Nov. 26, 1935. C. D. FAHRNEY 2,021,889

TELEVISION RECEIVER

Filed April 23, 1930 2 Sheets-Sheet 1

Fig. 1.

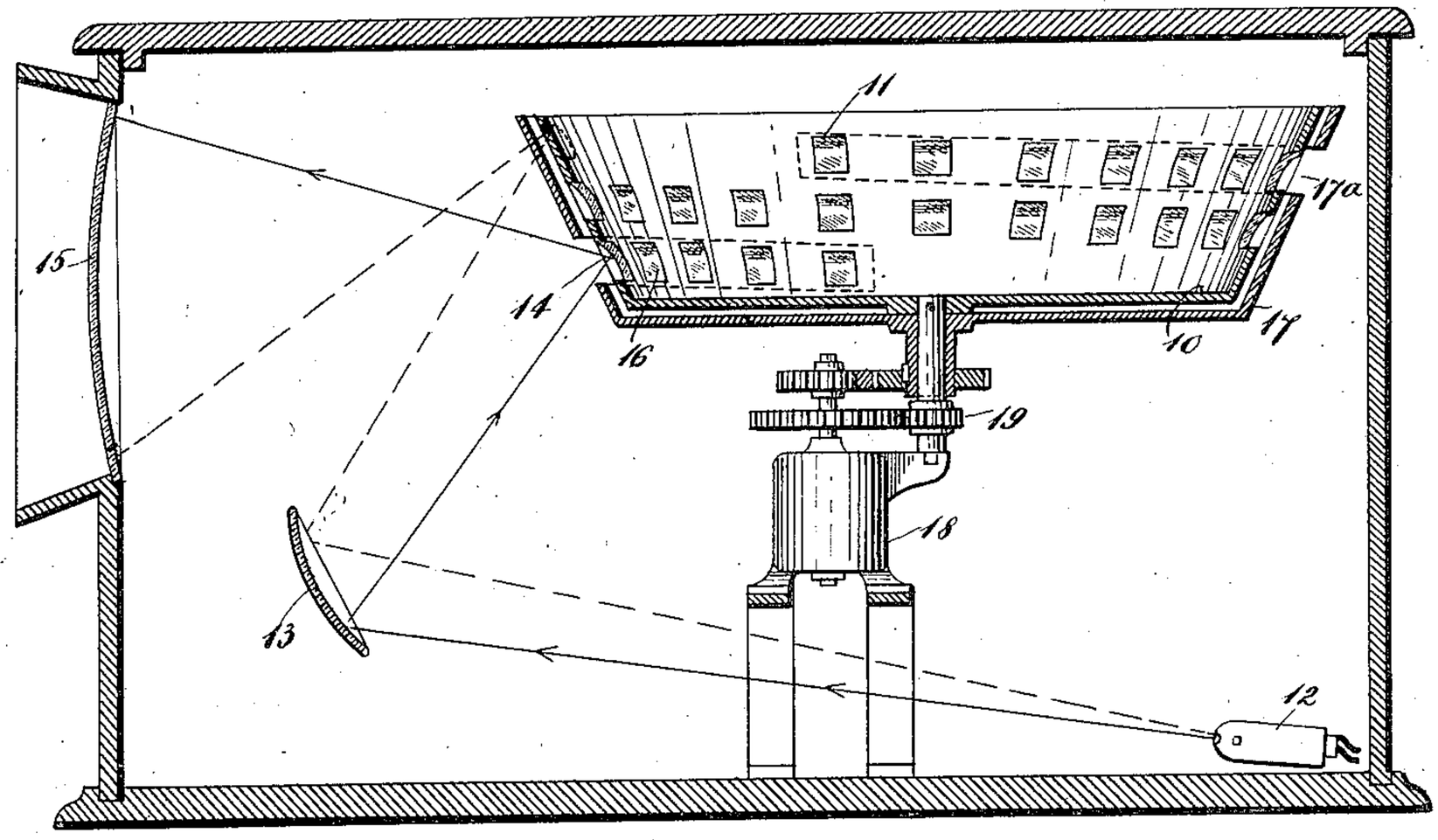


Fig. 2.

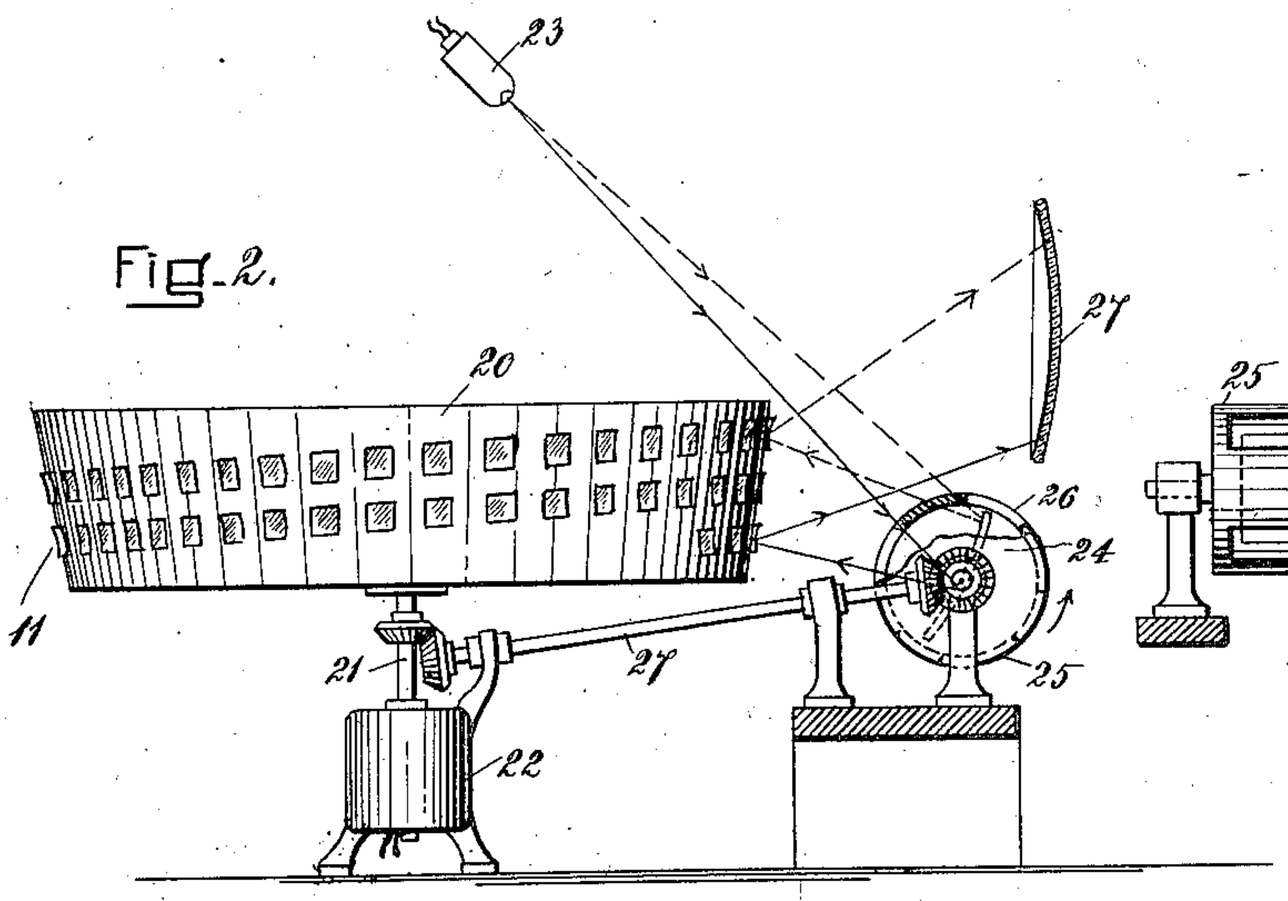
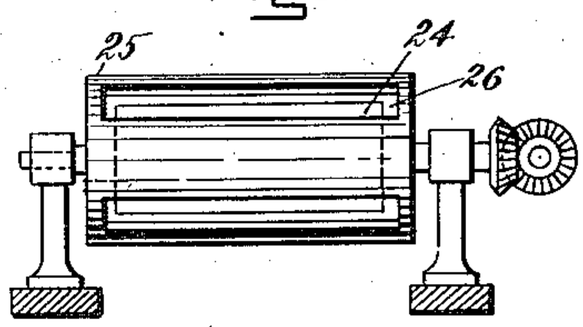


Fig. 3.



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Nov. 26, 1935. C. D. FAHRNEY 2,021,889

TELEVISION RECEIVER

Filed April 23, 1930 2 Sheets-Sheet 2

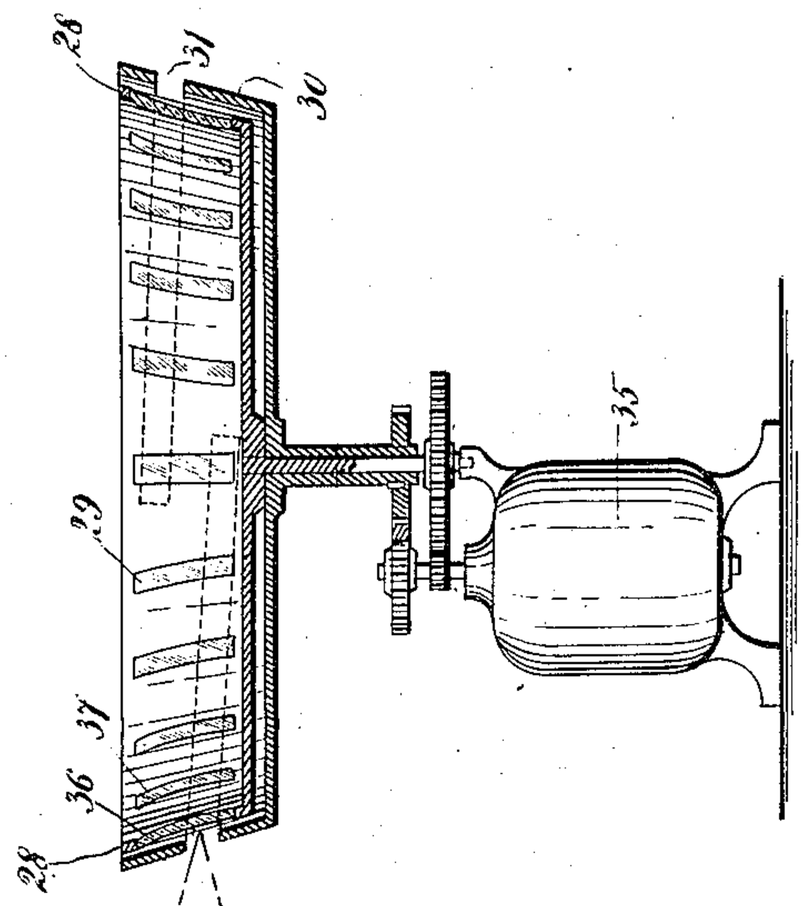


Fig. 4.

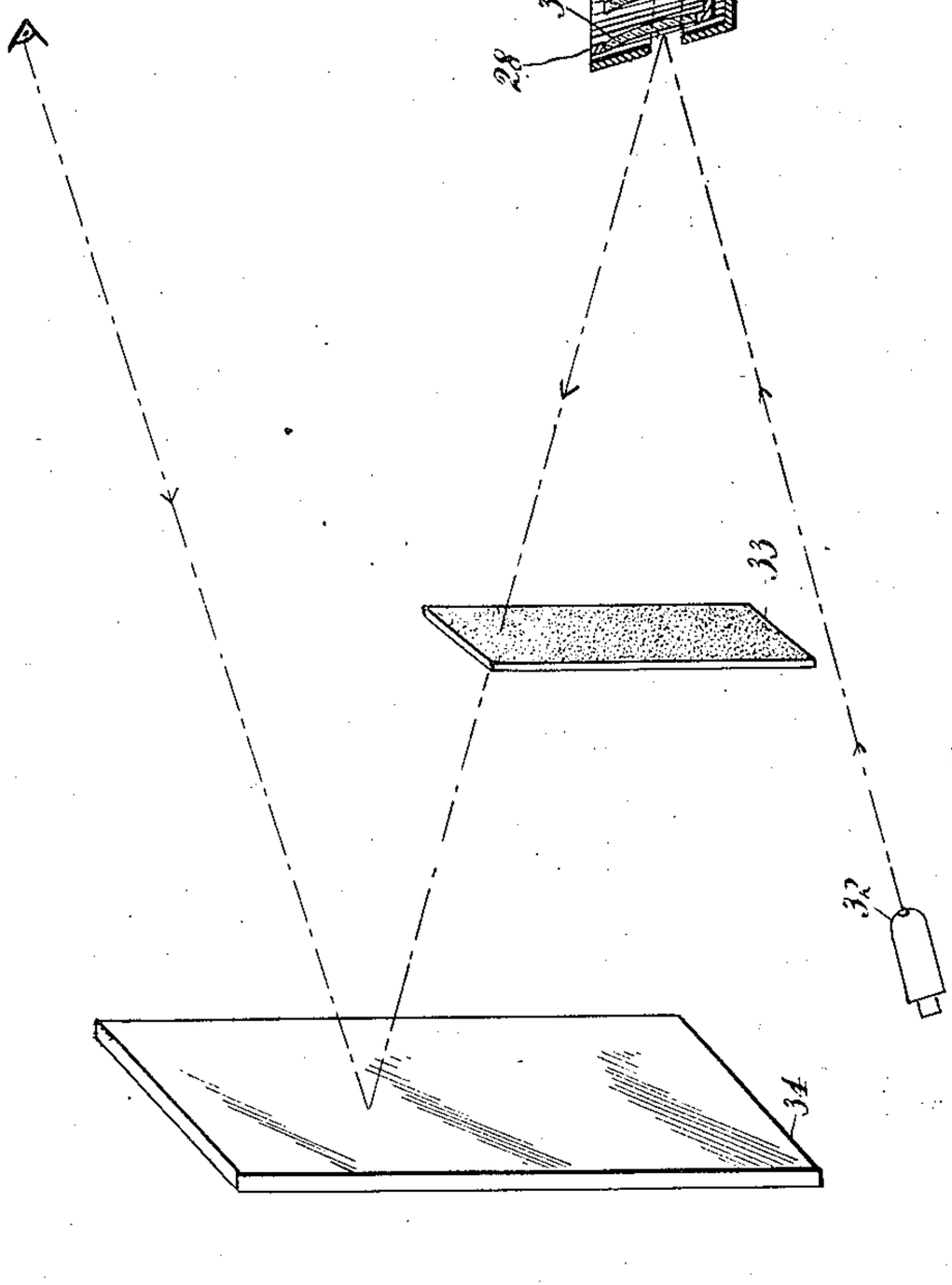
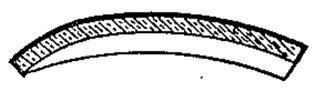


Fig. 5.



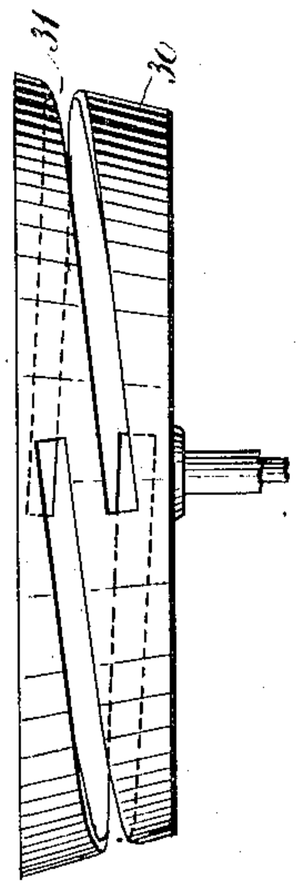


Fig. 6.

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TELEVISION RECEIVER

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Application April 23, 1930, Serial No. 446,726

17 Claims. (Cl. 178—6)

This invention relates to television receivers and introduces novel methods for assembling the picture at the receiving end and for presenting it to view in increased size and with relatively finer detail and greater clearness.

Heretofore in the reception of television it has been the practice for the most part to employ either one or the other of two rather sharply contrasted methods, one of which involves looking directly into the now well-known neon lamp through the apertures of a revolving scanning member and the other by throwing the picture onto a ground glass or screen of some kind.

The former method offers an advantage in that any light source viewed directly creates a much stronger impression on the eye than when seen through a ground glass or by reflection from a screen.

The basic size of a picture attainable by the former method, however, is limited by mechanical speed consideration in view of the necessity of traversing the entire radiant area by the apertures of a scanning device. Under present conditions it is very difficult to reproduce pictures satisfactory in quality and large enough to satisfy commercial demands as a result of radio broadcasting, one of the great problems met with being the construction and presentation of a satisfactory picture with the amount of light available from conversion of the carrier wave through the medium of lamps as heretofore constructed for that purpose, making it necessary to draw on other sources for light, or as an alternative, to at least conserve every scintilla of light available from such source and to employ it in more effective ways than is now customary for picture display purposes. However, point source lamps are now available for reception purposes which produce a radiant spot of light exceeding in brilliancy that from the plate of an ordinary lamp of the type now known and I show herein means for utilizing this spot of intense light for picture assembling and exhibition purposes by causing it to traverse a path within the limits of a picture reassembling area corresponding at every instant with the scanning being employed in transmitting the broadcasted scene, the variations in the traversing light spot impinging on a picture assembling surface producing a replica of the shades of the broadcasted scene and revealing the purpose to view.

Obviously this method conserves light inasmuch as all the light produced by the lamp employed is incident on the picture assembling and exhibiting surface continually in concentrated form, making it possible to introduce finer detail and to increase the dimensions of the picture accordingly.

It is not to be understood, however, that I confine myself to the employment of point source lamps of the nature described.

Having thus outlined the general nature and objects of my invention, I will now proceed to show and describe mechanical means for reducing it to practice, having reference to the accompanying drawings which, however, are merely illustrative and are not to be regarded as restrictive.

Referring to the drawings:

Fig. 1 is a longitudinal central section of a television receiving apparatus embodying salient features of my invention.

Fig. 2 is a side elevation partly in section of a device showing a different method of limiting the light supply to single cycles of the mirror reflectors employed in order to cause the said reflectors to function one at a time in the order adopted.

Fig. 3 is a front elevation of the light directing and limiting device shown in section in Fig. 2.

Fig. 4 is a side elevation partly in section of a device employing elongated strip concentrating reflectors preferably of parabolic type and means for utilizing different areas of their reflecting surface on successive appearance when revolved, and also novel means for screening and exhibiting the received picture.

Fig. 5 is a view of the shutter member employed in Fig. 4 in connection with the strip reflectors shown therein.

Fig. 6 is a view partly in section of a concave mirror reflector constructed in the form of a hyperbola and which for special adaptations may be dissected into strips or radial segments for providing graduated reflective strength and light positioning.

In the particular mechanical devices selected for illustrating the principles of my invention and set forth in the accompanying drawings, 10 in Fig. 1 represents a rotatable member, here shown in conical form, carrying on its peripheral surface outwardly facing concave mirror reflectors, one of which is indicated by 11, and which are here shown positioned thereon spirally forming two cycles, and also of graduated strength and positioning creating hyperbolic results similar to those obtained in employing individual parabolic reflectors. Such reflectors may be in the nature of ordinary glass concave mirrors or

constructed from metal suitable for the purpose and attached to the supporting member adjustably or rigidly, or may even be formed as an integral portion of a common rotatable surface.

In practice, the positioning of the concentrating reflectors as shown in Fig. 1, and also in Fig. 2, is designed for reassembling the view of a scene or object broadcasted by scanning it in parallel sections or strips through the employment of spirally arranged apertures in a revolving scanning surface or by traversing it by successive light spots; photo electric cells now well-known in the art, functioning in connection therewith in the transmitting process.

In the adaptation of the type of receiving device just described, I preferably employ a total number of concentrating reflectors equal to the scanning lines employed in transmitting the scene broadcasted.

In the operation of the apparatus illustrated in Fig. 1, **12** represents a fixed light source produced by a lamp of the point source type and varying in intensity in accordance with the variations in the carrier wave or current, as employed for transmitting purposes. The varying beam of light from the source **12** is reflected by the mirror indicated by **13**, which is preferably of mild concave form, and caused to impinge on a given area of the surface of the rotatable member indicated by **10**, the said member **10** being revolved at a predetermined speed by the synchronizing motor indicated by **18** through the gears indicated by **19**.

Distortion is one of the serious obstacles to reassembling on a picture exhibiting surface a view of a broadcasted scene through the employment of a fixed light source and revolving reflectors and I find that the best results are attainable in this respect by positioning the light source at a considerable distance, relatively, from the path of the concentrating reflectors and interposing between the two a reflector of mild concave type relatively near the said reflectors whereby the radiant beams of light from the source will be caused to impinge on each concentrating reflector in an optically straight line while traversing its functioning area for the reason that but a comparatively small fraction of the reflector surface is employed in reflecting the light beam and that this utilized fractional area shifts across the reflector surface in line with each concentrating reflector as it passes by in its regular course. In the adaptation of this feature of my invention I show its application in Fig. 1 by the employment of the reflector indicated by **13**, previously referred to, and in Fig. 2 by the elongated reflecting mirror indicated by **24**.

Such a reflector may also be employed in like manner in connection with the apparatus illustrated in Fig. 4.

With the type of rotatable member indicated by **10**, carrying plural cycles of concentrating reflectors it is obvious that the light from the source **12** as reflected by the mirror **13** would impinge on axially aligned reflectors of each cycle, causing them to function simultaneously, whereas it is necessary for them to function one at a time for reasons appearing herein. To overcome this objection, I provide in the construction shown in Fig. 1, an enveloping shutter member indicated by **17**, with a slot shown in its peripheral enveloping casing arranged in spiral form and indicated by *17a*. This shutter member is also rotatable and may also be revolved by the motor **18** through an appropriate gearing adaptation such as herein shown. In practice plural slots are preferably provided in this member **17**.

With the elements positioned in the apparatus as shown in Fig. 1, the light beam from the source would impinge on the particular concentrating reflector indicated by **14** and would be reflected thereby onto the diffusing screen indicated by **15**, here shown in slightly curved form and for this particular adaptation preferably in the nature of ground glass. The concentrating reflectors, one of which is indicated by **11**, are spaced at a distance from one another laterally with relation to their axis of revolution so that the light beams reflected by any two of them at the same time would be, at the location of the screen, a radial distance apart approximately equal to the width of the said screen or adopted picture limits so that as a result of rotating the said reflectors the reflected light spot from one reflector would have traversed a path across the said screen or picture area and disappeared by the time the reflected spot from the next reflector of the series appeared thereon.

It is obvious, therefore, that a source of light fluctuating in intensity in accordance with the variations of the carrier wave or current employed and so positioned or directed as to be reflected by each of the concentrating reflecting mirrors in sequence, when revolved in synchronization with the broadcast scanning, and impinged upon a picture exhibiting surface in the form of concentrated light spots and caused to trace parallel paths thereon in conformity with the scanning of the scene being broadcasted would through the variations in the traversing light spot reconstruct the view transmitted.

It is also obvious that the said concentrating reflectors, by reasons of form, spiral arrangement, staggering or positioning in other ways, may be caused to distribute, in like manner, reflected light from a source over a picture assembling surface limited in area only by considerations of luminosity for picture exhibiting purposes.

From the foregoing, it is obvious that an apparatus such as illustrated in Fig. 1, might be constructed with more than two cycles of concentrating reflectors and that the shutter member **17** might be provided with two or more slots about its casing to function in succession when rotated at the appropriate relative speed.

Again only a single cycle of this type of concentrating reflectors may be employed, dispensing with a shutter entirely, but in practice it is generally found preferable to employ at least two cycles of such reflector in combination with a shutter or light directing member of suitable adaptation. It is also obvious that the light source **12** of Fig. 1 may operate directly upon scanning member **10** in the same manner as the light source shown in Fig. 4. Referring now to Fig. 2, I show therein a device having a rotatable member of cylindrical type indicated by **20** carrying on its casing plural cycles of concentrating reflectors, one of which is indicated by **11**, they being of the same type and nature as those described in connection with Fig. 1.

The rotatable member **20** is shown mounted directly on the driving shaft of a motor of synchronous type indicated by **22**.

In the apparatus illustrated in Fig. 2, I show a means for controlling the light from the source lamp **23** and limiting it to the concentrating reflectors of one cycle at a time by the employment of an elongated reflector indicated by **24**, which is preferably of mild concave form and here

shown enclosed by a rotatable housing member indicated by **25** provided with elongated slots in its casing, one of which is indicated by **26**. This housing member is caused to revolve at a predetermined ratio of speed by means of a suitable gear system such as here shown, one of its elements being indicated by **27**.

In operation, the rays of light from the lamp source **23** reach the enclosed reflector **24** through one slot at a time and are reflected onto the concentrating reflectors one at a time as they pass by in order on successive revolutions, the light supply being caused to follow the spirals of concentrating reflectors. Like elements are indicated by like numerals in the view shown in Fig. 3.

In Fig. 4, I show an adaptation of my invention in which **28** represents a rotatable member carrying a cycle of strip concentrating reflectors preferably of parabolic construction and positioned radially with respect to their common axis of revolution, one of said reflectors being indicated by **29**. In this figure, I show an enveloping shutter member indicated by **30** provided with a spirally disposed slot in its casing indicated by **31**, means being shown for revolving both of the above described rotatable members by a synchronous motor, indicated by **35**, at different speeds through the employment of a suitable gearing adaptation such as here shown, or of other suitable type. **32**, in Fig. 4 represents a light source lamp of the point source type and as here positioned the rays of light from it would impinge directly upon a fractional portion of one of the said strip concentrating reflectors, indicated by **36**, through the slot as shown in the shutter member, and would be reflected in the form of a light spot onto the diffusing picture assembling screen indicated by **33**, which may be of ground glass or other semi-transparent material. By causing the rotatable member **28** to revolve the spot of light impinging on the member **33** would be caused to trace a path thereon horizontally and by the time the said spot of light reached the limits of said member the next strip reflector of the series indicated by **37** would have reached a position where it would function in like manner and reflect a spot of light onto the opposite side of the member **33**.

In the process of operation, while one of the strip reflectors is revealed by the cooperating slot mentioned and traverses a distance sufficient to cause the light spot reflected by it to trace a path across the member **33**, or other picture width provided for, the slot in the shutter member is caused to advance a sufficient distance so that the next strip reflector, through a relatively advanced portion of its surface, would cause the light spot reflected by it onto the member **33** to traverse a path across it adjoining that of its predecessor. By continuing the process it is obvious that the entire picture assembling area would be traversed in conformity with the scanning of the scene being broadcasted in the same way as described herein in connection with other embodiments of my invention.

In the adaptation of my invention illustrated in Fig. 4 it is readily apparent that not more than half as many concentrating reflectors of the strip type are required as compared with the adaptations employing a separate mirror corresponding with every line of scanning, and it is obvious that the process may be accomplished by employing relatively few of the said strip reflectors by a relative increase in speed of their revolution, with a corresponding adaptation of the slotted shutter member.

In practice, the strip reflectors described, may be constructed of glass or other suitable material or may be formed in contour and position as an integral part of a common rotatable surface in the same general manner as pointed out in connection with reflectors of the other type described.

Referring further to Fig. 4, the mirror indicated by **34** may, when suitably positioned relatively, be employed in connection with any or all of the embodiments of my invention shown and described herein, for providing more favorable picture presentation and observation, and likewise for viewing therethrough, when in suitable position, visual television images reconstructed by other methods than here shown, on a non-movable screen, surface, field or light diffusing area.

A further reason for employing such a mirror lies in the fact that under certain conditions it improves the quality of the picture.

In Fig. 5 I illustrate a shutter member provided with two slots, each extending half way around the enclosing surface, thereby requiring only half the speed necessary where only one slot is employed extending clear around. Such a shutter member may be provided with still more slots, if desired.

Having thus described my invention what I claim is:

1. In a television receiving device, means providing a picture assembling surface, a rotatable surface of revolution carrying concentrating reflectors positioned in spiral formation, means for revolving said surface, a fixed light source variable in intensity, shutter means for confining the light from said source so that it will be reflected by said reflectors when revolved in succession, one at a time, and caused to trace successively-positioned paths on said picture assembling surface and a concave reflector interposed between the light source and the functioning locality of the said concentrating reflectors.

2. In a television receiver, a rotatable member carrying strip concave reflectors preferably of parabolic construction positioned about its periphery radially, a light source variable in intensity and so positioned as to impinge light beams upon successive reflecting mirrors, shutter means for admitting the said light to a limited portion only of the reflecting surface of but one of said strip reflectors at a time, means for causing advanced portions of said strip reflectors to function on successive revolutions and a picture exhibiting surface positioned so as to be traversed by the light reflected from the said strip reflectors.

3. In a television receiver, a semi-transparent screen providing a picture exhibiting surface, a rotatable member carrying on its peripheral portion parallel strip concentrating reflectors, a light source variable in intensity and so positioned as to project its light onto successive concentrating reflectors, a shutter member provided with openings therein to reveal only a portion of each strip reflector as it passes a given point in order to cause the said light to be reflected and to traverse a path on said picture exhibiting surface, means for revolving said shutter member so that successively different portions of each reflecting strip mirror will function on successive appearances, when revolved, and a mirror positioned with respect to said screen so as to present the assembled picture to view in said mirror.

4. In a television receiver and picture displaying device, a rotatable member provided at its peripheral portion with spirally arranged concen-

trating reflectors, a light source variable in intensity and so positioned that light beams are reflected in a predetermined manner by the successive concentrating reflectors, when revolved, a stationary picture exhibiting surface of the nature of ground glass on which the reflected light is directed and on which a picture is developed by the sweeping of the light over the area of said surface, and a mirror positioned so as to reflect to view the picture as formed on the said picture exhibiting surface.

5. In a television receiving apparatus, in combination, means providing a stationary semi-transparent surface, a light source variable in intensity, means for reflecting the said varying light to cause it to sweep over an area of semi-transparent surface to construct a picture thereon and a mirror so positioned with respect to said stationary semi-transparent surface as to exhibit the picture produced thereon to view in the said mirror.

6. Television receiving apparatus comprising means providing a viewing surface, a source of light of variable intensity, a scanning device broadly illuminated by said source and including rotating means having a plurality of reflectors arranged to sweep light from said source over said surface in a predetermined manner, and a moving shutter enveloping said rotating means having means to shield said reflectors in a predetermined manner from said source of light so that the light will be reflected from but one reflector at a time onto said surface.

7. Television receiving apparatus as in claim 6 wherein the reflectors are concave mirrors that concentrate the light from said source to a small spot on said surface.

8. Television receiving apparatus as in claim 6 wherein the reflectors are arranged in multi-turn spiral order and wherein said enveloping shutter has means to expose to said light only successive mirrors in successive turns.

9. Television receiving apparatus comprising means providing a viewing surface, a source of light of variable intensity, a rotatable scanning device having a plurality of reflecting surfaces arranged about its periphery and extended over its surface, and a moving shutter enveloping said scanning device and interposed between it and said light source having means to expose only successive reflecting surfaces to said light source and only successive areas of said reflecting surfaces during successive rotations of said device, so as to trace successively displaced lines of light on said viewing surface.

10. Television receiving apparatus comprising a stationary diffusing field, means comprising a scanning device and a modulated light source for developing upon said field a spot of light of variable intensity and for moving said spot over said field for assembling an image on said field, and a mirror for viewing therethrough the image assembled on said field.

11. Television receiving apparatus comprising a stationary semi-transparent diffusing surface, means for developing upon said surface a spot of light of variable intensity and for moving said spot over said surface for reconstructing a picture upon said surface from one side thereof, and a mirror for viewing therethrough the picture from the other side of said surface.

12. Television receiving apparatus comprising a stationary diffusing field, means for sweeping a spot of light of variable intensity over said stationary field for constructing a picture on said field, and a mirror for viewing therethrough the picture constructed on said field.

13. Television receiving apparatus comprising a stationary diffusing screen, means for producing a modulated light spot on said screen and for sweeping said spot over said screen developing an intelligible image upon said screen, and a mirror that is materially larger in area than the area of the image positioned to view the image therethrough.

14. An apparatus for the assembling of pictures in television reception, comprising a number of mirrors corresponding to the number of picture lines, said mirrors being arranged at equal angular distances from one another along a rotary axis and being distributed over several helical turns, means for rotating said mirrors, and a rotary screen surrounding and having its axis parallel to the rotary axis of said mirrors adapted to be rotated at a slower speed than said mirrors to uncover only one of the mirrors lying in the same angular position.

15. An arrangement as claimed in claim 14, characterized in that said screen consists of a cylinder surrounding the mirrors.

16. An apparatus for the assembling of pictures in television reception, comprising a number of mirrors corresponding to the number of picture lines, said mirrors being arranged at equal angular distances from one another along a rotary axis and being distributed over several helical turns, a rotary screen comprising a cylinder surrounding said mirrors and adapted to be rotated at a slower speed than said mirrors to uncover only one of the mirrors lying in the same angular position, means for rotating the mirrors, and separate means for rotating the screen.

17. An arrangement as claimed in claim 14, characterized by the provision of means coupling the rotary screen to the rotating means of the mirrors.

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