

Aug. 13, 1940.

G. EFRON

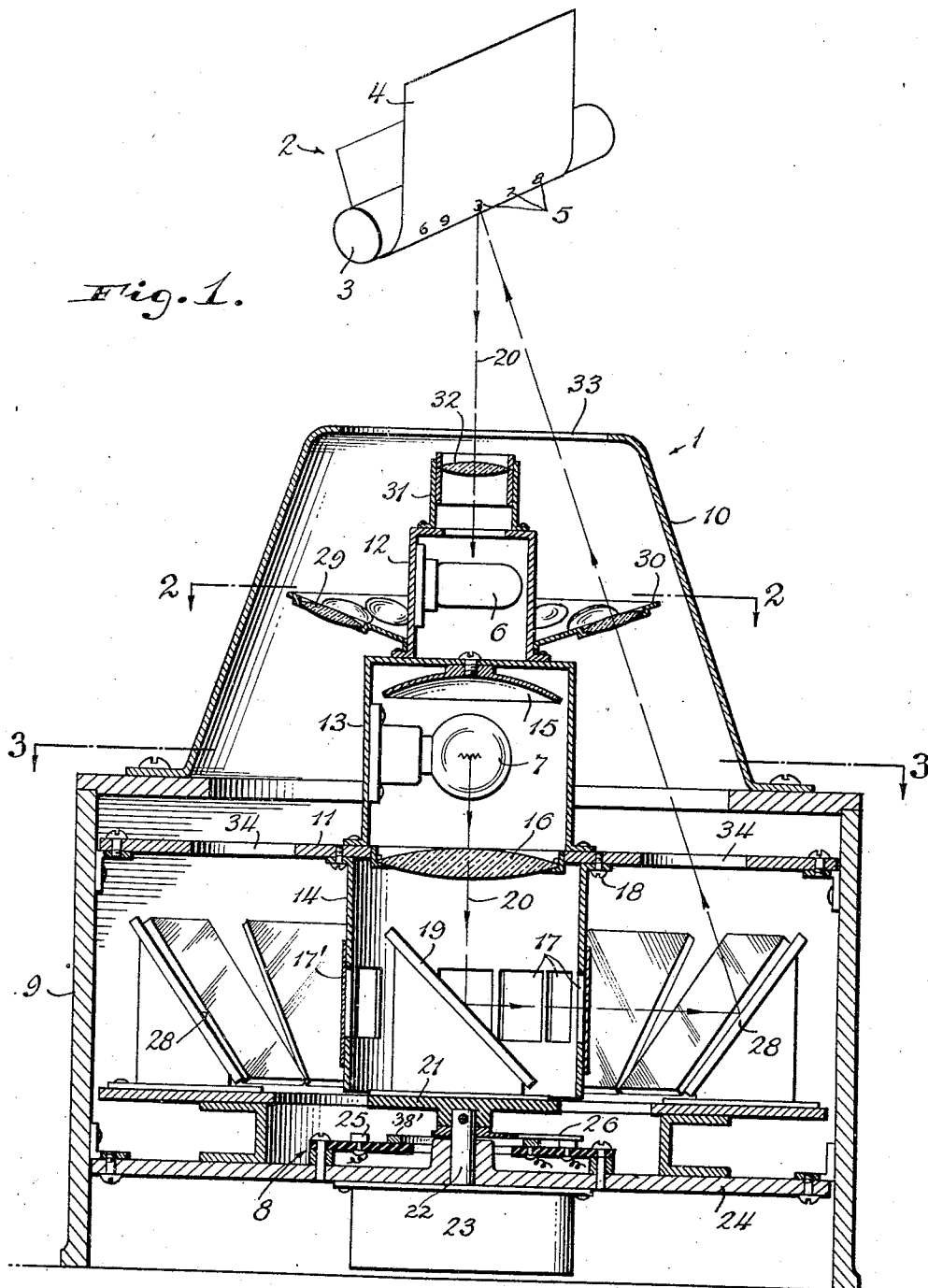
2,211,320

PHOTOELECTRIC CONTROLLING DEVICE

Filed Jan. 14, 1938

4 Sheets-Sheet 1

Fig. 1.



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4 Sheets-Sheet 2

Fig. 2.

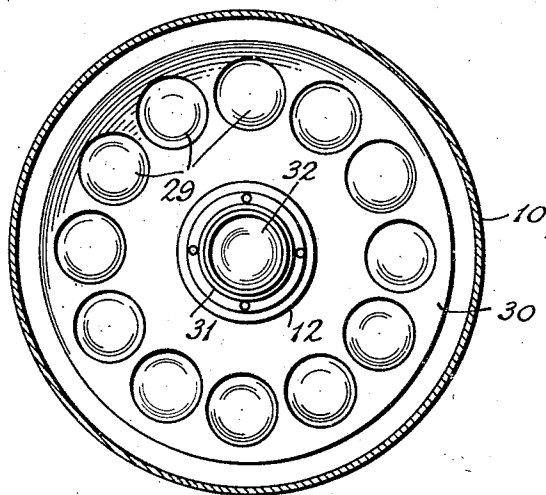
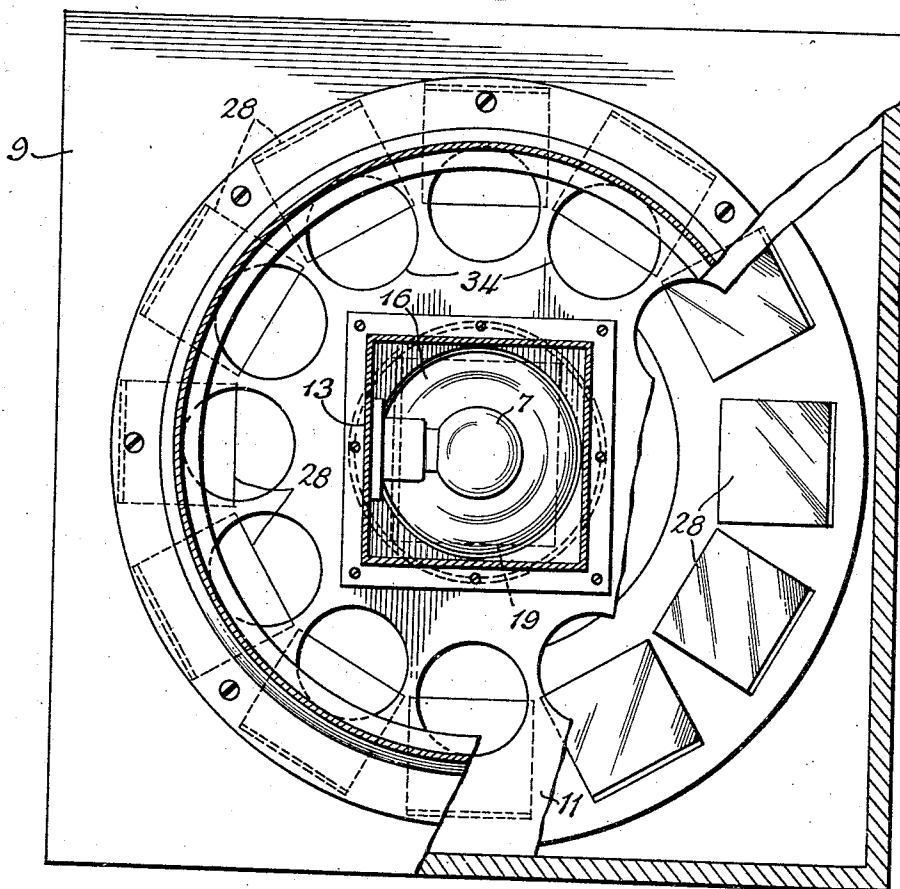


Fig. 3.



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4 Sheets-Sheet 3

Fig. 4.

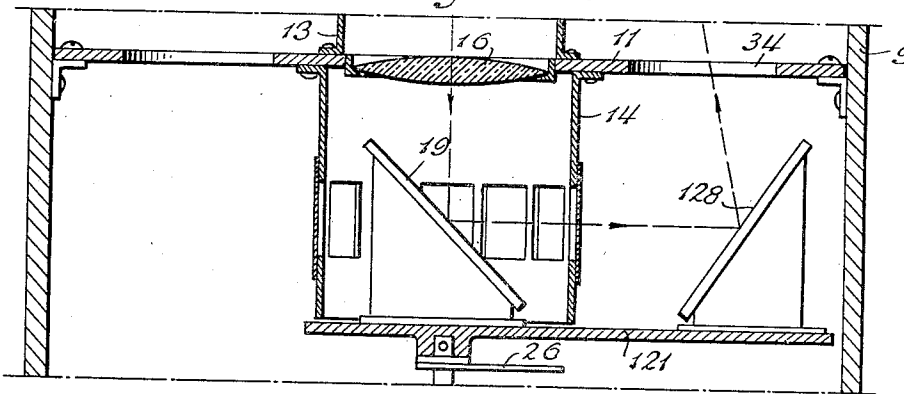


Fig. 6.

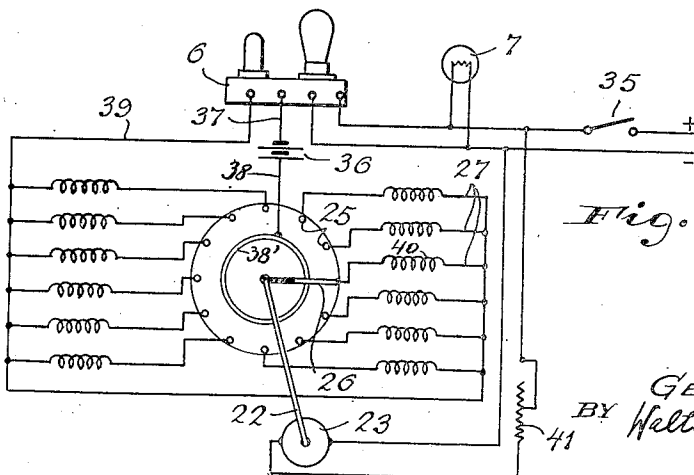
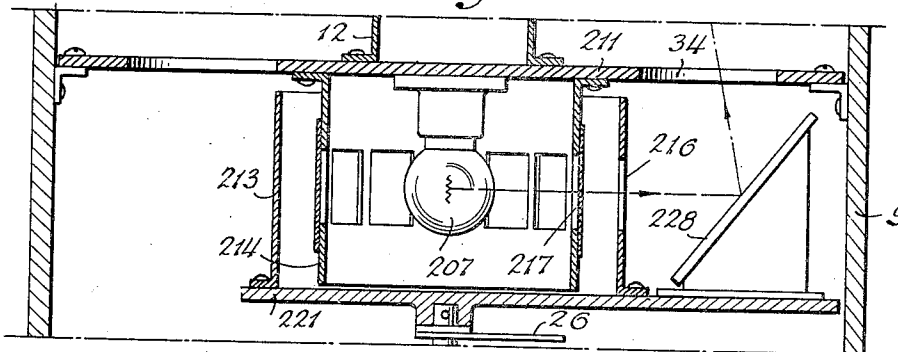


Fig. 12.

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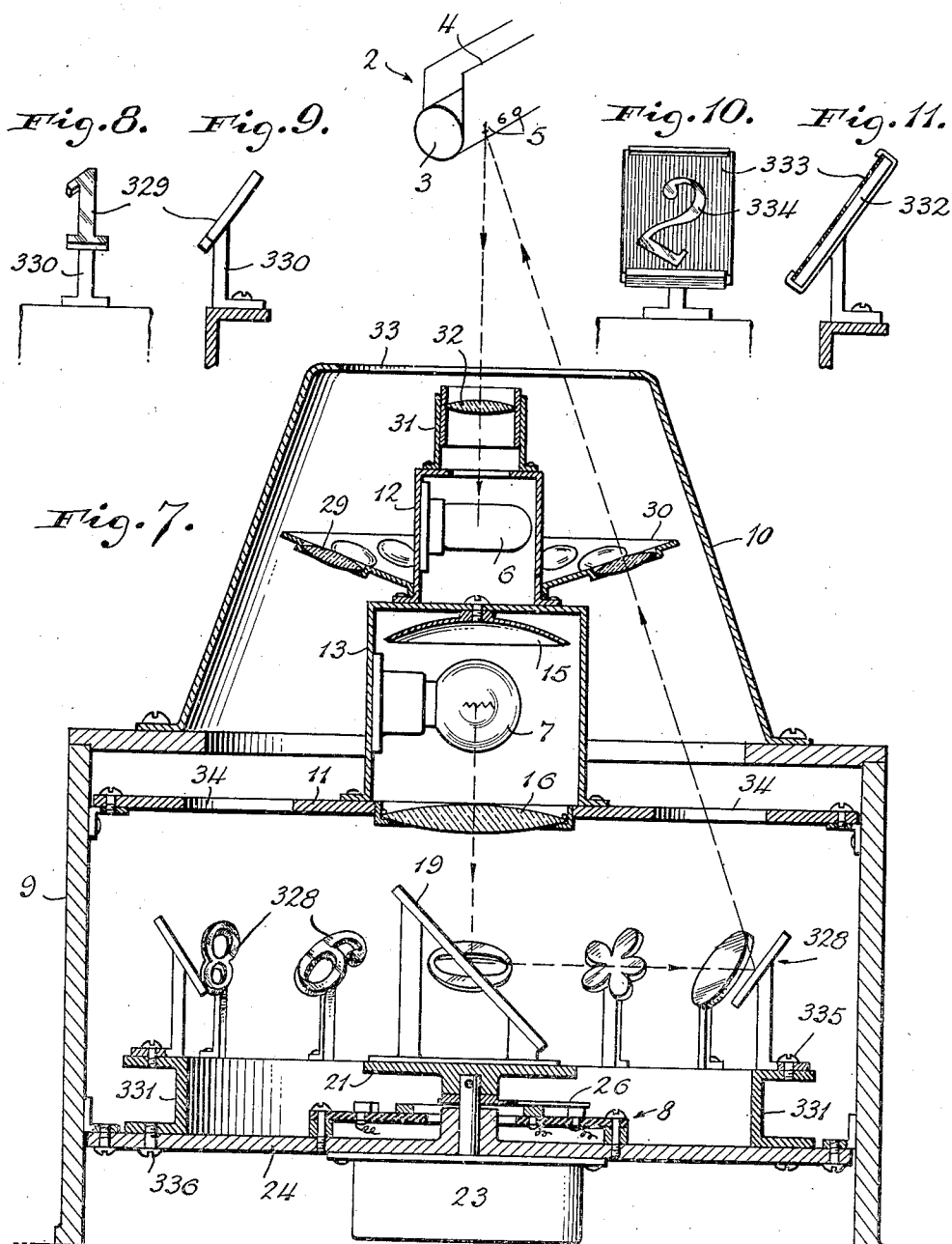
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PHOTOELECTRIC CONTROLLING DEVICE

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4 Sheets-Sheet 4



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2,211,320

PHOTOELECTRIC CONTROLLING DEVICE

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Application January 14, 1938, Serial No. 185,074

12 Claims. (Cl. 235—61.11)

The present invention relates to a photoelectric controlling device of the type in which characters are explored, and a controller is operated when the identity of an explored character is established by comparison with a negative thereof. A conventional apparatus of this type contains a photoelectric unit adapted to control a switch of an operating circuit when the light impinging on the photosensitive surface of the unit is a minimum. Such minimum occurs when a light beam containing the image of a character and another beam containing a negative image of a character coincide. In order to obtain such coincidence, a set of negatives to be compared with the character to be explored is movable relative to a light-source. This type of well-known device has the drawback that the stationary light beam carrying the negative image constantly changes not only in its intensity but also in its shape, and that owing to the movement of the negatives there is practically only an infinitesimal time of true coincidence frequently insufficient for a reaction of the photosensitive unit.

An object of the invention is to avoid said drawback and to maintain the coincidence of the image of a comparison character and of a character to be explored for a definite length of time.

A further object is to obtain images of strong light intensity with the aid of a relatively weak light source.

Another object of the invention is to provide an apparatus of substantially symmetric structure which is simple in its arrangement.

The invention consists in means for creating a movable light beam in connection with stationary comparison characters and an optical system whereby an image may be produced which is stationary for a definite time.

The invention further consists in stationary comparison characters of equal shape but larger size than the corresponding characters to be explored, in combination with means for reducing the size of the images of the comparison characters to that of the characters to be explored.

The invention also comprises means for casting the image of a comparison character upon a character to be explored while the image of a preceding character still prevails so that the times of the presence of the images overlap each other.

The invention consists also in means for casting a light beam through a stationary comparison character, and for reflecting its image upon the

character to be explored, and further on upon the sensitive surface of the photosensitive unit.

The invention further consists in mirrors having reflecting surfaces in the shape of comparison characters and in an optical system for casting a movable beam upon such mirrors, and for superimposing the images of said mirrors by the aid of said beam upon a character to be explored.

Further details and objects of the invention may be apparent from the description hereinafter, and the appended drawings illustrating embodiments of the invention by way of example. In the drawings,

Fig. 1 is a longitudinal section of an embodiment of the invention;

Figs. 2 and 3 are sections along lines 2—2 and 3—3 respectively, of Fig. 1;

Fig. 4 is a development of a cylinder carrying the comparison characters;

Figs. 5 and 6 show two different modifications of a portion of the embodiment of Fig. 1;

Fig. 7 is a longitudinal section of another embodiment of the invention in its preferred form;

Figs. 8 and 9 are an elevation and a sectional view of a part of the embodiment of Fig. 7;

Figs. 10 and 11 are modifications of Figs. 8 and 9; and

Fig. 12 is a circuit diagram.

Referring now to Figs. 1 to 4, the apparatus comprising the photoelectric controller is denoted by 1. In operative relation thereto, a carrier 2 of suitable design is arranged which is diagrammatically shown like a typewriter cylinder 3 with a sheet of paper 4 having characters 5 thereon. No means have been shown for bringing a particular area of the carrier with a character therein into operative position relative to controller 1, because such means are well-known in the art and do not form part of the present invention. The photoelectric controller comprises a photosensitive unit 6 such as a photoelectric cell with accessorial parts available as a unit on the market and described e. g. in the catalogue CR7505 of the General Electric Company on Photo-Electric Relays, and furthermore, a light source 7, a set of comparison characters, means for directing light rays from said source 7 so as to impinge on an area of the carrier 2 of the characters to be explored, and switching means 8 for the control of a plurality of circuits. Said carrier 2 is so positioned that said area can reflect the light rays toward the unit 6. Such reflection from the carrier will be either regular or irregular, depending on the optical smoothness or roughness of the carrier surface. This difference,

however, is immaterial since the unit 6 does not distinguish in its sensitiveness between direct and scattered light. In the illustrated embodiment, the mentioned parts are housed in a casing having a substantially cylindric portion 9, a co-axial top portion 10 in the shape of a truncated cone, and a partition 11. Within the casing, two central chambers 12 and 13 are provided, in which unit 6, and the light source 7 are respectively mounted. A parabolic reflector 15 and a collector lens 16 are provided so as to guide a light beam downward in the direction of the apparatus axis 20. The set of comparison characters is housed in the casing portion 9, and may be made in various ways, for instance, as shown in Fig. 1. In this figure, a hollow cylinder 14 is attached to the lower side of partition 11, coaxial with axis 20, and is provided with at least as many apertures as there are characters to be explored. A film ring 17' covers the apertures 17. In front of the latter, film portions 17'' (see Fig. 4) in the shapes of the various comparison characters are pervious to light. The remainder of the film is impervious to light. The comparison characters 17'' correspond in shape to the characters 5 respectively, but are larger in size than the latter for reasons to be explained hereinafter. The cylinder 14 may be removably secured to partition 11 for instance, by means of screws 18, so that another cylinder may be applied if the same apparatus is to be used in connection with a different set of characters.

Means are provided to render the light beam movable so that the beam may pass through the comparison characters one after the other, and travel on via the character to be explored towards the photosensitive unit 6. Such means may consist of an inclined plane mirror 19 rotatable about the axis 20 of the light beam of lamp 7. For this purpose a disc 21 is provided on a shaft 22 of an electric motor 23, the latter being secured to the removable bottom wall 24 of the casing portion 9. Mirror 19 is mounted on the disc 21 and so inclined that a beam of light emitted by lamp 7 and impinging on the mirror is reflected to rotate together with the mirror and to pass through the apertures 17 and comparison characters 17'' one after the other. Between disc 21 and bottom wall 24 a multiple switch is arranged which comprises a set of stationary contacting elements 25 on a circle about axis 20, and a contact arm 26 secured to shaft 22 so as to rotate in synchronism with mirror 19. The contacting elements 25 and arm 26 are so arranged in relation to the comparison characters 17'' and mirror 19, that arm 26 contacts a certain element 25 when the light beam reflected by mirror 19 passes through a corresponding aperture 17. In other words, each of the comparison characters is coordinated to one of the stationary elements, and as each of the elements is part of an individual actuating circuit 27 (see Fig. 12) of a set of circuits, the comparison characters are also coordinated to said circuits respectively.

A set of stationary inclined mirrors 28 is mounted on bottom wall 24 opposite to the comparison characters 17''. There are as many mirrors 28 as there are characters, and their inclination is such that all rays passing through characters 17'' are so reflected by mirrors 28 as to converge to a definite point on axis 20. The carrier 2 of the characters 5 is so located that said point lies in the center of the area containing a character which is in the position for being

explored. In the upper portion 10 of the casing, a set of lenses 29 may be arranged to produce real images of the comparison characters. With regard to the lenses 29 diagrammatically shown in the figures it is immaterial whether a single lens or a combination of lenses is used for each individual of the set, in other words whether lenses are selected which produce a real upright or a real inverted image, because the type of the lenses and the shape of the comparison characters can be easily adapted to each other so as to produce images which cover the corresponding characters. This is particularly easy in the case of the film strip 17' which may be applied either in the manner indicated or turned upside down and inside out whereby upright characters will be inverted. The lenses 29 are so located in relation to mirrors 28 as to reduce the cross-sections of the beams reflected by mirrors 28 to the size of the characters 5. Such reduction is unnecessary if the characters 17'' of cylinder 14 have the same size as the corresponding characters 5. However, it is advisable to use comparison characters of a size larger than that of the characters to be explored, because in that case a relatively weak lamp 7 is sufficient to produce the necessary light intensity of the reflected beams. Lenses 29 may be fastened in a mount 30 attached to chamber 12. A collector lenses 32 is mounted in a tubular extension 31 to project the light beam impinging upon and reflected by the area of the pertaining character 5 to the photosensitive unit 6. In order to permit the passage of the reflected beam, apertures of suitable size are provided in the top of the casing at 33 and in the partition 11 and 34.

The electric connections of the apparatus are shown in Fig. 12. The photosensitive unit 6, the light source 7 and the motor 23 are connected to an electric source $\pm$ via a main switch 35. Another electric source 36 is connected to unit 6 by wire 37 and to the contact arm 26 by wire 38 and ring 38'. The actuating circuits 27 start at the contact elements 25 and have a common return lead 39 for the current back to the unit 6. The actuating circuits may serve to provide external apparatus with current, so as to cause predetermined functions in such external apparatus under the control of the photosensitive unit and of a character to be explored. Individual means operative by current in the external apparatus are diagrammatically indicated by inductances 40 in Fig. 12.

The described apparatus operates in the following manner: First, the character carrier 2 is so adjusted that the character to be explored is in the operative position, that is to say, that its center lies substantially on axis 20 in the point to which the light rays from the mirrors 28 converge. When switch 35 is in its closed position, the photoelectric unit is excited, lamp 7 emits light rays, and motor 23 rotates. Driven by motor 23, the mirror 19 and contact arm 26 rotate also, and the beam of light projected by lamp 7 with reflector 15 and lens 16, and reflected by mirror 19 travels along a circle on the inner wall of cylinder 14. Wherever the beam finds an aperture i. e. a comparison character 17'', it passes on to the corresponding mirror 28 and through the coordinate lens 29 and is superimposed on the characters 5 which happens to be in the operative position, for instance, the character "3" in Fig. 1. From there, the beam is reflected upon the unit 6 through lens 32. Since the characters 5 are dark on a light background, and the beam passing through the comparison characters fur-

nishes light images, a minimum of light will be reflected upon the photosensitive unit when the beam cross-section corresponds in shape and size to that of the character to be explored. This will be the case in the example of Fig. 1 when the light beam passes through the comparison character representing the character "3". In the corresponding position of mirror 19, contact arm 26 contacts the coordinate element 25. Owing to the prevailing minimum of light impinging on the unit 6, the latter responds causing the passage of current which flows from electric source 36 through wire 38, ring 38', arm 26, corresponding circuit 27, return lead 39, unit 6, and wire 37 back to the source 36, thereby actuating the external device indicated by inductance 40 in Fig. 12.

It is a particular feature of the apparatus according to the invention, that the image of a comparison character projected upon the character to be explored remains stationary as long as any light reflected by mirror 19 passes through the corresponding comparison character during the rotation of the mirror 19. This stationariness is certainly not to be understood as meaning that the entire character to be explored is covered at once by the entire image of the corresponding comparison character. But, whenever even only a portion of the image is cast upon the character to be explored, such image portion will always cover the corresponding portion of the character. In other words, the position of the image relatively to that of the character remains constant. This phenomenon is due to the fact that in the optical system plane mirrors 19 and 28 are used, and that film 17' as well as mirrors 28 remain stationary with respect to the character carrier. While the image thus is stationary, its light intensity increases from zero to a maximum and, then, decreases again to zero owing to the decreasing and increasing inclination of the light beam relative to the plane of the comparison character. However, the apparatus cannot operate properly unless there is light constantly impinging upon the photosensitive unit except when the light beam passes through the comparison character corresponding to the character to be explored. For this reason the mirror 19 and the beam reflected by said mirror are so dimensioned with respect to their width that light passes through at least portions of two neighboring comparison characters when the beam center is directed towards the middle between said two neighboring characters, that, however, light passes only through one comparison character when the beam center is directed towards the middle of said comparison character. In consequence thereof, the image of one comparison character will progressively appear on the character to be explored and its light intensity will increase, while the image of the preceding comparison character is still present though fading.

When the light intensity of the comparison character reaches its maximum and, according to the width of the beam, shortly before such maximum occurs, the image of the preceding character will have entirely disappeared. When the reflected beam continues to rotate the intensity of the image of the comparison character will decrease while the image of the subsequent comparison character will progressively appear. Thus, it will be found, that, according to the width of the reflected light beam, two part images of different comparison characters may be si-

multaneously created. Even if, in that event, the two part images would combine so as to form an image having the shape of one of the characters to be explored, such occurrence would not interfere with the correct operation of the apparatus. It is clear that such combination could occur only when the beam center is directed to a point intermediate two neighbored comparison characters. If this is the case, the switch arm 26 of Fig. 12 is also in a position between two contacts 25. Hence, even if under such circumstances the photosensitive unit reacts to permit the passage of current, no current will flow through one of the circuits 27.

However, it will be understood, that the particular type and shape of characters shown in the drawings are selected only by way of example. As far as the device according to the present invention is concerned, the characters as such have no specific meaning. Each character to be explored serves, in a sense, to express a command to the apparatus to energize a co-ordinate circuit 27. Thus, the characters may be chosen from among the conventional forms of letters or figures, or they may be of any fanciful design. Hence, it is easy to avoid the possibility of a combination of the images of parts of two characters into the image of a third character belonging to the group of those to be explored. Furthermore, even if there are in a group two characters, parts of which may form an undesired combination any disturbance can be prevented by so arranging the sequence of the characters, e. g. on the film of Fig. 4, that the two characters under consideration are separated by another one. For instance, if the characters of Fig. 4 are used and if it is assumed that a combination of part of the "8" with part of the "9" may form an image similar to the "2" then, any other character of the group, e. g. the "1" or the "7" or the circle may be removed from its illustrated position and arranged between the "8" and "9". This can be done, because the particular sequence of the characters is obviously immaterial with regard to the operation of the device. It is only necessary that the sequence of the circuits 27 in relation to switch arm 26 is the same as that of the respectively co-ordinate comparison characters in relation to the rotating beam.

Particular optical phenomena are caused by the rotating beam, owing to the fact that the characters to be explored have a definite upright position, and that the comparison characters are stationarily arranged about the axis of the beam rotation. If all comparison characters are so arranged as to have equal upright positions, their images on the character to be explored will appear in a position turned with respect to the character notwithstanding a coincidence of the centers of the images and of the character to be explored. In order to obtain complete coincidence, only one comparison character may be so arranged that it is in an upright position on cylinder 14 and that its image appears also upright on the character to be explored. All other comparison characters must be so turned that their center lines which shall appear in their images in upright position are inclined on film 17' at the cylinder 14. The correct inclination is defined by the fact that each comparison character must be turned in relation to the position of the neighboring one about an axis perpendicular to the axis of rotation, at an angle equal to that traversed by the beam upon its rotation from one comparison character to the other one. This is

exemplified by the development of the film ring 17' as shown in Fig. 4. In this figure the ring 17' carries twelve comparison characters 17'', viz. the numerals "1" to "0", an asterisk and a circle. The numeral "1" is in upright position and will thus appear on the character to be explored provided the cylinder 14 with film ring 17' is secured to partition 11 in the correct position relative to the upright direction of said character. As the twelve comparison characters are arranged on cylinder 14 at equal distances from each other, the numeral "2" is turned 360°: 12=30° relatively to the numeral "1"; numeral "3" is turned 30° relatively to the "2"; etc.

15 If the apparatus is arranged for twelve different comparison characters as in the embodiment of Figs. 1 to 4, any number of characters up to twelve can be explored with its aid provided the shapes of the comparison characters correspond to those of the characters to be explored. In other characters are to be explored, it is only necessary to substitute a cylinder with suitable comparison characters for cylinder 14. This may be accomplished by removing the bottom plate 24 with the parts connected thereto, whereupon cylinder 14 may be easily exchanged. If more than twelve characters are to be explored, the sets of mirrors 28, lenses 29, contact elements 25 and comparison characters 17' of cylinder 14 must have at least the same number of elements as there are characters to be explored. In order to adjust the time required for one rotation of the light beam, to the number of comparison characters applied, so that each image prevails sufficiently long to cause the photosensitive unit to respond, means may be provided for altering the speed of the drive of the rotating member. Such means are indicated by an adjustable resistance 41 in Fig. 12, for adjusting the speed of motor 23.

Figs. 5 and 6 illustrate two modifications of the apparatus according to the invention as described hereinbefore. In the modification of Fig. 5, one rotatable mirror 128 is substituted for the set of stationary mirrors 28 in Fig. 1, and is so arranged that the beam reflected by mirror 19 is directed upon the mirror 128 which rotates synchronously with mirror 19. For this purpose the disc 121 on which mirror 19 is mounted has a larger diameter than disc 21 of Fig. 1, and also carries mirror 128 outside of cylinder 14. In all other respects the devices of Figs. 1 and 5 are alike. Since, upon rotation of disc 121 mirror 128 takes the position of the individual mirrors 28 of Fig. 1 one after the other, the device operates in the same manner as the embodiment described first, and the images of the comparison characters will appear and fade on the character to be explored in a manner similar to that described with respect to Fig. 1, provided the dimensions of mirror 128 are suitably selected. The embodiment of Fig. 5 offers the advantage that only one mirror 128 is required for any number of characters.

65 In the modification of Fig. 6, the light source for creating the rotating beam is a lamp 207 attached to the lower surface of the partition 211, and arranged within a cylinder 214 carrying the comparison characters. A cylindric screen 213 with only one aperture 216 incloses cylinder 214. The light of the lamp passes through all comparison character of cylinder 214 and is cast upon the inside of the screen 213. Only when the lamp, one of the comparison characters and the aperture 216 are in line, a beam impinges

upon mirror 228 and is reflected in the manner described. The rotation of the disc 221 brings the aperture 216 in registry with one comparison character after the other.

Fig. 7 illustrates the preferred form of an apparatus according to my invention. The arrangement of the character carrier 2, photosensitive unit 6, lamp 7, mirror 19, lenses 29, switching device 8, motor 23, and the housing with parts 9 and 10, partition 11 and bottom plate 24 are the same as in Fig. 1. However, cylinder 14 of Fig. 1 is lacking, and the stationary inclined mirrors 328 are so designed as to form the comparison characters whose images are to be cast upon the character to be explored. The mirrors 328 may be made in various ways. For instance, they may consist each of a highly polished metal plate 329 in the shape of one of the comparison characters, with a standard 330 as shown in Figs. 8 and 9. The standards may be secured to ring 331 of U-shaped cross-section, and the latter may be mounted on the bottom plate 24. In the modification of Figs. 10 and 11, an inclined plane mirror 332 is covered by a stencil sheet 333. The material of the sheet is light-absorbing, while light will be reflected by the mirror surface corresponding to the character 334 of the stencil sheet 333. In order to change the comparison characters of the apparatus of Fig. 7, either individual characters may be removed by loosening screws 335, or ring 331 with the entire set of characters 328 may be taken off the bottom plate 24 after screws 336 are removed. The switching elements 25 and the lenses 29 are coordinate to the comparison characters 328 in the same manner as they are coordinate to the characters 17' in Fig. 1.

The operation of the apparatus of Fig. 7 is similar to that of Fig. 1. When lamp 7 is burning and mirror 19 rotating, a light beam reflected by said mirror successively passes the reflecting comparison characters 328. Each character reflects in its turn a beam having the cross-section of the pertaining character, through the coordinate lens 29 upon the area of carrier 2 which contains the character to be explored in operative position. The images appearing on said area are in the same upright position as character 5, since the comparison characters are correctly turned relative to each other as clearly shown in Fig. 7, and as explained hereinbefore with relation to Fig. 4. Owing to the fact that the cross-section of the beam is sufficiently large to cover at least portions of two neighboring characters when the beam center is directed towards the middle therebetween, the image of a comparison character will appear superimposed upon the character 5 while the image of the preceding comparison character is still in the state of fading. Furthermore, an image of an entire comparison character remains on character 5 as long as the rotating beam impinges upon the whole surface of the pertaining comparison character. The light cast upon said area of character carrier 2 increases to a maximum which holds on for a certain length of time. Thereafter the light decreases. Light will be reflected by said area upon the photosensitive unit except when the image of the comparison characters 328 corresponds to and coincides with the character to be explored. In that instance the unit 6 will respond and cause an electric circuit to pass the switch element 25 coordinate to the pertaining comparison character to operate the actuating device 40 in the pertaining circuit 27.

While I have described, in the embodiments of my invention the use of a reflecting character carrier with non-reflecting characters to be explored, in connection with comparison characters producing light images, the devices according to my invention are operative with equal result if the characters to be explored are light, i. e. reflecting, on a non-reflecting carrier in connection with comparison characters furnishing dark images on a light background. I consider such reverse as an equivalent of the described embodiments, and desire that the appended claims are understood to include such reverse. Other changes may be made in the construction and arrangement of the described embodiments without departing from the scope and the spirit of the invention.

I claim:

1. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source, means for moving a light beam of said source about a predetermined point, a plurality of stationary means for giving the beam successively cross-sections corresponding to the various characters to be explored, said means being arranged in the path of said moving beam and at an angle thereto so as to be impinged upon by said beam one after the other, means for directing the beam from said last mentioned means upon an area of said character carrier, and means for directing light reflected from said area upon said photosensitive unit so as to enable the same to respond when the cross-section of said beam corresponds to a character in said area.

2. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source, means for rotating a light beam originating from said source about an axis and in a predetermined plane, a plurality of stationary means for giving the beam successively cross-sections corresponding to the various characters to be explored, said means being arranged around said axis in the path of the rotating beam so as to be successively impinged upon by said beam, means for directing the beam from said last mentioned means upon an area of said character carrier, and means for directing light reflected from said area upon said photosensitive unit so as to enable the same to respond when the cross-section of said beam corresponds to a character in said area.

3. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source, means for moving a light beam originating from said light source in a predetermined plane, a set of stationary comparison characters in the path of said light beam, said comparison characters respectively corresponding in shape to the characters to be explored, and being pervious to light and so arranged as to be passed by said moving beam one after the other, and an optical system for reflecting said beam after it has passed through any one of said comparison characters, upon the area of said character carrier opposite said photosensitive unit, so as to enable the same to respond when the cross-section of said beam corresponds to a character in said area.

4. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source, means for moving a light beam

originating from said light source in a predetermined plane, and a set of stationary mirrors in the path of said light beam, said mirrors having reflecting surfaces in the shape of comparison characters respectively corresponding to the characters to be explored, and being so arranged as to be passed by said moving beam one after the other, said mirrors being so inclined as to reflect said beam upon the area of said character carrier opposite said photosensitive unit, so as to enable the same to respond when the cross-section of said beam corresponds to a character in said area.

5. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source, means for rotating a light beam originating from said light source about an axis and in a predetermined plane, a stationary hollow cylinder arranged co-axially with said axis of rotation, said cylinder comprising a set of comparison characters pervious to light and arranged in the path of said beam so as to be successively impinged upon by said rotating beam, and an optical system for reflecting said beam after it has passed through any one of said comparison characters, upon the area of said character carrier opposite said photo-sensitive unit, so as to enable the same to respond when the cross-section of said beam corresponds to a character in said area.

6. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source, means for moving a light beam originating from said light source in a predetermined plane, a set of stationary comparison characters for giving the beam successively cross-sections corresponding to the various characters to be explored, said comparison characters being arranged in the path of said light beam, and being larger in size than but corresponding in form to the respective characters to be explored, and being so arranged as to be passed by said moving beam one after the other, and an optical system for directing said beam from said comparison characters upon the area of said character carrier opposite said unit, said optical system including means for reducing the cross-sections of said beam at said carrier to the size of the characters to be explored, whereby said photosensitive unit will be enabled to respond when the cross-section of said beam corresponds to a character in said area.

7. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source, means for rotating a light beam originating from said light source about an axis and in a predetermined plane, a set of stationary comparison characters in the path of said light beam, said comparison characters respectively corresponding in shape to the characters to be explored and being pervious to light and so arranged about said axis as to be passed by said beam one after the other, and an optical system comprising a mirror rotatable in synchronism with said beam about said axis of rotation, said mirror being arranged in the path of the beam behind said comparison characters, and being so inclined as to direct said beam permanently on the area of said character carrier opposite said photosensitive unit, so as to enable the same to respond when the cross-section of said beam corresponds to a character in said area.

8. In a photoelectric controlling device, including a photosensitive unit, for exploring charac-

ters on a character carrier, the combination of a light source, means for casting successively light beams originating from said light source from various points of a first closed curve towards the area of said carrier opposite said unit, so that said beams define a cone having its apex approximately in the center of said area, a plurality of stationary comparison characters arranged on a second closed curve concentric with said first closed curve and in the paths of the light beams respectively so as to give each beam a cross-section respectively corresponding to one of the various characters to be explored, each comparison character being turned in relation to the position of the neighboring one about the axis of the pertaining beam at an angle equal to the angle which corresponds to the arc of said second closed curve between the two neighboring comparison characters, whereby the images of all comparison characters will consecutively appear on said area in the same upright position, and means whereby light reflected from said area is directed upon said photosensitive unit, so as to enable the same to respond when the beam with a cross-section corresponding to a character in said area impinges upon the latter.

9. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source, means for rotating a light beam originating from said source about a center in a predetermined plane, a plurality of stationary inclined reflecting surfaces in the shape of comparison characters respectively corresponding to the characters to be explored, said comparison characters being arranged on radii in relation to said center so as to be successively passed by said rotating beam and to deflect the latter to the area of said carrier opposite said unit, each comparison character being turned in relation to the position of the neighboring one about the respective radius at an angle equal to the angle enclosed by the two radii on which the two neighboring comparison characters are located, whereby the images of all comparison characters will appear on said area in the same upright position, and means whereby light reflected from said area is directed upon said photo-sensitive unit so as to enable the same to respond when the beam impinges upon that comparison character which corresponds to a character in said area.

10. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source adapted to produce a light beam having a predetermined axis, a first inclined mirror in the path of said beam, means for rotating said mirror about said beam axis, a set of stationary

comparison characters in the path of the beam reflected by said mirror, said comparison characters relatively corresponding in shape to the characters to be explored and being pervious to light and arranged about said axis so as to be passed by said rotating beam one after the other, and a second inclined mirror in the path of said rotating beam at a greater distance from said axis than said set of comparison characters, said second mirror being rotatable together with said first mentioned mirror and being so inclined as to reflect the beam which has passed through a comparison character consecutively upon the area of said character carrier opposite said unit, so as to enable the same to respond when the cross-section of said beam corresponds to a character in said area.

11. In a photoelectric controlling device, including a photosensitive unit, for exploring characters on a character carrier, the combination of a light source emitting a beam of light, a rotatable inclined mirror in the path of said beam, a set of stationary comparison characters in the path of said beam reflected by said mirror, and an optical system for projecting the images of said comparison characters with the aid of said beam towards a predetermined point which is opposite to the sensitive surface of said unit, said photosensitive unit, said light source, said mirror, said set of comparison characters and said optical system having a common axis on which said point is located, whereby the entire device is in operative position with respect to a character to be explored when the center of the latter coincides with said predetermined point.

12. In a photoelectric controlling device for controlling a plurality of circuits in accordance with characters on a character carrier, the combination of a photosensitive unit, a light source, a set of comparison characters, an optical system for projecting the images of said comparison characters towards a character to be explored and positioned opposite the sensitive surface of said unit, a set of connections for said circuits respectively co-ordinate to said comparison characters; said unit, said comparison characters, said optical system and said circuit connections being arranged stationary with respect to each other, and movable means for consecutively directing a beam from said source upon said comparison characters and for connecting said unit to said circuit connections consecutively and synchronously with the movement of said beam whereby a circuit will be energized owing to the unit responding when the beam strikes a comparison character corresponding to the character to be explored.

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