

July 23, 1935.

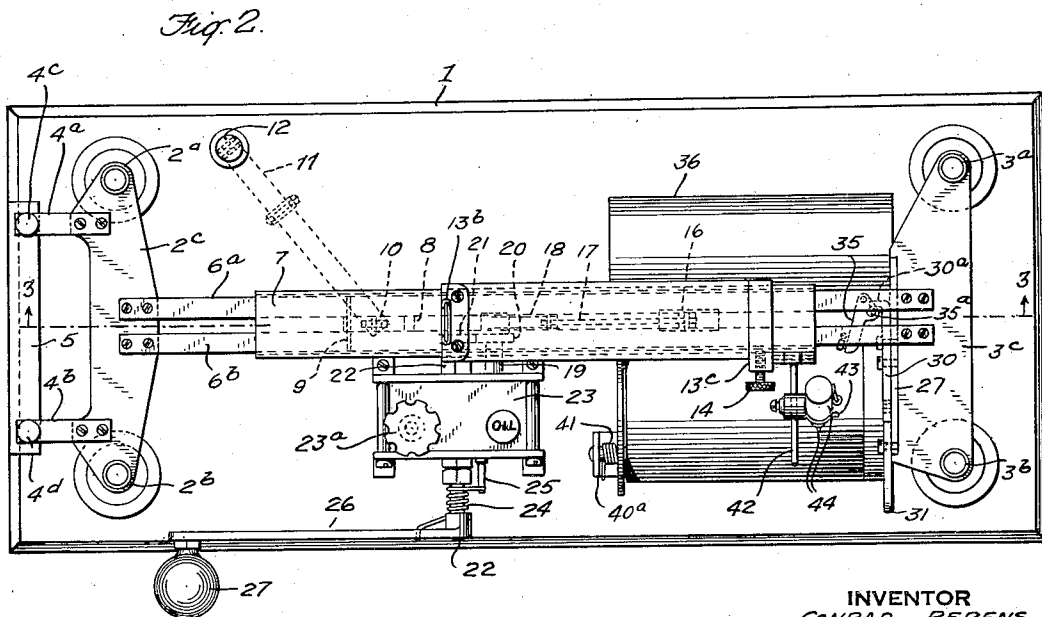
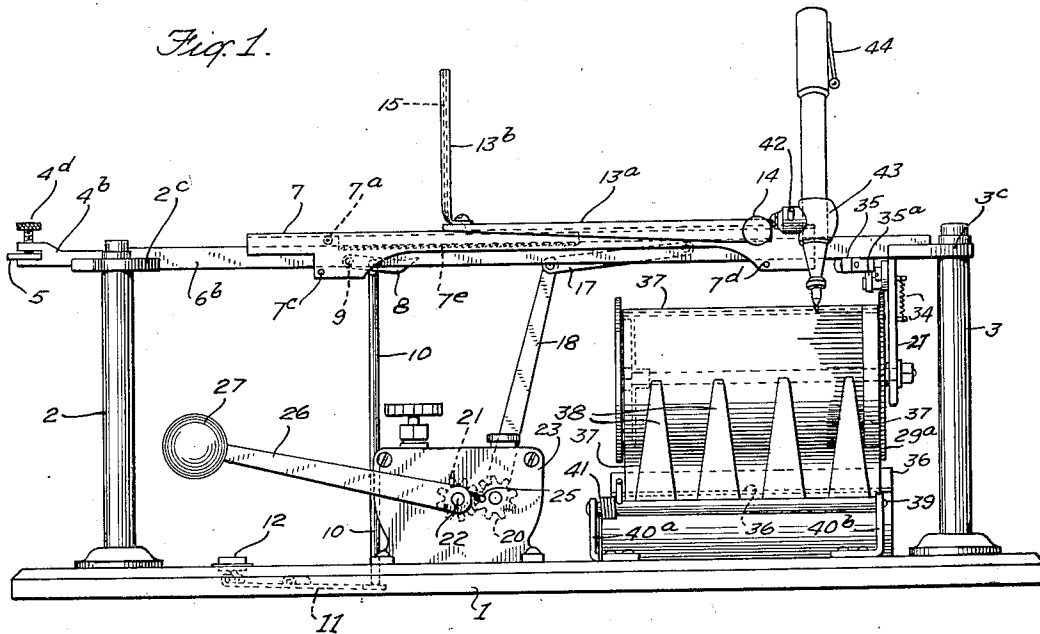
C. BERENS

2,009,158

OPHTHALMIC ERGOGRAPH

Filed Aug. 1, 1934

2 Sheets-Sheet 1



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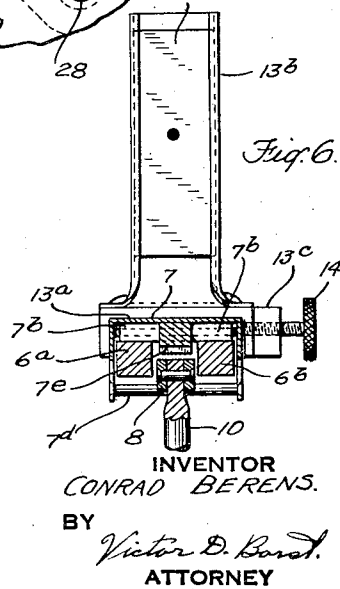
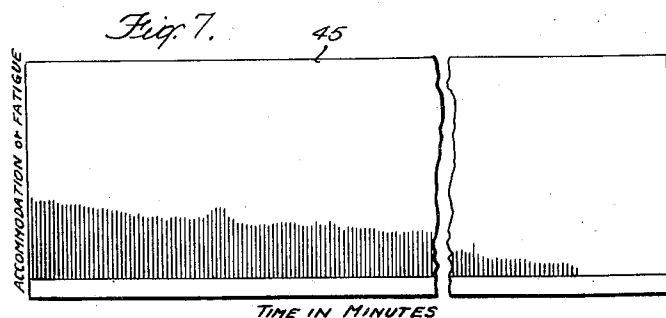
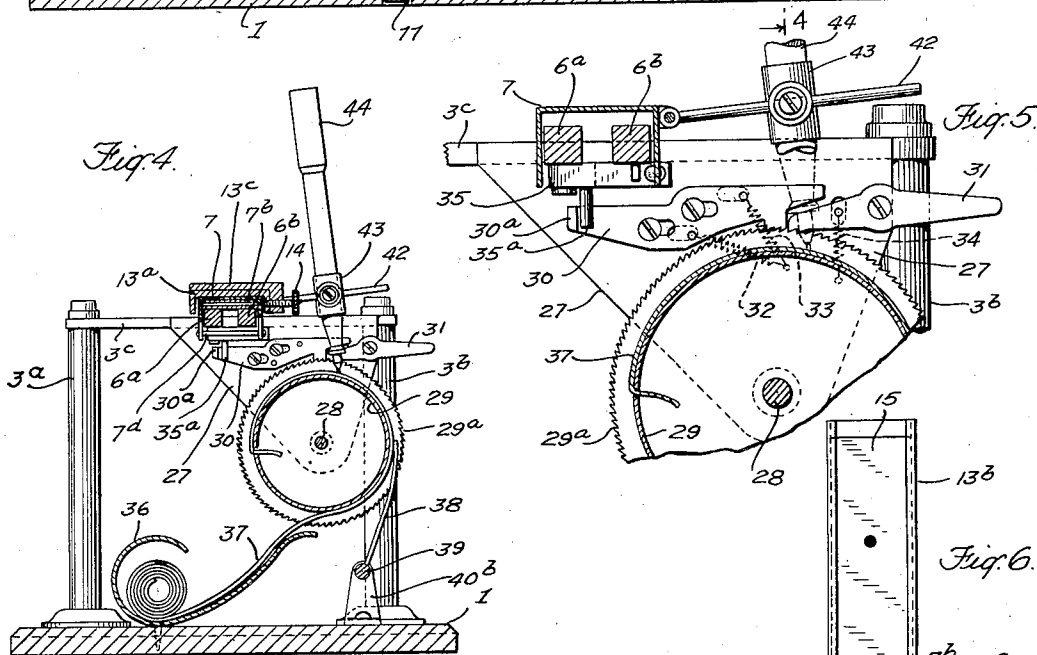
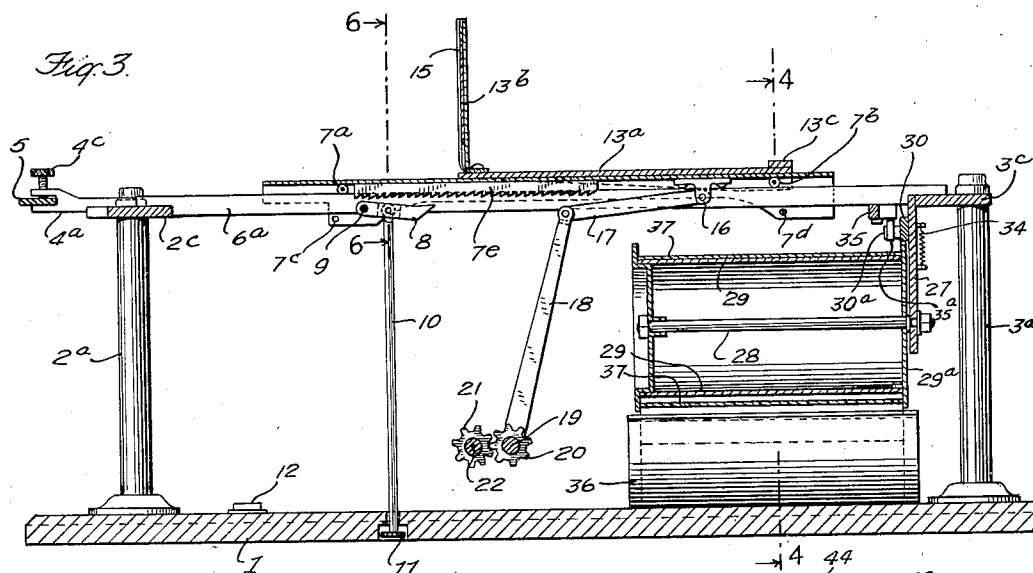
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UNITED STATES PATENT OFFICE

2,009,158

OPHTHALMIC ERGOGRAPH

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Application August 1, 1934, Serial No. 737,915

12 Claims. (Cl. 88—20)

Recent studies in ocular fatigue have demon-
strated the diagnostic value of a knowledge of
the fatigue of accommodation and convergence.
In addition, experiments have shown that in
many instances fatigue of accommodation and
convergence may to a certain extent be corrected
by exercising the eyes of a patient suffering from
insufficiency of accommodation and convergence.
Because of the fact that these studies require an
ergograph and the fact that the ergographs heretofore
found suitable are relatively expensive, the result
of the studies and experiments in ocular fatigue
have not been available for general use, and it is
the object of the invention herein disclosed to provide
an ophthalmic ergograph which is reliable and comparatively
inexpensive.

The ophthalmic ergograph of this invention includes
a movably mounted, test-object carrier, means for
moving the test-object carrier in one direction, a
check mechanism for controlling the speed of movement
of the test-object carrier in response to the moving
means, manually operative means for stopping and
reversing the movement of the test-object carrier,
and a kymograph for recording the movements of the
test-object carrier. In one embodiment of the invention,
a carriage is slidably mounted upon a bar which
extends between, and which is supported by two
spaced standards extending from a base. On one of
the standards, there is a holder for a tongue
depressor which a patient bites in order to fix his
head. A test-object carrier is mounted on the carriage
and positioned to display a test object to the patient.
The test-object carrier is adjustable on the carriage.
The carriage is moved towards the patient by a spring
and the speed of movement is controlled by a fluid
check mechanism. The movement of the carriage is
arrested and reversed by a manually operative lever
conveniently located for operation by the patient.
The kymograph includes a drum rotatably supported
by the standard distant from the patient. A ratchet
carried by the drum is engaged by a pawl which is
actuated upon returning the carriage against the
action of the spring. The carriage carries a
stylograph pen holder from which a stylograph pen
extends into contact with a web of paper around the
drum. Thus, the extent of successive movements of
the carriage are recorded.

Such an ophthalmic ergograph is illustrated in
the accompanying drawings, in which:

Fig. 1 is a side elevation of the ergograph;

Fig. 2 is a plan of the same;

Fig. 3 is a sectional elevation taken along the
line 3—3 of Fig. 2;

Fig. 4 is a transverse, sectional elevation taken
along the line 4—4 of Fig. 3;

Fig. 5 is an enlarged fragmentary, transverse,
sectional elevation similar to Fig. 4;

Fig. 6 is an end, sectional elevation taken along
the line 6—6 of Fig. 3; and

Fig. 7 is a plan of a record made by the ergo-
graph.

The ergograph illustrated includes a base 1
upon which the mechanism is mounted. All of the
parts are preferably made of metal, the base being
a solid piece of metal in order to provide sufficient
stability without the necessity of securing the
ergograph to a fixed support. Two standards, 2 and
3, spaced apart extend perpendicularly from the base.
Each standard includes a pair of spaced columns *a* and
b and a cross rail *c* parallel to the base and extending
between, secured to and supported by the columns.
A pair of arms 4*a* and 4*b* constituting a tongue
depressor holder extend from the cross rail 2*c* in a
direction towards the end edge of the base adjacent
the standard 2. The arms 4*a* and 4*b* are spaced apart
and each arm has one end secured to the cross rail
2*c* and the opposite or free end bifurcated. A tongue
depressor 5 is received in the bifurcated ends of the
arms and it is secured therein by thumb screws, 4*c*
and 4*d* threaded into the arms 4*a* and 4*b* respectively.
The tongue depressor so secured provides a bite
fixation, that is, the patient bites the tongue
depressor and thus fixes his head in the proper
position.

A pair of parallel bars 6*a* and 6*b* extend
between and are supported on the cross rails 2*c*
and 3*c*. These bars are spaced apart so that a
narrow slot is formed between the bars, and at
each end, each bar overlaps the cross rail to
which the end of each bar is secured by machine
screws. The bars 6*a* and 6*b* support a carriage 7
which is slidably mounted on the bars. The carriage
7 is channel shaped and embraces the bars, the
flanges extending downwardly along the sides of
the bars. Transverse rollers 7*a* and 7*b*, one at
each end of the carriage, are mounted on pins
extending between the flanges adjacent the web.
These rollers rest upon the bars 6*a* and 6*b* and
provide a rolling support for the carriage. At each
end of the carriage, the flanges thereof extend
below the lower edges of the bars and pins 7*c* and
7*d* extending between the flanges secure the carriage
on the bars. Mounted longitudinally of the web of
the carriage and secured thereto, a ratchet 7*e* is
received between the bars 6*a* and 6*b*. A pawl 8
is pivotally mounted on a pin 9 extending be-

tween the bars 6a and 6b and it is positioned to engage the teeth of the ratchet. The pawl is moved about its pivotal connection through a vertical rod 10 slidably mounted in the base at one end and pivotally connected to the pawl at the other end. A lever 11, pivotally mounted between its ends in a slot formed in the base has one end engaging the rod 10 and the other pivotally connected to a button 12 mounted in the base. When the button is pressed, the rod 10 is actuated through the lever 12 and brings the pawl into engagement with the ratchet which prevents further movement of the carriage towards the standard 2.

On the carriage, there is mounted a test-object carrier. The test-object carrier consists of a channel shaped base 13a embracing the carriage and an upright 13b extending vertically from the end nearer the standard 2. The base is provided with a strip 13c having a downwardly extending flange into which a thumb screw 14 is threaded. The base is slidable on the carriage and may be fixed in any position on the carriage by the thumb screw 14. The upright 13b is a sheet metal card holder having one end extending at right angles and secured to the base 13b and the side edges folded over to embrace the edges of a card such as the card 15 having a dot of a particular size thereon.

The carriage is moved towards the standard 2 by a spring and the speed of movement is controlled by a fluid check mechanism. At any point in its movement towards the standard, the movement of the carriage may be arrested and returned against the action of the spring. For the purpose of so operating the carriage, a bracket 16 is secured to the web of the carriage and extends downwardly between the bars 6a and 6b. To the bracket, there is pivotally secured one end of a lever 17, the other end of which is pivotally secured to one end of an arm 18 mounted on a shaft 19 extending from, and journaled in the side of the casing of a fluid check mechanism. The shaft 19 has a gear 20 mounted thereon which meshes with a gear 21 mounted on the shaft 22 of the check mechanism 23. The check mechanism may be of any of the well known types but it is preferably an oil type and may be of the radial vane type having a check valve through the vane and an oil passage from one side of the chamber to the other. A valve, such as the valve 23a is used in the oil passage for controlling the flow of oil and thus the speed of movement of the vane. The shaft 23 extends through the check mechanism and there is a spring 24 wound about the shaft. One end of the spring is secured to a pin 25 extending from the side of the case of the check mechanism and the other end is curled around a lever 26 mounted on the shaft 22. The lever 26 is provided with a handle 27 for the manual operation thereof. It will be apparent that when the lever 26 is moved towards the base, in a counter-clockwise direction as illustrated in Fig. 1, the carriage 7 is moved towards the standard 3. At the same time the spring 24 is wound so that when the lever is released, the spring actuates the lever in a clockwise direction and the carriage is moved towards the standard 2, the speed of movement being controlled by the check mechanism.

Movement of the carriage is recorded by a kymograph which is provided for that purpose. A plate 27 is secured to and extends downwardly from the cross rail 3c. Extending through the plate 27 and perpendicular thereto, there is a

shaft 28 on which a drum 29 is rotatably mounted. On the end of the drum adjacent the plate there is a circular ratchet 29a. A pawl 30 is slidably mounted on the plate 27 and positioned to engage the ratchet. Movement of the pawl 30 to the left as seen in Fig. 5 causes the drum to rotate counter-clockwise. A pivotally mounted stop pawl 31 prevents rotation of the drum in a clockwise direction. The pawl 30 is spring pressed towards the right as seen in Fig. 5 by springs 32 and 33. A spring 34 maintains the pawl 31 in engagement with the ratchet. The end of the pawl 30 is provided with a lateral flange 30a which lies in the path of a pin 35a depending from one arm of a bell crank lever 35 pivotally mounted on the bar 6a. The other arm of the bell crank lever lies in the path of a flange of the carriage 7. Thus, when the carriage is moved toward the standard 3, the bell crank lever is actuated and in turn actuates the pawl 30 to rotate the drum slightly. The drum is thus moved for each reciprocation of the carriage.

A trough shaped sheet metal strip 36 secured to the base 1 constitutes a holder for a rolled web of paper 37 which is fed over the drum. The end of the web of paper is inserted in a slot in the surface of the drum and the paper is held tightly against the surface of the drum by a tension member 38 pivotally mounted on a pin 39 extending between brackets 40a and 40b secured to the base. The tension member is resiliently pressed against the drum by a spring 41. To the side of the carriage 7 there is pivotally secured a rod 42 which extends over the drum. In this rod, adjustable thereon, there is a stylograph pen holder 43 which receives and holds a stylograph pen 44 in contact with the web of paper on the drum on which successive movements of the carriage are recorded, as illustrated by the record 45 shown in Fig. 7.

In using the ergograph, the head is fixed by having the patient bite the tongue depressor. The distance lenses or near lenses are worn and the near point of convergence or accommodation is tested five times and averaged. In taking the near point the carriage is held at the back of the track and the test object carrier is moved on the track. The test object carrier is usually receded 20 mm. from the average near point of convergence or accommodation; if the patient's accommodation or convergence is too poorly sustained, a greater amplitude of excursion is permitted. The time is noted. In testing convergence fatigue the patient permits the test object to approach the eyes until doubling of the dot on line occurs. At this point, the patient actuates the lever to return the carriage. In testing fatigue of accommodation a line of print is used in place of the dot and the patient stops the forward motion of the test object and returns the carriage when the print blurs with the right or left eye or with both eyes. When blurring occurs in accommodative fatigue plus lenses are placed before the eyes to determine whether the fatigue is accommodative or retinal.

The test is continued for 10 to 15 minutes, after which the duration of the test, the symptoms during and after the test, and the cooperation of the patient are noted. The muscle balance after the test and also the near point of accommodation or convergence are restudied and recorded. The ergograph may be used in the same way for exercising the eyes of patients suf-

fering from insufficiency of accommodation and convergence.

It will be obvious that various changes may be made by those skilled in the art in the details of the embodiment illustrated and described within the principle and scope of the invention as expressed in the appended claims.

I claim:

1. An ophthalmic ergograph comprising a base, a movable, test-object carrier supported by the base, means for moving the carrier in one direction, a fluid check mechanism for controlling the movement of the carrier under the action of said carrier moving means, manually operative means for returning the carrier to its original position, and means for recording the extent of movement of the carrier.

2. An ophthalmic ergograph comprising a base, a movable test-object carrier supported by the base, resilient means for moving the carrier in one direction, a fluid check mechanism for controlling the movement of the carrier, manually operative means for returning the carrier to its original position, and means for recording the extent of movement of the carrier.

3. An ophthalmic ergograph comprising a frame, a slidably mounted carriage, a test-object carrier mounted on the carriage and movable with respect thereto, means for moving the carriage in one direction, a check mechanism for effecting controlled movement of the carriage under the action of said carriage moving means, manually operative means for stopping and returning the carriage to its original position, and means for recording the extent of movement of the carriage.

4. An ophthalmic ergograph comprising a frame, a slidably mounted carriage, a test-object carrier mounted on the carriage and movable with respect thereto, means for moving the carriage in one direction, a check mechanism for effecting controlled movement of the carriage under the action of said carriage moving means, manually operative means for stopping and returning the carriage to its original position, and means for recording successive movements of the carriage comprising a rotatably mounted drum, a stylograph pen holder on the carriage and means for rotating the drum when the carriage is returned to its original position.

5. An ophthalmic ergograph comprising a frame, a slidably mounted carriage, a test-object carrier mounted on the carriage and movable with respect thereto, a check mechanism for effecting controlled movement of the carriage, manually operative means for stopping and returning the carriage to its original position, and means for recording successive movements of the carriage comprising a rotatably mounted drum, a ratchet on one end of the drum, a stylograph pen holder on the carriage, a pawl mounted in operative relation to the ratchet on the drum and means for actuating the pawl upon the return of the carriage after movement by said carriage moving means.

6. An ophthalmic ergograph comprising a frame including a pair of spaced standards and a support extending between the standards, a test-object carrier slidably mounted on the support for movement between the standards, means for moving the test-object carrier towards one of the standards, a check mechanism for controlling the movement of the carriage in response to said carriage moving means, and manually

operative means for stopping and returning the carriage.

7. An ophthalmic ergograph comprising a frame including two spaced standards and a bar extending between the standards, a test-object carrier slidably mounted on the bar for movement between the standards, resilient means for sliding the carrier along the bar towards one of the standards, a check mechanism for controlling the speed of movement of the carrier, and manually operative means for stopping and reversing the movement of the carrier.

8. An ophthalmic ergograph comprising a frame including a base, two spaced standards extending from the base and a bar extending between and supported by the standards, a test-object carrier slidably mounted on the bar for movement between the standards, resilient means for sliding the carrier along the bar towards one of the standards, a check mechanism for controlling the speed of movement of the carrier, and manually operative means for stopping and reversing the movement of the carrier.

9. An ophthalmic ergograph comprising a frame including a base, two spaced standards extending from the base and a bar extending between and supported by the standards, a holder for a tongue depressor on one of the standards, a test-object carrier slidably mounted on the bar for movement between the standards, resilient means for moving the carrier towards the standard having the tongue-depressor holder, a check mechanism for controlling the speed of movement of the carrier, and manually operative means for stopping and reversing the movement of the carrier.

10. An ophthalmic ergograph comprising a frame including a base, two spaced standards extending from the base and a bar extending between and supported by the standards, a holder for a tongue depressor on one of the standards, a carriage slidably mounted on the bar for movement between the standards, a test-object carrier mounted on the carriage and movable with respect thereto, resilient means for moving the carriage towards the standard having the tongue-depressor holder, a check mechanism for controlling the speed of movement of the carrier, and manually operative means for stopping and reversing the movement of the carriage.

11. An ophthalmic ergograph comprising a frame including a base, two spaced standards extending from the base and a bar extending between and supported by the standards, a holder for a tongue depressor on one of the standards, a carriage slidably mounted on the bar for movement between the standards, a test-object carrier mounted on the carriage and movable with respect thereto, resilient means for moving the carriage towards the standard having the tongue-depressor holder, a check mechanism for controlling the speed of movement of the carrier, manually operative means for stopping and reversing the movement of the carriage, and means for recording successive movements of the carriage comprising a rotatably mounted drum, a stylograph pen holder on the carriage and means for rotating the drum upon returning the carriage after movement by said resilient means.

12. An ophthalmic ergograph comprising a frame including a base, two spaced standards extending from the base and a bar extending between and supported by the standards, a holder for a tongue depressor on one of the standards, a carriage slidably mounted on the bar for move-

ment between the standards, a test-object carrier mounted on the carriage and movable with respect thereto, resilient means for moving the carriage towards the standard having the tongue-depressor holder, a check mechanism for controlling the speed of movement of the carrier, manually operative means for stopping and reversing the movement of the carriage, and means for recording successive movements of the carriage comprising a drum rotatably mounted at a level below the bar, a ratchet on one end of the drum, a stylograph pen holder on the carriage, a pawl mounted in operative relation to the ratchet on the drum and means for actuating the pawl upon return of the carriage after movement by said resilient means. 5

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