Dec. 11, 1934. E. WILDHABER 1,984,004

MEANS FOR PRESENTING PICTURES

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FIG. 1

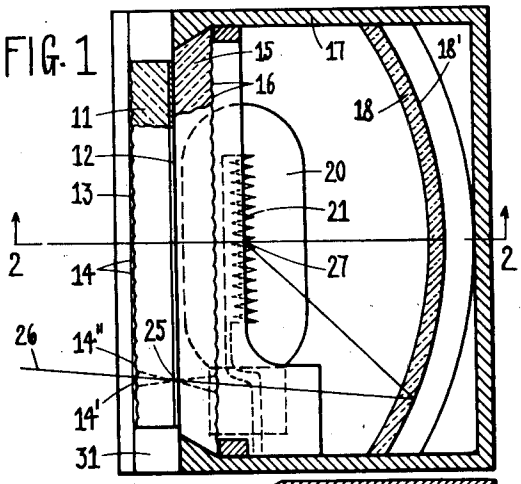


FIG. 3

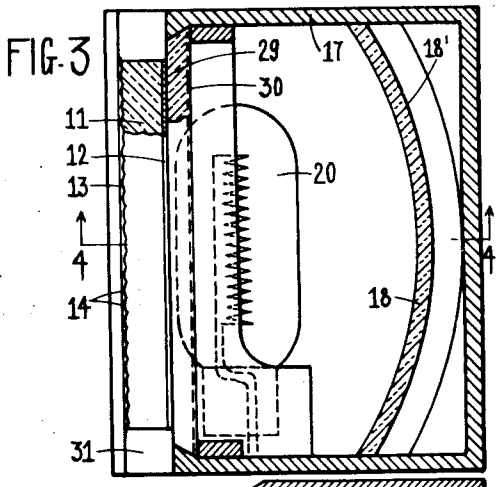


FIG. 2

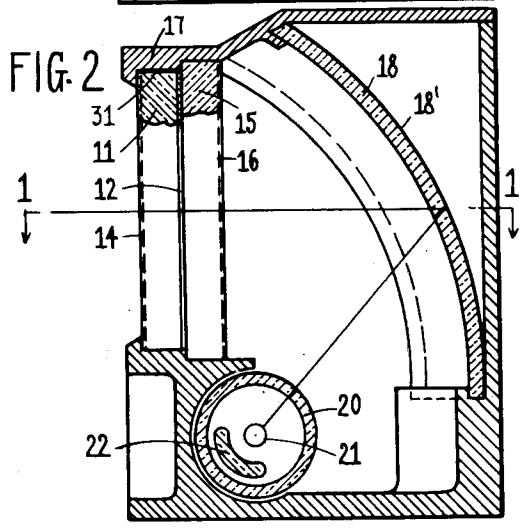


FIG. 4

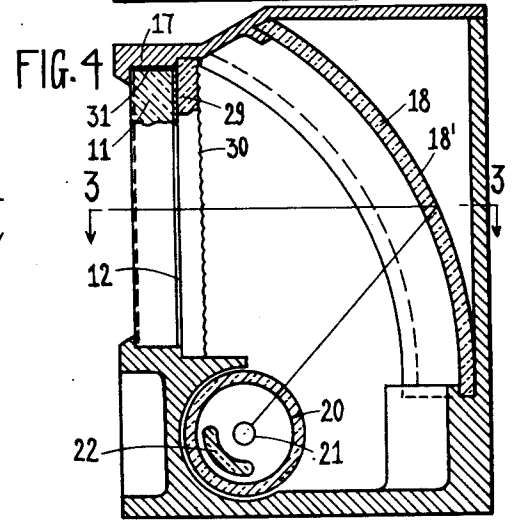


FIG. 6

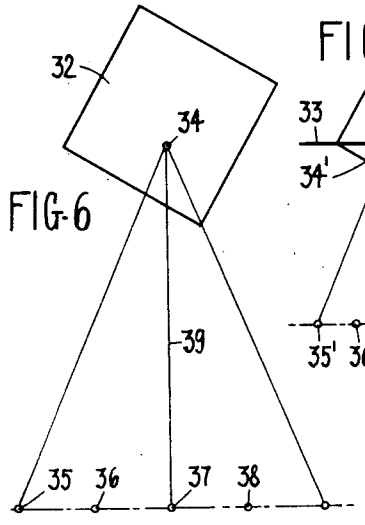


FIG. 7

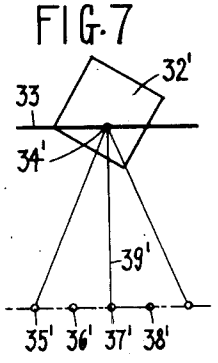
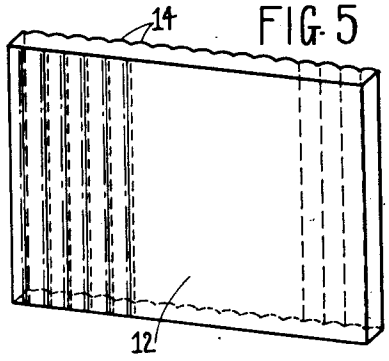


FIG. 5



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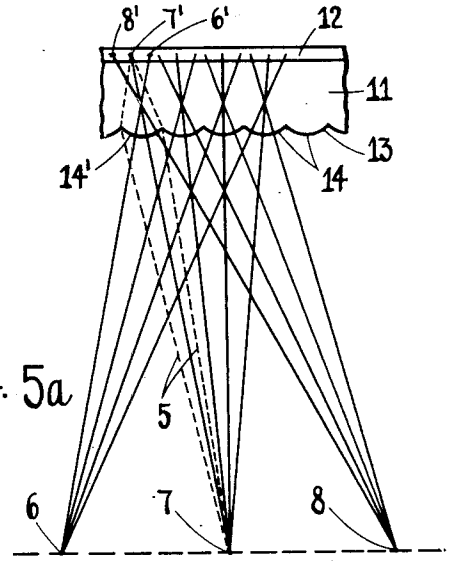


FIG. 5a

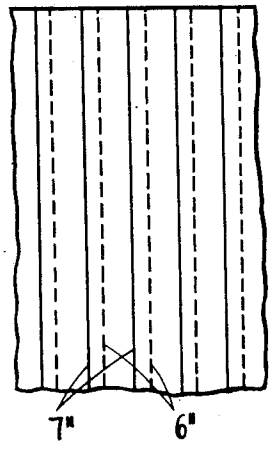


FIG. 5b

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FIG-8

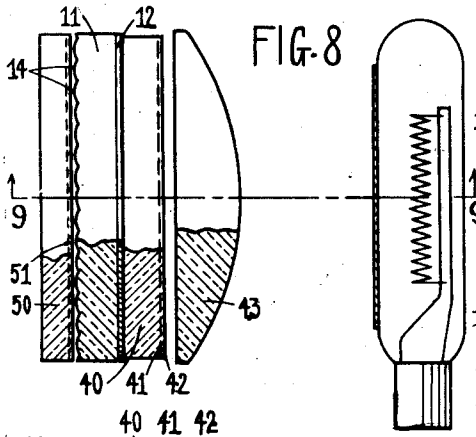


FIG-12

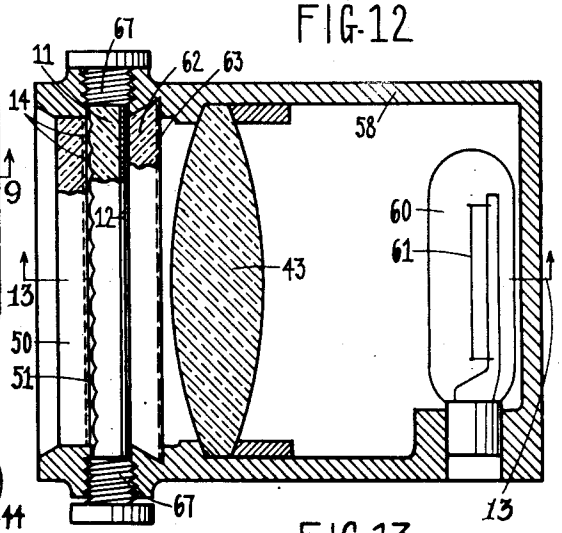


FIG-9

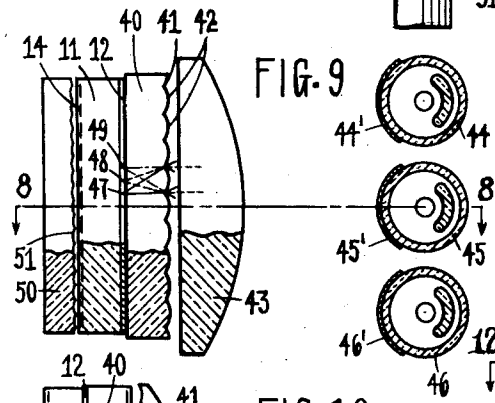


FIG-13

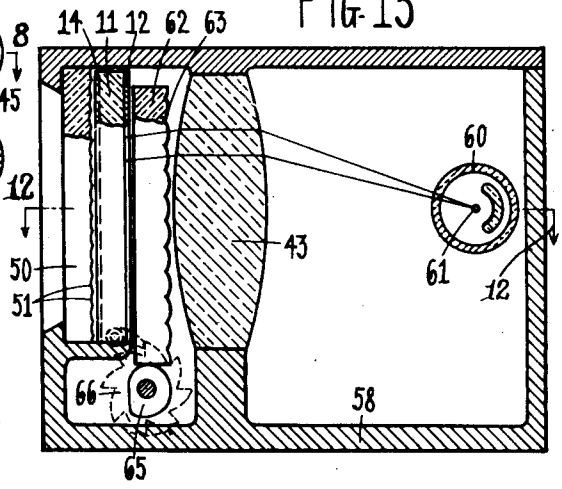


FIG-10

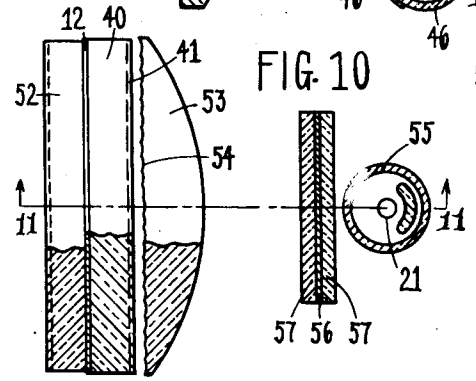


FIG-15

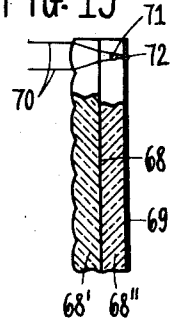


FIG-14

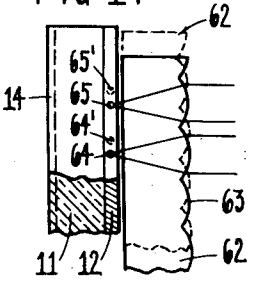
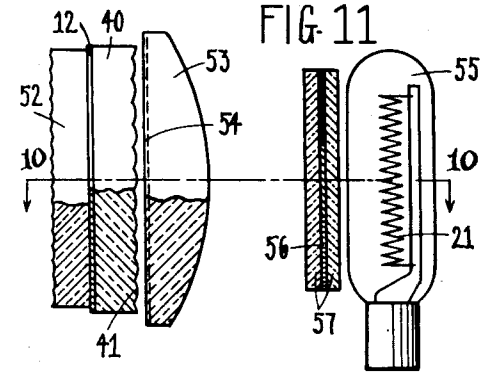


FIG-11



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FIG. 19

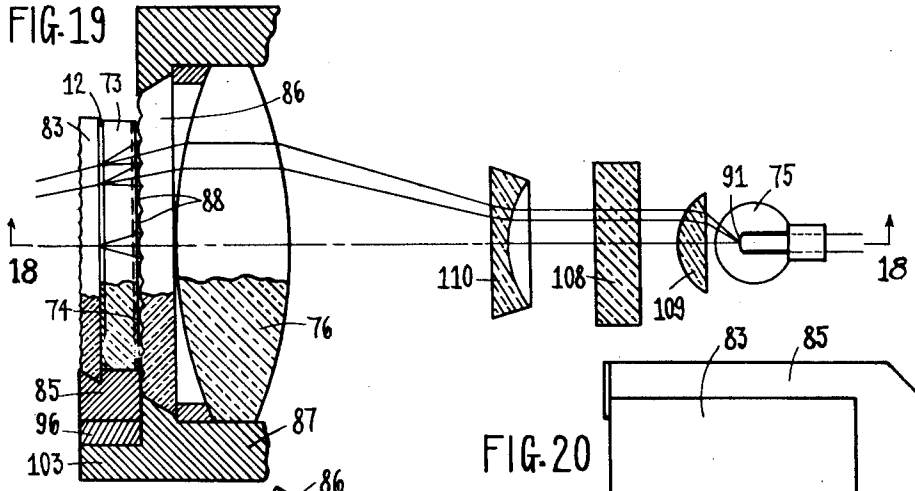


FIG. 20

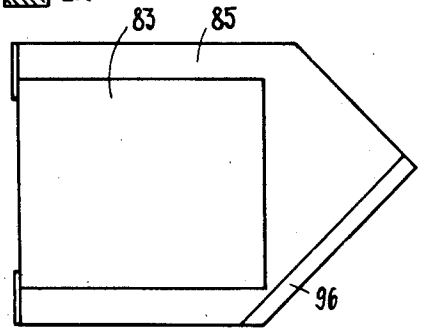


FIG. 18

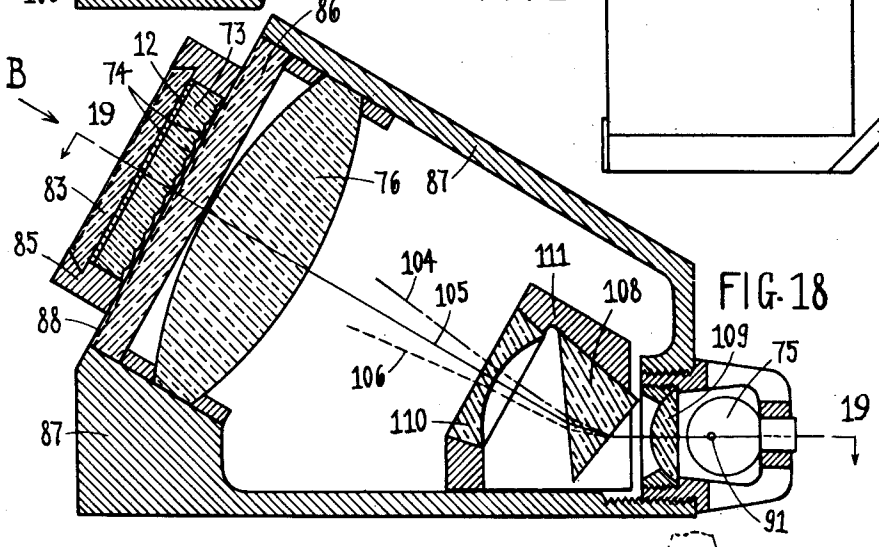


FIG. 16

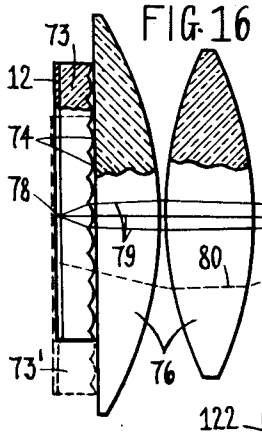


FIG. 16a

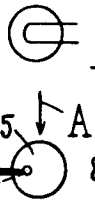


FIG. 17

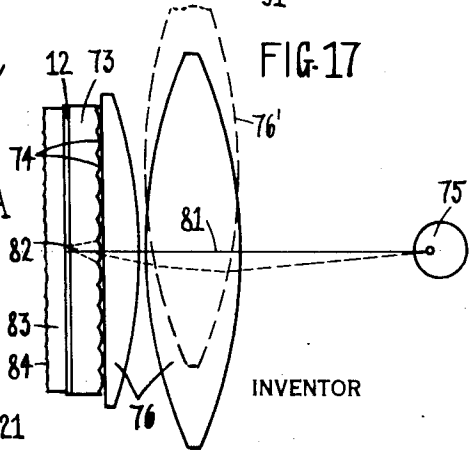
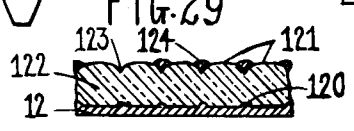


FIG. 29



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FIG-21

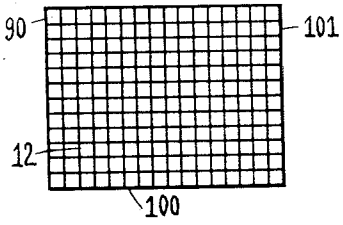


FIG-22

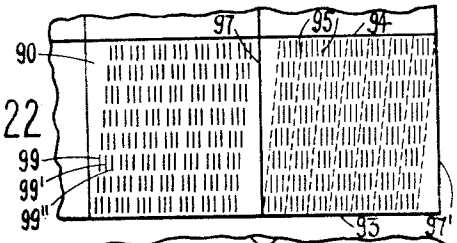


FIG-23

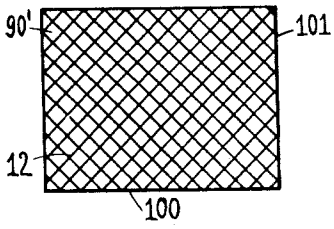


FIG-24

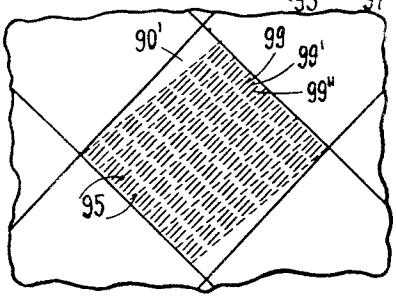


FIG-26

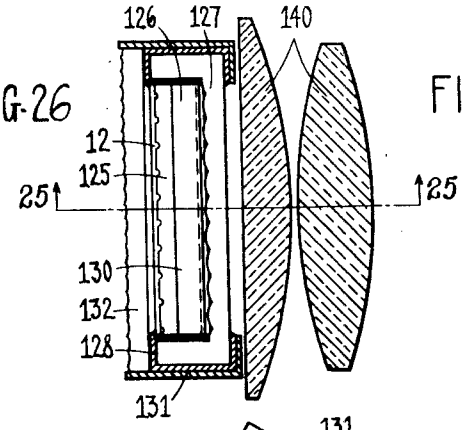


FIG-27

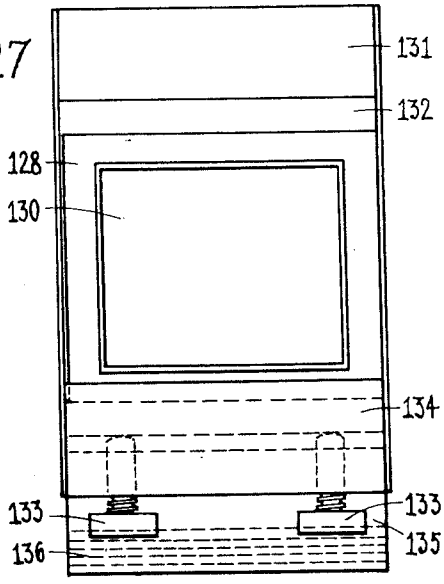
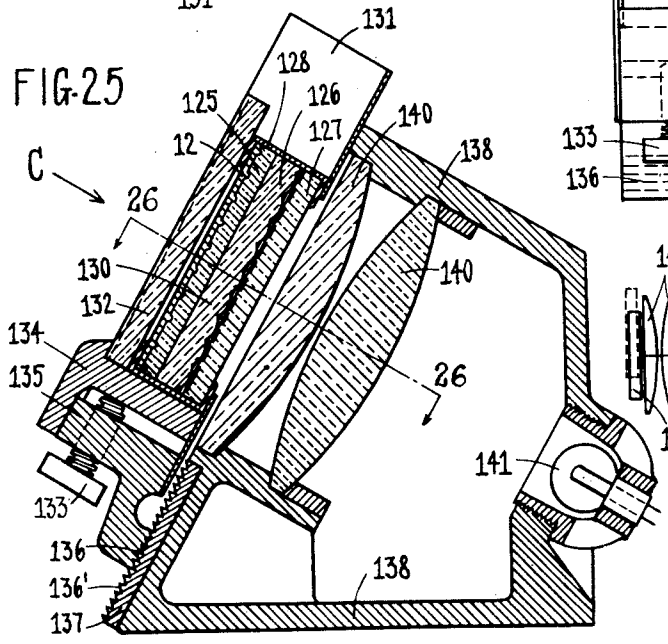


FIG-25



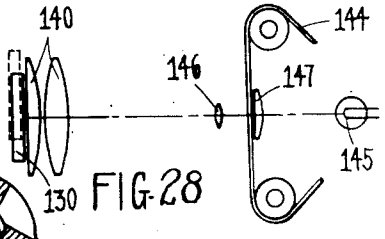


FIG-28

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Patented Dec. 11, 1934 1,984,004

UNITED STATES PATENT OFFICE

1,984,004

MEANS FOR PRESENTING PICTURES

Ernest Wildhaber, Brooklyn, N. Y.

Application January 18, 1929, Serial No. 333,500

10 Claims. (Cl. 88—1)

The present invention relates to means for presenting pictures of any kind, and particularly to presenting pictures on or adjacent the surface on which they are recorded.

One object of the invention is to provide means for presenting in succession a plurality of pictures recorded inside of the same joint picture area, and for presenting said pictures in strong light. A further aim is to broadly present a picture on or adjacent the surface on which it is recorded under improved lighting conditions and to effect an exclusive area of observation from which the whole picture may be seen in good light.

According to a known method of simultaneously presenting two pictures on the joint area on which they are recorded in a manner to be visible from different places of observation, each of said two pictures is visible from a plurality of places or zones which alternate with each other. In other words if adjacent different zones of observation are consecutively numbered 1, 2, 3, 4 and so on, one of said two pictures is visible from zones 1, 3, 5 and the other of said two pictures is visible from alternate zones 2, 4, 6 according to said known method. In many cases the said repetition of the zone of visibility of a picture is found to be a drawback, as further described hereafter. One aim of the present invention is to overcome this drawback, to reduce the number of separate places or zones of visibility of the same picture, and usually to effect a single place or zone of visibility of a picture.

A further important object of the present invention is to provide a picture carrier containing a large number of pictures split up in separate zones or separate points and recorded on the same joint picture area, and to present said pictures either simultaneously or successively through illumination in a manner differentiating the various pictures from one another. A related aim is to make possible recording of a large number of pictures or printed matter on the same area, and to reduce whole books with illustrations to a single leaf, as will be further described hereafter. A further aim is to record information on an utterly condensed space, and to present said information in a convenient and practical manner.

Another important object is to provide means for presenting moving pictures on or adjacent the area on which they are recorded, and for successively presenting pictures corresponding to different phases of motion by selective illumination of said area. A further object is to present moving pictures on or adjacent the joint area on which the individual pictures are recorded, by providing a source of light, and by displacing said area and the bundle of light passing to said area relatively to each other. A further aim is to effect moving pictures by displacing a picture area relatively to a stationary source of light.

Numerous other objects will appear in the course of the specification and from recital of the appended claims.

The present invention opens up various new fields. Hitherto books could be illustrated only with stationary pictures. With the present invention the printed matter of a book may be condensed to a single picture area, and the illustrations may moreover be substituted with moving pictures recorded on the same picture area. One or a few picture areas are sufficient to reproduce a book and to provide living illustrations. Many further novel uses are made obvious from reading the present specification.

The invention will be explained with reference to the accompanying drawings, in which:

Fig. 1 is a plan view, partly in section along lines 1—1 of Fig. 2, of a simple device embodying my invention in one of its simplest aspects, namely for presenting stationary stereoscopic pictures.

Fig. 2 is a side elevational view and section along lines 2—2 of Fig. 1.

Fig. 3 and Fig. 4 are views, partly in section, of a slightly modified device embodying my invention. Fig. 3 is a section along lines 3—3 of Fig. 4, and Fig. 4 is a section along lines 4—4 of Fig. 3.

Fig. 5 is a perspective view of a picture carrier for performing my method.

Fig. 5*a* is an enlarged partial view of the picture carrier also shown in Fig. 5, the view being taken in the direction of the cylindrical lens surfaces (14). Fig. 5*a* moreover is a diagram explanatory of certain principles underlying the present invention.

Fig. 5*b* is a front view and diagram corresponding to Fig. 5*a*.

Fig. 6 and Fig. 7 are diagrammatic views of an object and of its stereoscopic picture respectively, illustrative of certain inter-relations observed in making a stereoscopic picture.

Fig. 8 and Fig. 9 are a diagrammatic plan view, partly a section along lines 8—8 of Fig. 9, and a side elevational view, partly a section along lines 9—9 of Fig. 8 respectively, of an arrangement for presenting colored stereoscopic pictures in accordance with one embodiment of the present invention.

Fig. 10 and Fig. 11 are a plan view and a corresponding side elevation, partly sections along lines 10—10 of Fig. 11, and 11—11 of Fig. 10 respectively, of a diagrammatic arrangement for presenting colored pictures in accordance with the present invention.

Fig. 12 and Fig. 13 diagrammatically illustrate a device for successively presenting a plurality of stereoscopic views in accordance with the present invention. Fig. 12 is a plan view and partly a section along lines 12—12 of Fig. 13. Fig. 13 is a corresponding side elevational view, partly a section along lines 13—13 of Fig. 12.

Fig. 14 is an enlarged and diagrammatic section through an element shown in Fig. 12 and Fig. 13, further explanatory of the operation of the device referred to.

Fig. 15 is a section through one form of a picture carrier constructed in accordance with my invention.

Fig. 16 is a diagram explanatory of an arrangement for successively presenting a plurality of pictures, or for presenting moving pictures in accordance with the present invention.

Fig. 16*a* is a view of the source of light indicated in Fig. 16, taken in the direction of arrow A.

Fig. 17 is a diagram of a modified arrangement for successively presenting a plurality of pictures, or for presenting moving pictures.

Fig. 18 is a side elevation, partly a section corresponding to lines 18—18 of Fig. 19, of a simplified device for presenting colored moving pictures in accordance with the present invention.

Fig. 19 is a diagrammatic view, and partly a diagrammatic section along the mean path of light 19—19 indicated in Fig. 18.

Fig. 20 is a front view of the slide (85) shown in Fig. 18 and Fig. 19, the view being taken in the direction of arrow B of Fig. 18.

Fig. 21 is a diagrammatic general view of a picture area, illustrative of surface elements corresponding each to one picture point.

Fig. 22 is an enlarged view of a surface element shown in Fig. 21.

Fig. 23 is a diagrammatic general view of a picture area with differently positioned surface elements, as compared with the picture area illustrated in Fig. 21.

Fig. 24 is an enlarged view of a surface element shown in Fig. 23.

Fig. 25 is a side elevational view and a section along lines 25—25 of Fig. 26 of a further and important device for presenting pictures in accordance with the present invention.

Fig. 26 is a view and chiefly a section taken along lines 26—26 of Fig. 25.

Fig. 27 is a front view of the slide (131) indicated in Fig. 25 and Fig. 26, the view being taken along arrow C of Fig. 25.

Fig. 28 is a diagram illustrative of a way of recording pictures for presentation in accordance with my invention.

Fig. 29 is a section of a preferred form of corrugated plate used in accordance with the present invention.

Fig. 1 and Fig. 2 illustrate one way of presenting stereoscopic pictures, and especially living stereoscopic pictures, as will be further described. Referring to these figures, numeral 11 denotes a plate of refractive material, such as for instance glass, celluloid, or any other suitable transparent substance. Plate 11 contains on one side a developed photographic layer 12 or more broadly a picture layer, which preferably is permanently secured to it, so as to form a unit with said plate. On the side opposite to picture layer 12, plate 11 contains a corrugated surface 13, which is formed by a large number of small convex cylindrical lenses 14. Lenses 14 extend perpendicular to the drawing plane of Fig. 1 and parallel to the drawing plane of Fig. 2. Their arrangement is further indicated in the perspective view Fig. 5. The convex cylindrical lenses 14 contain circular or substantially circular profiles of such curvature, that they are focussed on layer 12. In other words, the profile curvature of the lenses 14 is such, that parallel or substantially parallel rays of light, which pass to the lenses from the left side of Fig. 1, would be concentrated through cylindrical lenses 14 in a manner that they appear to intersect in points of layer 12, in the view of Fig. 1.

In consequence points situated at a great distance from layer 12, as compared with the thickness of plate 11, such as for instance points 6, 7, 8 (Fig. 5*a*), have optical images formed by the lenses 14 on sensitive layer 12. For instance lens 14′ forms images 6′, 7′, 8′ of points 6, 7, 8. All the rays of light, which pass through point 7 and pass to lens 14′ are concentrated by said lens, and meet again at point 7′, which is the image of point 7. Said rays of light are included between dotted lines 5. The same action takes place with respect to any other points 6, 8.

As each point 6, 7, 8 corresponds to a different point on layer 12, and the rays of light meet again in said corresponding points, so also the rays coming from said corresponding points are concentrated through lenses 14 to meet again in the respective points 6, 7, 8.

With this structure, a point recorded at 7′ will be visible from point 7, but not from points 6 or 8. A point recorded at 6′ will be visible from point 6, but not from the points 7, 8; and a point recorded at 8′ will be visible from point 8, but not from points 6, 7.

Different pictures, for instance pictures of the same objects taken from different points, may be recorded along different parallel lines such as 7″, 6″, shown in Fig. 5*b* in full lines and in dotted lines respectively, and are then visible from different points 7, 6.

Another plate 15 of refractive material is disposed adjacent plate 11, on the side of layer 12. It contains corrugations in the form of convex cylindrical lenses 16, disposed on the side opposite to layer 12. Lenses 16 are of the same general structure as lenses 14 and extend parallel thereto. Plate 15 is secured in any suitable manner to a box 17, which contains a concave mirror 18 and a source of light 20. Box 17 is made light proof in the sense that no appreciable amount of light may enter it from the outside, except through plate 15.

The source of light 20 is shown in the form of an incandescent lamp containing an incandescent wire 21 of helical form, which is held in place by any suitable holder 22 indicated in section in Fig. 2. Mirror 18 consists of a curved glass plate containing a suitable known reflective substance provided on its rear surface 18′. Mirror 18 is so curved and so positioned that it forms a real image of the source of light 20 at a convenient distance of observation in front of plate 11, especially so when the plates 11 and 15 are imagined removed for the sake of explanation.

In explaining the nature of the stereoscopic pictures, plate 15 will be first considered nonexistent. First it will be realized, that in the plan view Fig. 1 only separate points of layer 12

can actually be seen from any one point of observation in front of plate 11. All the rays of light namely, which converge in one point of observation, pass through separate points of the layer 12. The said separate points of layer 12, and the point of observation are interrelated in the manner that said separate points are the images of the considered point of observation as formed by the lenses 14; and conversely the considered point of observation is the joint image of said separate points as formed by lenses 14. Another point of observation differently disposed in plan view Fig. 1 corresponds to other separate points of layer 12; and accordingly other points of layer 12 are exclusively visible from said other point of observation.

What has been said of points, referring to plan view Fig. 1, actually holds true of lines, which are perpendicular to the drawing plane of Fig. 1. Accordingly different lines of layer 12 are exclusively visible from different points of observation. Such different lines are indicated in Fig. 5 as dash and dot lines, as full lines, and as dotted lines respectively. Inasmuch as different sets of lines of layer 12 are visible from different points of observation, one picture may be recorded along the lines visible from one point, another picture may be recorded along the lines visible from another point of observation; a third picture may be recorded in the manner to be described hereafter along the lines visible from a third point of observation, and so on. In this connection it is to be borne in mind that for the sake of explanation the actual proportions have been exaggerated in the drawings, and that the cylindrical lenses are in reality spaced apart a distance small enough to provide a distinct picture. In the present instance, the pictures recorded along the different sets of lines differ from each other in the manner that they correspond to views of the same objects taken from different angles. So for instance the picture recorded along the lines indicated in full lines in Fig. 5 may be a direct front view of the objects, while the picture recorded along the lines indicated as dash and dot lines in Fig. 5 may be a picture of the same objects taken somewhat from one side at a slight angle as compared with the said direct front view. The picture recorded along the lines indicated as dotted lines in Fig. 5 may be a picture of the same objects taken somewhat from the other side at a slight angle to the direct front view. With this disposition stereoscopic vision may be effected, inasmuch as different pictures are presented to the two eyes of an observer, and inasmuch as the pictures observed with the two eyes may be made just so much different as the different views of the two eyes in natural vision.

Hitherto stereoscopic vision has been effected with single stereoscopic pairs of pictures. In contradistinction thereto I preferably provide a plurality of pictures in excess of single stereoscopic pairs. Accordingly more than two views of the same objects are recorded on layer 12. While an observer sees only one stereoscopic picture pair at one time, he may see another stereoscopic picture pair of the same objects by simply moving the head side wise. Pictures are then observed with the two eyes, as correspond to the different view points in natural vision.

The stereoscopic pictures recorded on layer 12 may be simultaneously taken with different photographic objectives, and then constitute a stereoscopic row of pictures corresponding to the same instant. Preferably however the stereoscopic row of pictures are successively taken, that is to say one picture after the other, while the same objective may be used to obtain all said pictures. The stereoscopic row of pictures then corresponds to a certain duration of time, and if the objects are moving, also to slightly different phases of motion.

Inasmuch as rapid motion of the objects affects the stereoscopic quality of stereoscopic picture pairs, of which the individual pictures are taken in succession, the motion of the objects is preferably confined to a moderate degree. In such a degree motion is found very desirable in stereoscopic rows of pictures in accordance with the present invention. When the observer moves relatively to plate 11 and layer 12, the objects appear not only in natural relief and from different angles, but also in different phases of motion. The objects appear to live and breathe and thus add a peculiar charm to the pictures.

One chief object of the device and the pictures illustrated in Fig. 1 to Fig. 4 is to provide novel and efficient means for advertising. In this use observers continuously move in front of plate 11, and accordingly see living pictured persons in full relief, frequently in miniature and often also in full colors.

The pictures corresponding to a simultaneously observed stereoscopic pair may be recorded either along immediately adjacent lines, (see Fig. 5) or along lines which are separated from each other through one or a plurality of other intermediate lines. When the range of observation is small, preferably this latter disposition is adopted.

The purpose and function of plate 15 will now be explained. Plate 15 serves to confine presentation of pictures inside of an area of observation, from which vision is correct and perfect. It serves to render a recorded point 25 (Fig. 1) visible only through cylindrical lens 14' through which it had been recorded, and prevents light of point 25 from passing through an adjacent lens, such as lens 14''. This purpose is effected by transmitting light through any point (25) in such a manner, that it falls only on the cylindrical lens (14') through which said point should be made visible and through which it had been recorded. The pitch of lenses 16, or their spacing, is approximately the same as the pitch of lenses 14, and corresponding lens centers of lenses 16 and 14 are situated on lines 26 which pass through a common point situated in front of plate 11. Lines 26 can be considered as rays of light reflected at mirror 18 and forming the real image of central point 27 of source of light 20. With this disposition, lenses 16 form images of the total length of incandescent wire 21 on layer 12. Said images are smaller or not larger than the pitch of lenses 16 and embrace all the points recorded through the corresponding lenses 14. Light falling on a lens 16 then passes through said image on layer 12 and then to the surface of the corresponding lens 14, to which said light is confined.

In the embodiment indicated in Fig. 3 and Fig. 4 stereoscopic pictures are presented in a slightly modified manner. Plate 15 of the previous embodiment is omitted. A plate 29 is disposed back of plate 11, and contains a corrugated surface 30. Surface 30 serves to diffuse the light of source 20, in a manner to render the pictures visible from a larger area of observation. Plate 29 contains corrugations extending along parallel horizontal lines, which serve to increase the area from which

the stereoscopic pictures may be observed in vertical direction. The shown profile of the regular corrugations is concave and circular. Any other form of diffusing surface 30 might however also be provided without affecting the general result.

Except in the points just mentioned, the embodiment shown in Fig. 3 and Fig. 4 is similar to the embodiment indicated in Fig. 1 and Fig. 2. Either embodiment preferably serves to present living stereoscopic pictures. In either case plate 11 contains layer 12 secured to it, and prior to presentation of the pictures plate 11 is moved from the side along suitable recesses 31 to the front and to the center of plate 15 or plate 29.

The production of the stereoscopic pictures will now be briefly explained. In the pictures the objects are usually shown in reduced size, and the production of reduced size stereoscopic picture rows will therefore be outlined. Reference is made to the diagrams Fig. 6 and Fig. 7, where Fig. 6 refers to an object and Fig. 7 to its stereoscopic reproduction in reduced size. The object is indicated as a cube 32, which in the pictures appears in relief as a smaller cube 32'. The plane of the pictures, or layer 12 is indicated as a full line 33 in Fig. 7. Its central point 34' corresponds to point 34 of Fig. 6. Points of observation 35', 36', 37', 38', Fig. 7, from which the pictures are viewed at different angles correspond to points 35, 36, 37, 38 from which the corresponding pictures should be taken. The latter points are offset from central line 39 by the same angles as the former points are offset from central line 39', but the distance of the individual points 35, 36, 37, 38 from each other is larger than the corresponding distance of the points 35', 36', 37', 38'. Disposition is made such, that the view observed from any point 35', 36', 37', 38' is a reduced size reproduction of the view observed from the corresponding points 35, 36, 37, 38. One way of accomplishing this aim is by taking pictures in rapid succession from the points 35, 36, 37, 38 and eventual further points. The pictures are then developed and a plurality of negative pictures is then obtained. The negative pictures are then successively projected to plate 11 and layer 12 by means of an objective successively placed at the points 35', 36', 37', 38' and corresponding further points, in the manner that the negative picture taken from one of said points (35) is projected from the corresponding point (35'). Projection is of course effected so that an upright and noninverted image results on the layer 12. Plate 11 and layer 12 are maintained in the position indicated at 33 in Fig. 7, with the corrugated side of plate 11 facing forward, that is to say towards the points 35', 36', 37', 38'. Care is taken during projection that no outside light passes to layer 12, and that the latter receives only the light of projection.

Layer 12 is then developed and then contains positive reproductions of the views obtained from points 35, 36, 37, 38 and eventual further points, recorded in the manner described with reference to Fig. 5, namely along separate parallel lines of which each one corresponds to a cylindrical lens 14.

The corrugated plates themselves may be produced with any suitable process resulting in high accuracy of the cylindrical lenses 14.

The diagrams Fig. 8 and Fig. 9 illustrate one way of obtaining colored pictures in accordance with my invention. Only the principal elements are indicated. Corrugated plate 11 of the character described forms again a unit with picture layer 12. Another corrugated plate 40 is disposed adjacent layer 12, with its corrugated side 41 facing backwards. Its convex cylindrical lenses 42 extend in horizontal direction, that is to say at right angles to lenses 14. In the embodiment now explained the concave mirror (18 in Fig. 1) is replaced by a convex spherical lens 43, which forms real images of the sources of light 44, 45, 46 when the parts disposed in front of lens 43 are supposed to be nonexistent. It is well known that for such purposes concave mirrors or convex lenses may be used interchangeably, and it is understood that either one of said two elements may be used in the various embodiments.

Cylindrical lenses 42 effect separation of the light coming from the individual lamps 44, 45, 46 in the manner that the light coming from the different lamps passes through different points of layer 12. This is diagrammatically indicated in Fig. 9, in which the end rays of light passing through a cylindrical lens 42 and coming from lamp 44 are shown in full lines and are seen to pass through point 47. The end rays of light coming from lamp 45 are indicated in dotted lines and are seen to pass through a point 48, in the view of Fig. 9. The end rays of light coming from lamp 46 are indicated in dash and dot lines and are seen to pass through a point 49 of layer 12. The three lamps 44, 45, 46 correspond to three different basic colors, and contain light filters 44', 45', 46' disposed in front, which pass only the rays having the color contained in the respective filter. The different colors are separately recorded on layer 12 in black and white or in a single color, along horizontal lines or zones. The three lines or zones which correspond to the considered individual lens 42 pass through the respective points 47, 48, 49 and are perpendicular to the drawing plane of Fig. 9. Diffusion of the color rays is obtained through lenses 42 and further through a diffusion plate 50 disposed adjacent plate 11. Plate 50 contains a diffusing surface 51 facing plate 11, and composed of cylindrical corrugations extending parallel to lenses 42 and perpendicular to the drawing plane of Fig. 9. Surface 51 therefore effects diffusion in one direction only, that is to say it effects diffusion and intermixture of the color rays in the view Fig. 9, whereas it has no effect upon the path of light in the plan view Fig. 8, as the cylindrical corrugations of surface 51 extend parallel to the drawing plane of Fig. 8. Diffusion in one direction, as described, is here desirable, inasmuch as general diffusion would disturb the stereoscopic vision provided by plate 11 and layer 12.

Living pictures appearing in full colors and in full relief may thus be obtained. The pictures are recorded on layer 12 in the general manner above described, with an additional plate disposed in front of plate 11, for effecting separation of the colors. The additional plate contains cylindrical lens surfaces like plate 40 and is disposed in the manner that its cylindrical lenses face the cylindrical lenses 14 of plate 11 and extend at right angles to them. Further description of the method of producing the recorded pictures is not necessary as the general principles are readily understood by those skilled in the art.

Fig. 10 and Fig. 11 diagrammatically illustrate an embodiment of the present invention, with which colored pictures may be presented without stereoscopic relief. This simpler embodiment is here specifically described also for the purpose

of individually pointing out the requirements of colored presentation, so that colored reproduction may also be applied to the embodiments, in which colors are not specifically referred to.

In the embodiment indicated in Fig. 10 and Fig. 11 plate 11 is omitted and layer 12 forms a unit with plate 40. A diffusing element 52 is disposed in front of plate 40 and layer 12, and serves to further intermix the colors. Spherical lens 53 is provided on side 54 with corrugations which extend in vertical direction, and which serve to diffuse the light of lamp 55 in horizontal direction, that is to say in the view Fig. 10, while not affecting the path of light in the view Fig. 11. A color filter 56 containing a plurality of elementary colors is securely held between glass plates 57. The individual color strips of filter 56 are seen to extend in horizontal direction, that is to say in the direction along which diffusion is effected through side 54 of lens 53. This diffusion is to the effect that light appears to come from broad color strips rather than directly from incandescent wire 21 and it renders the picture visible from an increased area in front of the picture. Corrugations 54 may be omitted, if so desired, and in this case element 52 is provided with a corrugated surface of a nature to effect diffusion in all directions, in horizontal direction as well as in vertical direction.

The pictures corresponding to the different colors are produced on layer 12 in known manner, by providing a color filter adjacent the photographic objective in taking the pictures, and by disposing plate 40 in a manner that its corrugated side 41 faces said objective. The layer 12 is then developed while remaining fixed to plate 40 and the resulting negative pictures are inverted to positive ones in known manner.

It is particularly noted that in presenting the pictures, as described, the corrugations of plate 40 face towards the source of light. In order to obtain natural pictures without inversion of right and left sides, the pictures are preferably photographed through a vertical mirror, or as seen in a vertical mirror.

An important feature will now first be introduced and explained through the embodiment indicated in Fig. 12 and Fig. 13, namely the feature of relative displacement between the picture surface and the relative path of light. The embodiment indicated in Fig. 12 and Fig. 13 illustrates a device which may be used for instance for advertising. It is suited to provide a plurality of sets of stereoscopic pictures, whereby the different sets of stereoscopic pictures may refer to different objects, or broadly whereby the different sets may or may not be related to each other.

Plate 11 contains corrugations 14 of the character described, and forms a unit with photographic layer 12. Plate 50 containing a diffusing surface 51 is disposed in front of plate 11 and performs the same function as described with reference to the Figures 8 and 9. A convex spherical lens 43 is held in any suitable known way in box 58 and collects the light coming from incandescent lamp 60, which contains a single incandescent wire 61 maintained in horizontal position. A corrugated plate 62 is disposed back of layer 12 and contains horizontal corrugations in the form of convex cylindrical lenses 63 which are focussed on layer 12. In other words cylindrical lenses 63 extend parallel to the incandescent wire 61 of lamp 60. Like many other dimensions, their pitch has been exaggerated in the drawing for the sake of explanation.

Cylindrical lenses 63 form real images of the incandescent wire 61 on layer 12, in a manner that each of said lenses forms one image. Light is therefore concentrated to a system of parallel straight lines of layer 12, namely to the lines which coincide with said images.

Through the illumination described, the picture recorded on layer 12 along said system of parallel straight lines is made visible to observers situated in front of box 58. Inasmuch as said straight lines occupy only a fraction of the total surface of layer 12, other pictures may be recorded along similar parallel lines, which are somewhat displaced with respect to the first said lines. Said other pictures are presented or made visible by displacing plate 62 relatively to layer 12 in a direction perpendicular to the cylindrical lenses 63 by such a distance that the lines of light coincide with the lines along which a picture is recorded. The lines of light are again the images of incandescent wire 61, as formed by the cylindrical lenses 63. A plurality of pictures are recorded on different systems of parallel straight zones or lines of layer 12 in the manner to be outlined hereafter, and are presented successively by vertically displacing plate 62 and with it the illuminated lines of light of layer 12. The principle employed in successively presenting different pictures is further illustrated in the diagram Fig. 14, which is an enlarged and partial view of layer 12 and plate 62, the view being taken in the lengthwise direction of the cylindrical lenses 63. In the position of plate 62 as shown in full lines, images 64, 65 and so on of line of light 61 are formed on layer 12. In the position of plate 62 as shown in dotted lines images 64', 65' and so on are formed on layer 12. The latter images and further images produced in other positions of plate 62 fully or partly occupy the space intermediate the former images, and accordingly a plurality of pictures are recorded along systems of parallel lines of which the lines of different pictures are adjacent to each other.

With the device illustrated a plurality, namely eight different stereoscopic views may be successively presented, by effecting eight different vertical positions of plate 62. Such positions may be obtained for instance by means of a cam 65, which is maintained in a fixed position by a ratchet wheel 66. The latter is periodically moved and then successively effects presentation of the different views by periodically displacing plate 62 within the range of one pitch of lenses 63.

Plate 11 together with layer 12 are introduced and brought into the shown position through slots disposed on the sides of the box 58, which are omitted in the drawings. Plate 11 is held in place by means of screws 67, which occupy the centers of said slots.

While in the foregoing the terms of vertical and horizontal have been often employed for concise definition of the matter, it is understood that such terms only illustrate a preferred arrangement and that they should not restrict the scope of the present invention.

Fig. 15 illustrates a composite plate 68 which forms a unit with a photographic layer 69, and which may be devised for obtaining increased accuracy. When a plate consists of a single piece, then its cylindrical lenses naturally contain the known errors of single lenses, which in

some cases may hamper the high accuracy aimed at. A certain amount of correction may then be provided by employing a composite plate 68 composed of two individual plates 68', 68'' made of different glass or broadly of different refractive substances. Although plate 68'' is a plate of constant thickness, it has here nevertheless the action of concave lenses or convex lenses, depending on whether its mean coefficient of refraction is larger or smaller than the coefficient of plate 68'. In drawing Fig. 15 it has been assumed that the mean coefficient of refraction of plate 68'' is larger than the coefficient of plate 68'. Plate 68' would focus parallel rays 70 at a point 71, if the plate would be continued up to that point. Plate 68'' effects a focus at point 72 instead, on account of its larger coefficient of refraction, and in this application therefore acts like a concave lens, that is to say it diverges the light.

Certain corrections can be obtained with combinations of convex and concave lenses made of different glass, as is well known, and similar corrections may be obtained in the present instances with a combination of two plates 68', 68''.

One important application of the present invention is to presenting moving pictures, and especially moving pictures for individuals rather than a large number of spectators.

A principle of presenting moving pictures in accordance with my invention will first be explained with reference to the diagrams Fig. 16 and Fig. 17. A corrugated plate 73 contains a system of parallel and convex cylindrical lenses 74 of a structure similar to the lenses 14 previously described. A picture layer 12 is permanently secured to plate 73. Light of an incandescent lamp 75 is transmitted to layer 12 through convex lenses 76. These lenses are so proportioned that they form an image of the incandescent wire of lamp 75 in front of plate 73, at a convenient distance of observation, when corrugated plate 73 is imagined to be nonexistent. The corrugations of plate 73 effect a suitable diffusion of said image in a direction perpendicular to said cylindrical corrugations, so as to render a picture visible from a zone. The latter is preferably made to extend in horizontal direction by a disposition which corresponds to a horizontal drawing plane of Fig. 16.

The cylindrical lenses 74 effect each a real image of the wire of lamp 75 on layer 12, in such manner that light is not uniformly distributed over layer 12, but is concentrated to a system of parallel straight lines, which appear as points in Fig. 16. One such point is denoted with the numeral 78, and 79 denotes rays of light which are concentrated to point 78 through a lens 74. According to the embodiment referred to in Fig. 16, light of lamp 75 is concentrated to other systems of parallel straight lines by displacing the unit consisting of plate 73 and its picture layer 12. One position of the displaced unit is indicated in dotted lines 73'. A central ray of light 80, which passes through the same cylindrical lens as considered in connection with rays 79, is indicated in dotted lines and corresponds to the central ray 79. The difference in the inclination of the two central rays is particularly noted. In the position of plate 73 first referred to, the central ray (79) which passes through the center of the circular profile of a lens 74 is perpendicular to the surface of layer 12. In the position 73' of plate 73, the central ray 80, which passes through the center of the circular profile of the same lens 74, is inclined to the surface of layer 12. Accordingly the two considered central rays, and the corresponding bundles of light pass through layer 12 in different points, that is to say in different lines which appear as points in the view Fig. 16.

What holds true in this manner for one lens 74 holds true for other lenses 74 too, with the result that light is concentrated to different systems of parallel straight lines in the different positions (73, 73') of plate 73 and layer 12. The lines simultaneously illuminated may be made very thin, especially when layer 12 is permanently secured to plate 73, and a large number of differing pictures may be recorded on the different systems of parallel straight lines.

The diagram Fig. 17 differs from the diagram Fig. 16 chiefly by substituting displacement of a lens 76 for the displacement of plate 73 indicated in Fig. 16. The effect is in principle the same. The displacement of a lens 76 changes the angle of incidence of the rays of light which pass to any one lens 74, and accordingly changes the location of the point or line of layer 12, to which the light is concentrated. In the position of lens 76 indicated in full lines, a central cylindrical lens 74 concentrates light to a point situated on central ray 81, whereas in the position of lens 76 indicated in dotted lines 76', the light passing to the same cylindrical lens 74 is concentrated to an offset point 82. Rays of light corresponding to the displaced position 76' of lens 76 are indicated in dotted lines.

By moving lens 76, different sets of parallel straight lines of layer 12 are successively illuminated, and the pictures recorded in the points of said sets are thereby successively rendered visible. A refractive diffusing element 83, having a corrugated surface 84, is disposed in front of layer 12. This element serves to equalize a picture composed of a set of lines and to broaden the lines into zones which nearly or fully flow into each other, when the picture is observed from in front of element 83. Aside from the artistic effect which may herewith be obtained, element 83 also serves to render a picture visible from an increased area of observation. The corrugations of element 83 may be made such that diffusion is effected in all directions. A diffusion element of the said character could of course also be provided in the embodiment referred to in Fig. 16 and in other embodiments.

Fig. 16, Fig. 17 and subsequent figures all contain the feature that a large number of different pictures are recorded inside of the same picture area, and that these pictures are successively presented through selective illumination, by providing relative displacement between the path of light and photographic layer 12.

Frequently the pictures recorded on layer 12, or a part of said pictures constitute moving pictures, and are successively taken snapshots of moving objects. Continuous motion of either plate 73 (Fig. 16), or of lens 76 (Fig. 17), or of another element then renders the pictures visible in succession so that they appear as moving pictures.

The method of presenting moving pictures may be combined with a described method of presenting stereoscopic pictures, or with a method of presenting colored pictures or colored stereoscopic pictures.

An important way of presenting colored moving pictures will be described with reference to Fig. 18, Fig. 19 and Fig. 20. The embodiment indicated in these figures also contains the feature

of successively presenting a largely increased number of pictures recorded on the same layer 12. The latter forms a unit with plate 73, whose one side is provided with convex cylindrical lenses 74. The said unit is inserted into a slide 85, which is shown in front view in Fig. 20, and which contains a diffusing element 83 of the character described. A refractive plate 86 is secured to a box 87, which also contains a spherical lens 76 suitably fastened to it and a small incandescent lamp 75 screwed to it in a manner permitting a cooling draft of air. Plate 86 contains convex cylindrical lenses 88 on the side facing plate 73. Lenses 88 contain the same focal distance and may be made of the same pitch as lenses 74. They are disposed along parallel straight lines extending perpendicular to the lenses 74, and jointly with the latter cylindrical lenses constitute equivalents of a large number of spherical lenses. It is well known that a pair of closely adjacent convex cylindrical lenses at right angles to each other amount to an equivalent of a spherical lens, and accordingly the two sets of cylindrical lenses 74 and 88 constitute as many spherical lenses as there are lens crossings. The combined lenses subdivide the layer 12 underneath into small squares 90 (see Fig. 21). Individual squares are indicated in a larger scale in Fig. 22. It is understood from the foregoing, that each of the small combined lenses, which are equivalent to spherical lenses, forms an image of the small incandescent wire of lamp 75. This wire is incandescent only on its short front part 91, while the holding portions are made thick enough to contain only small electric resistance, so that they remain dark. When slide 85 is moved by one pitch sidewise with respect to lenses 88, the image of incandescent wire 91 moves across its square 90 (Fig. 21 and Fig. 22). In the fractional view Fig. 22, the said image moves for instance from side 93 to side 94. When slide 85 is moved a plurality of pitches across lenses 88, the image of wire 91 moves as often over a considered square 90 as the number of pitches which make up the displacement of slide 85. This feature will be readily understood by those skilled in the art.

Accordingly we have here means by which localized illumination may be made to move periodically across the squares 90 while slide 85 is continuously moved in one direction. In order to change the path of the illuminating image of wire 91 so that said image successively crosses the squares 90 along parallel lines 95, slide 85 is moved in a direction, which contains a component extending at right angles to lenses 74. In other words slide 85 is not only moved crosswise to lenses 88 but at the same time also crosswise to the lenses 74. The path of slide 85 may be inclined at an angle of 45 degrees to the sides of the squares 90. This is indicated in Fig. 20, where 96 denotes the side along which slide 85 is displaced.

Displacement of slide 85 in a direction crosswise to lenses 74 has the effect previously explained of displacing the real image of wire 91 continuously in one direction, so that at the end of the total displacement said image has moved once across a square 90, for instance from side 97 to side 97′ or for a fraction of said distance.

Fig. 22 further illustrates a picture layer having not only a large number of pictures recorded inside of the same picture area, but also having different colors of said pictures separately recorded. A plurality of colors of a picture, such as three are recorded along three dashes 99, 99′, 99″, which can be considered as real images of one or of a plurality of incandescent wires 91. In pictures containing a single color, a point of each picture is recorded along a single dash or elementary spot, and the dashes of the various pictures are arranged along parallel lines 95. In colored pictures, that is to say in pictures containing a plurality of colors as seen by observers, a point of each picture or an element of each picture is recorded along a plurality of dashes, for instance along three dashes as indicated in Fig. 22. Said plurality of dashes form a unit. The units which correspond to the individual pictures are arranged along parallel straight lines 95, as indicated.

The disposition of the cylindrical lenses 74 and 88 parallel to the sides 100, 101 of the layer surface, as referred to in Fig. 21 and Fig. 22, requires a direction of feed of slide 85 inclined to said sides 100, 101.

Frequently it is more desirable to feed or to displace the slide (85) parallel to one of said sides 100, 101. Such refinement may be readily accomplished by disposing the cylindrical lenses 74, 88 at an angle to said sides 100, 101. Fig. 23 and Fig. 24 refer to such a case, where namely the cylindrical lenses are disposed at an angle of 45 degrees to the sides 100, 101 of the picture layer 12, and where therefore the latter is subdivided in small squares or rectangular elements 90′, whose sides are inclined at the same angle of 45 degrees to sides 100, 101. Fig. 24 also refers to presentation of colored pictures. The elementary colors of a picture are separately recorded in one color, namely in the present instance along three dashes 99, 99′, 99″ as explained above, and the units constituted by said three dashes of the individual pictures are arranged along lines 95.

The photographic layer 12 is preferably made very thin and of very fine grain, which is finer than used ordinarily in photography. A very large number of the above said units may then be recorded on a surface element 90 or 90′, which corresponds to one point of the presented pictures. Accordingly a very large number of pictures may be recorded inside of the same picture area, namely a number sufficient to provide a suitable long presentation of moving pictures.

Presentation of one color moving pictures or also of multicolor moving pictures is obtained by continuously moving the picture slide (85) along a straight guidance 103 provided on box 87. The continuous motion or feed of the picture slide may be effected either directly by hand, or with a screw turned by hand, or by a suitable known spring motor, or other motor which effects uniform feed in any known manner.

The following points should be particularly noted:

A plurality of pictures in excess of two, usually a large number of pictures, are successively presented on or adjacent the joint surface on which they are recorded. Presentation is obtained by selective illumination. The path of light relatively to the picture carrier is changed, so that different pictures are successively rendered visible. A preferred way of obtaining a change in the relative path of light is by displacing the picture surface (12). Corresponding points of successive pictures are recorded adjacent each other, and in the presentation of the pictures gradually melt into each other. The periodical change of pictures as practiced in the conventional moving picture projection is eliminated,

and a continuous successive presentation of adjacent points is substituted for it.

Presentation in a plurality of different colors will now be more particularly described. In accordance with the present invention rays of different colors, for instance rays partly indicated as lines 104, 105, 106 in Fig. 18 are projected at different angles to cylindrical lenses 74, so that said lenses concentrate the rays of different colors to different dashes of elements (99, 99', 99'') of the small squares formed by the two sets of cylindrical lenses. On these dashes or elements are recorded the intensity values of the individual colors. The record itself is preferably in a single color. The pictures are observed in full colors from in front of slide 85, the colors having been intermixed through the action of lenses 74, and further through diffusion element 83, at least when the latter is provided with a corrugated surface suited to provide diffusion in all directions.

In the instance particularly illustrated in Fig. 18 and Fig. 19, colored rays of different inclination are obtained from a single incandescent lamp 75 by means of a prism 108, or a plurality of prisms. A convex lens 109 is disposed immediately in front of lamp 75 and is selected of such focal distance that it changes the diverging rays coming from incandescent wire 91 into a bundle of substantially parallel rays. The substantially parallel rays are split through prism 108 in known manner into different bundles of colored rays, which include slight angles with each other, and in which the rays of the same color are again substantially parallel. A concave lens 110 reestablishes the original divergence of the rays, so that the bundles jointly cover the entire range of the pictures. Lens 110 and prism 108 are held in any suitable known manner by means of a piece 111 inserted in box 87. While I have shown single lenses 109, 110, 76 only, it is understood that composite and highly corrected lenses might also be used in their place. Further it is evident that in place of prism 108 color filters may be employed.

In general the colors are preferably recorded in one color on layer 12, and the illuminating rays of light are separated into different colors before they pass to layer 12, whichever may be the exact disposition for separating the colors.

One way of recording the colored pictures in one color on layer 12 is the following. The pictures are first taken with color filters in a manner that one picture is taken with each color filter, per complete colored picture. Preferably three color filters are provided, which may be in three basic colors, or which may comprise three different ranges of colors. The negative pictures are disposed on a film (144, Fig. 28) and are transmitted to layer 12 in the same general manner, as will be described with reference to Fig. 28. In addition to the means enumerated with respect to Fig. 28, rotary color filters and a prism (108) are used in successively projecting the film pictures to layer 12. The rotary color filters shut off all color rays except those which have the same color or colors as the picture which is being projected, and only let the corresponding color rays pass to layer 12. The prism (108) provides the angularity of the rays of light, which is reproduced in presenting the pictures. It is of course understood that lenses of the character of lenses 109, 110 may also be used, and that the recording operation is essentially the reversal of picture presentation, as will be further explained with respect to Fig. 28.

It has been already pointed out that the picture layer is permanently connected with a corrugated plate in the preferred embodiments of the present invention, and is disposed on the side opposite the cylindrical lenses of said plate. It is important for the accuracy of reproduction that relative displacement or shrinkage between the picture layer and said plate is prevented. This may be accomplished with known means by effecting the best possible adhesion between the layer and the plate. Moreover I preferably provide fine grooves in the plate on the side of the film. Such grooves 120 are indicated in cross section in Fig. 29, and are seen to be in alinement with the cylindrical lenses 121. They contain substantially the same pitch or a multiple of the pitch of said cylindrical lenses 121. In all preferred embodiments of my invention such grooves 120 are provided without being specifically shown. They are found to materially increase the adhesion of the film on plate 122 and prevent shrinkage or distortion of the film.

Fig. 29 further illustrates another detail feature of a corrugated plate 122. To increase the accuracy of the cylindrical lenses 121, their active aperture is made smaller than their width. Grooves 123 are provided at the places where adjacent lenses join each other; and these grooves are filled with opaque material 124. Light is thereby shut off from the sides of the cylindrical lenses. Grooves 123 may be made of straight profile, and may be produced by grinding with V-shaped masters. Broadly I preferably provide opaque zones (124) separating the cylindrical lenses 121.

A final preferred embodiment of my invention will now be described with reference to Fig. 25, Fig. 26 and Fig. 27. In these drawings I have refrained from indicating reproduction of pictures in a plurality of colors, inasmuch as exactly the same principle of colored reproduction may be applied here as already described with respect to Fig. 18 and Fig. 19. It is however understood that colored presentation as described may be well applied to the now considered embodiment, and that indication of colored reproduction is omitted for the sake of clearness and to avoid repetition.

Layer 12 is permanently connected with a refractive plate 125 which forms a unit with corrugated plates 126 and 127. The latter contain convex cylindrical lenses on the sides facing each other. Said lenses extend along parallel lines at right angles to each other and are focussed on layer 12. Plate 125 is made of a different kind of refractive material as compared with plates 126 and 127, as described with reference to Fig. 15. The plates 125, 126, 127 and also layer 12 are held together as a unit 130 by means of a suitable frame 128, which may be made of metal. Unit 130 is inserted into a slide 131, and a diffusing plate 132 may be disposed on top of unit 130. Fine adjustment in one direction may be obtained with screws 133, which displace the part 134 on which the mentioned plates rest. Slide 131 proper consists of a U-shaped portion containing a rectangular hole and of a lower portion 135, which contains a projection provided with threads 136. The latter extend along straight lines in a direction perpendicular to the plane of the drawing Fig. 25, and engage other threads 136' provided on a part 137 secured to box 138. Threads 136' form

guides for moving slide 131 in lateral direction on box 138. Convex lenses 140 serve to concentrate light of incandescent lamp 141 towards observers. Said lamp 141 is made of a construction as described with reference to Fig. 19, according to which only the front portion of its wire is incandescent and emits light.

One chief difference of this embodiment and the embodiment described with respect to Fig. 18 and Fig. 19 is unit 130, which contains both corrugated plates 126, 127 through which light is transmitted to layer 12, whereas in the previously described embodiment only one corrugated plate 73 forms a unit with layer 12. The other corrugated plate 86 through which light is transmitted to layer 12 is secured to the box (87). Except for this difference and the resulting different feed motion of the slides the two embodiments are very similar.

Displacement of slide 131 has the general effect described with respect to Fig. 16: Different pictures are successively made visible through displacement of slide 131 along threads 136'. Moving pictures may be obtained through slow and uniform displacement. It will be readily understood from the description of Fig. 21 and Fig. 22, which in principle also hold true for the embodiment now described, that the pictures presented or made visible during one motion of the slide along the threads 136' are those recorded in a row parallel to side 93 (Fig. 22). Other pictures may be presented by disengaging the threads 136 and 136', by displacing slide 131 upwardly or downwardly by one thread or pitch, and by reengaging the threads 136, 136'. Another row of recorded pictures is then presented. Instead of displacing slide 131 by direct hand pressure I may provide a screw arrangement, or a spring motor, or any other known mechanism suited to effect a very uniform motion.

Fig. 28 diagrammatically indicates a way of recording the pictures on layer 12. It is sufficient for the present purposes to outline here production of photographic records of single color pictures. A conventional negative film 144 contains the pictures to be recorded, and is intermittently fed in known manner past a suitable aperture. Its pictures are successively projected with light furnished by an incandescent lamp 145. The latter is identical with or similar to the incandescent lamp (141) used in presenting the pictures in accordance with the present invention. A unit 130 containing a photographic layer (12) is disposed adjacent lenses 140, which are made identical with the lenses 140 of the device for presenting pictures. An objective 146 projects a picture of film 144 to unit 130 and to its photographic layer (12). Lens 147 effects an image of the incandescent wire of lamp 145 preferably adjacent objective 146. Said image is made of the same size as the incandescent wire of the lamp 141 used in presenting the pictures and is made to appear at the same distance from lenses 140 and unit 130 as in the presentation of the pictures. Each picture is thus recorded with light equivalent to the light used in reproduction. While film 144 is intermittently moved, unit 130 may be either intermittently or continuously moved, continuous motion being ordinarily preferred.

During presentation of the pictures, the light of the lamp (141) passes to layer 12 through the corrugations of unit 130 and reaches only those and all those spots or points of layer 12, in which the corresponding picture is recorded. It is readily understood that the path of light of the presentation is a duplication of the path of light effected in recording the pictures on layer 12.

To obtain noninverted pictures in viewing the pictures from in front of unit 130, it is necessary to project the pictures of film 144 to unit 130 as inverted pictures, so that their right and left sides are interchanged, the right side of the actual objects and the objects at the right side appearing at the left side in the pictures, and the objects at the left side appearing at the right side in the pictures, when viewed from the side of objective 146. Such inversion may readily be obtained, as well known, for instance by turning film 144 over, so that the side of film 144 which in usual projection would face towards lamp 145 then faces towards objective 146.

As unit 130 is slowly fed, picture projection may be either continued without any change, namely if the projected pictures are substantially larger than unit 130, or preferably objective 146 is slightly displaced in correspondence with the feed of unit 130. The displacement is made such that the projected picture is made to follow unit 130, and that it continues to fill its area in a manner that the center of the pictures coincides substantially with the center of unit 130.

The term picture is herein used in its broadest meaning, and especially comprises also lettering and written or printed information.

The present invention makes possible to record whole books on a single area of the size of a sheet of the book, or on a very few of said areas, and to render the contents in large letters. The letters may be made much larger than is compatible with reasonable economy of space in books. Accordingly such records presented in the manner described are easy to read.

Illustrations of books may be recorded on the same area as the contents of a book, and as an attractive novelty the contents of books or broadly of a descriptive record may be illustrated with moving pictures. A story on which a moving picture is based may be illustrated with the moving picture itself or with prominent scenes thereof, and sold or rented like a book. In the embodiment described with reference to Fig. 25, Fig. 26, and Fig. 27 individual moving picture scenes are preferably made to last a duration corresponding to a complete transverse sweep of slide 131. Complete descriptions alternate with moving picture illustrations. In conventional moving pictures, titles and descriptive matter use up much space, as the corresponding film record is presented at the same rate as the pictures, so that about sixteen equal descriptive records are required per second. In the presentation of descriptive matter according to the present invention the record is maintained stationary. There is no danger of undue heat, as the light of the small lamp (141, Fig. 25) is spread over a large area, while in conventional moving pictures strong light is transmitted through a small area. On the other hand only a small source of light is required in accordance with the present invention, as it does not have to cover a large area of observation, but may be concentrated to an individual or to only a few persons.

For such reasons descriptive matter is only recorded once in accordance with the present invention and does not need to be repeated. Presentation of ample descriptive matter in addition to moving pictures is thus favored and a novel and distinct type of entertainment and information is thereby created through the present in-

vention. I have called it the individual moving picture.

Numerous changes and modifications may be made in my invention by simply applying the current knowledge of the art and without departing from its spirit.

For definition of the scope of my invention I rely on the appended claims.

What I claim is:

1. A unit for presenting pictures substantially on the surface on which they are recorded, comprising a refractive plate containing a plurality of parallel cylindrical lenses which extend continuously across said plate, a picture layer connected with said plate and disposed on the side opposite said lenses, another refractive plate containing parallel cylindrical lenses, said other plate being disposed adjacent cylindrical lenses of the first said plate and having its cylindrical lenses disposed at an angle to the cylindrical lenses of the first said plate, both sets of cylindrical lenses being focussed on said picture layer, and a frame for holding said plates together as a unit.

2. A unit for presenting pictures substantially on the surface on which they are recorded, comprising a refractive plate containing a plurality of parallel cylindrical lenses which extend continuously across said plate, another refractive plate containing parallel cylindrical lenses, the cylindrical lenses of said other plate being disposed adjacent and at right angles to the cylindrical lenses of the first said plate, a picture layer connected with a further plate of different refractive qualities than the aforesaid plates, both sets of cylindrical lenses being focussed on said picture layer, and a frame for holding said plates together as a unit.

3. In a device for presenting pictures adjacent the surface on which they are recorded, a picture carrier bearing a plurality of pictures recorded on different points of the same picture area, said recorded pictures having the size in which they are to be presented, a refractive element containing parallel cylindrical lens surfaces, means for mounting said picture carrier and said refractive element adjacent each other with said lens surfaces facing in a direction opposite to the viewing direction of the observers, a source of light for transmitting light through said picture carrier, and a concave mirror inclined to said picture carrier and disposed in the path of light between said light source and said picture carrier.

4. In a device for presenting pictures adjacent the surface on which they are recorded, a refractive plate containing parallel cylindrical lens surfaces on one side, a picture layer secured to said plate on the opposite side, said layer having recorded pictures appearing noninverted and upright when viewed through said lens surfaces, means for mounting said plate with said lens surfaces facing in a direction opposite to the viewing direction of the observers, a source of light for transmitting light through said layer and plate, and condensing means for forming a real image of said source of light in front of said cylindrical lenses, said condensing means being disposed in the path of light between said light source and said layer.

5. In a device for presenting pictures adjacent the surface on which they are recorded, a refractive element containing parallel cylindrical lens surfaces on one side, a picture layer secured to said element on the side opposite to said lens surfaces, said layer containing recorded pictures appearing noninverted and upright when viewed through said lens surfaces, a diffusing element having corrugations extending in one general direction, means for mounting said refractive element adjacent said diffusing element with its cylindrical lens surfaces facing towards the observers and extending at right angles to the general direction of said corrugations, a source of light, and a concave mirror inclined to said refractive element and disposed in the path of light between said light source and said layer.

6. In a device for presenting pictures substantially on the surface on which they are recorded, a refractive plate containing a plurality of parallel cylindrical lenses which extend continuously across said plate, a picture layer connected with said plate and disposed on the side opposite said lenses, another refractive plate containing parallel cylindrical lenses, said other plate being disposed adjacent to the cylindrical lenses of the first said plate and having its cylindrical lenses disposed at an angle to the cylindrical lenses of the first said plate, both sets of cylindrical lenses being focussed on said picture layer, a frame for holding said plates together as a unit, and a light source for transmitting light through said layer, said refractive plates being positioned between said light source and said layer.

7. In a device for presenting pictures substantially on the surface on which they are recorded, a picture carrier having pictures recorded at different points of a joint area, said recorded pictures having the size and upright position in which they are to be presented, means for separating the visibility of said pictures so that only one picture is visible at a time from a given point of observation, a light source for transmitting light through said picture carrier and through said separating means in a direction opposite to the viewing direction of the observers, and condensing means disposed in the path of light between said light source and said picture carrier, said condensing means having a smooth curved surface arranged to transmit substantially all the light passing from said light source through said picture carrier.

8. In a device for presenting pictures substantially on the surface on which they are recorded, a picture carrier having pictures recorded at different points of a joint area, said recorded pictures having the size and upright position in which they are to be presented, means for separating the visibility of said pictures so that only one picture is visible at a time from a given point of observation, a light source positioned to transmit light first through said picture carrier and then through said separating means in a direction opposite to the viewing direction of the observers, and condensing means disposed in the path of light between said light source and said picture carrier, said condensing means having a smooth curved surface arranged to transmit substantially all the light passing from said light source through said picture carrier.

9. In a device for presenting pictures substantially on the surface on which they are recorded, a picture carrier having pictures recorded at different points of a joint area, said recorded pictures having the size and upright position in which they are to be presented, means for separating the visibility of said pictures so that only one picture is visible at a time from a given point of observation, a light source positioned to transmit light first through said picture carrier and then through said separating means in a direc-

tion opposite to the viewing direction of the observers, and a concave mirror disposed in the path of light between said light source and said picture carrier.

10. In a device for presenting pictures substantially on the surface on which they are recorded, a picture carrier having pictures recorded at different points of a joint area, said recorded pictures having the size and upright position in which they are to be presented, means for separating the visibility of said pictures so that only one picture is visible at a time from a given point of observation, a light source positioned to transmit light first through said picture carrier and then through said separating means in a direction opposite to the viewing direction of the observers, and a lens disposed in the path of light between said light source and said picture carrier for condensing substantially all the light which passes from said light source through said picture carrier.

ERNEST WILDHABER.