

Jan. 5, 1943.

W. C. EDDY

2,307,202

PROJECTING KALEIDOSCOPE DEVICE

Filed Jan. 27, 1940

3 Sheets-Sheet 1

Fig. 1

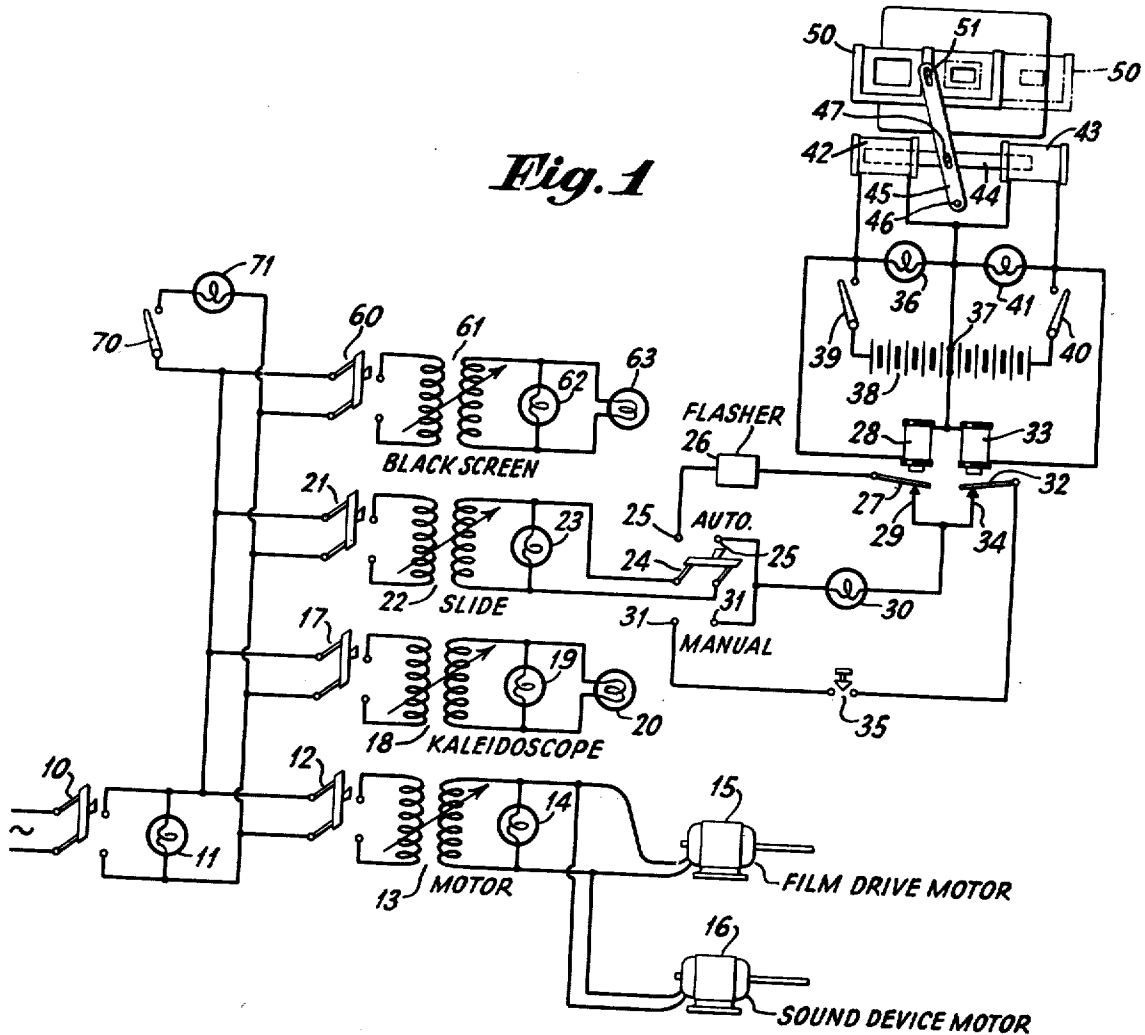
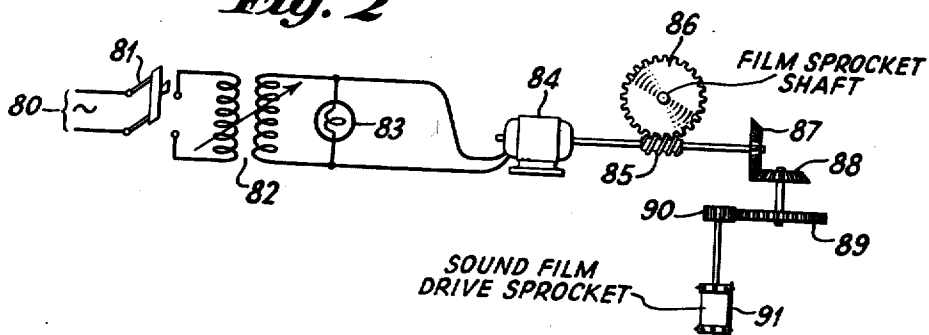


Fig. 2



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3 Sheets-Sheet 2

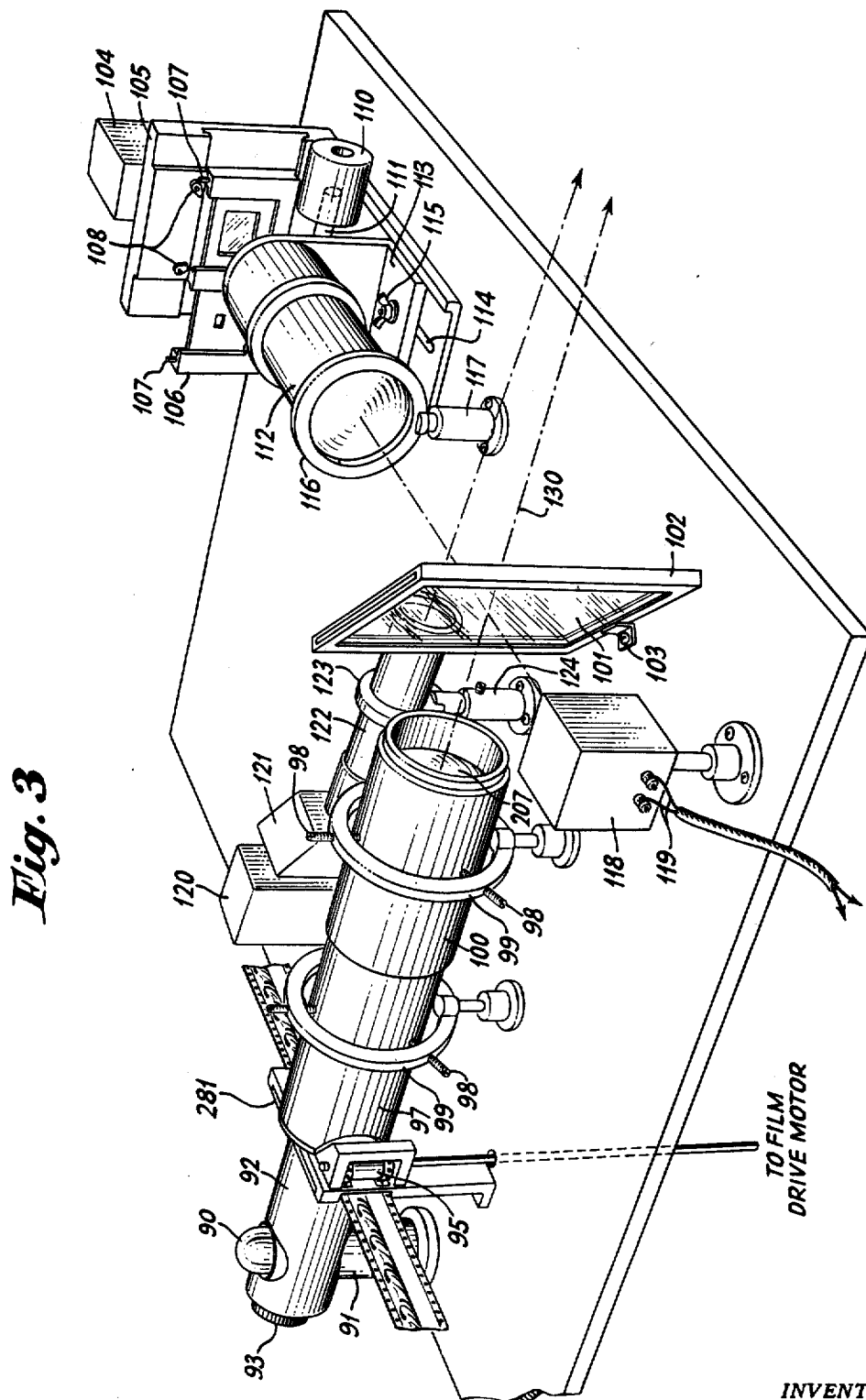


Fig. 3

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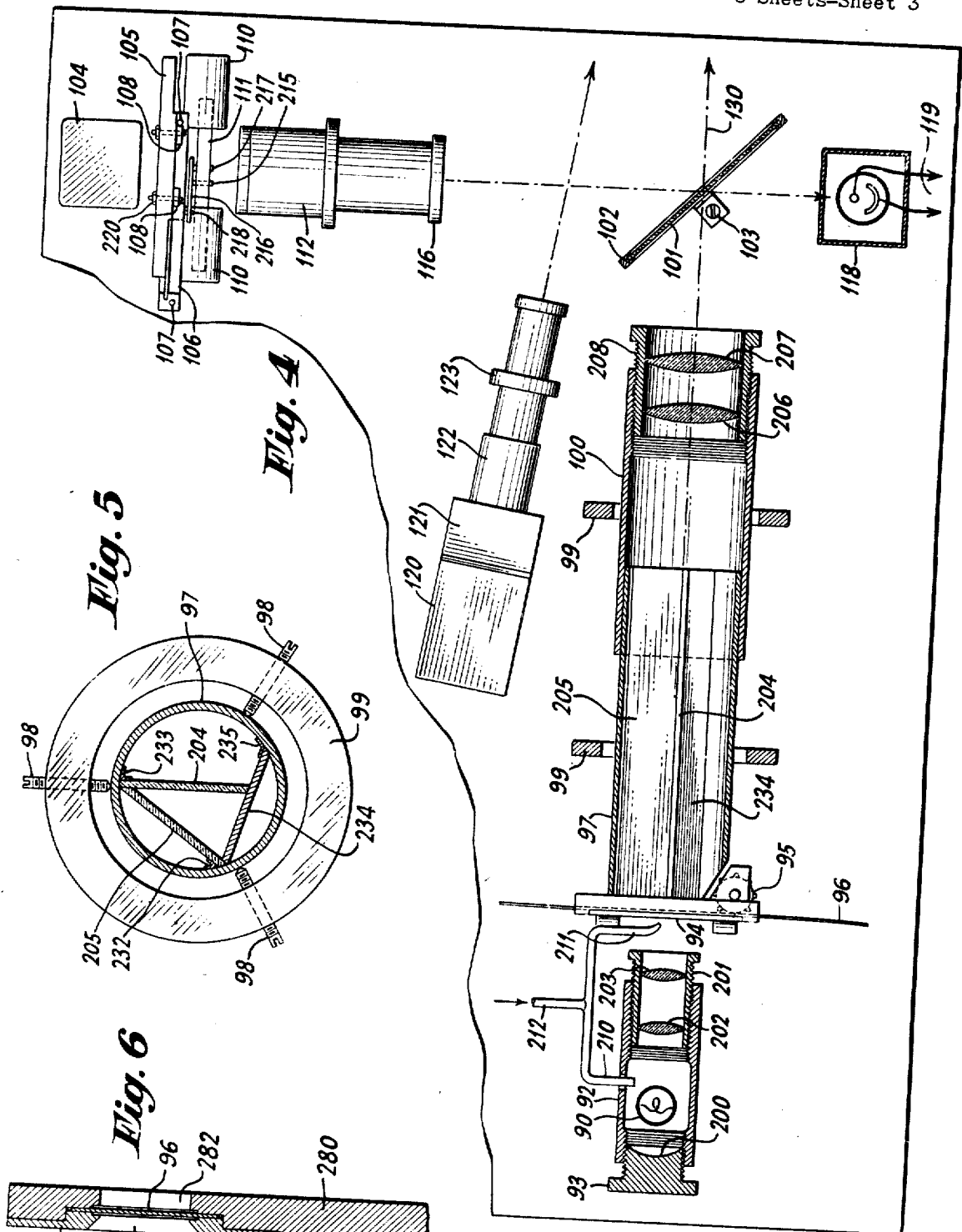
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3 Sheets-Sheet 3



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2,307,202

PROJECTING KALEIDOSCOPE DEVICE

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Application January 27, 1940, Serial No. 315,934

6 Claims. (Cl. 88—24)

My invention relates, in general, to apparatus for the display of abstract figures. These figures may be of the geometric or non-symmetrical type. More particularly, the invention relates to a kaleidoscope projection system associated with other apparatus for producing the combination of real and abstract figures.

At the present time, program material for television usually requires a definite time value to be properly understood. That is to say, every sequence exhibited, to be properly appreciated, must have a beginning and an end which delineates a definite time limit. The present invention provides television program material which does not necessarily have such a definite time element. This best can be accomplished by the use of abstract designs formed so as to be pleasing to the eye. The design may be of interesting monochromatic shades, and also may incorporate such movement of the pattern as may be required to maintain the interest of the viewer. It is a well known fact that the human eye is exceptionally appreciative of the perfection found in geometric figures. A kaleidoscopic pattern has been found to be particularly satisfying and applicable to this particular usage. Accordingly, it is one of the objects of my invention to provide program material which may be used in conjunction with television apparatus and which will be pleasing, interesting, and yet abstract in nature, and which may form a satisfactory program without the necessity of material which is sequentially related.

Projection kaleidoscopes have been known heretofore, but these devices of the prior art have been either impractical or inapplicable to the demands of television programs, as will hereinafter become apparent. Accordingly, it is another of the objects of my invention to provide a satisfactory projecting kaleidoscope which, when associated with other projecting apparatus, will provide material which is highly satisfactory for use as television program material.

Where it is necessary to exhibit static printed messages, such for instance as advertising material, instruction material, characteristic symbols and the like, it has been found that a dynamic background enhances the effectiveness of the aforementioned material and definitely contributes to maintaining the interest of the viewer. Accordingly, it is another of the objects of my invention to provide an apparatus which not only may exhibit a static printed or otherwise formed message, but will

supply also a dynamic background in the form of an abstract kaleidoscopic figure.

In order to make full use of the building of a kaleidoscopic pattern to hold the interest and attention of the viewer, the system to be described herein incorporates also a secondary lens system capable of projecting a characteristic symbol which may serve for instance as a medium for identification. Accordingly, it is another of the objects of my invention to provide a projection kaleidoscope which, with associated apparatus, will successfully demonstrate such characteristic symbols either as an advertising message or as an identification of the particular transmission then in operation.

In order to introduce and remove from the field of view the aforementioned characteristic symbol, it is preferable that eradication of the symbol from the field of view be done substantially instantaneously in so far as the viewer is concerned. If the symbol is not removed instantaneously in so far as the viewer is concerned, then it is preferable that the symbol gradually fade from the field of view. This symbolic material may be replaced by other characteristic material if so desired, and accordingly it is another of the objects of my invention to provide an apparatus for successfully carrying out the aforementioned functions, and in which the material such as the characteristically symbolic material may be changed automatically or successively introduced or removed from the field of view.

This device is contemplated for use with television apparatus but is not necessarily limited thereto, as will be appreciated by those skilled in the art. In television practice the optical view to be transmitted is effectively divided into a number of lines, and these lines are linearly and sequentially scanned so as to interpret the optical values thereon and to develop signals representative of these optical values. This is done by a tube known as an "Iconoscope" which includes among other elements a photoelectric mosaic comprising a great number of discrete photoelectric cells onto which the view to be transmitted is projected and a developed beam of electrons is moved linearly across this mosaic, the beam being necessarily deflected in order to contact the mosaic and in effect measure the charge on each element thereof. Reference should be had to the article entitled "Theory and Performance of the Iconoscope" by Zworykin, Morton & Flory, printed in the proceedings of the I. R. E. for

August 1937. The "Iconoscope" comprises then an electron type of scanning tube.

It has been found in electronic practice using the mosaic type of camera tube that any picture whose subject matter has heavy black areas at or near the bottom of the picture will generally have an aberration around the transmitted picture known as bottom and side flare. This particular phenomenon consists primarily of a white ghost-like indefinite border tangent to the dark areas in the lower section of the picture. In a way, this can be overcome by use of additional apparatus known specifically as rim lighting, but in this invention it is proposed to circumnavigate this particular objection by furnishing a white or light border about the picture which will be produced on the iconoscope plate, but by reason of limitation in the scanning sweep of the electron beam, will not be reproduced in the transmitted picture. Accordingly, it is another of the objects of my invention to provide an apparatus which will not be subjected to the aforementioned type of aberrating influence.

The rapidly changing patterns which it is possible to produce with such a kaleidoscopic device as will be hereinafter described necessarily at times have a rapidly changing light content, that is to say, that the change in total light flux emanating from the pattern during a short period of time may be considerable. It is both necessary and desirable that some automatic integrating device be incorporated in the system to maintain the balance in the electrical characteristics of the system during the rapid changes which take place under these conditions. Such may be done, for instance, by developing a variable signal which may be used to bias the amplifiers in the television system so as to determine and control the amplifying characteristics at any particular time. Accordingly, it is another of the objects of my invention to provide an arrangement wherein automatic balancing of the transmission apparatus may be accomplished during rapid changes in the light value of the pattern produced in the apparatus. Since the focal plane on which the material is formed may vary in position, and further since there may be other desirable changes to be made for the purpose of meeting varying conditions of operation, the lens systems hereinafter disclosed are separately adjustable. The combination of these adjustments allows variation of the size and intensity of various sections of the overall pattern. Accordingly, it is another of the objects of my invention to provide a kaleidoscopic projection system in which the lenses are separately and relatively adjustable.

The particular apparatus which in actual practice has been used utilizes a pattern recorded on standard 35 mm. film as objective material for the kaleidoscopic portion of the system. Since a great deal of light is lost in any projection system, it is necessary that a fairly intense lamp be used in the projector. It is apparent that such film material must film at a very slow speed past the light source and at considerably slower speed than is true in normal motion picture practice. Due to the intensity of the light source and the relatively slow speed of the film past the light source, some means must be provided for preventing destruction of the film by the intense heat. In actual practice I have provided an air jet which will prevent the film on which the objective material is recorded from absorbing the radiant heat of the light source. This system is preferred to a filter system which would reduce

the total available light. Accordingly, it is another of the objects of my invention to provide an apparatus in which destruction of the film on which the objective material is recorded, due to the heat from the projection lamp associated with the kaleidoscopic projector, is prevented.

The optical sensory system comprises a large proportion of the human senses. Although this is an established fact, it is also true that the addition of an oral equivalent tends to amplify the interest and to augment the optical sensory system. To this end my apparatus embodies not only the production of projected kaleidoscopic images, but also produces in conjunction therewith auditory material, the production of which is synchronized with the production of the kaleidoscopic images. Investigations with this apparatus have shown that the addition of this oral material fortifies the program value of an abstract pattern projector device. Accordingly, it is another of the objects of my invention to provide a device which will project abstract patterns, and further to provide supplementary oral material to be used in conjunction therewith, and further to synchronize the display of the abstract material and the oral material.

Due to the fact that kaleidoscopic pictures are truly geometric in form, and the standardized frame of a television image is in the form of a rectangle having an aspect ratio of 4 to 3, it is necessary to select from a purely geometric pattern which may be produced the portion which is desired to be transmitted within the standardized television image frame. In doing this, the difficulties encountered by other kaleidoscopic projection systems in balancing or compensating the brightness of the various sectors is circumnavigated by selecting an equally balanced fan shaped portion as the pattern for the projector. This section generally incorporates as the locus of the pattern the lower center of the television frame.

The projection kaleidoscope hereinafter to be described specifically in detail comprises in general a source of light which, through suitable condenser lens means, is caused to produce at an objective aperture a light of such intensity as will cause kaleidoscopic material passed by the objective aperture, between the aperture and the source of light, to be reflected and re-reflected through a triangular arrangement of mirrors at such intensities as will allow the image so formed to be projected through a lens system used in conjunction with the mirrors onto a plane of projection. Since the triangular arrangement of mirrors and the associated lens system have a definite line of projection, this will be referred to hereinafter as the axis of projection.

A secondary projection system is positioned as closely to the center line of the kaleidoscope mirrors as is practical, and projects onto the same plane of projection or screen as do the kaleidoscope mirrors. The image projected from this secondary lens system will naturally be from an oblique angle if the plane of projection or screen is perpendicular to the axis of projection of the kaleidoscope mirrors. Since this is true there will be formed on the screen or plane of projection an image which is "keystoned," or in other words, slightly distorted. To compensate for this phenomenon the material used in the secondary projection system and projected therefrom usually is recorded on a film or slide and is photographed from an angle which is complementary to the angle formed between the projector and

the screen or plane of projection, thus causing the exhibited image to be correct when viewed along the axis of projection of the kaleidoscope mirrors.

A third projector with associated apparatus is positioned so that its line of projection is substantially at right angles to the axis of projection of the kaleidoscope mirrors. This latter projector is particularly useful for the exhibition of static images such as characteristic symbols. All of these arrangements will, of course, be explained more in detail hereinafter in the specification.

It has been explained hereinbefore that the third projector has its line of projection substantially at right angles to the axis of projection of the kaleidoscope mirrors. These lines then must of necessity intersect. In the apparatus which will be hereinafter described there has been positioned a semi-transparent partially reflecting surface in the form of a half silvered mirror, with the approximate center thereof located at the point of intersection of the two axes hereinbefore referred to and positioned substantially at an angle of 45 degrees both with respect to the line of projection of the third projector and the axis of projection of the kaleidoscope mirrors.

There is positioned adjacent this half silvered mirror and on the side thereof remote from the third projector, an integrating device in the form of a photoelectric cell. It will be appreciated that a part of the light from the kaleidoscope image will pass through the half silvered mirror and thence onto the plane of projection while a portion will be reflected onto the photocell depending upon the reflecting and transparent characteristics of the half silvered mirror. Similarly, a portion of the light from the third projector will pass through the mirror while a portion will be reflected onto the exhibiting plane or screen. Similarly, the light from the secondary projector may be made to pass through the half silvered mirror and a portion reflected therefrom, or since the secondary projector is used for static messages in general, when so used the amount of light projected remains fixed and can be allowed for in setting the integrating device. This integrating device comprises a photoelectric cell and the cell may be used with associated apparatus for developing a potential representative of the total amount of light on the plane of projection. Since rapid changes may occur in the overall amount of light, and further since these changes may unbalance the television transmission system if they are very rapid and of large values, the potential developed by the photocell may be used in the form of a bias for determining the operating level of the equipment and thus compensating for rapid changes and inequalities in the total light of the images transmitted.

Since in actual practice the material forming the kaleidoscopic figures has been recorded on a standard 35 mm. moving picture film, and further since the change in the kaleidoscopic figures is comparatively slow compared to the normal rate of projection of a moving picture, and further since the projection lamp associated with the kaleidoscopic mirrors is comparatively intense in value due to the necessity of projecting an image having good light characteristics and also due to losses within the lens system, some means must be provided to prevent burning of the film by the intense heat from the projection lamp. Accordingly, I provide an air jet imme-

diately adjacent the film and closely adjacent the objective aperture for cooling the film and preventing burning.

My invention will be understood best by reference to the figures in which—

Fig. 1 is a schematic showing of the energizing circuits,

Fig. 2 shows an alternative mechanical synchronizing arrangement for sound and image transmission,

Fig. 3 is an isometric sketch of the projection apparatus,

Fig. 4 is a plan view of the projection apparatus partially cut away,

Fig. 5 is a cross-section of one of the elements of Fig. 4, and

Fig. 6 is a more detailed view of one of the parts of Fig. 4.

Referring to Fig. 1, there is shown the energizing circuit for the multiple projector systems. A source of alternating current, usually 110 volts, is brought into the equipment through a double pole-single throw switch 10. A pilot light 11 acts as an indicator of the power being applied to the entire system. The motors in the apparatus are separately energized.

A film drive motor device is energized through a double pole, double throw switch 12. This brings power to the primary of an autotransformer 13 across whose secondary is connected a pilot light 14, indicative of the degree of transformation accomplished through the variable autotransformer 13, and the motor or motors necessary to drive the film and complementary sound system. These motors in this figure are indicated as a film drive motor 15 and a sound device motor 16. The latter motor can be used, for instance, in the case where sound is recorded either on film or a separate record, and it is desired to have a sound accompaniment. This will be explained more fully hereinafter.

The power for the kaleidoscope projection system is furnished through another double pole-single throw switch 17 which brings power into the primary of the variable autotransformer 18. Across the secondary of this transformer is connected a pilot light 19 and projection lamp 20 of the kaleidoscopic projection system.

There will be explained hereinafter that the device includes not only a kaleidoscope projecting device but two independent projectors which are associated therewith and which will be described more fully hereinafter. For this reason the allusion is made to the black screen, the slide, and the kaleidoscope.

For energizing the slide device I provide a double pole-single throw switch 21 energizing the primary of a variable autotransformer 22. Across the secondary are positioned a pilot light 23 and a double pole-double throw switch 24. When this latter switch contacts the terminals identified as 25, a magnetic or thermal flasher 26 which is interposed in one leg of the circuit causes the A. C. power to be interrupted at pre-set intervals. This flasher is connected serially with one pole of the switch. Also connected serially with the flasher 26 is the armature 27 of a magnetic relay 28. This armature normally contacts with a contact point 29, completing the circuit back through the light source 30 of the projection system. With the double pole-double throw switch 24 thrown in the opposite position, power is brought to contacts designated as 31, and by reason of an equivalent armature 32, solenoid 33 and secondary contact 34, this self-same

light source 30 of this self-same projection system is caused to be energized provided the serially connected and manually operated switch 35 is in a closed position. It is evident that opening of this particular switch will break the circuit causing light source 30 to be extinguished.

A secondary or separately excited portion of this projection system consists of two slide actuating devices with their attendant pilot light system and solenoid control of the afore-mentioned light source 30. The winding 28 of the relay which is associated with the armature 27 is connected serially with a pilot light 36 and the center tap 37 of the battery, or other equivalent form of energizing means 38. The latter has associated therewith two switches 39 and 40. The switch member 39 is thus connected serially with the winding 28 and a portion of the battery or other energizing means 38. It will be noted that the pilot lamp 36 is shunted directly across this section of the battery and the switch 39. The same arrangement holds true with respect to the winding 33 and the switch member 40, and an additional pilot lamp 41. Shunted directly across the pilot lamp 36 and thus in parallel with the switch and battery section 39 and 38 respectively, and also in shunt with the winding 28 is the actuating winding 42 of a solenoid horizontal motor.

Similarly, an additional solenoid winding 43 is connected in shunt with the pilot lamp 41 and also connected in shunt with a section of the battery 38 and the switch 40, and also in shunt with the winding 33 of the relay winding associated with the armature 32. Positioned so as to operate in the field of the windings 42 and 43 is solenoid armature 44. Connected to the member 44, and in pivotal relationship thereto, is a fulcrum arm 45 which is pivoted at the point 46 and connected in driven mechanical relationship with the solenoid arm 44 at the point 47. By reason of this mechanical advantage, this arm will cause a slide member 50 to move horizontally in its guide when horizontal actuation of the solenoid armature 44 is accomplished. A pivotal point 51 is the locus of transmission of its horizontal movement to the slide member 50. It will be noted that the slide member has been shown in one position thereof and in dotted lines to show the other position thereof when the armature 44 moves in the opposite direction. This slide member in general comprises a guided member having two apertures into which may be placed fixed slides or other exhibiting material, and will be explained more fully hereinafter.

The preferred operation of this device is as follows: If by reason of the subject-matter selected, it is desired to have static material exhibited intermittently at predetermined intervals, the double pole-double throw switch 32 is thrown in contact to energize points 25, thus causing the flasher to automatically extinguish and light up the projection light 30 on its particular system. If it is required by reason of the material selected to exhibit only this material as needed, the switch 24 is thrown to contact points 31 and the manually operated switch 35 is then used to extinguish and light the projection lamp 39 as and when desired. If it is required to shift the exhibited material positioned in the slide holder 50, the switch 39 or 40 may be closed depending upon the motion desired and indicated by the red and green color pilot lights 36 and 41. Energizing of this switch causes the following sequence.

The windings of solenoid 28 and 42 and the filament of the pilot light 36 are energized. The energizing of the winding 42 causes the armature 44 to move to the left resulting in a movement of the slide 50 and its exhibiting material. In order not to have this exhibiting material wiped across the picture, at the instant of closing the switch the solenoid operated switch 27 is attracted, causing the illumination device 30 on this projection system to be extinguished. The action of the opposed movement being in all respects a concentric system is similar in all respect to the sequence hereinbefore described. It is to be understood that any or all of these devices may be normally operated either singly or in multiple with each other.

For television applications in which it is required or desired to project a light surface frame on the picture or any other applications where it is desired to mat out certain portions of the design, a projector is energized through double pole-single throw switch 60 and is designated as the black screen projection system. Power is brought to variable autotransformer 61 and thence to the secondary to the projection light source 63 and its pilot light source 62. The theory of the black screen projector will be more fully explained with reference to Fig. 3.

Also shunted across the power line is a further switch member 70 connected serially with a pilot light 71. The light 71 is used in a fashion which is similar to the dash light on an automobile for instance, the reason being that this equipment is usually operated in a darkened projection room, and since there are many adjustments to be made during the course of a projection sequence, a lamp of this nature or its equivalent is required on the operating board.

It will be noted that there has been described hereinbefore the power system for energizing the motors 15 and 16, and these motors have been referred to hereinbefore as the film drive motor and the sound device motor. It will be evident to those skilled in the art that it is desirable to complement this abstract video picture provided by kaleidoscopic projection and the associated projectors with a sound equivalent. To do this there are shown two motors 15 and 16. Motor 15 drives a serrated film sprocket wheel through a worm and gear arrangement at a speed satisfactory for normal display of kaleidoscopic images. Motor 16 running synchronously with motor 15 drives through a suitable worm and gear arrangement, a turntable on which can be placed a transcription, and the soundtrack of this transcription is suitably cued for starting with the film being driven synchronously by motor 15. By use of proper indicating marks on both transcription and film it is possible and entirely feasible to run these two devices synchronously throughout a full film sequence.

It will be appreciated that the tempo of the music may be gauged so as to augment the figures shown kaleidoscopically. For instance, if the pattern is changing slowly the music may have a slow tempo, and conversely, if the pattern is changing quickly the music may have a fast tempo. Similarly, if the design consists of heavy sections, the music may emphasize the bass notes. This type of musical synchronization with changing lighting and figures is known to musicians as exemplified by the so-called color organ. Slight variations from a normal speed of recording will not seriously affect the use of such an arrangement as hereinbefore described.

Referring to Fig. 2, there is shown an alternative arrangement whereby sound and abstract kaleidoscopic figures may be synchronized where the sound is recorded on a recording medium such as a film, and may be reproduced therefrom by well known methods such as the projection of a light beam therethrough working co-operatively with a photoelectric cell and associated amplifier circuits such as are known to the prior art. As the relative speed of the film on which the kaleidoscopic material is recorded is considerably less than the speed of a film on which sound representations are recorded, two distinct films have been used in actual practice. In this figure there is shown a power source 80, a double pole-single throw switch 81 feeding the primary of a variable autotransformer 82 across which, and connected in shunt therewith, is a pilot light 83 indicative of the degree of transformation accomplished through the aforementioned variable auto-transformer, and further included across this network in shunt thereto is the motor 84. Mechanically driven from the shaft of the motor 84 is the worm 85, and gear 86, the latter which may be directly connected to the slow moving film sprocket shaft on which the kaleidoscopic material is recorded. Also serially connected on the same shaft as the worm gear 85 is a series of spur gears 86, driving its complementary spur gear 88, the latter of which drives the gear member 89 which meshes with gear 90, the latter being connected to the sprocket 91 in which is driven the film on which the sound is recorded. For purposes of simplicity, the film and its associated light and photocell system are not shown, as such systems per se are well known.

Referring to Fig. 3, an isometric sketch of the general arrangement of the multiple projection systems is shown. The kaleidoscope or main optical system comprises in part a light source 90 mounted in an adjustable holder 91. Associated with the light source 90 is a chamber 92 containing the necessary condensing lenses and a reflecting member. The lens system and reflector will be shown more fully hereinafter with reference to Fig. 4. The adjustment screw for the reflecting member is disclosed in this figure as 93. Directly in front of the light projection apparatus is positioned the film gate 94 and the film actuating device 95. The kaleidoscopic figures or material are contained on a film member 96 illustrated herein. Directly in front of this film gate is the main kaleidoscopic optical barrel 97 supported tri-laterally by means of adjusting screws 98 contained within an adjustable mounting ring 99. Affixed to this barrel 97 and mounted concentrically with respect thereto is the focussing lens assembly 100 which section can be moved forward and back along the kaleidoscopic barrel 97 to obtain correct optical focus, and is itself supported by a similar tri-lateral arrangement of screws and adjustable ring similar to that supporting the main kaleidoscopic barrel 97. Mirrors, or reflecting members, for creating the kaleidoscopic image from a planar image will be illustrated more fully hereinafter in Fig. 4, and particularly in Fig. 5. Continuing along the self-same optical center line of the kaleidoscopic mirror assembly, there is positioned a semi-transparent mirror 101 or its optical equivalent mounted within a supporting frame member 102, which is in itself attached to the operating board by screw 103. The normal position of this semi-transparent reflecting device is 75

substantially 45° off the normal kaleidoscopic center line in a horizontal elevation.

Positioned 90° off the optical center line of the kaleidoscopic mirrors is the characteristic symbol or static design projecting system which comprises in part a light source with its attendant reflecting and condenser lens system contained within a housing 104. Directly continuing down the center line of this optical system which is 90° off the kaleidoscopic center line, there is positioned a slide guide 105. Suitably mounted on the slide guide is a device known as a slide holder 106 which contains the display material for this projection device. This will be explained in more detail in Fig. 4. It will be noted that there are shown two pin members 107, one at either extremity of the slide holder. The slide guide 105 has mounted thereon two cam-shaped members 108 which are adjustable. These members 108 act as stops to limit transverse movement of the slide holder 106, and it will be readily apparent that an adjustment of the members 108 allows a varying latitude of movement of the slide to satisfy any particular set of conditions. There is also indicated in the drawings part of the mechanizing apparatus for driving the slide holder, in particular a solenoid winding 110 with an associated armature 111.

Continuing on the center line of this projector 30 is positioned the focussing lens system 112 mounted in an angular adjustable support 113, and the adjustable support being obtained by a keyway 114 cut in the supporting base for this particular projector and adapted to be limited in movement by a bolt and wing nut arrangement 115 which passes through the slot upwardly through the angular support 113. By reason of the physical length of the required optical system, we have shown an additional adjustable ring support 116 and its associated pedestal 117.

Continuing on down its optical center line through the semi-transparent mirror, there is positioned an adjustable housing 118 containing therein, but now shown, a suitable condensing lens system and a photoelectric cell or its electrical equivalent. Electrical connections to this device or apparatus are indicated at 119.

A third projector is shown mounted slightly off one side of the original or kaleidoscopic center line. This projector known as a black screen projector consists in part of a light housing 120 containing an associated reflector, and lens system. Along this established center line is a housing 121 containing an exhibiting aperture, and directly in front of this is positioned an optical lens system contained within a suitable barrel 122. By reason of the physical length of this apparatus another adjustable ring gear 123 and its pedestal 124 are indicated.

The normal operation of the complete mechanism disclosed in this figure is as follows: Display material reproduced on film is caused to move in front of the light source 80 by reason of the film drive device 95. By reason of reflection and re-reflection within the barrel by the mirrors within the barrel 97, a complex geometric figure is produced. This image is collected and focussed on an objective screen at some point along the optical center line 130. This image traverses a transparent mirror positioned substantially at 45° with respect to the center line of the kaleidoscopic mirrors, and by reason of the reflective co-efficient of this particular optical device, a portion of this image is reflected into the

photoelectric control device contained in housing 118.

Positioned substantially 90° off the kaleidoscopic center line 130 is the static display material projector with its attendant mechanical shifting device. Objective material placed within one or two of the holders is successfully projected and focussed on the objective screen along optical line 130, being reflected 90° during this process by the semi-transparent mirror 101. It will be seen that a portion of this projection image traverses the transparent mirror 101 and is also collected upon the cathode of the photoelectric cell mounted in housing 118.

It will be apparent to those skilled in the art that this will cause a superimposition of the two projected images on the objective screen positioned normal to the optical line 130. It will be further seen that in superposition the optical images will register upon the cathode of the photoelectric cell mounted in housing 118.

It is desirable to superimpose two images of like or unlike characteristics on the final objective screen in order that we might successfully identify the transmission, particularly for use of television. The projection device with its optical center 90° off the optical center line 130 allows us to superimpose static material which may be illustrative, printed or otherwise indicative. It further allows us by utilization of the control device hereinbefore described for automatically or manually transferring the material contained within the slide holders of this projection device to satisfactorily shift this subject-matter by reason of extinguishing its light source or by further resort to the control device of blending or dissolving the particular material into a complete picture created on the objective screen positioned along optical center line 130. It will be apparent that in the particular application of television, we usually are forced to transmit a frame having an aspect ratio of 4 to 3. It will be further seen by those versed in the art that therefore it will be necessary to choose a portion of a polygon sided figure created by the kaleidoscopic device to be transmitted.

To allow this to be done in the most feasible manner, a third projector or black screen projector has been mounted adjacent the kaleidoscopic mirrors holder 97. By use of a negative having an aspect ratio of 4 to 3 and projecting this negative mat upon the next scanned portion along optical line 130, it is possible to obliterate a portion of the polygon sided kaleidoscopic figure so that only the required subject matter is successfully reproduced. Furthermore, by use of this particular type of projection of a black negative 4 by 3 area, we can allow the necessary white border to be projected on the "Iconoscope" plate for electrical adjustment purposes of the iconoscope camera, even though this particular border will not be a part of the transmitted television image.

The projecting of the aforementioned black area onto the objective screen is done by means of the projector positioned immediately adjacent the kaleidoscopic mirrors in Figures 3 and 4. This projector plays a very important part in the proper forming of the kaleidoscopic image on the objective screen. It has been mentioned hereinbefore that only a portion of the kaleidoscopic image is used for the purpose of having a balanced light content for all sections thereof. It also has been mentioned that the locus of the kaleidoscopic image is at the bottom of the frame.

Since the entire kaleidoscopic image is formed by the kaleidoscopic device, the only way of getting the effect mentioned hereinbefore, viz. that of providing the locus of the image at the bottom of the frame, is to effectively frame the produced image. This is not feasible and it is impractical to place a physical frame member adjacent the screen, since in the case of television usage the screen is inside an Iconoscope tube. Also, due to the focal lengths involved it is impractical to place such an arrangement between the kaleidoscope mirrors and the objective screen. Accordingly, this is done by projecting the black background with the white surrounding border so that the image is allowed to form on one section of the background and is effectively wiped out in the other section, hence an optical equivalent of masking is accomplished.

Since the projector which produces the so-called black screen arrangement is positioned at an angle with respect to the optical axis of the kaleidoscope, and further since the objective screen usually is at right angles to the objective axis of the kaleidoscope, the frame projected onto the screen would be slightly distorted or "keystoned." To prevent this the slide or film material on which the frame is produced and projected by this projector is photographed from an actual frame member at an angle which is compensatory to the angle that its own optical axis forms with the optical axis of the kaleidoscope.

It is evident that a continuously changing combination of light and dark areas as is normally produced by the kaleidoscopic projector and as generally produced by the static display material projector, would necessitate the making of frequent adjustments of the average brightness control of the pick-up of the television pick-up device. In order to facilitate such adjustments, there is positioned the photocell in the holder 118 adjacent the semi-transparent mirror and this photocell is equipped with such a lens that the relation of light and dark area will be integrated on the surface of the cathode directly as is caused to occur by change of either or both of the main projectors. Variation of the reflective and transmission coefficient of the semi-transparent mirror or similar optical equipment can be compensated by prior adjustment of the variable auto-transformers supplied for each light projection unit allowing the operator of this particular apparatus to balance the values of any or all of his projected images.

Referring to Fig. 4, there is shown a plan view partially cut away of the complete apparatus. In this figure similar parts to the parts of the same apparatus shown in Fig. 3 are identified by the same numeral. This view shows more clearly the internal arrangement of the kaleidoscopic projector. The lamp 90 has positioned immediately therebehind a reflecting member 200 such as a mirror, which is mounted in the threaded member 93 hereinbefore referred to. The chamber 92 being similarly threaded, the member 93 can be moved inwardly or outwardly, thus moving the mirror closer or further away from the lamp 90. Positioned at the end of the chamber 92 remote from the member 93 is a threaded holder 201 into which are mounted two projection lenses 202 and 203. The member 201 also is threaded on the periphery thereof and the chamber 92 is threaded to accommodate this element. Hence, the position of the projection

lenses may be varied with respect to the lamp 90 and the kaleidoscopic mirrors.

Light from the lamp 90 passes through the lens members 202 and 203, and thence through the film member 96 on which the kaleidoscopic material is recorded. This film is moved slowly across the aperture positioned between the holder 201 and the chamber 97 and by multiple reflection from the kaleidoscopic mirrors 204 and 205 the image formed passes through lens members 206 and 207 along the axis 130. The aperture has consisted of a plate covering the end of the barrel in which is mounted the kaleidoscopic mirrors and having a small triangular opening in the plate. The lens members 206 and 207 are mounted in a holder 208, the periphery of which is screw-threaded, and the chamber 100 is similarly screw threaded to accommodate the holder. Thus, it will be seen that it is possible to adjust these lenses in three ways. First by moving the chamber 100; secondly, by rotating the member 208; and thirdly, by a combination of the two methods outlined above. Interception of the plane mirrors with the optical image to be projected and kaleidoscopically formed takes place at the optical center of the associated lens systems.

Since the traversal of the film on which the kaleidoscopic image is recorded is rather slow, and the heat developed by the lamp member 90 is fairly intense, means should be provided for avoiding injury to the film. For this purpose, in actual practice there have been provided two tube members 210 and 211 which join together and are supplied by a single member 212. Air is forced through the member 212 and, accordingly, a jet of air will emerge from the end of each of the tubes 210 and 211. The tube 210 is positioned with its end adjacent the projection lamp 90 and the tube 211 has the tip thereof positioned near the film 96 and near the point thereof where the beam of light from the lamp 90 strikes the film and is projected therethrough.

Also, in this figure there is brought out somewhat more clearly the action of the solenoid motor which actuates the slide holder 106 in the static projector, use of which is made to project fixed material comprising static images such as characteristic symbols and the like. This motor comprises the windings 110 having a solenoid armature 111 positioned so as to have both of its extremities actuated by the windings. Joined to the armature 111 is a pin 215, the other extremity of which is co-operatively associated with a lever arm 216, this arm being pivotally fastened by the member 217 and pivotally connected to the slide member 106 by the pin member 218. Hence, it will be seen that when the armature is actuated, the lever arm tends to turn about the pin 217, thus forcing the slide member along in the guideway associated therewith. Movement of the slide holder is limited by the impingement of the pin member 107 with one of the cam shaped stop members 108, the latter being adjustable in position by means of bolt and nut arrangement 220.

In the drawings there has been shown a fixed projector which is located immediately adjacent the kaleidoscopic mirrors and identified in the drawings, and particularly in Figure 4, as having the elements 120, 121, 122 and 123. Also there is shown a projector having its optical center line positioned substantially at right angles with respect to the optical axis of the kaleidoscopic projecting device and this projector is shown as hav-

ing a device for accommodating slides, the slide members being actuated by a solenoid type of motor. It should be appreciated that these are preferred embodiments in the actual device as it has been used, but that this showing should in no wise comprise a limitation since two fixed projectors could be used, or two projectors having devices for accommodating slides, the projector shown merely being exemplary of the actual arrangement used. The fixed projector hereinbefore in this specification has been referred to as the black screen projector and the other projector has been identified as the slide projector.

Referring to Fig. 5, there is shown a cross-section of the kaleidoscopic projector taken through the barrel member 97. Parts of this figure corresponding to the same parts in Figs. 3 and 4 have been identified by the same numeral. In this case, only the ring member 99 with the associated adjustable screw members 98 has been shown, and the particular part of the support which is fastened to the base has been omitted for purposes of simplicity. It will be seen that the barrel 97 is supported by the three screw threaded members 98, the latter being positioned 120° apart. In the particular apparatus shown, two kaleidoscopic mirrors are used although it will be appreciated by those skilled in the art that the arrangement is not so limited. The two mirror members are identified as 204 and 205 respectively, and the mirror 205 is supported by being held against the mirror 204 at one extremity thereof and being joined to a support member 232 at the other extremity thereof. The mirror 204 is supported at one extremity thereof by the support member 233 and abuts the member 234 at the other extremity thereof. The member 234 in this particular illustration and in actual practice has comprised a dark light-absorbing non-reflecting member. This member in turn abuts the member 205 at one extremity thereof and is held by support member 235 to the barrel 97 at the other extremity thereof.

While the arrangement for producing the kaleidoscopic image has been shown as a plurality of mirrors angularly positioned each with respect to the other so that the optical image intercepted will be reflected and re-reflected, it should be appreciated that this is not the only manner of accomplishing this result. A prism having the outer faces thereof silvered could be substituted for the mirrors and interception of the image would take place at an end thereof positioned adjacent the aperture through which the image from the kaleidoscopic film is projected. Such an arrangement would have the advantage that formation such as dust would have no effect, since the image would be reflected and re-reflected entirely within the prism. Such an arrangement also could be mounted easily and there would be no overlapping of edges as in the case of the kaleidoscopic mirrors since it is practically impossible to fit the mirrors together perfectly.

Referring to Fig. 6, there is shown a cross-section of the means for guiding the film onto which the kaleidoscopic material is recorded past the mirrors and the light projected from lamp 90. This particular guide in general is made in two sections comprising the sections 280 and 281. The section 280 has an aperture 282 cut therein through which the light projected from the lamp may pass to the kaleidoscopic mirrors, and the member 281 has a similar aperture 283 for the same purpose. The member 281 has a slot cut in

the face thereof which fits against the member 280, etc. The film is shown in cross-section as the member 96. Adjacent the light apertures 282 and 283, the face of both of the members 280 and 281 which face each other are cut in a fashion which allows and insures the easy passage of the film therethrough. In actual practice, the member 281 is held in place by two spring members, one of which is shown here as the member 285. This spring is fastened by the screw member 286 in a manner whereby it may be rotated about the nut at least for a portion of a cycle of rotation. This holds the member adequately and yet resiliently in place.

The slot through which the film passes in its movement past the objective aperture is so formed that the plate member 281 contacts the plate member 280 in a manner best illustrated in Fig. 6, wherein there is shown that the film does not necessarily contact the metallic sides of the slot but can touch only at a portion of the film adjacent the edges thereof and on which there is no recorded material for kaleidoscopic projection. This allows film to be used for several successive traversals of the aperture without mechanic scratches being imposed upon the sensitive emulsion deposited upon the film. Lightening of the clearance of the slot formed between plate 281 and 280 allows the film to move freely through the film guide without the intermittent motion which any restriction on this free movement would impose.

There has been referred to hereinbefore a lens positioned between the photoelectric member mounted in the holder 118 and the partially transparent reflecting member 101. This lens plays a very important part as it is so selected that its characteristics are such that it may in effect search the illuminated surface of the partially transparent reflecting member, and its focal length is so chosen that it focuses the light so obtained from the partially transparent reflecting member onto the cathode of the photoelectric tube, and produces a true electrical integration of the light variations impinged on or transmitted through this mirror. This, of course, prevents interference from light sources and illuminations which are not directly impinging on the half silvered reflecting mirror and may be termed spurious or non-essential illuminants to the controlling device.

It will be appreciated, of course, that the partially reflecting transparent member 101 which has been referred to hereinbefore as being a half silvered mirror need not necessarily be such a mirror, but can be replaced by any other optical equivalent which will allow a percentage transmission and reflection of an optical image thereon and therethrough.

It should be borne in mind also that the synchronization of the audible material with the kaleidoscopic pattern need not be exactly as hereinbefore described. For instance, it can be any variation or combination of audible sounds which might be considered complementary to the visual material portrayed. For instance, the exact sequence of musical tempo with relationship to the kaleidoscopic pattern which has hereinbefore been set out in this specification may be varied from widely in a manner which will be considered appropriate by persons skilled in the art to which this belongs. In fact it has been found that this kaleidoscopic material lends itself satisfactorily to combination or augmentation of the spoken

word or the spoken word and a musical background.

Hereinbefore there also has been reference made to the projection of the so-called static image, and it should be appreciated that this static image may comprise any desirable fixed image in addition or as a substitute for characteristic symbols which have been referred to hereinbefore.

In fact, for a sequential exhibition of fixed material it is sometimes necessary to employ this projector as one of the sources of this material allowing the operator a transfer function between this projector and a similar projector which may be substituted for the background projector which is positioned immediately adjacent the kaleidoscopic mirrors. This in fact gives the operator a wide latitude of operations in the way of dissolves, wipes, and the like. Of course, such devices could be interlocked by well known means so that their actions were complementary.

In addition it should be understood that this device is not limited to the production of black and white kaleidoscopic patterns with the associated fixed material that has been referred to hereinbefore, but comprehends the full use of the color spectrum in creating optical images in any combination of colors which it may be found to be desirable or feasible to be used.

It should be understood also that this device is not limited for use with television apparatus.

It also should be borne in mind that the background projector may be utilized to project any background effect of any desired configuration, and is in no way limited to the projection of a background having an aspect ratio of 4 to 3 as hereinbefore referred to.

In addition it should be understood that this invention is in no wise limited to the use of kaleidoscopic material recorded on film, but may use physical objects and other material which will allow images to be directed onto the mirror surfaces for reflection and re-reflection by any means.

It will be appreciated that there may be departures from the particular arrangement shown herein which will fall fairly within the spirit and scope of my invention and, therefore, no rights are waived to such equivalents, but I feel myself to be entitled to all apparatus which falls within the scope of the invention as defined in the hereinafter appended claims.

What I claim is:

1. A projecting kaleidoscope system comprising means for reflecting and re-reflecting optical images, a source of optical images, means for moving said source of optical image and said reflecting and re-reflecting means relative each to the other, illuminating means for directing the optical images onto said reflecting and re-reflecting means whereby a kaleidoscopic pattern is formed, means for focusing said pattern onto an image plane, and means for combining a static image with the kaleidoscopic pattern on the plane of projection, said latter means comprising means positioned angularly with respect to the axis of projection of the kaleidoscopic pattern developing means for projecting said static pattern, and reflective means positioned adjacent said latter means to project the static pattern for reflecting said static pattern onto the plane of projection.

2. A projecting kaleidoscope apparatus comprising means for reflecting and re-reflecting optical images, optical image source means, means

for directing the optical images from said source onto said means for reflecting and re-reflecting, a source of static optical images, means associated with said source of static optical images for changing the static image, and means for combining the static image with the kaleidoscopic image formed by reflection and re-reflection.

3. Apparatus in accordance with claim 2, wherein said means for changing the static image comprises a slide holder for holding a plurality of slide members, and means for changing the position of the slide holder with respect to the static image source whereby static images may be changed.

4. A projection kaleidoscope apparatus comprising a plurality of reflecting surfaces angularly arranged each to the other for reflecting and re-reflecting optical images, housing means for holding said reflecting and re-reflecting surfaces, and a plurality of ring shaped members embracing said housing, each of said ring shaped members having a plurality of adjustable support members held thereby, whereby the position of said housing may be altered in two co-ordinates of movement.

5. A projecting kaleidoscope system comprising prismatic means for reflecting and re-reflecting optical images, a source of optical images, means for moving said source of optical images and said reflecting and re-reflecting means relative each to the other, illuminating means for directing the optical images onto said reflecting and re-reflecting means whereby a kaleidoscopic pattern is formed, means for focusing said pat-

tern onto an image plane, and means for combining a static image with the kaleidoscopic pattern on the plane of projection, said latter means comprising means positioned angularly with respect to the axis of projection of the kaleidoscopic pattern developing means for projecting said static pattern, and reflective means positioned adjacent said latter means to project the static pattern for reflecting said static pattern onto the plane of projection.

6. A projecting kaleidoscope system comprising means for reflecting and re-reflecting optical images, a source of optical images, means for moving said source of optical images and said reflecting and re-reflecting means relative each to the other, illuminating means for directing the optical images onto said reflecting and re-reflecting means whereby a kaleidoscopic pattern is formed, means for focusing said pattern onto an image plane, and means for combining a static image with the kaleidoscopic pattern on the plane of projection, said latter means comprising means positioned angularly with respect to the axis of projection of the kaleidoscopic pattern developing means for projecting said static pattern, reflective means positioned adjacent said latter means to project the static pattern for reflecting said static pattern onto the plane of projection, and a third image producing means positioned to direct an optical image upon the image plane of the other of said images and thereby to define and limit the viewed area of said first images.

WILLIAM C. EDDY.