Oct. 20, 1931. R. H. RANGER 1,828,000

ANALYZING SYSTEM FOR PICTURE TRANSMISSION

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Fig. 1

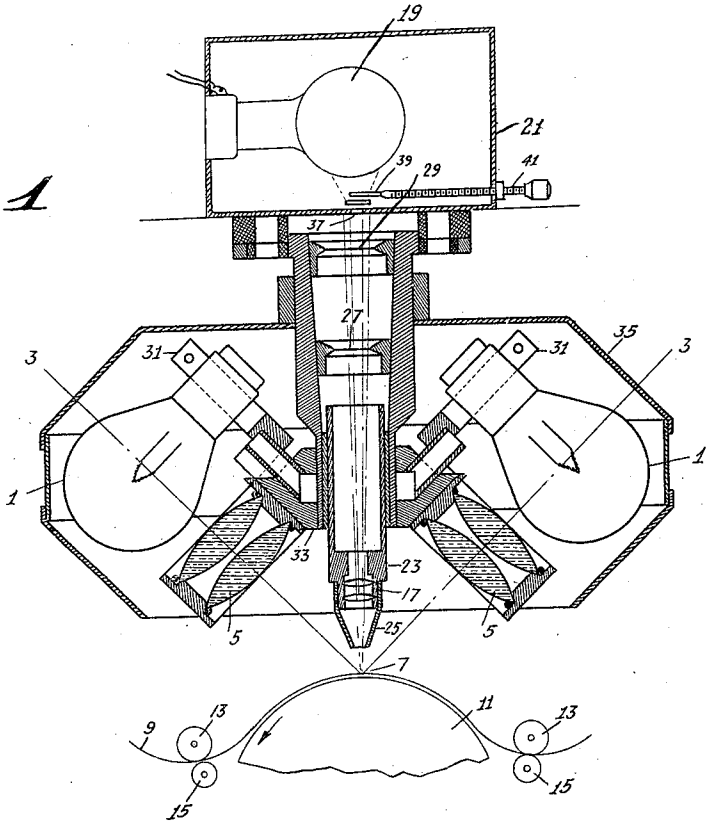
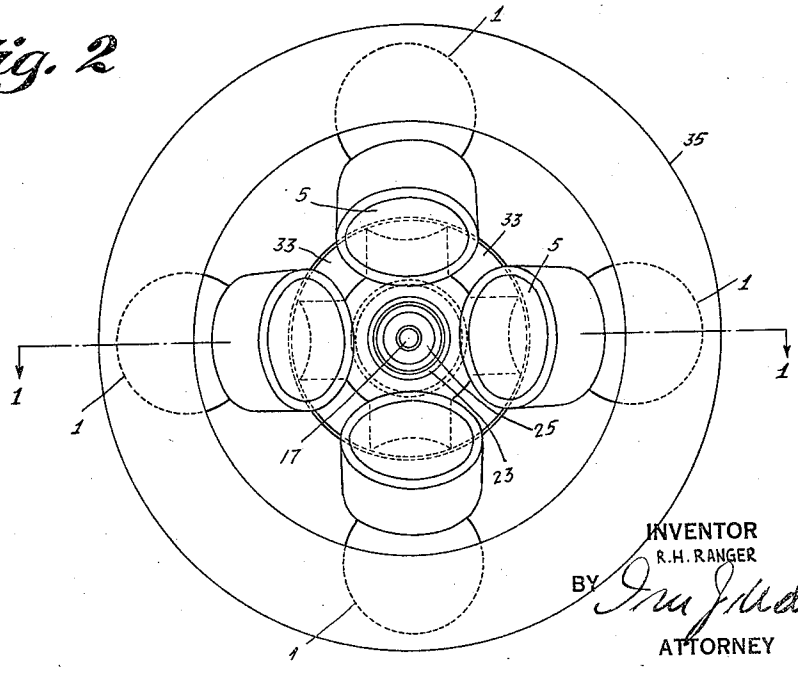


Fig. 2



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ANALYZING SYSTEM FOR PICTURE TRANSMISSION

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The present invention relates principally to what has generally become known in the art as picture transmission by means of an electric current or wave, or, by means of a multiplicity of currents or waves either by wire connection or a radio transmission system, or wired radio systems, connecting and existing between the sending and a receiving apparatus conveniently located.

By the term "pictures" suitable for transmission, I, of course, mean the transmission of all information, such as produces a visible interpretation when viewed and wish to include in the term "pictures" the transmission of pictures, views, manuscripts, checks, finger prints, drawings, newspaper articles, and, in fact, all of the general types of information falling within the same above named class.

As is well understood in the art, in order to electrically transmit a picture, the picture surface must be analyzed, scanned, or broken up into a great multiplicity of parts, dots, or segments, by means of appropriately controlled light beams and the reflected or transmitted light emanating or being transmitted from or through any and every given dot or surface may be converted into electric current impulses whose intensities vary in direct ratio to the intensity of the light itself, that is, the variations in current impulses must be in direct proportion to the variations in intensities in light and shade in the picture surface. Such a modulated current forms the basis of the transmission scheme and my invention particularly refers to an improved means of obtaining the requisite primary illumination of the picture, dot, segment, or part, that is to be transmitted at any particular instant.

As shown, the invention appears to be primarily intended for use in transmitting opaque pictures but from the accompanying description it will at once become apparent that it may also be applied to the transmission of transparent and semi-transparent material by the simple process of reversing the optical system. One of the outstanding requirements in picture transmission is the provision of suitable light in abundance, as is well known to those skilled in the art to which the invention relates. In picture transmission schemes the actual loss of light is very great and this is due primarily to the poor reflecting surface of the material or picture being transmitted as the picture itself or the scanning lens or both must, of necessity, be in constant motion. It follows that considerable difficulty is also experienced in bringing a strong enough light to bear upon a rapidly moving spot. Generally speaking, lamps, such as, arc lamps, or cumbersome metal filament lamps must be avoided for illumination purposes due to practical reasons. In practice it is objectionable to use light from any fixed source because of the fact that the objects or scanning lens of the transmission system is always in constant motion and varying distances are set up between the light source and the illuminated spot. To arrange an arc lamp or other bulky form of light source in a manner such that it travels across the picture surface in any preferred manner is also most objectionable for mechanical reasons and because of the mechanical difficulties encountered in arranging a system of this character.

It is also understood that the light ray, as reflected from an illumination picture surface or spot, or, as directed through a transparent or semi-transparent picture surface or material, must be conveyed ultimately to a photoelectric cell or element suitable for producing current variations in accordance with the variations in the intensity of light and shade in the picture. This requires the use of a lens of suitable size and focus which must, of necessity, travel with or scan the illuminated spot and such a lens should be located near the picture surface. In practice a distance from one half to one inch has been found quite a suitable distance for placing the lens from the picture surface.

It is, therefore, an object of my present invention to overcome some of the difficulties involved in the use of light systems for analyzing or scanning pictures, as above set forth.

Still another object of my invention is to provide a compact and convenient arrange-

ment of a light source which will provide light intensities considerably greater than those now used, so far as I am aware, for the purpose of illuminating a picture surface for the purpose of analyzing the picture.

Still another object of my invention is to produce a system of lights, arranged for analyzing a picture to be transmitted, in which the lights are of such a size that they may conveniently travel with the analyzing system and photo cell for producing current variations in accordance with the variations in intensity of light and shade in the picture surface.

Still another object of my invention is to produce a light system in which the use of the several individual lights coming down at various angles to the picture surface has the advantage of giving a better distribution of the light so that there will not be undue reflection from the ink on a part of the picture which might happen if the light was all coming in one direction and the angles of the ink surface were such as to give almost the correct angle between the incident and the reflected light to send a bit of light to the photo cell.

Still another object of my invention is to produce a light system composed of a plurality of light sources surrounding a scanning lens system in which the average illumination which is produced is more satisfactory in giving greater differentiation between the white and black portions of the picture surface.

Still a further object of my invention is to produce an adjustable diaphragm system positioned between the analyzing lens and the photo cell so that the exact size of unit pick-up by the photo cell may be made adjustable to fit the given line advance of the picture surface and the size of detail desired. In this construction it is desirable to focus that portion of the picture illuminated exactly upon the diaphragm although this is not essential.

Other objects of my invention are to produce, in a manner to be hereinafter set forth, an illumination system for illuminating picture surfaces for the purpose of analyzing, and to produce an illumination system which is compact in its arrangement, durable, convenient to install, a system which occupies the minimum amount of space, a system which is inexpensive, as well as a system which is fool-proof and highly efficient in its use.

Other and ancillary objects of my invention will be apparent from a reading of the following specification and claims when considered together with the accompanying drawings which form a part of my disclosure.

In the accompanying drawings illustrating my invention in one of its preferred embodiments

Fig. 1 illustrates a sectional view taken on the line 1—1 of Fig. 2 and shows a portion of the light systems; and,

Fig. 2 illustrates a front view of my illumination system looking at Fig. 1 from the end thereof nearest Fig. 2, as shown by the drawings.

In accordance with my invention I have provided a system wherein I have arranged a series of small concentrated metal filament lamps, preferably of equal size and intensity, on a circle concentric with a scanning lens and have interposed between the circle of concentric lamps and the spot on the picture surface to be illuminated, condensing lenses of suitable diameters and focal lengths. The optical axes of the lamp combinations should preferably be arranged conical one to the other and at such an angle to the major axis of the light beam from the spot to the photo-electric cell as is necessary in order to avoid the light issuing from the separate lamps striking the scanning lens and its mounting.

In accordance with this arrangement an extremely small amount of available space is used to great advantage and the illuminated spot on the picture surface receives a constant amount of highly concentrated light at all times.

It must be borne in mind and understood that the reflected light ray, which influences the photo cell, is preferably at right angles to the plane of the picture surface which is illuminated and I have found an angle of approximately 45° between each of the minor light beams and the major beam to be quite satisfactory although the question of the angle used is merely one of choice and one which is preferably determined for each particular installation and I, therefore, do not wish to be limited to any particular angle at which I may direct the minor light beams from each separate lamp to the picture surface.

The question of the number of lamps is also one of choice, and, for example, I may use one lamp with its condensing lens only, or I may employ the use of any number of units. In practice four units, as has been shown by the drawings, and which units are arranged as the four corners of a square, have been found to give quite satisfactory results.

Now referring more particularly to the drawings I have illustrated the separate light source 1 as directing their individual light beams along the paths 3 to condensing lenses 5 in such a manner that they all direct the issuing light as a point source 7 upon a picture surface 9.

The picture surface 9 is carried by a drum 11 (only a section of which has been shown) which may, if desired, rotate in step-by-step movement in the direction of the arrow after the light sources, as a unit, have travelled

longitudinally thereof for its complete length, or may rotate continuously and the light source may advance slowly longitudinally thereof so as to trace, in the first case, a series of parallel paths longitudinally back and forth across the drum, or, in the second case, a spiral path longitudinally of the drum. In the case, as shown, however, the system has particularly adapted for the first named type of motion of the lens and drum systems and, it is to be understood, in order to change the system into the second type all that is necessary is to wrap the picture surface completely around the drum 11 and continuously rotate the same at a suitable and desired rotational speed. As has been shown, the picture surface 9 may be advanced continually with respect to the drum 11 by means of rollers 13 and 15.

The light directed from the separate lamps 1 along the individual paths 3 to focus itself by means of the condensing lenses 5 as a point source 7 is then reflected at 90° from the picture surface 9, as shown, back toward a scanning lens system 17. The function of the scanning lens system 17 is to collect the light reflected from the picture surface 9 at the point 7 and to direct the same to the photoelectric element or cell 19 arranged to produce variations in electric current strength in accordance with the point for point intensity of light and shade on the picture surface. Preferably, the photo cell is contained within the light opaque housing 21 so that it may be uneffected by external light, other than that light which reaches the cell as a reflected light beam from the picture surface. The cell 19 may be associated with any desired type of amplifying circuit, and I have found a suitable arrangement may consist, for example, of a system substantially similar to the arrangement disclosed in certain of my copending applications, for example, Serial No. 695,175, filed February 26, 1924; or Serial No. 726,235, filed July 16, 1924.

The scanning lens system 17 is carried in a light tube member 23 which extends from the screen or shield portion 25 about the lens 17 back to the point where the housing 21 is preferably mounted. The screen or shield portion 25 is for the purpose of preventing internal or stray light reflections from influencing the scanning lens and in turn the photo cell. This tubular portion 23 is rigidly secured to the light tight housing 21 and is, as shown, carried therewith back and forth longitudinally of the drum member 11.

Located within the light tube member 23 are a series of baffle rings 27 and 29, for the purpose of preventing reflected light from the sides of the tubular housing from reaching the cell. As shown, the baffle ring 29 is of slightly larger size than the ring 27 inasmuch as the light from the point source 7 passing through the scanning or analyzing lens system 17 back to the photo cell 19 diverges in direct proportion to the length of the path between the picture surface and the photo cell.

Positioned between the end of the light tube member carrying the baffle ring 29 and the photo cell 19 I have arranged an adjustable diaphragm member, generally designated 37. This diaphragm is preferably made of a flat piece of metal secured either to the housing 21 or to the light tube member and is provided with two slidable members 39 (only one of which is shown for convenience of illustration). These slidable members are positioned and adjustable at right angles with respect to each other by means of a screw adjustment 41 and are so arranged as to limit the size of the final hole left uncovered in the diaphragm. By this means it is possible to change the height or breadth of the hole which is done by screwing upon one or the other, or both, slidable members 39 to give exactly the size of opening desired.

The entire optical system including the analyzing or scanning lens 17 throws back more of an image than is desirable to use. By means of the adjustable diaphragm 37 the exact size of unit pick-up is made to fit the given line advance of the picture surface and the amount of detail desired. In this connection the portion of the picture illuminated is focused directly on the diaphragm, and the scanning lens or microscopic lens 17 is of such an appropriate focal length as to fit this condition.

The metal filament lamps 1 are carried by supporting brackets 31 which are mounted from a support ring 33 carried by the light tube member 23. These lights are preferably adjustably mounted with respect to the supporting brackets so as to enable the lamp filament location with respect to the condensing lens systems 5 to be critically adjusted. Similarly, the lens systems 5 are carried from the same supporting ring 33 which supports the brackets for carrying the lamps 1 although, as shown, the condensing lens systems are not adjustable with respect to the supporting ring.

In order to avoid the influence of external light on the picture surface it is preferable to arrange a housing 35 about the lamps and condensing lens systems 1 and 5 respectively. This is not essential to the invention although it has been found under certain conditions to be advisable while under other conditions of operation it has been found that equally satisfactory results may be obtained without the use of housing about the illumination system. Similarly, I have found that small reflectors may, if desired, be placed back of the lamps 1 so as to reflect the light, which issues from the lamps in a direction opposite to that of the lens systems. These

reflectors have not been illustrated inasmuch as they are, if used, of the usual commercial type and would be placed at the ends of the supporting brackets 31 and arranged back of the lamps 1 so as to reflect the light issuing from the lamps back toward the lens systems 5.

If desired, the major reflected beam of light which passes through the light tubular member 23 may be composed of one or any number of light beams each having its own axis depending upon the number of lines it is required to be transmitted at one time.

While the accompanying drawings illustrate only one application of my invention as applied to the illumination of opaque pictures, from the above description it can readily be seen that a transparent or semi-transparent picture may also be similarly illuminated by locating the light giving elements within the confines of a transparent picture drum. In this latter case, also, the light units will travel in synchronism with the analyzing lens system in a similar manner to that above disclosed.

While I have above described my invention in one of its preferred forms it is readily seen that certain modifications as to design and arrangement may be made in so far as they fall fairly within the spirit and scope of this invention as defined by the following claims, wherein;

I claim:

1. An illumination system for illuminating picture surfaces for analyzing purposes in the transmission thereof which includes a plurality of light sources each arranged concentrically with respect to each other, a picture surface for transmission, means for directing the light from each of said concentrically arranged light surfaces to a single point on said picture surface, means for redirecting the light from said picture surface, and photoelectric means for producing electric current variations when subject to the influence of the redirected light rays so as to produce electric currents varied in direct proportion to the varying intensities of light and shade on the picture surface.

2. An analyzing system for picture surfaces to be transmitted which includes an analyzing lens system, a photoelectric cell arranged along the focal path of said lens system, a plurality of light sources arranged concentrically about said analyzing lens system, means for directing light from each of said light sources at an angle with respect to a point on said picture surface and at an angle with respect to the optical axis of said analyzing lens system, and means for redirecting the light from said point on said picture surface through said analyzing lens system to said photoelectric member for producing electrical current variations therein in direct proportion to the varying intensities of light and shade on the said picture surface.

3. An analyzing system for transmitting pictures which includes a picture surface to be transmitted, an analyzing lens system for analyzing the varying intensities of light and shade in a picture surface for transmission, a tubular housing for supporting said lens system, a photoelectric cell supported at one end of said tubular housing for said lens system, a plurality of light sources carried by said tubular housing and arranged concentrically with respect to said analyzing lens system, means for directing the light from all of said plurality of light sources to a common point on said picture surface, and means provided by said lens system for influencing the said photoelectric cell by the light reflected from said picture surface so as to produce electric currents through said photoelectric cell varied in direct proportion to the varying intensities of light and shade on said picture surface.

4. An analyzing system for analyzing pictures for transmission which includes a picture surface for transmission, an analyzing lens system supported adjacent said picture surface, a tubular housing for supporting said lens system, a photoelectric cell carried at the end of said housing opposite said lens system, a plurality of light sources supported by said tubular housing for said lens system and mounted concentrically with respect thereto, condensing lens systems for directing the light issuing from all of said light sources to a single point on the said picture surface along paths extending at an angle with respect to the axis of said tubular housing for said analyzing lens system, and means provided by the reflected light from said picture surface passing through said analyzing lens system to said photo cell for producing electric currents through said photo cell which are varied in accordance with the varying point for point intensities of light and shade on the said picture surface.

5. An illumination system for analyzing pictures for transmission which includes a picture support surface, a picture surface carried thereby, an optical analyzing lens system mounted adjacent said picture surface and at right angles with respect thereto, an elongated tubular housing for supporting said analyzing lens system at one end thereof, a plurality of adjustably mounted light sources carried by said tubular housing and arranged concentrically about said housing, a plurality of lens systems also carried by said housing and arranged concentrically with respect thereto for directing the light from each of said individual light sources as a point source on said picture surface corresponding to the focus point of said analyzing lens system, means provided by said analyzing lens system for directing the reflected

light from said picture source varied in accordance with the varying intensities of light and shade on the said picture surface backwardly through said tubular housing member, and photoelectric means positioned at the end of said tubular housing opposite said analyzing lens system for producing electric current impulses varied in proportion to the varying intensities of light reaching the said cell.

6. The system claimed in claim 5 which includes, in addition, a plurality of baffle rings carried by said tubular housing for preventing reflected light from the edge of said housing from reaching the said cell, whereby only the light passed direct from said analyzing lens system influences the said photoelectric cell.

7. The system claimed in claim 5 including, in addition, a shield arranged about said analyzing lens system for screening the said lens and its associated photo cell from internal and stray light reflections.

8. An analyzing system for transmitting pictures which includes a picture surface to be transmitted, an analyzing lens system for analyzing the varying intensities of light and shade in a picture surface for transmission, a tubular housing for supporting said lens system, a shield portion for shielding the said lens system from undesired light carried by the portion of said housing supporting said lens system, a photoelectric cell supported at one end of said tubular housing for said lens system, a plurality of light sources carried by said tubular housing and arranged concentrically with respect to said analyzing lens system, means for directing the light from said plurality of light sources to a common point on said picture surface, and means provided by said lens system for influencing the said photoelectric cell by the light reflected from said picture surface so as to produce electric currents through said photoelectric cell varied in direct proportion to the varying intensities of light and shade in said picture surface.

9. In an analyzing system for picture transmission apparatus, a picture surface arranged for transmission, a scanning lens system for scanning said picture to be transmitted, a tubular housing for supporting said lens in one end thereof and adjacent said picture surface, an illumination system surrounding said lens and housing and arranged annularly with respect thereto for illuminating the said picture surface, means carried by said housing for directing all of said light at a single point on said picture surface corresponding to the focal point of said lens system, and means at the end of said housing opposite said lens system for translating varying intensities of light and shade on the elemental areas of said picture surface reaching said scanning lens into proportionate variable strength electric current pulses.

10. A system for illuminating picture surfaces for analyzing purposes which includes a plurality of light sources and means associated therewith for directing the light issuing from each of said sources to a single point on a picture surface to be transmitted, means for redirecting the light striking the said picture surfaces as a point source, photoelectric means for producing electric current variations proportional to the varying intensities of light and shade at the said point on the picture surfaces, and an adjustable diaphragm positioned between said means for redirecting the light and said photoelectric means for regulating the amount of detail in the picture transmitted and adjusting the system for a predetermined line advance of the picture surface.

11. An analyzing system for picture surfaces to be transmitted which includes an analyzing lens system, a photoelectric cell arranged along the focal path of said lens system, a plurality of concentrically arranged light sources about said analyzing lens system, means for directing light from each of said light sources at an angle with respect to an elemental area on the picture surface and at an angle with respect to the optical axis of said analyzing lens system, means provided by said analyzing lens system for redirecting the light from said elemental area on said picture surface to said photoelectric member for producing electrical current variations therein in direct proportion to the varying intensities of light and shade on said picture surface, and an adjustable diaphragm member positioned between said analyzing lens system and said photoelectric member for controlling the amount of light reaching said photoelectric member.

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