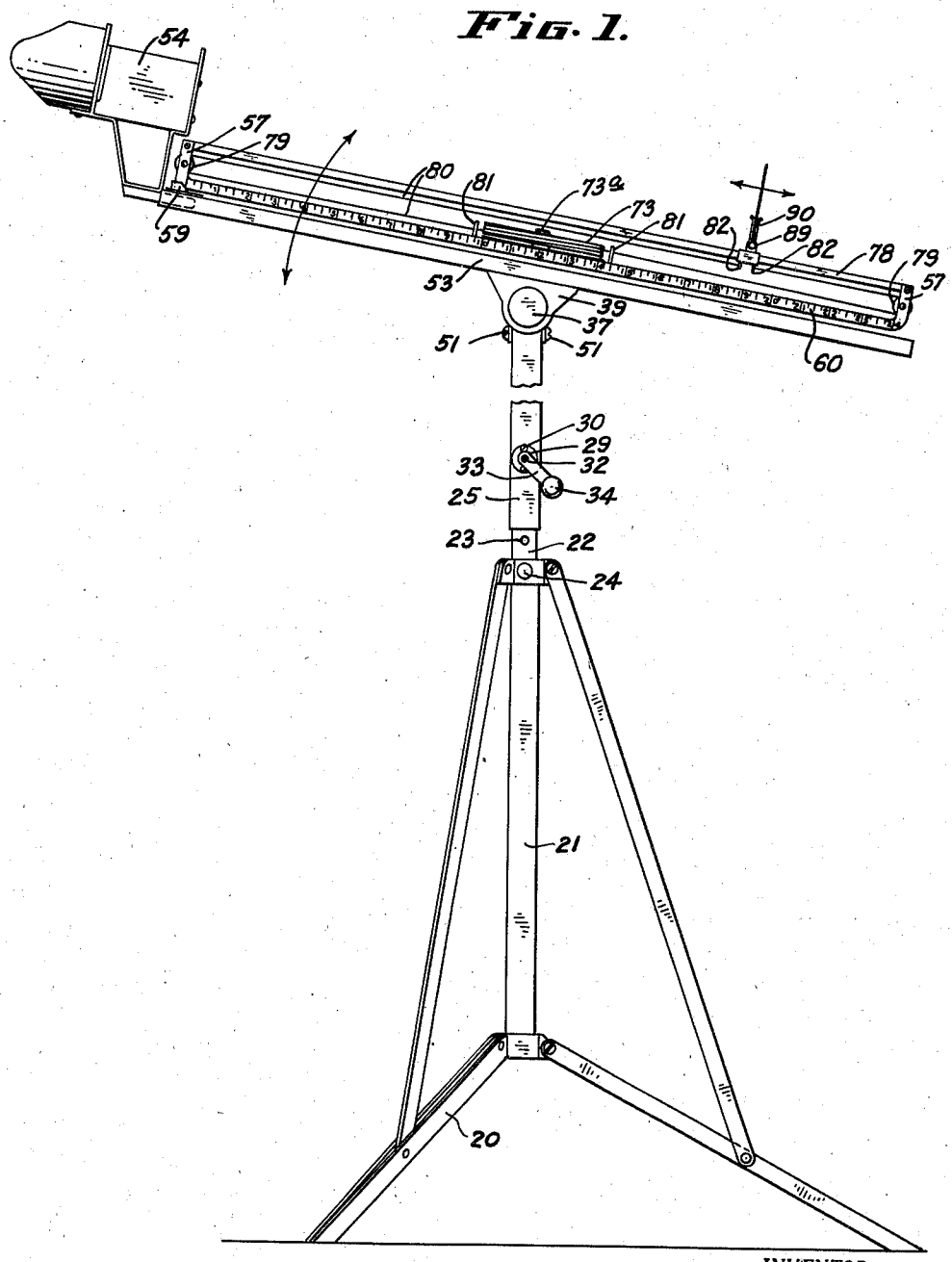
Nov. 18, 1941. E. QUINAN 2,263,190

SIGHT RECTIFIER

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Fig. 1.



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Fig. 11.

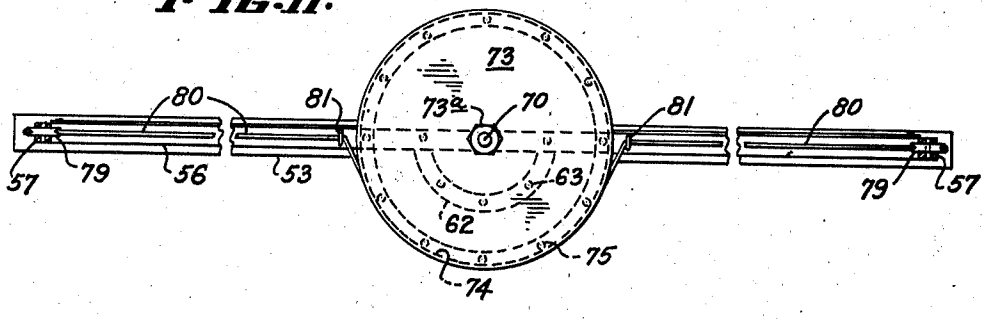


Fig. 2.

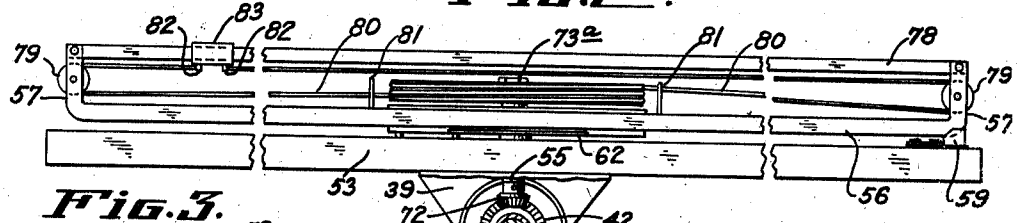


Fig. 3.

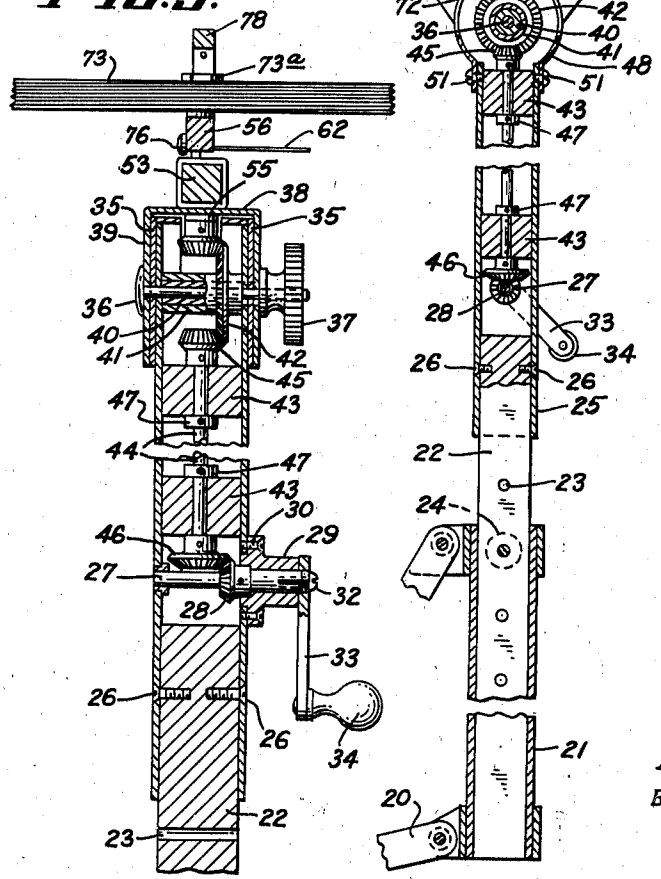
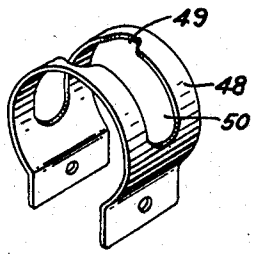


Fig. 15.



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SIGHT RECTIFIER

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Fig. 6.

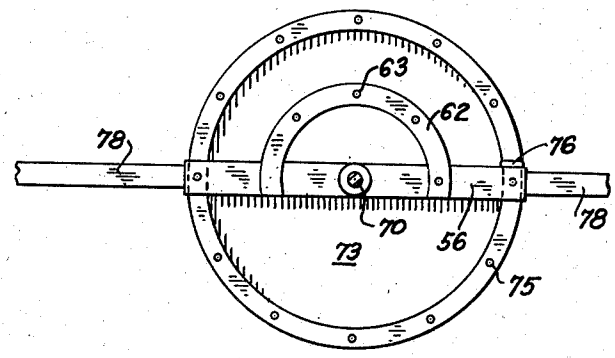


Fig. 9.

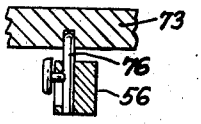


Fig. 4.

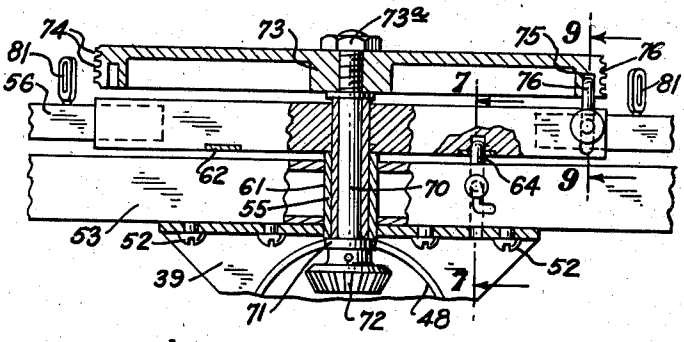


Fig. 7.

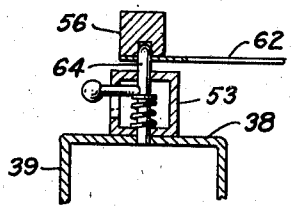


Fig. 12.

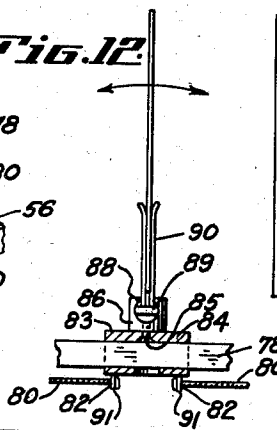


Fig. 5.

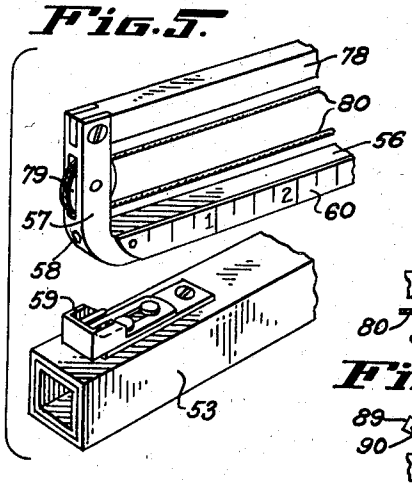


Fig. 14.

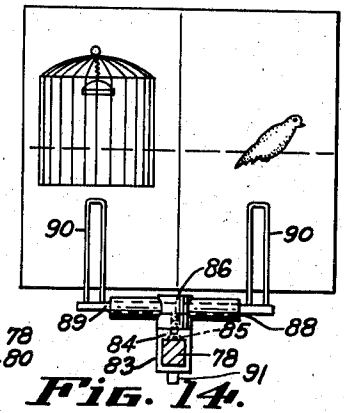
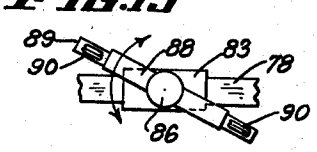


Fig. 13.



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SIGHT RECTIFIER

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Fig. 8.

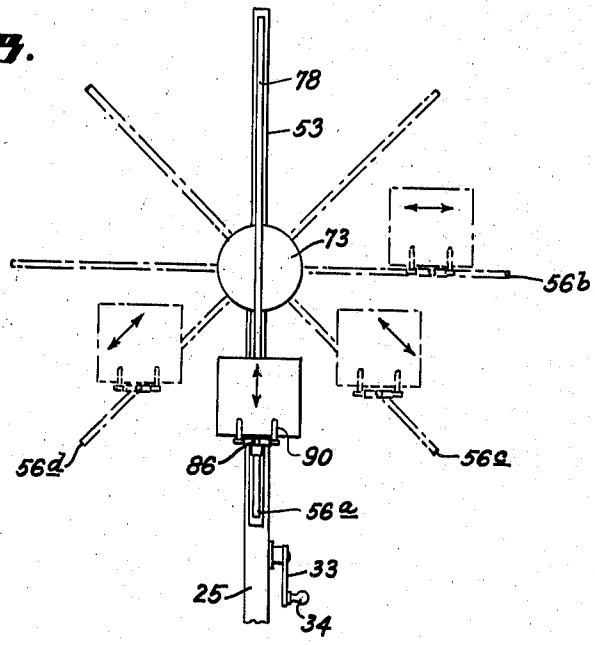
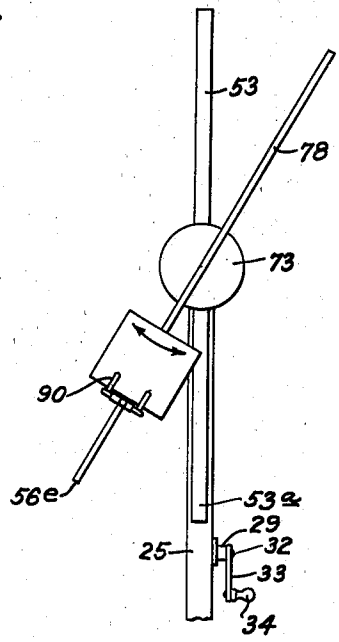


Fig. 10.



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Patented Nov. 18, 1941

2,263,190

UNITED STATES PATENT OFFICE

2,263,190

SIGHT RECTIFIER

Ernest Quinan, Berkeley, Calif.

Application November 30, 1940, Serial No. 367,974

22 Claims. (Cl. 128—76.5)

My invention relates to mechanism for exercising the human eye.

My invention hereinafter described also was designed for the purpose of diagnosing and remedying the various ailments of the human eye that are not of a degenerative nature, but are due, rather, to tension and imbalance of the extrinsic muscles.

Another object of my invention is to furnish a positive, measurable and unvarying mechanical means for attaining the ends proven possible, through the research and discoveries of the late Dr. William Horatio Bates, whose work, "Perfect Sight Without Glasses," has been microfilmed for interment in "The Crypt of Civilization" by Oglethorpe University of Georgia.

A suitable target conducts the eyes through every directional movement of which they are capable, namely: to and fro, vertical, oblique, transverse and circular, and both speed and extent of such movements are under instant control, since the machine is manually operated, as it preferably should be, to attain the ends desired. The object of these various movements when used in conjunction with certain methods of inducing muscular relaxation, is to relieve abnormal muscular tension, thus allowing the eyeball to regain its natural spherical shape when at rest.

For example, each eye has four recti and two obliqui muscles. The recti being attached to the bulb of the eye in such a manner that acting singly, they will turn its corneal (front) surface either upward, downward, medial-ward (nasal-ward) or lateral-ward (outward). Acting in conjunction, their concerted pull flattens the eyeball in the degree necessary to focus distant objects. The obliqui muscles girdle the eyeball immediately back of its equator. Acting singly, the superior oblique turns the pupil downward and laterally. The inferior oblique turns the pupil upward and laterally while in acting together their constricting effort elongates the eyeball to the degree necessary for close vision. Thus, these two sets of muscles cause the eye to accommodate itself for near or distant vision precisely as a camera is focussed on a near or distant object.

(*a*) If, for any reason, the four recti muscles remain in a contracted state holding the eyeball in a flattened position so that light rays reflected from objects close at hand come to a point back of, instead of on, the retina, hyperopia (farsightedness) is produced, with print and nearby objects blurred.

(*b*) If, on the other hand, the two obliqui muscles remain contracted, permanently elongating the eyeball so that light rays reflected from distant objects come to a point before reaching the retina, myopia (shortsightedness) is produced and distant objects are blurred.

(*c*) If, with vision otherwise normal, there is a more or less constant pull on the part of one or more muscles resulting in corneal deformation, astigmatism (confused imperfect image) is produced which becomes hyperopic-astigmatism if in conjunction with (*a*) or myopic-astigmatism if in conjunction with (*b*), etc., etc.

(*d*) Finally, if the muscles of the two eyes do not act in perfect harmony, the eyes may either cross (convergent squint or strabismus), diverge (divergent squint or strabismus), have vertical imbalance (vertical squint or strabismus), or a combination of one and three or two and three.

When Dr. Bates discovered and conclusively proved, that the extrinsic muscles of which we have been speaking were alone responsible for accommodation and not the intrinsic ciliary muscles and lens, he soon after also discovered that these muscles could be made to release their abnormal tension by certain means of relaxation, thus permitting the eyeball to resume its normal shape and the muscles their elasticity and functions. The device hereinafter described supplies means for effecting this rectification of sight.

Broadly, the object of my invention is to provide an apparatus capable of moving a target carriage at will, in various directions. More particularly, my invention resides in the combination of a guide member, on which the carriage slides, with suitable parts which render it capable of movement in several planes and at various selected angles.

My invention will now be described with reference to the drawings forming a part hereof, in which:

Fig. 1 is a side elevational view of the machine with stereoscope attached;

Fig. 2 is a side elevational view, partly in section;

Fig. 3 is an enlarged vertical sectional detail view taken at right angles to Fig. 1;

Fig. 4 is an enlarged sectional detail view of the saddle, showing the bearings and parts mounted thereon;

Fig. 5 is an enlarged detail view of the target-arm-lock-stop with the parts spaced away vertically for clarity;

Fig. 6 shows the under side of main-pulley and half-circle index;

Fig. 7 is an enlarged sectional detail view of target-arm-stop;

Fig. 8 shows the different angles at which the target-arm may be set with cross-bar in vertical position;

Fig. 9 is an enlarged detail view of pulley-stop;

Fig. 10 shows the target-arm circling as a unit with main pulley;

Fig. 11 shows upper face of main-pulley and cable direction;

Fig. 12 is a detailed sectional side view of target-carriage assemblage;

Fig. 13 is a top view of the target-carriage with card-bar partially rotated;

Fig. 14 is a face view of target-carriage assemblage; and

Fig. 15 is a view in perspective of the gear housing.

In the above drawings the invention is shown as comprising a rigid three-point base **20**, collapsible for shipping, whose square, tubular, vertical member **21** receives and provides adjustment for, a second or adjusting tube **22** of similar length, with holes drilled through opposite sides at equidistant intervals **23** to receive locking pin **24**. This adjusting tube slip-fits into the lower end of the main-upright member **25**, being held in place by suitable screws **26**, hence is detachable for telescoping into the base to form one of the two units into which machine is reduced for shipment. The left side of main-upright **25** just above its point of connection with adjusting-tube **22**, is drilled and bushed to receive one end of crank-shaft **27**, the opposite side having an opening large enough to permit entry or withdrawal of pinion-gear **28** attached to shaft. A flanged and bushed member **29** (see Fig. 3) fitting into this opening and held in place by screws **30**, provides the second or main bearing for crank-shaft **27**. The latter extends beyond the exterior face of main-bearing in **29** and is drilled, split and threaded both inside and out, to receive expanding-screw **32**. The latter serves to attach the drilled and threaded crank **33** with handle **34**.

Fastened to the upper extremity of main-upright **25** on its right and left sides are two steel discs **35** (see Fig. 3) with centers drilled to receive a bolt-shaft **36**, the threaded end of which carries a knurled nut **37**. An inverted U-shaped member or saddle **38** whose parallel sides **39** are of a shape and distance apart for their inner surfaces to fit tightly against the two outer faces of discs **35**, also have their centers drilled so that the bolt-shaft **36** passing through them and the two discs besides forming a bearing on which saddle **38** may be turned from a vertical position on one side of main-upright through a circle to a similar position on the opposite side, serves as well to hold in place a hollow steel shaft **40**. The two ends of shaft **40** impinge against the opposite sides of main-upright **25** and act as a spacer against the pressure created when knurled nut **37** is tightened to provide the friction necessary to hold saddle **38** in any desired position. The exterior of spacer-tube **40** forms the bearing for the bronze tube **41** on one end of which main bevel gear **42** is pressed. Two short lengths of round bronze **43** whose O. D. form easy press-fit. with the interior walls of main-upright **25** have their centers drilled to act as bearings for shaft **44**. A pinion-gear **45** is mounted on said shaft and meshes with main bevel-gear **42**, and at its lower end a bevel-gear **46** is mounted to mesh with pinion-gear **28** on crankshaft **27**. Gears **45** and **46** are held in place and adjusted by set screws, as are collars **47**, so that the bearings, gears and shaft form a unit, that may be inserted or withdrawn from interior of main-upright **25** when bolt-shaft **36** and main bevel-gear assemblage have been removed, an operation requiring but a few seconds. A metal strip **48** provides a gear-housing (see Figs. 2, 3 and 15). It is slotted along its center **50** and this slot is enlarged at **49** to permit passage of pinion gear **42**. The strip fits around the perimeter of discs **35** and its two ends are attached to the face and back of main-upright **25** by screws **51**.

Attached to top of saddle **38** by four screws **52** and paralleling its two sides **39** is a square hollow cross-bar **53**, to the front end of which may be attached a suitably adapted stereoscope **54** (see Fig. 1). Both cross-bar **53** and saddle **38** are drilled at mid-length to receive a bronze bushing **55** which extends slightly beyond the walls of the hole at either end to act as spacers and thrust bearings. Paralleling the cross-bar **53** and slightly above is a solid square target-arm **56** (see Fig. 4) which is thicker near its middle. Its ends are turned upward to form right-angle bends **57**. The end of arm **56** nearest the operator (see Fig. 5) has a hole **58** drilled in the face of the bend for reception of sliding-lock-stop **59** situated directly beneath on cross-bar **53**. When locked, it holds arm **56** rigidly in place to protect the bearing against strain or stress.

A 24 inch scale **60**, preferably with black figures on white background, is fastened to the right side of target-arm **56**. Said arm **56** is drilled at mid-length to receive a press-fit hollow bronze shaft **61**. A semi-circular indexing band **62** has its two ends fastened to target-arm **56** on either side of center **62** and it has four holes **63**, each of which may in turn be made to register with a spring-actuated stop **64** (see Figs. 4, 6 and 7) situated directly beneath in cross-bar **53**. Thus, when the cross bar **53** is in vertical position Fig. 8, the target-arm **56** may be held selectively in vertical **56**—*a*, in transverse **56**—*b*, or in either of two oblique positions **56**—*c*, **56**—*d*.

This same positioning is possible, even with the omission of the band **62** and stop **64**, by having the patient sit facing the machine as shown in Fig. 1 and then placing the target on the carriage **90** which can be rotated 90° to where it holds the target facing the patient. Then to get any desired angularity of traverse the arms **53** and **60** are tilted as a unit about the pivot **36**.

Passing up through target-arm-bearing (see Fig. 4) is a shaft **70**. This has a collar **71** near its lower end which contacts the lower end of bushing **55** through cross-bar and saddle. Below collar **71** is attached the regulating pinion-gear **72** which meshes with main bevel-gear **42**. The upper end of shaft **70** screws into the center of main-pulley **73** and is held in place by lock-nut **73**—*a*. The perimeter of pulley **73** has a helical groove **74** instead of the usual connected V groove. On its under side are provided a series of equidistant indexing holes **75** for reception of a stop **76** mounted in target arm **56**. When the target is in a chosen position the stop **76** is entered into nearest hole **75**, then the arm **56** and pulley **73** revolve as a unit in circles (Fig. 10, **56**—*e*) provided both stops **59** and **64** in cross-bar **53** have been disengaged to liberate arm **56** for the purpose. Due to the friction of the drive and the friction of the carriage **83** on rod **78** it is possible to obtain this circular motion without engaging

the stop **76**. A square target-rod **78** (see Fig. 2) is fastened to the upturned ends **57** of target-arm **56**, thus paralleling the latter throughout its length. The upturned ends **57** are slotted to accommodate small idler-pulleys **79**. Thus, cable **80**, after passing around main-pulley **73**, and through eyelets **81** set in arm **56**, will pass just above and parallel with arm **56** to, and under idler-pulleys **79**, around and over top of same to connect with each end of target-carriage base at **82**.

The target-carriage base **83** is formed of a section of square tubing of a size to slide freely upon target-rod **78**. Its upper face is reinforced at **84** to allow for counter-boring from under side to depth necessary for recessing screw-head **85**, which serves to secure rotatably to base **83** a section of round metal or pedestal **86**. A short distance above its base (see Fig. 14), pedestal **86** is drilled at right-angles to its sides for reception of a short tube **88**, which in turn houses a snug fitting bar **89**, the ends of which as they emerge from tube **88** are flattened and drilled to receive and have soldered in place, bronze spring-wire target-grips **90** which may thus be tilted to any plane while carriage is rotated on pedestal to any desired angle. The bottom of carriage base **83** is slit in from its ends and the metal between cuts turned down at right-angles to bottom **91** and drilled to receive the cable-ends **80**.

From the foregoing description, the operation of my device will be readily understood. Assuming (*a*), that the type of exercise desired is one in which the target is advanced on a horizontal plane to and from the eyes, the device will be substantially in the position shown in Fig. 1. In this position, with lock-stop **59** and target-arm-stop **64** engaged, turning crank **34** will actuate pinion-gear **27**, bevel-gear **46** (in ratio of two to one), shaft **44**, pinion-gear **45**, main bevel-gear **42**, pulley pinion-gear **72** and main-pulley **73** causing cable **80** around periphery of pulley after passing through eyelet and around idler-pulley, to move target-carriage **83** (Fig. 14) on its rod **78**, in the direction crank is being turned either to or from eyes (with or without stereoscope attached).

Assuming (*b*) that it is desired to have target travel on a vertical plane, cross-arm **53** will be turned to a vertical position in either of the ways suggested above (Fig. 8, **53**—*a*) and target similarly adjusted, whereupon, movement of crank **34** will be transmitted to target carriage **83** in the identical manner described in (*a*), now causing target to travel in a vertical instead of horizontal plane.

Assuming (*c*) that it is desired to have target travel in a transverse or in either of the oblique directions shown in Fig. 8, lock-stop **59** (Fig. 5) will be disengaged and with target-arm-stop **64** withdrawn, target-arm will be turned to either **56**—*b*, —*c*, or —*d* positions and stop **64** re-engaged. The target-pedestal **86** is then adjusted to a horizontal positions, whereupon movement of crank will again be transmitted as in (*a*) and (*b*), causing target to pursue whichever of the three courses arm **56** has been set for. This may also be accomplished without the use of stop **64** by having the patient face the machine as in Fig. 1 and incline the arm **53** around pivot **36** to the desired angle. Then the target is suitably held in carriage **86**. The latter is moved by operation of crank **34**.

Assuming, finally, (*d*) that it is desired to have target set in circular motion as shown in Fig. 10, **56**—*e*, target will be moved to the position on its rod **78** corresponding with circumference of circle desired, pulley-stop **76** is entered into nearest hole **75**, target-pedestal is set at right-angle to target-rod and target-arm-stop **64** is disengaged, whereupon movement of crank **34** will be transmitted to main pulley **73** as in (*a*) and will cause main pulley and target arm to revolve as a unit in whichever direction desired.

In all movements save the last-above enumerated, the position of target in relation to its distance from the eye or eyes, as in (*a*) or, when crossing the field of vision in various planes as in (*b*) and (*c*), is shown by scale in inches fastened to target-arm Fig. 5, **60**. It follows, therefore, that in (*a*) with stereoscope attached, the point of convergence, its extent and fluctuations, may be definitely established and results of treatment ascertained. In (*a*) with stereoscope detached, the visual acuity of either eye or the two in conjunction may be measured, the location and extent of blurring in myopia and hyperopia determined, and the location and extent of astigmatic periods definitely defined and followed through all their vagaries. The various movements described under (*b*), (*c*) and (*d*) are principally used for inducing muscular-coordination following exercise for some specific imbalance.

While I have described and illustrated a preferred form of my invention to comply with the statute, I do not thereby intend to give up any other form in which it may be embodied, provided such modification contains the essence of my invention as set forth in the attached claims.

For example, where I have shown a gear drive in the base to the pulley **72**, a cable drive or a Bowden wire may be substituted, while still retaining my invention. Likewise, a worn drive along arm **56** may be substituted. Others may vary the structure by omitting certain of its functions, such as being able to tilt bar **53** to a vertical position and still retain my invention. The permissible variations are many, which still retain my invention.

What I claim is:

1. In an eye exercising machine, the combination of a supporting means, a crankshaft mounted therein, a shaft extending vertically in said supporting means with bevel gears on each end, a bevel gear on said crankshaft engaging one of said gears, an arm pivotally secured to said supporting means, a shaft extending transversely through said arm and having a bevel gear on one end, a bevel gear mounted concentric with the pivot of said arm and supporting means and in engagement with said last-named bevel gear and with the other bevel gear on the shaft in said supporting means, a second arm adjacent said first named arm and pivoted for movement in a plane parallel therewith, a target carrying means movable along said second arm, a drive pulley adjacent said arm and secured to the shaft extending through the first named arm, idler pulleys mounted along the second arm, a cable passing around said drive pulley over said idler pulleys and connected to opposite ends of said target means, locking means for securing said arms together in several angularly spaced positions, and a second locking means for securing said second arm to said drive pulley when said first named locking means is disengaged.

2. In an eye exercising machine, the combination of a support, an operating lever mounted in said support, an arm pivoted to said support, a second arm mounted for movement in a plane parallel with and adjacent to the first arm, a target carrying means supported for movement over said second arm, a drive means connecting said operating lever and said target means whereby the latter may be made to move over said arm, and a lock means between said drive and said second arm, which, if engaged, will transmit the movement of said operating lever to cause said arm to rotate and said target means will remain stationary over said arm.

3. In an eye exercising machine, the combination of a support, an operating lever mounted in said support, an arm pivoted to said support, a second arm mounted for movement in a plane parallel with and adjacent to the first arm, a target carrying means supported for movement over said second arm, a drive means connecting said operating lever and said target means whereby the latter may be made to move over said arm, a locking device for securing together said first and second arms when it is desired that said target means move over its arm, and a lock means between said drive and said second arm, which, if engaged, will transmit the movement of said operating lever to cause said arm to rotate and said target means will remain stationary over said arm.

4. In an eye exercising machine, the combination of a base, an arm pivoted thereon for adjustment either side of a horizontal position, a second arm pivoted to said first named arm and adapted to rotate about said pivot in a plane parallel with the latter arm, locking means for uniting said arms for simultaneous movement, a target carrying means movable in a straight path, along said second arm when it is locked to said first arm, and movable in a circular path with said second arm when said locking means is disengaged, a drive therefor, mounted in said base, and transmission means in the pivot of said first named arm and base for communicating said drive to said target means.

5. In an eye exercising machine, the combination of a base, an arm pivoted thereon for adjustment either side of a horizontal position, a second arm pivoted to said first named arm and adapted to rotate about said pivot in a plane parallel with the latter arm, locking means for uniting said arms for simultaneous movement, a target carrying means movable in a straight path along said second arm when it is locked to said first arm, and movable in a circular path with said second arm when said locking means is disengaged, a drive therefor, mounted in said base, transmission means in the pivot of said first named arm and base for communicating said drive to said target means, comprising a pulley mounted adjacent said second arm and connected to said transmission means, and a cable drive to said target.

6. In an eye exercising machine, the combination of a base, an arm pivoted thereon for adjustment either side of a horizontal position, a second arm pivoted to said first named arm and adapted to rotate about said pivot in a plane parallel with the latter arm, locking means for uniting said arms for simultaneous movement, a target carrying means movable in a straight path along said second arm when it is locked to said first arm, and movable in a circular path with said second arm when said locking means is disengaged, a drive therefor, mounted in said base, transmission means in the pivot of said first named arm and base for communicating said drive to said target means, comprising a pulley mounted adjacent said second arm and connected to said transmission means, a cable drive to said target, means for locking said pulley to said second arm whereby they may be rotated in unison, when the locking means between said two arms is released.

7. In an eye exercising machine, the combination of a supporting means, a crankshaft mounted therein, a shaft extending vertically in said supporting means with bevel gears on each end, a bevel gear on said crankshaft engaging one of said gears, an arm pivotally secured to said supporting means, a shaft extending transversely through said arm and having a bevel gear on one end, a bevel gear mounted concentric with the pivot of said arm and supporting means and in engagement with said last-named bevel gear and with the other bevel gear on the shaft in said supporting means, a second arm adjacent said first-named arm and pivoted for movement in a plane parallel therewith, a target carrying means movable along said second arm, a drive pulley adjacent said arm and secured to the shaft extending through the first named arm, idler pulleys mounted along the second arm, a cable passing around said drive pulley over said idler pulleys and connected to opposite ends of said target means, locking means for securing said arms together, and a second locking means for securing said second arm to said drive pulley when said first named locking means is disengaged.

8. In an eye exercising machine, the combination of a supporting means, a crankshaft mounted therein, a shaft extending vertically in said supporting means with bevel gears on each end, a bevel gear on said crankshaft engaging one of said gears, an arm pivotally secured to said supporting means, a shaft extending transversely through said arm and having a bevel gear on one end, a bevel gear mounted concentric with the pivot of said arm and supporting means and in engagement with said last-named bevel gear and with the other bevel gear on the shaft in said supporting means, a second arm adjacent said first named arm and pivoted for movement in a plane parallel therewith, a target carrying means movable along said second arm, a graduated scale on said arm lying adjacent and parallel with the path traversed by said target carrying means, a drive pulley adjacent said arm and secured to the shaft extending through the first named arm, idler pulleys mounted along the second arm, a cable passing around said drive pulley over said idler pulleys and connected to opposite ends of said target means, locking means for securing said arms together, and a second locking means for securing said second arm to said drive pulley when said first named locking means is disengaged.

9. In an eye exercising machine, the combination of a support, an operating lever mounted in said support, an arm pivoted to said support, a second arm mounted for movement in a plane parallel with and adjacent to the first arm, a target carrying means supported for movement over said second arm, a drive means connecting said operating lever and said target means whereby the latter may be made to move over said arm, a graduated scale on said arm lying adjacent and parallel with the path traversed

by said target carrying means, and a lock means between said drive and said second arm, which, if engaged, will transmit the movement of said operating lever to cause said arm to rotate and said target means will remain stationary over said arm.

10. In an eye exercising machine, the combination of a base, an arm pivoted thereto, a clamping member by which said arm is fixedly held in position on said base at horizontal, or at any angle at either side of horizontal that may be desired, a secondary arm pivotally mounted to said first mentioned arm, a target carrying track mounted on said secondary arm, a target carrying means mounted on said track for slidable movement on said track, a pulley rotatably mounted on a shaft, said shaft being the pivotal means by which said first and second arms are pivotally mounted one on the other, a crank, a transmission means transmitting the power applied to said crank to rotate said pulley, a belt co-acting with said pulley, said belt being attached to said target carrying means and providing the means by which said target carrying means is propelled on its track.

11. In an eye exercising machine, of the character described, the combination of a support, an arm mounted at one end of said support, said mountings including a clamp member by which said arm may be rigidly clamped to said support at any of the many angles desired, a frame comprising two parallel strips, spaced apart and fixedly attached to each other by means of connecting strips riveted to the two strips at the ends thereof, said frame being pivotally attached to said arm by a pin upon which said frame can rotate, a sheave, or pulley, pivotally mounted upon said frame and pivotally mounted to said arm by said mentioned pin, grooves in said sheave for engaging a belt, or cable, said cable being attached to the target carrying means, means for actuating the said pulley or sheave causing same to rotate and in turn to drive the belt in one direction, thus carrying the target carrying means along its track, and which target means may be returned by reversing the rotation of said sheave, means provided by an arrangement of gears, pinions, and shafts to transmit the power for rotating the pulley or sheave, said transmission means being so arranged as to rotate the sheave in either direction and in any position the said arm may be fixed with relation to the support.

12. In an eye exercising machine, the combination of a support, a tubular column mounted on said support, a crank mounted on said tubular column, a shaft and bevelled pinion actuated by said crank, a shaft with bevelled pinion at one end co-acting with said bevelled pinion on said crank actuated shaft, a bevelled pinion on the other end of said shaft, said pinion co-acting with a bevelled gear mounted on a tubular shaft, a pinion co-acting with said bevelled gear and so mounted as to extend in opposite direction from the other said bevelled pinion co-acting with said gear, a shaft connected to said pinion and driven by said pinion, said shaft having mounted thereon a master pulley or sheave, a belt co-acting therewith, said belt being attached to a target carrying means, said target carrying means being mounted on a suitable track to permit its sliding along said track by the force conveyed by the said belt, said track member being pivotally mounted to an arm pivotally mounted on said tubular column by means of a clamping member attached to said arm, means for locking said track member and said arm together, said clamp pinned to said column by means of a bolt extending through holes in the clamp and corresponding holes in the column, said bolt being threaded to receive a nut, a tubular spacer sleeve mounted on said bolt, said tubular shaft mounted on said tubular spacer, the clamping members actuated by tightening or loosening of said nut, thereby enabling change of angularity of said arm to horizontal or to any position either side of horizontal desired, and held rigidly to such position.

13. In combination, an eye exercising machine of the character described, a tubular support, a bearing in said support, a shaft mounted horizontally in said bearing, a bevelled pinion attached to said horizontal shaft, means for rotating said shaft, a bevelled pinion mounted on a vertical shaft and co-acting with said pinion on said horizontal shaft, said vertical shaft being mounted in bearings within said tubular support, a beveled pinion mounted on upper end of said vertical shaft and co-acting with a bevelled gear mounted on a tubular shaft and keyed thereto, said tubular shaft being rotatably mounted on a tubular spacer sleeve or bearing, a yoke or saddle provided with a bearing surface and two downwardly projecting wings, a hole through each of said wings to receive a bearing pin, said bearing pin consisting of the said tubular gear shaft, and said tubular spacer sleeve, and a retaining bolt having a head on one end, and a thread on the other end, a nut to co-act with said thread, said bolt being the means of assembling the said bevelled gear, and its tubular shaft and its spacer sleeve between said wings of said yoke, and bolting them to said tubular support, performing the dual purpose of providing a bearing for said bevelled gear, and an adjustable clamping means by which said yoke may be fixed at horizontal or to various angles either side of horizontal, and mounted on said yoke a target carrying member, a track for said member, and means actuated by said pinions, shafts and gears for propelling the said target carrying member on its track.

14. In an eye exercising machine, the combination of a support, an operating lever mounted in said support, a cross-arm secured to said support, a target arm mounted above substantially parallel to said cross-arm, a shaft extending through said arms, whereby one may be rotated end over end about a single point in a plane parallel to the other, a target carrying means movable along said target arm, a drive means combined with said shaft for moving said target along said target arm by said operating lever.

15. In an eye exercising machine, the combination of a support, an operating lever mounted in said support, a cross-arm secured to said support, a target arm mounted above substantially parallel to said cross-arm, a shaft extending through said arms, whereby one may be rotated end over end about a single point in a plane parallel to the other, a target carrying means movable along said target arm, a graduated scale arranged adjacent the path of said target carrying means, a drive means combined with said shaft for moving said target along said target arm by said operating lever.

16. In an eye exercising machine, the combination of a base, a support mounted in said base, an operating lever mounted in said support, a cross-bar pivoted to said support, a target arm mounted for movement in a plane parallel with and adjacent to the said cross-bar, a target carry-

ing means supported for movement on said target arm, a drive means connecting said operating lever and said target means whereby the latter may be made to move over said target arm, said pivoted cross bar means comprising a clamp mounted to said support by a bolt connecting same to the support in such a way as to permit the clamp to rotate on the said bolt, said clamp forming a saddle on which is mounted the said cross-bar and said target arm, a transmission means, said transmission means consisting of a vertical shaft, an upwardly projecting bevel-pinion at the upper end of said shaft, said pinion coacting with and driving a bevel master gear, said master gear mounted for rotation on the said bolt for said clamp, a bevel-pinion driven by said master bevel-gear and mounted on a vertical shaft, which shaft is mounted in the upper face of said clamp or saddle, a sheave or pulley mounted on upper end of said shaft, and rotated by said shaft, a locking device for securing together said cross-bar and said target-arm when it is desired that said target means move over its arm, and a lock means between said drive means and said target arm, which, if engaged, will transmit the movement of said lever to cause said target arm to rotate and said target means will remain stationary over said target arm.

17. In an eye exercising machine, the combination of a base, a vertical support mounted in said base, means for adjusting the length of said support, an operating lever mounted in said support, a flanged saddle member comprising a clamp, pivotally mounted to said support by means of a bolt, said bolt extending through holes in the flanges of said saddle or clamp and corresponding holes in the said support, said bolt being provided with a thread and a nut by which the clamp may be rigidly locked, or may be loosened to permit of readjustment of said saddle to different angles with relation to the said support, said saddle supporting a cross-bar, a target arm mounted to said cross-bar, a target member mounted on said target arm, a track for said target member, said track being mounted to said target arm, a power transmitting means, said transmission means including a master bevel gear rotatably mounted on said adjustable bolt upon which said saddle is mounted, said master bevel gear being driven by a bevel pinion and shaft, said bevel master gear in turn driving a bevel pinion and shaft mounted in said saddle and said cross-bar, and rotating a sheave or pulley attached to last mentioned shaft, and by which arrangement of bevel pinions, bevel gear, and shafts, the power applied to said lever is transmitted to actuate or rotate the target arm, and said pulley or sheave at any angle with reference to the said support that said cross-bar, target arm, and said pulley may be set and locked by said pivotally mounted clamp or saddle.

18. In an eye exercising machine, the combination of a base, a support mounted in said base, a cross-bar pivoted to said support for adjustment to horizontal position or to either side of a horizontal position, a target arm pivotally mounted above said cross-bar, locking means for connecting said cross-bar with said target arm, a target carrying means movable along said target arm, a drive therefor consisting of a movable cable actuated by a rotating sheave or pulley, said sheave or pulley being mounted on a shaft, said shaft mounted within holes in said cross-bar and said target arm, said shaft and pulley being actuated by a bevel pinion mounted on said shaft, said bevel pinion driven by a bevel gear rotatably mounted on an adjustable pin or bolt, a flanged clamp forming a saddle for said cross-bar, said clamp being pivotally mounted to said support by the said adjustable bolt extending through corresponding holes in the said clamp and the said support, said bolt having threads and a nut to enable tightening or loosening of said clamp, a shaft and bevel pinion co-acting with said master bevel gear for transmitting the power applied to a lever or crank, by which arrangement of gears, pinions, and shafts, said power is transmitted to actuate said target arm, and said pulley at any angle to which the said cross-bar may be adjusted and locked by said clamp.

19. In an eye exercising machine, the combination of a supporting means, a flanged clamp member attached to said support by an adjustable bolt extending through holes in the flanges of said clamp and through said support, said bolt being provided with a thread and a nut for tightening or loosening said clamp, said clamp forming a saddle on which is mounted a cross-bar, a target arm mounted above said cross-bar, a sheave or pulley keyed to a vertical shaft, said shaft extending through holes in said target arm and said cross-bar, thus providing a pivotal mounting for said target arm and said cross-bar; and through a hole in upper face of said clamp or saddle; a master bevel gear rotatably mounted on said adjustable bolt, said gear co-acting with and driving a bevel pinion on said pulley shaft, a bevel pinion co-acting with said master bevel gear, suitable shaft and bearings and bevel gears for transmitting power applied to a lever mounted in said support and by which arrangement of shafts, pinions, and gear, power is transmitted to rotate said target arm, and pulley at any angle with reference to the said support that the cross-bar, target arm, and pulley may be set and locked by the clamping device, a target mounted on said target arm, means for transmitting power by rotation of said pulley to cause said target to move to and fro on said target arm.

20. In an eye exercising device, the combination of a base, a support mounted in said base, a flanged clamp member pivotally mounted to the upper end of said support, said mounting consisting of an adjustable bolt extending through holes in the flanges of said clamp and through holes in the upper end of the said support, said bolt being provided with a thread and a nut by which said flanges of said clamp may be tightened or loosened on said support, said clamp forming a saddle on which is fixedly mounted a cross-bar, a target arm mounted above and adjacent to said cross-bar, a shaft, a pulley attached to said shaft, said shaft projecting through a cylindrical bearing in said target arm to serve as a mounting for said target arm, a bearing to permit of rotation of said target arm on said shaft, said shaft extending through a cylindrical bearing in said cross-bar, and projecting through a hole in the upper face of said saddle or clamp, a bevel pinion mounted on lower end of said shaft, a master bevel gear rotatably mounted on the said adjustable bolt, said master bevel gear in engagement with and driving the last said bevel pinion, said master bevel gear being driven by a bevel pinion in engagement therewith, said bevel pinion being mounted on a shaft, said shaft mounted in suitable bearings in the said support, said shaft being driven by bevel gears and by which arrange-

ment of gears and shafts and master gear power applied to a lever or crank mounted on said support is transmitted to drive said pulley, said pulley by means of a cable and idler pulleys to move said target, or to rotate said target arm on its bearing, and by the adjustable means of said pivoted connection between the said cross-bar and the said support, the said target arm, the said pulley shaft, and said pulley may be actuated at various angles with relation to the said support.

21. An eye exercising machine, the combination of a support, an operating lever mounted on said support, a vertical pulley shaft, a pulley attached to the upper end of said vertical pulley shaft, a target arm rotatably mounted on said pulley shaft, a cross-bar, said pulley shaft projecting through said cross-bar, an adjustable pivot clamp member, said cross-bar being mounted on a bearing on the upper face of said pivot clamp member, said clamp member being attached to the upper end of said support by an adjustable bolt projecting through holes in flanges of said clamp member and through corresponding holes in said support, said clamp being rotatably mounted on said bolt for adjustment of said cross-bar, said target arm, said pulley shaft and said pulley, at various angles relative to said support, a bevel pinion mounted on lower end of said pulley shaft, a master bevel gear loosely mounted on said adjustable bolt, said master gear engaging said bevel pinion on lower end of said pulley shaft to drive said pulley shaft, means for transmitting power from said lever through said bevel gear and said pinion by which the said target arm and said pulley are actuated and whereby said pulley by means of a cable co-acting therewith moves a target to and fro on said target arm.

22. In an eye exercising machine the combination of a support, means for varying the length of said support, a crank mounted on said support, a flanged clamp pivotally mounted on said support, said mounting comprising an adjustable bolt projecting through holes in the flanges of said clamp and through corresponding holes in said support, said bolt being provided with a thread and a nut by which said clamp may be tightened or loosened on said support, a cross-bar mounted on the said flanged clamp and attached thereto, a target arm mounted immediately above said cross-bar, a pulley, a shaft for said pulley, said pulley mounted on the upper end of said pulley shaft, said pulley shaft projecting downwardly through holes in said target arm and said cross-bar and in said adjustable clamp, a bevel pinion on the lower end of said pulley shaft, said bevel pinion and pulley shaft and pulley being rotated by a master bevel gear mounted on said adjustable bolt and co-acting with said bevel pinion, said master bevel gear being actuated by power transmitted from said crank, and by which means said target arm may be caused to rotate on a common center with said pulley shaft and the said pulley to drive a cable or belt to move a target to and fro on said target arm, and by adjustment of said adjustable clamp said operations may be obtained in various angles of adjustment.

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