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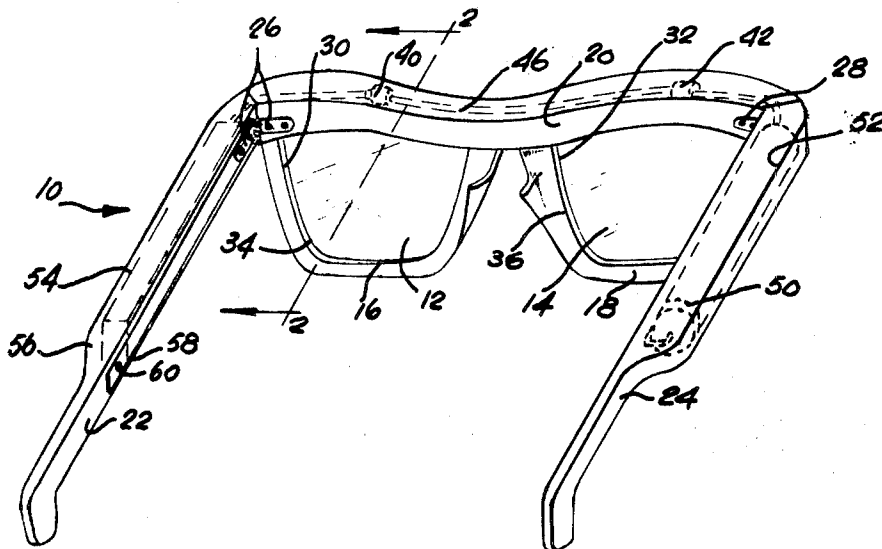
[54] **SENSORY DEVELOPMENT APPARATUS**
8 Claims, 19 Drawing Figs.

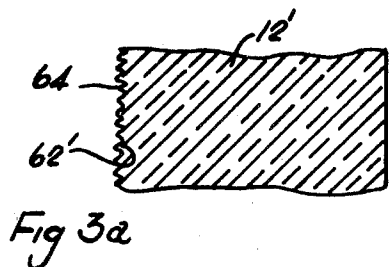
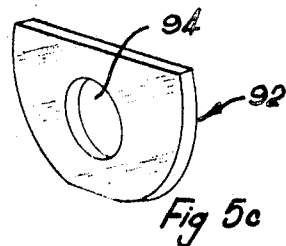
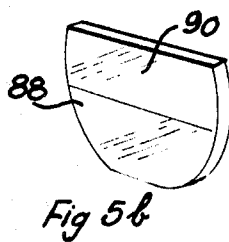
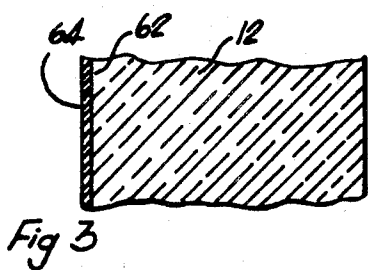
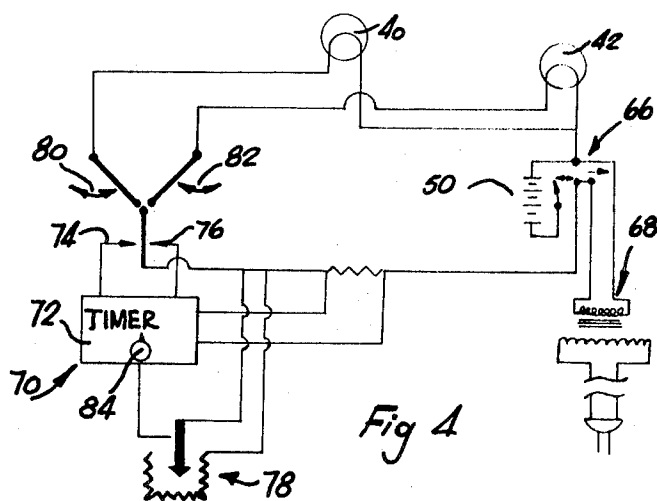
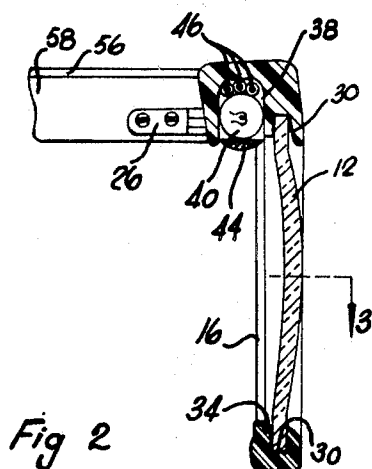
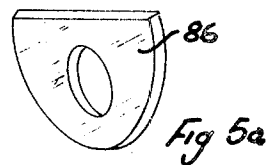
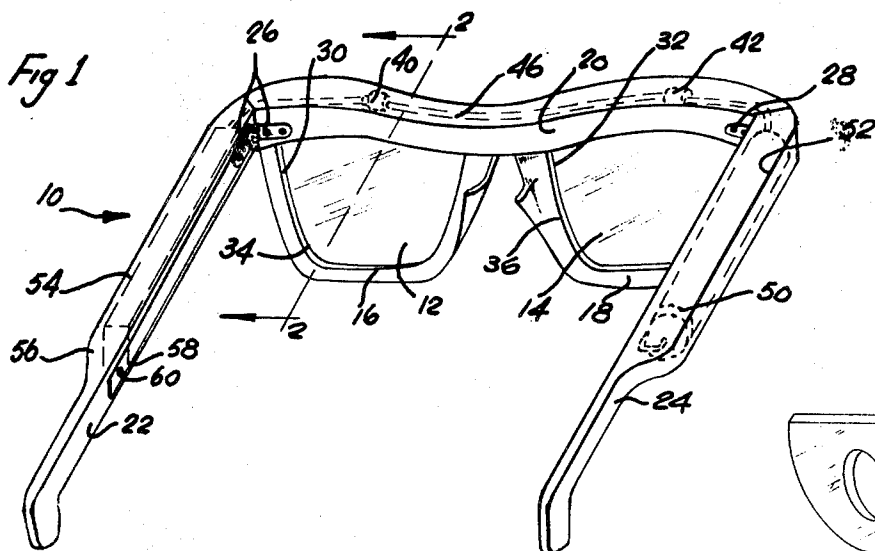
[52] U.S. Cl. **128/76.5**
 [51] Int. Cl. **A61h 5/00**
 [50] Field of Search **128/76.5**

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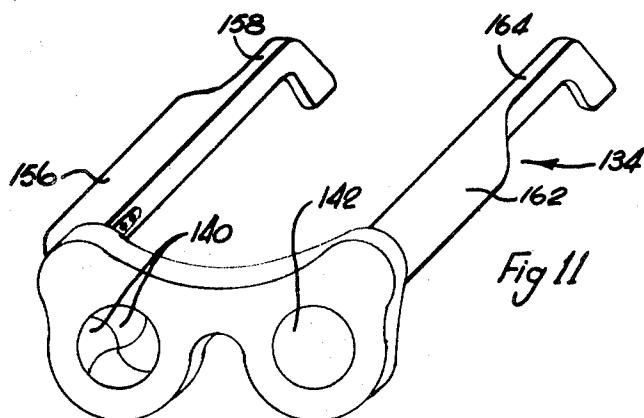
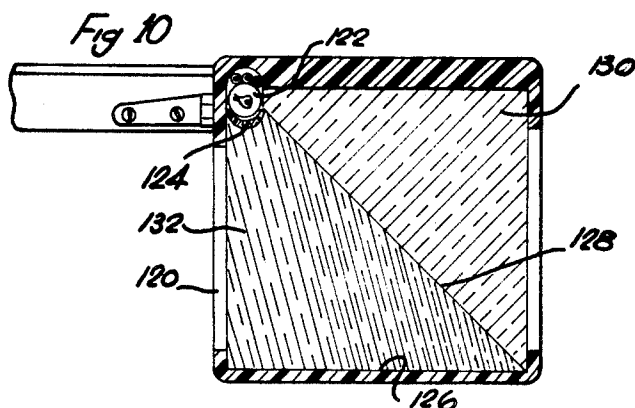
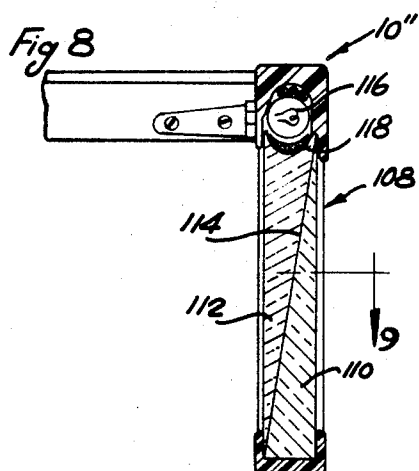
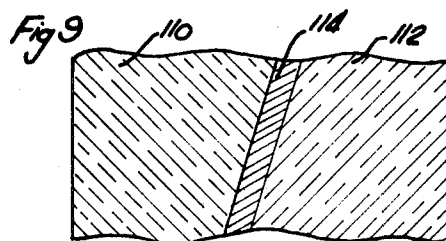
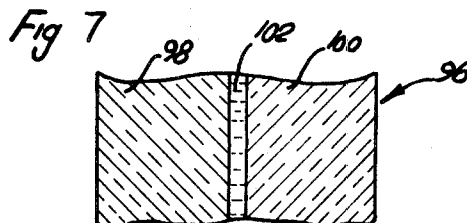
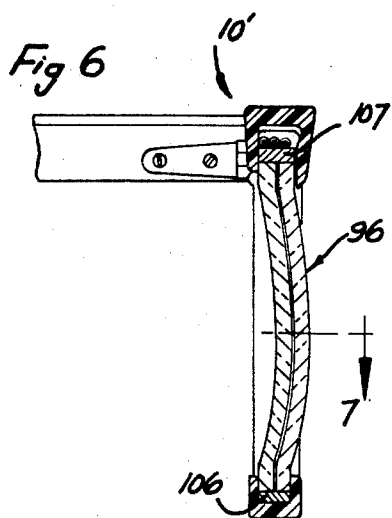
ABSTRACT: Sensory development apparatus in the form of an optical frame carrying eyepieces in which perception therethrough is recurrently and selectively diminished. In one embodiment, light is flashed recurrently against the inner surfaces of alternate eyepieces to diminish perception therethrough. In another embodiment liquid crystal is contained by the eyepieces between selectively controlled electrodes on opposite edges thereof.





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Fig 12

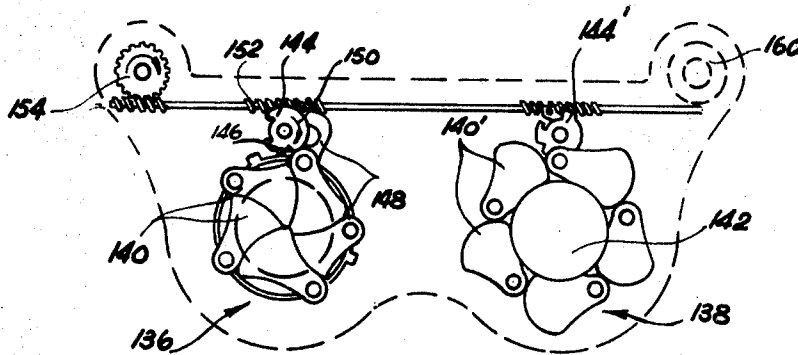


Fig 13

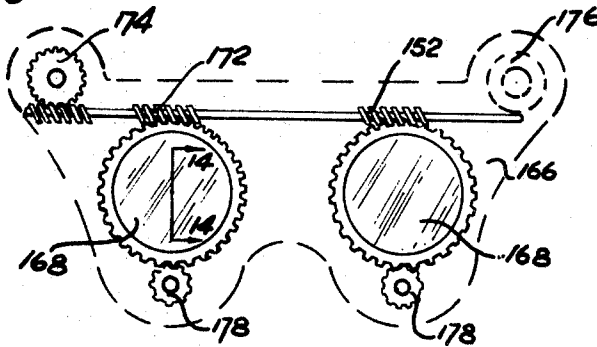


Fig 14

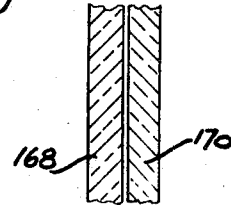


Fig 16

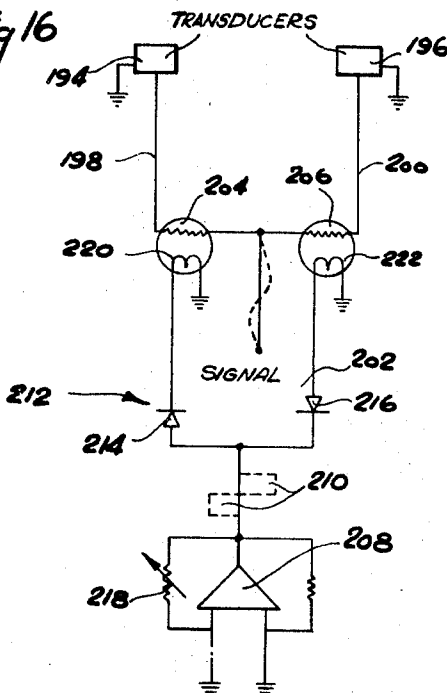
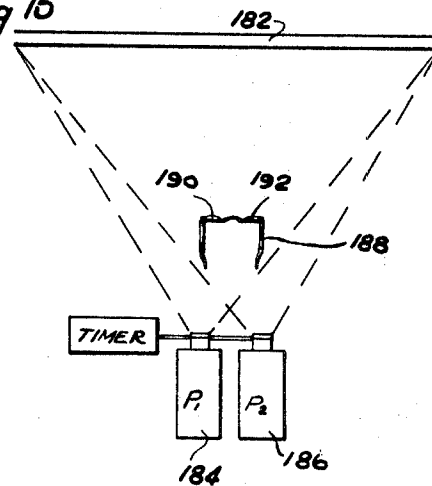


Fig 15



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SENSORY DEVELOPMENT APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of art to which the invention pertains includes the field sensory development devices, particularly orthoptic devices.

2. Description of the Prior Art

The human body is constructed with two similar lateral halves; i.e., man independent sensory experiences or stimuli. Ideally, these independent a symmetrical being. The brain that directs sensory activity is symmetrical and in effect there are two interconnecting brains. In this regard, each eye perceives a distinct image, each ear observes sound at a different location, the tactile experiences are independent, and in general the two halves or sides of the body undergo independent stimuli or sensations are coordinated or integrated in the brain by being fused in a manner which enables the person to accurately perceive the motion of various objects relative to him.

Considering optical sensation as a specific example, the two eyes perceive a field of vision from two distinct viewpoints, providing essentially two separate fields of vision. The visual stimuli coming in from the left eye goes to the left as well as to the right hemisphere of the brain as does the visual stimuli to the right eye. These four visual stimuli must be "pulled" together. The brain does the "pulling" together by mentally fusing the stimuli. If the fields of view are spatially displaced the fusion can provide dimensional vision, or the stereoscopic effect. In this fusion process, the two visual fields are in the closest registration, i.e., they overlap, and the brain can interpret the differences between them as spaced distance. In a somewhat similar manner of fusion or information coordination, the information sensed by the displaced ears afford directional sensitivity for determining the location of sound sources.

The ease with which distinct information perceived from the lateral sensory organs may be coordinated or fused varies among people and with environment. For example, persons having keen fusion capabilities for lateral sensations normally possess accurate depth perception, good directional sensitivity and in general are physically well coordinated. Conversely, persons having poor or even no fusion capability may suffer an extreme physical handicap. Specifically, for example, one form of fusion failure results in the inability to accomplish retinal correspondence in which the two planar images perceived by the eyes are fused into a three-dimensional or stereoscopic object. In reacting to this lack of fusion, the central nervous system may compensate in any of several patterns, e.g., by totally rejecting one of the images, sequentially accepting the images alternately from the two eyes or by diverting one of the eyes to an extreme in which it is ineffective and can be ignored. These compensation patterns provide the person's ability to orient himself so that he as at least one clear planar image; however, his depth perception is lacking.

In "normal" situations, one eye is dominant and is used for fixation, with the other eye simply moving in concert with it. In other situations, the central nervous system may not select or favor a dominant image from one eye, the muscles from the nondominant eye are too weak to effect registration, or there is unequal innervation. As a result, if the brain does not use one of the compensation patterns, the person is presented a wildly disorganized scene of flying objects set entirely in a single plane with his attention commanded first by one object, then another. Concentration by the person to focus his attention on a single object or area under these conditions is extremely difficult and trying. As a result, the person is not only severely physically handicapped but furthermore the uncorrected strain of living out of orientation in relation to surrounding physical objects can produce severe psychological problems.

The lateral (and/or vertical) difficulty of fusing optical images may also be related to other dual senses. That is, per-

sons experiencing the problems of visual fusion may also have difficulty fusing the stimuli sensed independently by their two ears, or fusing tactile stimuli sensed from two points on their body. Thus, while most individuals can accomplish fusion of perceived stimuli and thereby respectively orient themselves to their surroundings, persons suffering from difficulties in this regard not only have trouble maintaining orientation but also may have difficulty preserving a point of consciousness or center of attention. That is, considering the vast multitude of stimuli continually perceived (including hundreds of objects in the field of vision, a multitude of random sounds, and the variety of tactile stimuli from skin-contact points) without fusion, the person becomes completely incapable of effectively orienting his senses to effect control. In this regard, persons with lesser fusion capability frequently must exert extreme mental effort to accomplish routine physical tasks. That is, the failure of the central nervous system to accomplish fusion necessitates that a concentrated effort be made to compensate. If the individual can accomplish fusion at all, the effort is continually required to maintain it. During intervals in which the various stimuli or perceived information are not fused, physical manipulations demand an exhausting effort. Some appreciation of this effort may be realized as an existence in which the central nervous system fails to organize information perceived by the senses to provide orientation as normally enjoyed. The human operation can be analogized to that of controlling and directing an unseen robot from a multitude of communication channels all of which continually deliver data with no precedence. A further manifestation of laterality difficulty may be stuttering speech. For example, a disoriented person lacking a reference for organization faced with a disarray of data concentrates so intently on listening to his own speech that a conflict arises between speaking and listening with stuttering as a result.

With particular reference to visual problems arising as a result of a diminished fusion capability, various methods and devices have been developed to aid in effectuating some degree of correction. Thus the optometric sciences have developed certain treatments which have been termed "visual training." In visual training, the patient is required to exercise concentration on objects in an attempt to train the mind to properly coordinate and direct the nondominant eye. These methods and devices that have been developed for the use of these methods generally rely on an effect wherein it has been generally found that when one eye is crossed or suppressed while both are open, that eye will function normally when the other eye is closed. By alternately occluding each eye at a rate that is faster than the brain can suppress and switch over, each eye thinks correctly, that it is the only one seeing and functions accordingly. Both eyes function independently and the brain gets in the habit of fusing the information. Eventually, neural paths are so well established that they overcome original habits and aid in obtaining natural fusion.

In many cases, visual training has been successful in improving vision but the primary present disadvantage is that it generally requires a great amount of effort and willpower on the part of the patient. If the patient is not willing to concentrate and force his eyes to perform the required exercises, the doctor treating him is incapable of effecting results. Even in cases where the patient is possessed of the determination of willpower and fully cooperates with the doctor, the correction of vision by visual training requires a considerable amount of time. The use of devices which automatically force the eyes to concentrate is an improvement on unaided exercises in some respects, but such devices generally do not allow the patient to view a real world situation during treatment; typically, lights are flashed to the patient's eyes in alternating fashion to effect a kinetic stimulation thereof. Other devices do not allow the patient to be mobile. As a result of these characteristics, treatment is generally limited to the time spent in the physician's office, and often requires close supervision.

SUMMARY OF THE INVENTION

The present invention provides apparatus for sensory development which aids in obtaining fusion, yet can be worn by the subject, allowing him to be mobile, and generally can be utilized to present a real world situation to be sensed in a fused fashion. In accordance herewith, sensory means are provided that are wearable by the subject spaced apart to thereby provide independent but fusible sensations. Means are provided for periodically occluding at least part of the sensation from one of the sensory means. The occlusion can alternate from one sensory means to the other. The sensory means can be visual, aural and/or tactile.

With specific regard to visual stimulation, the sensory means comprise eyepieces supported within an optical frame as in an ordinary pair of eyeglasses. Means are provided for blocking the perception of light through at least a part of one of the eyepieces or through both of the eyepieces in alternating fashion. In accordance with one embodiment of this invention, occlusion of the field of vision is obtained by recurrently flashing light against the inner surface of the occluded eyepiece wherein the light is reflected from that surface into the eye of the subject to diminish his ability to perceive the field of vision with that eye. The intensity of the flashing light can be adjusted or varied to accomplish additional therapy. In other embodiments of this invention, mechanical shuttering means are provided for accomplishing alternating recurrent occlusion. In still other embodiments of this invention, the subject perceives independently projected film images through polarized glasses, or other eyepieces having mutually exclusive transparency characteristics, and recurrent occlusion is accomplished by programming the projection.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective and diagrammatic view of an optical frame and eyepieces constructed in accordance with the principles of the present invention;

FIG. 2 is a cross-sectional view through the structure of FIG. 1, taken on line 2—1 of FIG. 1, in the direction of the arrows;

FIG. 3 is a sectional fragmentary view through the structure as depicted in FIG. 2, in the direction of the arrow 3;

FIG. 3a is a sectional, fragmentary view similar to that of FIG. 3 but with respect to an alternative embodiment of the invention;

FIG. 4 is a rudimentary wiring diagram of the electrical portion of the device of FIG. 1;

FIG. 5a is a perspective view of a stop utilizable with the structure of FIG. 1;

FIG. 5b is a perspective view of an eyepiece utilizable in the structure of FIG. 1 but with respect to an alternative embodiment of the present invention;

FIG. 5c is a perspective view of an eyepiece utilizable in the structure of FIG. 1 but with respect to an alternative embodiment of the present invention;

FIG. 6 is a cross-sectional view of an alternative eyepiece utilizable in the present invention;

FIG. 7 is a sectional, fragmentary view through the structure depicted in FIG. 6 in the direction of the arrow 7;

FIG. 8 is a cross-sectional view of an alternative eyepiece structure of the present invention;

FIG. 9 is a sectional, fragmentary view through the structure depicted in FIG. 8 in the direction of the arrow 9;

FIG. 10 is a cross-sectional view of an alternative eyepiece structure of the present invention;

FIG. 11 is a perspective and diagrammatic view of a mechanically shuttered structure constructed in accordance with the principles of the present invention;

FIG. 12 is a plan and diagrammatic view of the shuttering mechanism utilized in the structure of FIG. 11;

FIG. 13 is a plan and diagrammatic view of an alternative shuttering mechanism in accordance with the principles of the present invention;

FIG. 14 is a cross-sectional view of a portion of the structure of FIG. 13, taken on the line 14—14, in the direction of the arrows;

FIG. 15 is a diagrammatic view of an embodiment of this invention utilizing stereo-optical projection; and

FIG. 16 is a diagrammatic view of an embodiment of the present invention utilizing transducers for sensory stimulation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As explained above, persons possess varying degrees of ability to accomplish and preserve the fusion of spaced apart stimuli. FIGS. 1—15 depict a variety of embodiments of the present invention which are designed to aid and develop sensory fusion with respect to visual stimuli. FIG. 16 diagrammatically depicts embodiments of this invention designed to aid and develop fusion of oral and/or tactile stimuli. Each of these embodiments have certain common features. Each of the embodiments is sufficiently portable so as to be wearable by the subject, allowing long term continuous treatment of the subject while he is mobile and, in many of the embodiments, while the subject is going about his normal activities. In each of the embodiments, pairs of sensory means provide individually distinguishable, sensations at like, opposed body locations. Means are provided for recurrently occluding at least part of the sensations from one of the sensory means in such manner that the other sensory means is unoccluded during such occlusion. In each of the embodiments, perceivable sensations can be alternately occluded.

Referring to FIGS. 1—5, and specifically to FIGS. 1 and 2, there are shown a pair of glasses 10 including eyepieces or lenses 12 and 14 which may incorporate a corrective prescription, or may be plain glass, and which are supported in frames 16 and 18, respectively, joined by a bridge 20. The bridge 20 extends over both frames 16 and 18 and is joined at its opposite end to earpieces 22 and 24 by means of hinges 26 and 28, respectively. The bridge 20 is formed integral with each of the frames 16 and 18 and defines curved channels 30 and 32 with the frame 16 and 18, respectively, for retention therein of the lenses 12 and 14. The bridge 20 also defines with the frames 16 and 18 additional, shallower channels 34 and 36 for retention therein of filters, stops, or the like (not shown in FIG. 1).

The bridge 20 is shaped inwardly from the frames 16 and 18 to define a channel 38 running therealong and accessible from either side of the eye glasses 10. The channel 38 houses a pair of very small, grain-of-wheat light bulbs 40 and 42 spaced centrally and inwardly from the top of each of the lenses 12 and 14. A small lens (only one of which is shown as 44 in FIG. 2) is secured within the bridge channel 38 adjacent each light bulb 40 and 42 to appropriately spread light therefrom. The bulb socket above each lens 12 and 14 is connected by wires 46, running through the bridge channel 38, to a dry cell battery (shown in shadow at 50 in FIG. 1) releasably positioned in a battery housing 52 integral with one of the earpieces 24, and is further connected by the wires 46 to a timer circuit (shown in shadow at 54 FIG. 1) positioned in a battery housing 56 integral with the other earpiece 22. Each of the earpiece housings is provided with a swing-away portion 58 on which one half of each leaf hinge is secured and which is releasably connected to the earpiece by a small screw 60.

Referring additionally to FIG. 3, the inner surface 62, of each of the lenses 12 and 14 is coated with a layer 64 of silver which is thin enough so that the coated lenses 12 and 14 are semitransparent or may be coated in a manner of well-known mirrored lenses. Alternatively, as illustrated in FIG. 3a, the inner surface 62' of each lens 12' is roughened to obtain a lightly frosted surface 64'. In each of the alternative embodiments, the subject is provided with a field of vision through each lens 12, 14 which is normally sufficient to provide a view of the subject's surroundings. However, when the light bulbs 40 and 42 are actuated as hereinbefore described, the subject's field of vision thereat is temporarily occluded.

As indicated above, a variety of ocular difficulties can arise from an inability on the part of the subject to fuse visual stimuli. Some of these types of ocular difficulties include: strabismus, a condition in which binocular sensation is not present under normal conditions; suppression, which is the lack of perception of normally visible objects of one eye occurring on simultaneous stimulation of both eyes, which also may be termed ocular cortical inhibition; suspensopia or suspension, which is an involuntary ignoring of the object in the field of vision of one eye when visual attention is directed to objects in the field of vision of the other eye; and alternating perception, a situation in which a patient who is capable of seeing with either eye ordinarily consciously observes objects with only one or the other eye, but not both eyes. These and other ocular disorders further described in U.S. Pat. No. 3,277,888, entitled "Orthoptic Devices" wherein prior art methods of treatment are set forth. In accordance with the present invention, the foregoing ocular deficiencies may be treated by selectively occluding perception of the field of vision from one or the other of the lenses 12 and 14. In a particular embodiment, light may be recurrently flashed from one of the light bulbs, say 40, to reflect from the mirrored surface of the lens 12 thereof to effectively occlude perception of the field of vision through that lens 12, while the other lens 14 is allowed to remain unoccluded. In this manner, where the subject's eye adjacent to the lens 14 is nondominant, that eye is viewing a field of vision during a period of time of occlusion of the other lens 12 and thus functions as if it is the only eye seeing during that period of occlusion, as indeed it is. In the absence of this treatment, the nondominant eye is "lazy" and doesn't attempt to fix on the "target." However, when the dominant or fixing eye is alternately occluded and nonoccluded by means of this treatment, the nondominant eye must fix on that same target or the patient will find that he is looking to one side or the other of the intended target.

In another form of treatment, light is flashed from both bulbs 40 and 42 in alternating fashion so as to occlude first the field of vision through one lens 12 and then the field of vision through the other lens 14, repeating this pattern continuously. By alternately occluding each eye at a rate faster than the brain can suppress and switch over, allowing only one eye to see at a given instant, each eye functions as the only one seeing (which indeed it is at that instant). Both eyes thus function independently, and the brain develops the habit of fusing the visual information. Eventually neural paths are so well established that they overcome the original habits. Further, the method of treatment utilized herein allows the patient to be completely mobile and out of danger from vision-obstructed accidents inherent in treatments such as eyepatches, which are used to force the nondominant eye to fix.

Referring to FIG. 4, a rudimentary wiring diagram is shown for enabling recurrent flashing of one or both of the light bulbs 40 and 42. The light bulbs 40 and 42 are each connected in parallel to a source of power, which may be the battery 50 described above or may be connected by a jack, as indicated at 66, through a transformer 68 to a wall socket. The bulbs 40 and 42 also connected in parallel to a timer circuit, indicated generally by the numeral 70 enclosed within the housing 54 described above with reference to FIG. 1. The timer circuit 70 may include a standard design flip-flop multivibrator 72 electrical circuit utilizing solid-state electronics, for example, utilizing the circuitry depicted in FIG. 16 but wherein the light bulbs in 40 and 42 are substituted for the photoelectric cells utilized therein. A variable resistance 78 is provided to allow the intensity of the light from the bulbs 40 and 42 to be adjusted to an appropriate level, and means are provided, as indicated by the arrows 80 and 82 for removing one or the other of the light bulbs 40 and 42 from the timing circuit so that operation as first indicated above can be accomplished wherein the nondominant eye is allowed a constant view of the field of vision and the dominant-eye is recurrently occluded. The timing circuit is adjustable as indicated at 84 to obtain any desired periodicity or recurrency rate.

Referring to FIGS. 5a-5c, there is shown a variety of additional embodiments in the manner of embellishments on the foregoing structure. FIG. 5a depicts a stop 86, one or more of which is retainable within the shallow recession 34 and 36 in eyeglass frames 16 and 18 to limit the field of vision as may be desired for a particular treatment. FIG. 5b depicts a lens 88 having only the top half 90 thereof silvered so that occlusion is only of such top half, for treatment of a particular condition; alternatively, the bottom half can be only silvered to occlude that half. FIG. 5c depicts a lens 92 in which the region surrounding a central portion is silvered while the central portion is not silvered to thereby provide occlusion around a central aperture 94, for treatment of a particular condition; alternatively the central portion 94 can be silvered with the surrounding regions unsilvered to occlude the central portion.

Referring to FIGS. 6 and 7, an alternative embodiment of the invention is depicted wherein an eyeglass frame 10' is provided that is constructed similarly to the eyeglass frame 10 of FIGS. 1 and 2, but wherein the lenses, one of which 96 is shown in cross section, each constitute matching halves 98 and 100 sandwiching a thin layer of liquid crystal 102 therebetween and having metallic electrodes 104 and 106 on opposite sides thereof in contact with the liquid crystals. Such liquid crystals 102, as known to the art, become opaque when subjected to a voltage differential, as supplied by the electrodes 104 and 106. The circuitry utilized can be similar to that of FIG. 4, appropriately modified for use in this embodiment. In operation, the field of vision is occluded by subjecting the liquid crystals in the occluding lens to a difference of potential across that eyepiece. The resultant opacity would prevent perception of the field of vision through the lens. Of course in this embodiment, variation in intensity of occlusion is not available. A Kerr cell can be utilized in place of the liquid crystals and sandwiching structure, but such devices are very expensive and require more complex circuitry.

Referring to FIGS. 8 and 9, another embodiment of this invention is depicted wherein the eyeglass frame 10' is constructed somewhat in accordance to the structure depicted in FIGS. 1 and 2, but the lenses, such as depicted in 108, are each composed of opposed prisms 110 and 112. One of the common surfaces of the prisms 110 and 112 is coated in the manner described with reference to FIGS. 1 and 2, with a layer 114 of silver so as to be transparent under normal lighting conditions, but which occludes perception of a field of vision therethrough when reflecting light in the manner of the device of FIGS. 1 and 2. In this regard, a light bulb 116 and lens 118 therefore are provided centrally within the top surface of each of the inner prisms 112 to selectively flash light against the mirrored surface 114 thereof.

Referring to FIG. 10, still another alternative embodiment of this invention is depicted wherein eyeglass frames are provided securing blocks of beam splitting prisms 120 in front of each eye. A light bulb 122 and a spreading lens 124 therefore are provided for each beam splitter centrally and within the top inner surface thereof so that when actuated, light therefrom reflects from the bottom surface 126 of the beam splitter 120 to the beam splitting common surface 128 defined by the opposed halves 130 and 132 of the beam splitter 120, and from there to the subject's eye, to occlude perception of the field of vision therethrough. The electrical circuitry of FIG. 4 can be utilized to provide the recurrent flashing capability. Additionally, a pattern, e.g., of lines, can be painted on the bottom surface 126 of each beam splitter to provide a fusible pattern as desired.

Referring to FIGS. 11 and 12, there is depicted a pair of eyeglasses 134 fitted with a shuttering mechanism (FIG. 12) for mechanically alternately occluding perception of the field of vision by one or the other of the subject's eyes. Each eyepiece has associated therewith a diaphragm shutter 136 and 138, each composed of shuttered leaves 140 and which are mutually arranged so that when the shutter leaves 140 over one of the subject's eyes are closed the shutter leaves 140' over the other eye of the subject are open to form an

aperture 142 thereat. The shutter diaphragms are constructed in a manner well-known to the art and each utilizes a drive element 144 operatively connected to a shutter opening pin 146 which drives an actuating ring 148 to open or close the shutter leaves 140. The drive elements are each rotated, in the direction of the arrow 150 by means of a worm gear 152 operative therewith and which is driven by a worm wheel 154 contained within a housing 156 located on one of the earpieces 158 and which is powered via wires (not shown) through the frame by a battery 160 enclosed within a housing 162 on the opposite earpiece 164. Means are provided (not shown) for turning the apparatus on and off and for adjusting the rate of shuttering.

Referring to FIGS. 13 and 14, still another mechanical shuttering device is depicted wherein eyeglass frames 166 are constructed to enclose pairs of rotatable polarized disks 168 and 170. The disks are arranged so that the one member 170 of each pair is fixed while the other 168 is rotatable by means of a worm gear 172 which is driven by a worm wheel 174 in the manner depicted with respect to FIG. 12. A battery 176 is enclosed in a housing therefor in one of the experiences idler wheels 178 are provided to secure the rotatable disks. The disks are oriented so that while one pair 168, 170 are crossed, thereby occluding light, the other pair are in alignment to admit light therethrough.

Referring to FIG. 15, another embodiment of this invention is depicted wherein the subject does not view a real world situation, but instead is confronted with pictures, which may be stereo-optical, being flashed on a screen 182 from a pair of projections 184 and 186. The subject is provided with a pair of glasses carrying lenses 190 and 192 which have mutually exclusive transparency characteristics such that the projected image from one of the projectors 184 is seen through one of the lenses 190, but not through the other lens 192 and the image projected from the other projector 186 is seen through that other lens 192 but not through the first lens 190. Conveniently, one can utilize oppositely polarized lenses and polarized projections, as is well known in the art, and one can utilize stereo-optical images to obtain a three-dimensional effect. Selective occlusion can be effected in a number of ways. The projected images can be programmed so that the picture to one eye is alternately blanked out and then allowed to be seen; or the shutters on the projectors 184 and 186 can be synchronized so that they alternately display only one projected image at a time and the rate of projection is rapid enough to project an apparent continuous image to each eye. Alternatively, shutters, such as depicted in FIG. 12 can be utilized and connected to a timing circuit as described with respect to FIG. 4. The shuttering rates can be chosen to reduce the effect of accidentally synchronizing with the flicker rate of the film or rotating prism systems can be utilized with the projectors. An advantage of this format is that a program can be tailored to exercise specific areas and functions as desired.

The discussion of exemplary embodiments of the present invention as provided above has been directed primarily to visual devices. However, as indicated in the introduction hereof and in the summary of the invention, the problem extends to other senses, e.g., hearing and touch. In such regard, the provision of alternately occluded stimuli is effective for these senses for developing fusion of the perception of such stimuli in a manner similar to the fusion of optical perception. In considering audio fusion, the problems may not be readily apparent; however, the auditory organs receive sound at two distinctly separated locations to provide intelligence which must be fused for directional information. The accomplishment and maintenance of such fusion for persons suffering from laterality problems can be aided by apparatus for providing separate, alternating stimuli.

Further in some instances, it has been determined to be desirable to provide apparatus which delivers tactile stimuli, sensed by the physical sense of touch.

Referring to FIG. 16, apparatus is disclosed therein for producing either audio or tactile stimuli by means of transducers 194 and 196. One lead 198 or 200 on each transducer 194 and 196, respectively, is connected to a signal generator 202 but is interrupted by leads to and from a photocell 204 and 206, respectively. The photocells 204 and 206 are such that the resistance thereacross is effectively infinite in the absence of light impingement thereon, but has no effective resistance when impinged with light. A bipolar power supply feeds plus and minus voltage to an amplifier 208 which is designed to emit a square wave 210 to a flip-flop circuit 212. The diodes 214 and 216 of such circuit are opposed so that one passes negative and the other positive current. The frequency of the square wave 210 is controlled by a variable resistor 218 across the amplifier. As the current is passed by each diode 214 or 216, it lights a globe 220 or 222, respectively, which is facing the photoelectric cell 204 or 206 thereat. In operation, as the circuit 212 flip-flops, the signal 202 is fed first to one transducer e.g., 194, as a result of impingement of light on its photocell 204, and then the signal 202 is fed to the other transducer 196. The cycle is repeated to effect alternating occlusion of the transducers.

For audio stimuli, the transducers 194 and 196 can constitute bone conduction apparatus to transmit signal tones 202 to the subject, which signal tones may or may not be variable in intensity. Alternatively, the transducers 194 and 196 can constitute a pair of ear phones for receiving an audio signal 202. In still other embodiment, the transducers 194 and 196 can constitute a pair of hearing aids and the signal 202 can constitute a switching signal to occlude the hearing aid to which the signal is fed. By this latter embodiment, a stereophonic effect can be maintained and the subject can be treated while being subject to the audio characteristics of his surroundings.

In another embodiment of the invention the transducers 194 and 196 can constitute vibrators, each having a head which engages the subjects body and which is driven to provide a definite tactile stimulation. Alternatively, the transducers 194 and 196 may be constituted to provide a mild electrical shock, heat, or various other tactile stimuli, as directed by the signal 202, and the intensity of which may be controlled by appropriate control of the signal 202.

In general, from the above consideration it may be seen that applicant has discovered a variety of effective structures for use by persons who for one reason or another experience difficulty in fusing or interpreting optical, auditory, or tactile stimuli. They may also be utilized by a "normal" person to "fine-tune" his perceptual abilities.

What is claimed is:

1. Apparatus for use by a human subject for sensory development, comprising:

eyepieces which are transparent when unoccluded to present fields of vision therethrough;
occlusion means for recurrently diminishing perception through at least one of said eyepieces; and
an optical frame wearable by said subject for holding said eyepieces in relation to the eyes of said subject;
said occlusion means comprising electrical selection means on said frame and means integral with at least one eyepiece for cooperating with said selection means to diminish light perception through that eyepiece.

2. The apparatus of claim 1 including a timing circuit connected to said selection means for effecting recurrency of diminishing perception through said eyepiece faster than the brain can suppress and switch perception over to the other eyepiece.

3. The apparatus of claim 1 wherein said occlusion means alternately diminishes perception through first one eyepiece and then the other eyepiece.

4. The apparatus of claim 1 including means for adjusting the rate of recurrency of said occlusion means.

5. The apparatus of claim 1 including means for adjusting the level of perception through at least one of said eyepieces.

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6. The apparatus of claim 1 wherein said selection means comprises a source of light adjacent the inner surface of at least one of said eyepieces for recurrently flashing light against said inner surface to reflect back from said eyepiece to selectively diminish perception through that eyepiece.

7. The apparatus of claim 6 including means for adjusting the intensity of said light.

8. The apparatus of claim 1 in which said means integral with said eyepiece comprises a layer of liquid crystal contained by said eyepiece, and said selection means comprises electrodes on opposite edges of said layer of liquid crystal in contact therewith.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,603,305 Dated September 7, 1971

Inventor(s) Jess Oppenheimer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 11, cancel "independent sensory experiences or stimuli. Ideally, these independent"; line 12, after "independent" insert -- is --; line 18, after "independent" insert -- sensory experiences or stimuli. Ideally, these independent --; line 58, "sued" should read -- used --. Column 3, line 40, after "2-1" should read -- 2-2 --. Column 4, line 74, "hereinbefore" should read -- hereinafter --. Column 7, line 22, "experiences" should read -- earpieces --; line 31, "projections" should read -- projectors --. Column 8, line 44, "his" should read -- has --; line 66, "thin" should read -- than --.

Signed and sealed this 1st day of August 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents