revolutions. It is well known that a weight or spring driven clock can be made very accurate, gaining or losing only a few seconds per week, hence is sufficiently accurate for maintaining synchronism over the comparatively short period that a television will be in operation. If such a clock is of the synchronous or Telechron type, driven by the A. C. supply circuit through dotted wires 74, synchronous operation of the television can be maintained indefinitely if the circuits of the transmitter and receiver are synchronized at frequent intervals, but in the latter case it might also be sufficiently accurate to use a synchronous motor at 23 without synchronizing apparatus of any sort under certain conditions.

It should be particularly noted that the blower 33 puts a comparatively heavy load on the motor 23, and thus reduces the tendency toward hunting and pumping that exists with an unloaded or lightly loaded motor. While a synchronous motor might operate alone on a properly synchronized circuit without the clock attachment, yet there are certain inductive conditions where the motor might pump or pulsate during one revolution, and thus partly defeat its purpose. For such conditions, the automatic synchronizing system would be necessary. If a universal motor is employed, capable of operation both on A. C. and D. C., as would be desirable with a standard factory-made equipment for filling all conditions, then the clock would always be necessary, either with or without synchronized A. C. circuits or with D. C. Synchronous motor operation is usually attended with some difficulties and is not always desirable.

In short, the clock synchronizer forming part of this invention, consists of two independent rotatable elements: (1) A primary control disc driven by the clock mechanism, and (2) a motor or disc driven member running at exact scanning speed or motor speed, the latter member being driven from the disc or motor by a rigid or flexible shaft.

When both members are running at exactly the same speed, there will be no correction made with the motor. Should the motor momentarily run faster than the clock member, then contacts will be made within the clock that add to the friction load of the

governor through the control magnets 68, arm 70 and control wires 73. At the same time, the movement of 70 opens the contact 75, inserting additional resistance into the motor circuit and thus still further acting on the motor speed.

If the motor driven member should momentarily slow down below the speed of the clock driven member, then the internal contacts will cause the magnets 68 to act in the opposite direction, removing a certain proportion of the governor friction load, closing the contacts 75, and thus shorting out part of the resistance in the motor circuit. The combined effect is to allow the motor to speed up slightly until the motor is again running at the speed determined by the clock. This acceleration is prompt and a noticeable change can be made within a small fraction of one revolution.

With a clock losing five minutes per week, the variation is only $1/2016$ while a motor speed variation of slightly less than 1% is permissible without causing trouble in the projection. This demonstrates that clock synchronism can be made perfectly practicable and as accurate as any other system under the ordinary methods of operation. In short, a clock-controlled motor can operate for nearly 20 hours before it becomes out of phase within the present permissible limits. It can then be instantly reset for another 20 hour run by momentarily opening 62 until the picture is again "in frame". While the clock does not actually synchronize the motor, so that the motor and scanning disc are always exactly in step, yet it is close enough to this ideal for all practical purposes, and avoids a great deal of complication experienced with other means of synchronization proposed to date.

It must be understood that in this description, I have proceeded on the theory that light is most generally considered as a form of vibration, although other theories are gaining ground. The terminology used conforms to the vibration theory. The invention, however, is independent of the exact character of light, and should other theories presently become more firmly established, I wish it understood that the terminology can be changed to conform without departing from the spirit of my invention. I have described various embodiments of my invention, but naturally this must not be construed as a limitation to the exact forms shown, as my invention is susceptible of many modifications without departing from its spirit.

What I claim as new is:

1. In a modulated polarized light system, means for increasing the light efficiency thereof, comprising a source of light, a polarizer in which the light from said source is polarized in a reflected beam, and a transmitted

beam, and means for recombining the polarized beams.

2. In a modulated polarized light system, means for increasing the light efficiency thereof, comprising a source of light, a polarizer in which the light from said source is polarized in a reflected beam, and a transmitted beam, magnetic means responsive to varying signals for separately rotating said beams, and means for recombining the polarized beams.

3. In a modulated polarized light system, means for increasing the light efficiency thereof, comprising a source of light, a polarizer in which the light from said source is polarized in a reflected beam, and a transmitted beam, magnetic means responsive to varying signals for separately rotating said beams, and means for recombining the polarized beams, said magnetic means comprising coils responsive to said varying signals, and poles therefor having reflecting means from which the polarized beams are reflected.

4. In a modulated polarized light system, means for increasing the light efficiency thereof, comprising a source of light, a polarizer in which the light from said source is polarized in a reflected beam, and a transmitted beam, magnetic means responsive to varying signals for separately rotating said beams, and means for recombining the polarized beams, and means for controlling flicker in said device comprising reactive coils on said magnetic means for compensating for voltage changes therein.

In witness whereof, I hereunto subscribe my name this 25th day of July, A. D. 1930.

JOHN B. RATHBUN.

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