May 26, 1931. R. H. RANGER 1,807,011

ANALYZING SYSTEM FOR MULTIPLEX FACSIMILE TRANSMISSION

Filed May 3, 1929

Fig. 1

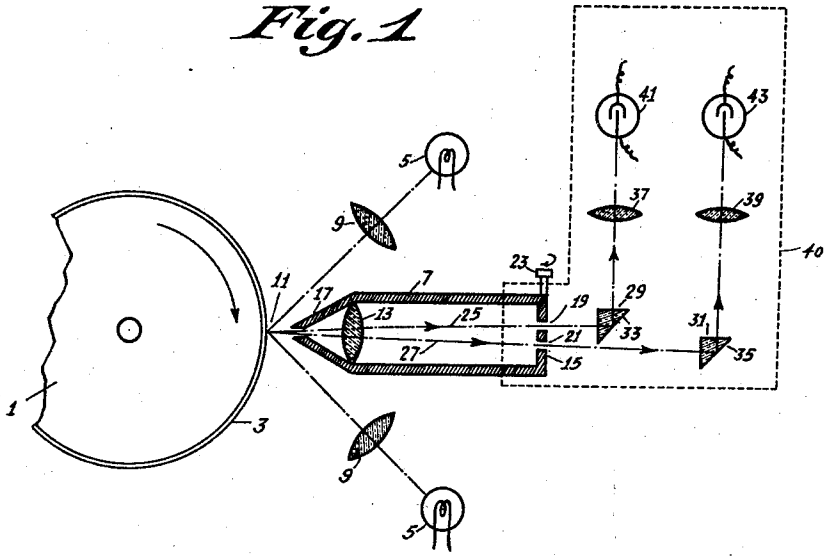
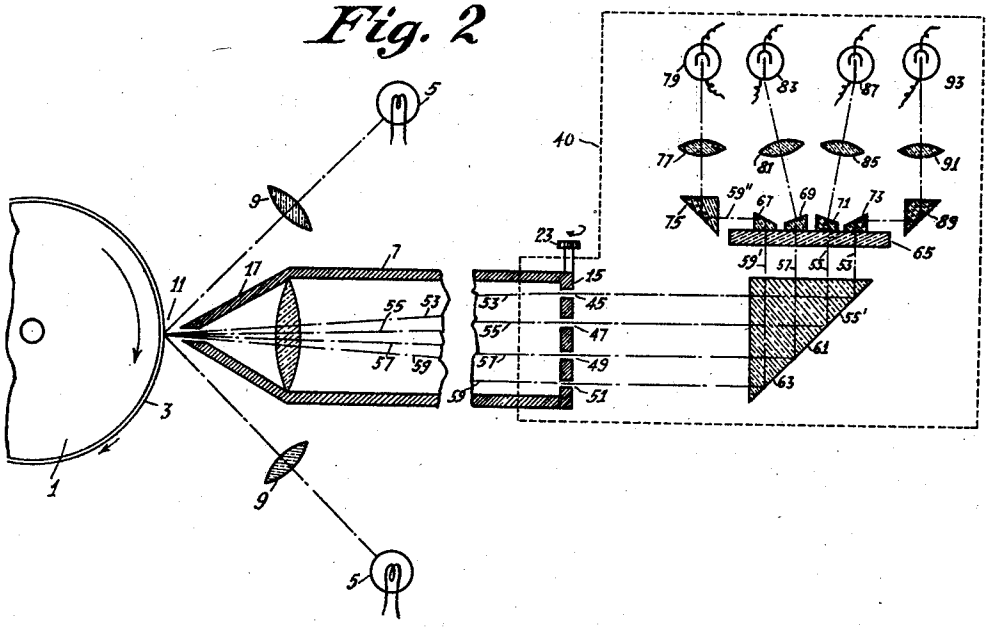



Fig. 2




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# UNITED STATES PATENT OFFICE

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## ANALYZING SYSTEM FOR MULTIPLEX FACSIMILE TRANSMISSION

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The present invention is directed to facsimile and/or television transmission, and, more particularly, to a scanning or analyzing system for use in conjunction with facsimile and/or television transmitters when used especially for multiplex communication.

By my copending application, Serial No. 321,821, filed November 26, 1928, I have disclosed an illumination scheme for either facsimile or television transmission in which a plurality of light sources have been arranged concentrically with respect to a reflecting light tube, and each source of light arranged to direct the light beams issuing therefrom to a single point on the record or television surface. By the above identified application, however, I have not attempted to adapt such scheme for multiplex transmission, and it is, therefore, an object of my present invention to provide an illumination system of the general type disclosed in the above identified copending application and adapt the same to multiplex transmission and reception.

Therefore, as a primary object of my invention, I have sought to provide a method and means by which pictures and the like (by which I wish to include, views, photographs, newspaper articles, magazine covers, checks, finger prints, fashion plates, legal documents, financial statements, code messages, messages in foreign languages, television subjects, motion picture films, as well as the sound records thereon, and the like) may be transmitted with substantially increased speed by reason of analyzing and reproducing a plurality of different points on the picture or television surface simultaneously.

As a further object of my invention, I have sought to develop a method and means by which light rays corresponding to the intensity of light and shadow on elemental areas of the picture or television surfaces may be split up into a plurality of light rays corresponding to the tone intensity of each individual point and then projected to a separate photo cell or to a single or a pair of photo cells each subjected to a light beam so chopped as to produce definite tone or carrier frequencies. As an example of a means by which the multiplex transmission may be effected, reference is to be had to my copending application, Serial No. 349,076, filed March 22, 1929, and also to my copending applications Serial Nos. 309,274 and 269,099, filed, respectively, September 29, 1928, and April 11, 1928, disclosing a means for effecting multiplex transmission.

Still further objects of my invention are to provide, by a method to be hereinafter set forth in one of its conventional embodiments, although the invention is not specifically restricted thereto, a method for multiplex analyzing in connection with facsimile or television transmission which is simple in its construction and arrangement of parts, a system which is compact, conveniently installed, easily set up, readily operated, efficient in its use, and a system in which it is unnecessary to continually make adjustments and readjustments so as to make the same suitable for use at all times.

Still further and ancillary objects of my invention will become apparent and at once suggest themselves to those skilled in the art to which the invention relates by reading the following specification and claims in conjunction with the accompanying drawings, wherein

Figure 1 illustrates in a schematical manner a system for effecting multiplex analyzing or scanning on a two channel system; and

Figure 2 conventionally illustrates a system for effecting multiplex transmission on four channels of communication.

It is, however, to be understood that the system is not restricted to the use of two or four channels, as illustrated, but that any number of channels found suitable and desirable from two to ten, or even more, may be substituted by following the principles herein set forth and described.

Now particularly referring to the drawings, and first to Figure 1 thereof, I have shown a drum 1 upon which a picture surface 3 is carried in any convenient and appropriate manner. The arrangement which

has been illustrated has been provided so that the picture may be analyzed along a helix by continuously rotating the picture carrying drum 1, and either advancing the drum 1 longitudinally with respect to the point of illumination or by continually rotating the drum and moving an illumination system longitudinally thereof in any appropriate and desired manner. The invention is also applicable to a type of facsimile transmission wherein the drum 1 is either moved longitudinally with respect to the illumination system or the illumination system is moved longitudinally with respect to the drum so that lines extending in a longitudinal direction of the drum are scanned, and then the drum is advanced an amount equal to the line advance for the predetermined number of channels in use, which, in the case of an arrangement of the type illustrated by Figure 1, would be two scanning lines.

Also, it is to be further understood that the invention is not limited to facsimile transmission but may equally as well be applied to television transmission wherein the drum 1 may be a flat surface, for example. In such a case the scanning ray projected is broken up into a plurality of distinct light beams so that in the case of a lens scanning disk, for example, the size thereof may be substantially increased, or of the usual size with lenses sufficiently large to provide illumination of the desired area of the surface, and the reflected or projected rays passing therethrough may be split up into a number of distinct rays proportional to the number of scanning channels in operation.

As has been shown in the drawings wherein the invention has been illustrated in its application to facsimile work, for example, I have provided an illumination system, including, a plurality of light sources 5 arranged in a concentric manner about a light tubular member 7, as has been disclosed in my above referred to copending application, Serial No. 321,821, filed November 26, 1928. The light issuing from the illumination source 5 which may, if desired, be small lamps of high candle power or intensity, is then directed by means of lens systems 9 so as to focus at a point 11 on the picture surface 3. If the light beams issuing from the source 5 are focused as a point source 11 on the picture surface 3, it may readily be seen that the entire illumination will not be concentrated as a true point source since the intensity of illumination spreads out to a slight extent and illuminates an area proportionate to the spreading out of the light. Thus, more than a single element of the picture may be scanned or illuminated at any one time, and by means to be hereinafter set forth and described, it will become apparent how I thereafter separate the light beams corresponding to the separate and individual points corresponding, of course, to the number of channels utilized in transmission.

As light reaches the point 11 on the picture surface 9, it is reflected back from the surface in the case of a reflection type of transmitter, wherein opaque or semi-opaque pictures or the like are carried by the drum 1 so that the reflected light enters the light tubular member 7, and by means of a lens system 13 the reflected light beams are projected backward through the tubular member 7 to a diaphragm 15 arranged at the end of the tubular member opposite the pick-up end. In order to shield the lens 13 directing the light rays backward to the tubular member 7 to the diaphragm 15, I have provided a shield 17 as was disclosed in my copending application, Serial No. 321,821, filed November 26, 1928, and the distance of this shield from the picture surface may be varied at will by any convenient method as, for example, by the method shown and described in connection with the above named copending application. As light is reflected backward through the tubular member 7 in the direction shown by the arrows, it impinges upon the diaphragm 15 which may be formed of two separate portions (referring, of course, to a two channel multiplex system) so as to pass light through the openings 19 and 21 therein. These openings 19 and 21 may be adjusted in two planes by means of adjusting screws 23 (only one of which is shown). Adjusting screws 23 are for the purpose of moving the diaphragm openings 19 and 21 further apart or closer together depending upon the intensity of illumination upon the picture surface 3, and it will readily be seen if these diaphragms 15 are adjusted in two planes at right angles that a small square opening for light to pass through may be provided which will increase and decrease in size or area proportionate to the adjustment of the adjusting screws 23.

As the light reflected from the picture surface 3 passes through each of the diaphragm openings 19 and 21 along the paths 25 and 27, it will be projected upon prisms 29 and 31 from the faces 33 and 35 of which it will, as shown, be bent at approximately a right angle, and be directed through the lenses 37 and 39 respectively where it may be projected upon the photoelectric elements 41 and 43. A light chopping disk operating upon the principle of the disk disclosed by Figure 3 in particular of my copending application, Serial No. 349,073, filed March 22, 1929 may be interposed between the lens system 37 and 39 so as to chop the light at different tone or carrier frequencies prior to the time when it is projected upon the photo-

electric elements 41 and 43. In such a case, as above suggested, of course, the photo cells 41 and 43 are placed with respect to the light chopping disk so that they each receive light projected from the paths 25 and 27, and in the case of a two channel system of the type herein disclosed, a double track chopping disk is provided, although for more channels the number of individual tracks on the disk may be suitably increased, although the need for increasing the number of photo cells is immaterial. For the purpose of screening the photo cells from external light I have provided a high opaque housing member 40, enclosing the entire optical system and photoelectric bodies.

Now referring to Figure 2 of the drawings, I have shown similar illumination elements for the picture surface and a similar light tube member 7 for projecting light reflected backward from the picture surface. However, in the present instance, in a case where four channels are provided in the multiplex system, instead of the diaphragm 15 being provided with the two square openings 19 and 21, I have provided four openings designated 45, 47, 49 and 51. In such a case, the adjustment of the openings as to the size of the square hole through which the light is projected is controlled in the same manner as disclosed by Figure 1, by means of adjusting screws 23, which may be provided to adjust the size of the openings along two lines at right angles to each other.

As the light is projected through openings in the diaphragm member 15 along paths 53, 55, 57 and 59, it is split up into this particular series of light paths and is then projected upon a reflecting prism 61 from which the individual beams are reflected at substantially a right angle from the face 63 of the prism 61. As the light beams leave the prism 61 along paths 53′, 55′, 57′, 59′, the light beams are then projected upon a glass plate 65. Since there is very little separation in the individual paths of light (although for the purpose of illustration the separation has been considerably accentuated), it is necessary to provide an arrangement by which the individual light beams may be substantially separated one from the other so that they may be directed to the different tracks on the light chopping disk above referred to in connection with Figure 1. I have provided on the upper surface of the glass plate 65, a plurality of reflecting prisms indicated as 67, 69, 71, 73, each of which reflect a single light beam so as to spread the paths of the same to a considerable extent. As shown, the prism 67 is arranged to reflect the light beam 69′ at right angles to the line in which it strikes the glass plate 65 so as to direct the same along a path 59″ to a reflecting prism 75 from which it is reflected at right angles through a lens system 77 to a photo cel 79. Similarly, the light beam passing through the prism 69 is slightly bent to the left, as shown, so as to be projected through a lens system 81, from which it may be directed to a photo cell 83. In like manner, the light beam passing through the prism 71 is bent slightly to the right, as shown, so as to be projected through a lens system 85 to reach a photo cell 87, and the beam 53′ passing through the prism 73 is then bent at right angles to the light in which it strikes the glass plate 65 so as to be directed along a path 53″ against a reflecting prism 89 from which it is directed through a lens 91 to reach a photo cell 93.

For the purpose of clearness of illustration, I have chosen to illustrate each of the light beams reflected by means of the prisms 67, 69, 71 and 73 mounted above the glass plate 65 as being directed to an individual photo cell. However, in practice, I have provided only a pair of photo cells of the general type shown in my above named copending application, Serial No. 349,076, filed March 22, 1929 so that light projected from each of the lens systems 77, 81, 85 and 91 may be projected to a single track of a chopping disk of the general character set forth by the said copending application, and then directed to a pair of photo cells, it is readily seen that where there are a different number of distinct reflecting surfaces in each track of the light chopping disk that a different tone or carrier frequency will be produced upon the photo cells for each of the distinct paths of light, and thus, where an elongated photo cell is provided, if the light beams issuing from the disk are projected thereto, it is only necessary to provide two photo cells. It will be understood in connection with this application that the use of a plurality of analyzing beams of light is intended to be used in connection with the disk of such type above set forth.

While I have illustrated only two of the many embodiments which my invention will assume, it is understood that I may make many modifications therein, and the illustration and description while applied to the specific modification should not be limited thereto but may be considered as being applicable to all types of arrangements which fall within the spirit and scope of my invention as defined in the hereinafter appended claims.

Having now described my invention, what I claim and desire to secure by Letters Patent is the following:

1. A system for analyzing pictures to be transmitted including a record surface, means for illuminating the record surface, means for separating the light beams reflected from the record surface by virtue of said illumination into a plurality of in-

dependent and distinct light beams, a plurality of independent photoelectric bodies, and a series of prisms in the path of said reflected light beams for causing each of said reflected light beams to influence said photoelectric bodies in accordance with the intensity of light and shadow on elemental areas of the said surface.

2. A system for analyzing pictures for multiplex transmission thereof which includes a record surface, means for illuminating the record surface, means for projecting light beams from the record surface of an intensity corresponding to the intensity of light and shadow on the portion of said record surface illuminated, means for separating said projected light beams into a plurality of independent and distinct light beams, a plurality of photoelectric bodies, and a series of optical bodies in the path of said plurality of light beams for causing said beams to separately influence said photoelectric bodies by each of said independent separated light beams.

3. A system for analyzing pictures for multiplex transmission thereof which includes means for illuminating a portion of a picture surface, means for directing light beams reflected from said picture surface in accordance with the intensity of light and shadow on the portion of said surface illuminated along a predetermined path, means for separating said reflected light beams into a plurality of independent and distinct paths corresponding to different adjacent elemental areas of the picture surface, a plurality of photoelectric bodies, and means for reflecting and deflecting each of said independent light beams to separately influence said photoelectric bodies and produce currents therefrom of an intensity proportionate to the intensity of light and shadow on the picture surface.

4. An analyzing system for analyzing pictures to be transmitted including a support means for holding a record surface, means for illuminating the said record surface, means for separating the light beams reflected from the record surface due to the illumination thereof into a plurality of independent and distinct light paths, a plurality of independent light responsive bodies, and optical means for causing each of said reflected light beams to influence said light responsive bodies in accordance with the intensity of light and shadow on elemental areas of the said record surface.

5. A system for analyzing pictures for multiplex transmission thereof which includes a record surface, means for illuminating the record surface, a light pickup system adjacent said record surface, means for projecting reflected light beams from the record surface through said light pickup means, said reflected light beams being of an intensity proportionate to the intensity of light and shadow on the portion of said record surface illuminated, a diaphragm means associated with said light pickup for separating said light beams reflected through said pickup means into a plurality of independent and distinct light beams, a plurality of photoelectric bodies, and optical means in the path of said separated light beams for causing each of said light beams to separately influence each of said photoelectric bodies.

6. A system for analyzing pictures for multiplex transmission thereof which includes means for illuminating a portion of a picture surface, a light pickup means for directing light beams reflected from said picture surface in accordance with the intensity of light and shadow on the portion of said surface illuminated along a predetermined path, an adjustable diaphragm for separating said reflected light beams into a predetermined number of independent and distinct paths corresponding to different adjacent elemental areas of the picture surface, said paths corresponding in number to the number of channels in the multiplex system, a plurality of photoelectric bodies, and prismatic means for reflecting and deflecting each of said independent light beams to separately influence said photoelectric bodies and produce a current flow therefrom of an intensity proportionate to the intensity of light and shadow on elemental areas of the said picture surface.

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