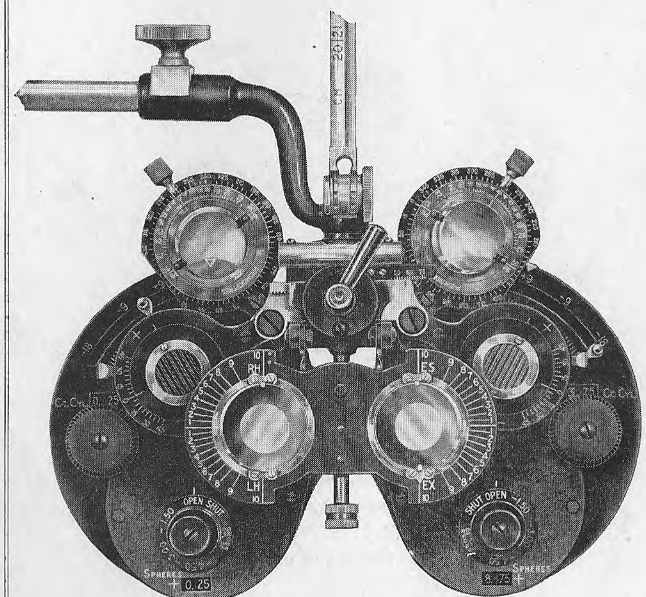


THE GENOTHALMIC REFRACTOR

The Genothalmic Refractor

REFRACTOR
versus
TRIAL CASE

SHUR-ON STANDARD OPTICAL COMPANY, INC.
Established in 1864
GENEVA, NEW YORK, U. S. A.

BRANCHES:

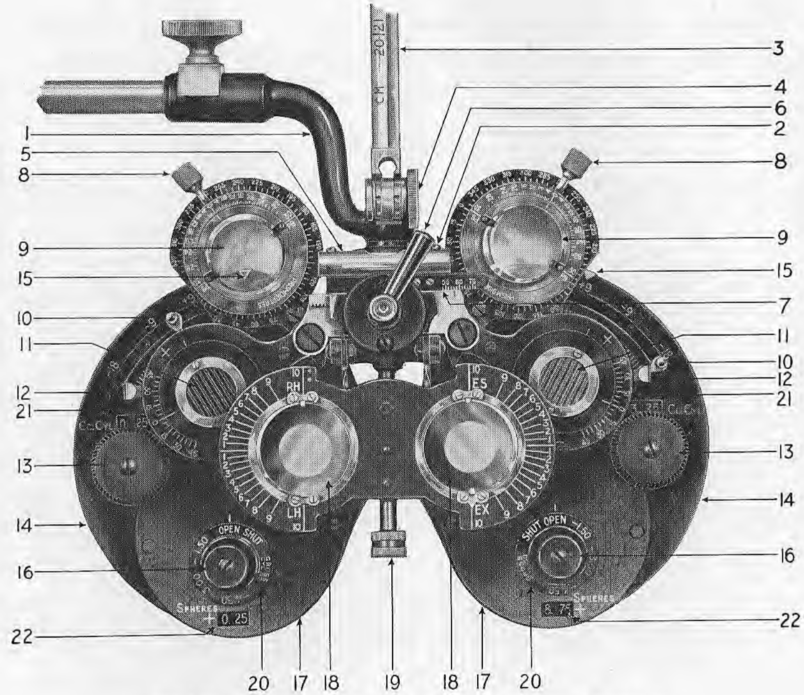
100 East 42nd St.
New York

Main and E. 5th Sts.
Cincinnati

1211 Chestnut St.
Philadelphia

Chicago
5 S. Wabash Ave.

San Francisco
278 Post St.



THE GENOTHALMIC REFRACTOR

Fig. 1

KEY TO PARTS

Front View

1—Suspending Arm—A construction which keeps all parts free from contact with nostrils and mouth.

2—Leveling Screw —which, once set, insures *accurate* axis and base line readings for every cylinder and prism in the instrument.

3—Reading Rod —easily turned up out of way but never misplaced because never removed.

4—Reading Rod Lock Nut.

5—Spirit Level —insuring, with the Leveling Screw, perfect horizontal alignment of all parts.

6—Interpupillary Distance Lever Arm Adjustment.
7—Interpupillary Distance Scale.
8—Risley Prisms Rotating Knobs.
9—Risley Rotating Prisms, 30△ each.
10—Cylinder Axis Changing Levers.
11—Red and White Maddox Multiple Rods.
12—Maddox Multiple Rods Turning Pins.
13—Cylinder Lens Changing Knobs.
14—Cylinder Lens Housings.
15—Supplementary Lens Changing Pins.
16—Spherical Lens Changing Knobs.
17—Spherical Lens Housings.
18—Stevens Phorometer.
19—Phorometer Rotating Knob.
20—Auxiliary Disc Rotating Knob.
21—Cylinder Power Registration.
22—Spherical Power Registration.

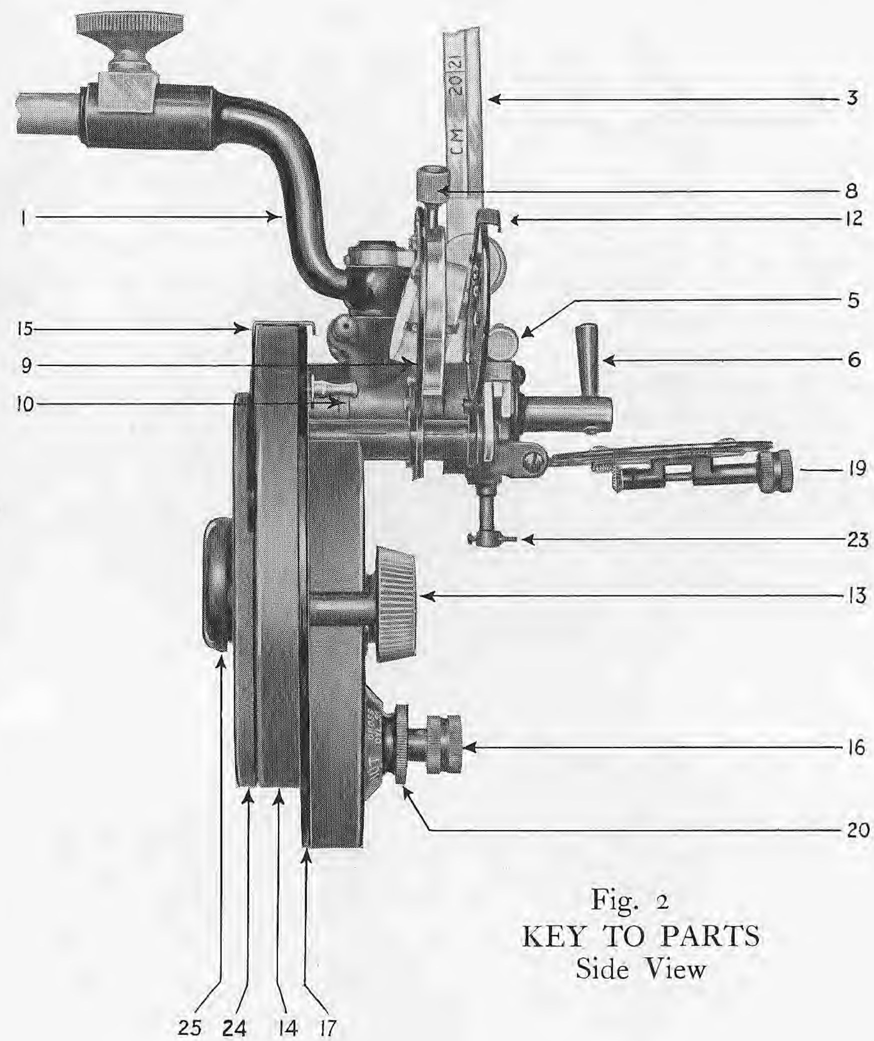


Fig. 2

KEY TO PARTS

Side View

1—Suspending Arm.
3—Reading Rod.
5—Spirit Level.
6—Interpupillary Distance Lever Arm Adjustment.
8—Risley Prism Rotating Knob.
9—Risley Rotating Prism.
10—Cylinder Axis Changing Lever.
12—Maddox Multiple Rod Turning Pin.
13—Cylinder Lens Changing Knob.
14—Cylinder Lens Housing.
15—Supplementary Lens Changing Pin.
16—Spherical Lens Changing Knob.
17—Spherical Lens Housing.
19—Stevens Phorometer Rotating Knob.
20—Auxiliary Disc Rotating Knob.
23—Stevens Phorometer Stop.
24—Supplementary High Power Lens Housing.
25—Sanitary Eyecup.

The Genothalmic Refractor

REFRACTOR *versus* TRIAL CASE

So long as the human element remains a variable quantity the subjective test will remain fundamental in the field of ocular refraction.

This is true because the objective tests cannot point out the extent to which the true calculation of the error must be modified to satisfy the idiosyncrasies of the individual case.

Yet that subjective test is most trustworthy which is based upon accurate objective findings.

Hence in designing the *Genothalmic Refractor* no effort was spared to make it not only the premier subjective testing apparatus but also the most efficient device for applying either static or dynamic retinoscopy.

The irreducible minimum in a subjective and a retinoscopic test are a series of trial lenses, a means for holding these lenses before the eye, a test chart and of course in the objective test, a retinoscope and a fixation object.

There was a time when a basket full of ready-made glasses and a sign across the street were expected to satisfy these requirements, but here all factors were faulty and justly superseded by a series of removable trial lenses, a trial frame and a chart containing letters based on the Snellen principle.

These answered so long as the work remained in a crude state and sole dependence was placed upon spherical corrections but proved inadequate to the modern demand for the employment in great variety of spheres, cylinders, prisms, cross-cylinders, colored discs and many other auxiliaries.

It is not possible to make the necessary muscle tests at distance and near with loose lenses and prisms in any trial frame thus far designed, nor is it possible with the trial frame and loose lenses to make the most satisfactory retinoscopic test.

The refinements that modern practice demands do not involve a change in the basic principle of getting different

values before the eye but a refinement in the technique of getting different lenses, prisms and other necessary auxiliaries before the eyes most conveniently, most systematically and most accurately.

A heavy trial frame hurting nose and ears may in itself vitiate a test. Longer intervals between some changes in lenses than between others, variations in the amount of light entering an eye with accompanying changes in pupil diameter, relative position of lenses to each other and to the eye, tilting of lenses forward or backward in the trial frame are some of the factors that created the insistent demand for an improved form of trial lens technique in visual acuity tests, in muscle tests and in retinoscopy.

The *Genothalmic Refractor* meets all of these demands.

It relegates the method of handling loose lenses from a trial case as surely as the trial case relegated the basket of ready-made glasses on a counter from which the patient "chose his own poison."

Fate decreed that the trial case appear years before the *Refractor* was developed but had the *Refractor* with its simple, instantaneous, smooth, accurate and uniform way of changing lens and prism values appeared first and been used for years, the crude trial case method would never have obtained a serious hearing.

Old habit sustains the trial case in some quarters now but eventually its costly short-comings will be recognized universally and it will be forced to give way to the *Refractor* principle. It is because this advance is so imminent that, with the aid of men who stand in the forefront of the profession, we have developed the *Genothalmic Refractor* to its present perfection.

Consider these facts:

A trial case contains from 200 to 300 separate lenses, prisms and discs.

All these parts are exposed to dust and finger marks. They require constant cleaning and in consequence soon become scratched. Scratched lenses are not trustworthy master-lenses, and those used most become scratched most.

Loose trial lenses require the use of a trial frame. This frame must have many working parts to be adaptable to various faces and to the varied requirements of objective and subjective testing, and the better the frame in these respects the heavier it is sure to be.

The trial frame is not only a source of annoyance and discomfort to the patient but is a source of error insofar as it shifts its position on the face as the lenses are manipulated. Its cells have to be made sufficiently wide to accommodate the thickest lenses which permit the thinner ones to wabble and tilt and the distance between them to vary and their effective power to change.

In a two or three lens combination there is no assurance that the lenses composing it will be placed in the same order on every occasion.

For instance, a +3. sphere may be in the rear cell, a −1. cylinder in the next and a +2. sphere added for reading in the third cell. This is the natural order of building up a correction with the ordinary trial lenses in testing for distance and reading glasses.

The +3. sphere in one cell and the +2. two cells away will not give the same effective power as a +5. sphere in the first cell. One arrangement calls for one allowance, while the other calls for a different allowance and yet how few are willing to calculate the differences in effectivity between these two commonly used combinations. These sources of uncompensated inaccuracies are ignored, consciously or unconsciously, by some who complain because some of the optometer lenses are a few millimeters further away from the eye, even though compensated.

With the *Refractor* one thing is certain, namely, that any lens value it presents is always uniform because it can be obtained in one way only and in one form only, with the lenses always in exactly the same relation to the eye, to the instrument and to each other. And this holds true of every lens value, every combination of lens values and combination of lens and prism values in the instrument.

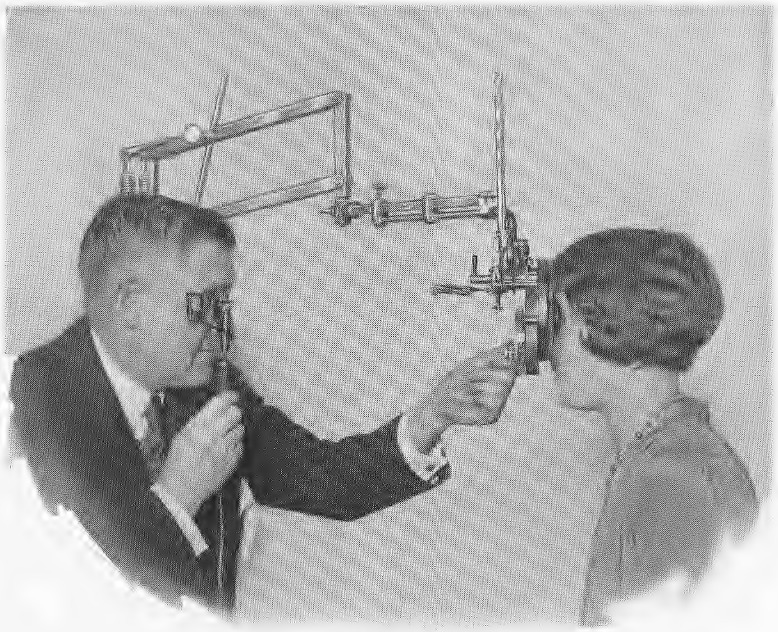


Fig. 3

Showing ease with which dynamic or static retinoscopy may be applied with the Refractor. The working distance may be established, before or after, by dropping the ever-handy, calibrated reading rod into place for a moment. Sphericals and cylindricals, for right or left eye, turned in with ease and without disturbance of anybody or of anything. And with equal ease and still without the slightest disturbance prisms may be used while the action of the reflex is watched! And all the while the patient is screened from all distractions with nothing in the field of vision but the distance or the near fixation chart.

Any power registered by the *Refractor*—spherical, cylindrical or sphero-cylindrical—represents effective power.

The fact that some lenses are further from the eye than others has no adverse bearing on the truth of this statement, because all these lenses are compensated accordingly.

Because this compensation is not feasible with loose trial lenses is one of the much-overlooked disadvantages of the trial case and, conversely, because it *is* feasible in the *Refractor* is one of the outstanding advantages of this instru-

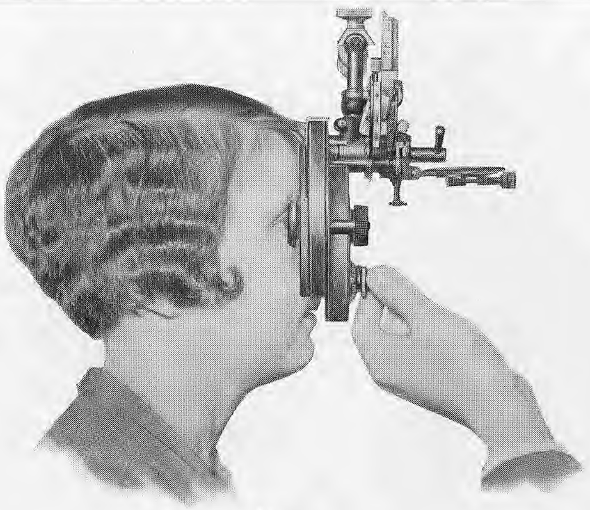


Fig. 4

With patient's eyes snug in the eyecup, all extraneous light shut out, all distractions eliminated because the Refractor screens all from the field except the chart; any change in spherical or cylindrical or prismatic power presented before either or both eyes instantaneously; no disturbance of other lens or prism values, no wabbling of lenses, no soiled lenses—can anything finer be conceived for conducting the distance subjective test?

ment in all subjective and objective testing.

The fact should not be overlooked that the plus lenses of a trial case neutralize the minus because each plus is deliberately ground weaker than its respective minus. The −20. in a trial case is a true −20. power, but the so-called +20. that neutralizes it is only approximately 18. This is compensation of a sort but not trustworthy because these loose lenses may be used in any one of the three cells of the trial frame and therefore create a variety of inaccuracies at these various distances, whereas in the *Refractor* each lens has its definite plane and its definite compensation for that unvariable plane.

Hence trial case lenses must never be trusted to neutralize the true effective powers of the *Refractor*.

It is not expected that a single loose trial case lens will neutralize a telescope, a microscope, or an opera glass, yet

each of these instruments has a definite effective power and gives definite results to an eye placed at its ocular.

On the same basis, the *Refractor* gives precise results to an eye placed at its ocular or eyecup, and it is this result, this all-important effective power, that is automatically registered in the spherical and cylindrical openings.

With the accuracy of the lens values of the *Refractor* assured it is difficult to conceive how anyone will continue to use the loose trial case lenses with which it is utterly impossible to develop the delicate technique readily attainable with the *Refractor*.

In the old trial case method if a lens value is to be increased or decreased either the lens must be taken from the frame and replaced by one higher or lower in value, the accommodation running wild during this interval, or an extra lens must be held in front of the other; in either case the position of the trial frame and of the lenses in it may be disturbed, causing an error if unnoticed or calling for resetting if noticed.

With the *Refractor* a quarter-turn of a handy knob increases or decreases the power of any lens value with no disturbance of any of the factors involved, including the patient as well as his accommodation and convergence.

This last mentioned point is a very important factor. Suppose that a +2.25 S. is to be substituted for a +2. S. The +2. is removed from the trial frame and, of course, from before the eye, the accommodation jerks up that amount and then relaxes, we trust, when the +2.25 is placed in position. These jerks play havoc with the accommodation and represent a relatively crude, unscientific method in comparison with the *Refractor* way of changing so smoothly and so quickly that the transitional stage from one lens to the other cannot be perceived by the eye under test.

The change in the *Refractor* is from one lens to the next instantaneously and *not* as with loose trial lenses from one lens down to zero and then up to the next.

Fig. 5

With objective and subjective refraction determined, note how easily two Risley prisms, two Maddox rods and a Stevens phorometer may be swung into action. Still no weight whatever on patient's nose, not the slightest disturbance of any lens value; distance visual acuity, near visual acuity, distance extrinsic muscle tests, near extrinsic muscle tests, monocular or binocular, alone or in combination—no limit to near and distance, monocular and binocular, subjective and objective tests available. Just how can any modern refractionist resist the temptation to work with the Refractor?

Then, where cylinders are employed all the advantage lies with the *Refractor*. With the trial frame each change requires taking one lens from the cell, replacing it in the trial case, picking out the next lens to be tried, cleaning it, placing it in the cell and then carefully setting its axis at the position desired—the accommodation again running wild during the tedious operations. Then consider that all these operations have to be gone through for each change of lens, involving a vast waste of time and energy, fatigue to both patient and operator, and vitiated results.

On the other hand, with the *Refractor* one operation sets all the cylinders from .25 to 3.75 at any desired axis and a quarter-turn one way or the other brings a stronger or a weaker cylinder instantaneously into position with its axis already accurately set. And these changes are made so quickly that the accommodation has not time to act between the changes.

Another bad feature of the trial case method arises here. With a sphere and a cylinder in the trial frame it is frequently necessary to change the sphere after the cylinder has been changed, when to take the sphere out of the frame without disturbing the cylinder is no easy matter.

No such annoyance accompanies changes in the *Refractor* where either sphere, cylinder or axis may be changed instantaneously and independently with the added assurance that all relations will be maintained in all cases.

The trial case has been a most serious offender in discouraging investigation of the binocular muscle balance and another of the great outstanding advantages of the *Refractor* over the trial case is its practical, easy adaptability to all forms of muscle testing and innervational development.

With a trial frame full of lenses it is no wonder muscle work was found impracticable. It is impossible to use successfully in connection with the lenses in the trial frame the multiple rods, rotating prisms, cross-cylinders, phorometer and other auxiliaries necessary in this work.

Investigating the condition of the extrinsic muscles at near, which takes into consideration the action of the ciliary, is utterly impracticable with a trial frame and the loose lenses and prisms of a trial case.

With the *Refractor*, however, any sphero-cylindrical combination may be set in a fixed position before the eyes. Then, without disturbing that in any way, either one or two multiple rods, one or two rotating prisms, one or two cross-cylinders, or the phorometer with its 5° prisms so useful in so many ways may be used.

Furthermore, any group of these muscle testing devices may be used at will with ease, that is, one rod may be used in conjunction with one or two rotating prisms, two rods may be used with one or two rotating prisms; one or two rods may be used with the phorometer; one or two rotating prisms may be used with the phorometer; or two rods, two rotating prisms, and the phorometer may be used at once.

Now add to this the cross-cylinders that may be used monocularly or binocularly and you have the most comprehensive phoro-optometer that has been conceived and the *Refractor* is the only one that embodies built-in cross-cylinders, so useful in the modern treatment of binocular imbalance.

With the Refractor, answers to searching questions come promptly and confidently because the comparison between any two lenses is all but instantaneous; whereas, with the trial case answers come reluctantly and uncertainly because of the relatively long interval and the many distracting influences that come between the visual impressions of the first and the second lens, as the latter comes slowly and clumsily into place.

Some may contend that with all its faults the trial case in expert hands is as trustworthy as the *Refractor*. This might be granted if lenses only were considered, but it is futile to contend that the trial case affords a dependable means for conducting the muscle tests so essential to the establishment of comfortable binocular balance or permits tests such, for instance, as the following:

OBJECTIVE DYNAMIC RETINOSCOPY UNDER SUBJECTIVE CROSS-CYLINDER CONTROL

This advanced test can be made properly only with the *Genothalmic Refractor* and its built-in cross-cylinders.

While the details of this combined test may seem somewhat difficult the test is really applied very simply, as follows:

Ascertain the patient's interpupillary distance when fixating for the working range.

Set the *Refractor* at that P.D. and the cross-line target, Fig. 6, page 16, on the reading rod at that working distance.

Direct patient to concentrate on the cross-line target, as a dynamic fixation point, and in the usual manner neutralize the error of each eye, employing no stronger retinoscopic illumination than required to obtain a clearly defined fundus reflex.

Turn in or set in before the left eye the cross-cylinder, always with plus axis at 180.

Turn down both Risley prisms, set, of course, at zero and in position to obtain base-in power.

Turn down the Stevens phorometer with right eye prism base up. Both eyes functioning, this produces two images of the cross-line target, the upper belonging to the left eye and the lower to the right. (An easy way to keep this clear in one's mind is to consider the prism an arrow pointing at its respective image, thus the left eye's prism points up at its upper image.)

Direct patient to look at the upper image (left eye's) with cross-cylinder before it and state whether or not its horizontal and vertical lines are equally black, *while you watch with the retinoscope the action of the reflex of the right eye from before which the cross-cylinder has been turned out.*

If the lines of this upper image are equal, change cross-cylinder from the left to the right eye and shift the retinoscope to that eye and watch its action while the patient's attention is directed to the lower image (right eye's) with cross-cylinder before it; if the horizontal and vertical lines of the lower image are also equal, leave cross-cylinder before right eye and replace that of left eye so that both are back in place and ask if one target is directly over the other. If the upper be to the right (as it frequently is) exophoria is indicated and base-in prism should be applied, through the Risleys, until vertical alignment, orthophoria, obtains.

This addition of base-in prism may cause the retinoscopic reflex to go markedly "with" and the horizontal lines of each target to stand out blacker, in which event plus spherical power should be added until the shadow is neutralized objectively and the lines of the targets equalized subjectively.

Keep thus alternating the increased plus sphere and the increased base-in prism until binocular balance is secured objectively and subjectively. Keep in mind that the cross-cylinder must be removed temporarily from before the eye that is being viewed with the retinoscope.

Here then we have true dynamic retinoscopy applied with both accommodation and convergence, acting interdependently, under subjective and objective control and observation.

With this beautiful and vital interplay between accommodation and convergence now open to observation the refractionist has just cause to be proud of the superiority of this method of ocular examination.

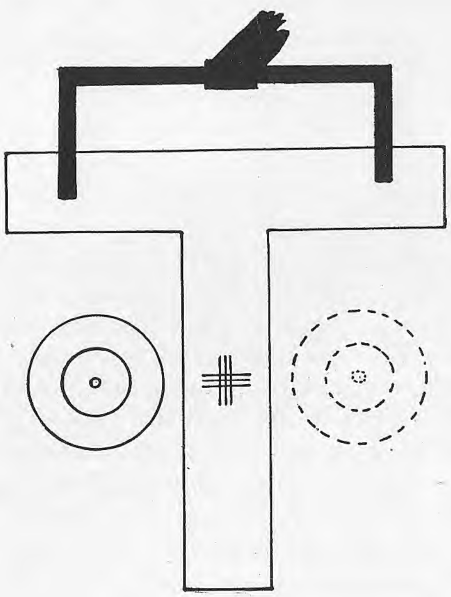


Fig. 6

DESCRIPTION OF GENOTHALMIC REFRACTOR

The closest scrutiny of every detail of the *Genothalmic Refractor* proves that it is built by optical engineers in touch with the needs of the refractionist.

Being suspended instead of supported no part of the instrument interferes with or is contaminated by emanations from the nose and mouth of the patient.

Rigidity is insured as never before.

The eyecups fit snugly and comfortably around the eyes, holding the head in correct relation to the instrument and shutting out extraneous light.

In all tests the instrument acts as a screen, accentuating the test objects and hiding all the disconcerting objects so much in evidence when an open trial frame is employed.

The instrument once set by means of the spirit-level brings each part into proper alignment when in use without further attention.

The lever adjustment for interpupillary distance is smooth and rapid. Its construction embodies double-acting bars which brace the instrument in a manner that eliminates all danger of the right and left sides ever being twisted out of alignment.

The interpupillary distance adjustment ranges from 48 to 72 mm, meeting the requirements of any case.

The rod which carries the reading and other near test charts is calibrated in centimeters, diopters and inches. When not in use it swings up out of the way but remains attached and cannot be misplaced.

All lens discs are protected by compact housings.

The lenses are rotated into position with speed and steadiness by accessible knurled knobs.

By a single operation of a small lever, unique in action, the cylindrical lenses may be set at any axis desired and held there, positively, during any change of power.

Beside the lenses and auxiliaries built in the instrument two extra lenses or other auxiliaries may be placed before either eye in cells calibrated for axes readings.

The effective power, without addition or subtraction, of all minus cylindrical up to 3.75 and plus spherical combinations up to 8.75 may be read directly from single sets of figures in their respective openings.

The lenses of the *Genothalmic Refractor* run in quarter-diopter graduations as follows:

Plus spheres from 0.25 to 17.75 D.

Minus cylindricals from 0.25 to 3.75 D.

Minus spheres from 0.25 to 22.50 D.

Plus cylindricals may be had in place of minus for a moderate additional cost.

MINUS SPHERICAL VALUES

The minus spherical values are represented by the difference between the supplementary −9.00 or −18.00 and the plus spherical powers. Thus if the supplementary −9.00 is in place and a +7.00 is registered by the spherical disk a −2.00 value is before the eye.

Low power minus values up to 4.50 may also be obtained by using the −1.50, −3.00 or −4.50 auxiliary lens in combination with plus lenses. Thus if −0.50 is required it may be obtained by turning in the auxiliary −1.50 and a +1.00.

The extreme minus value of 22.50 is obtained by adding the auxiliary −4.50 to the supplementary −18.00.

PLUS SPHERICAL VALUES

Plus spherical values up to and including 8.75 are read directly.

Any plus power above 8.75 is obtained by combining the supplementary +9.00 with the plus values in the spherical disks. Thus if the supplementary +9.00 is in place and a +7.00 is registered by the spherical disk a +16.00 value is before the eye.

To this all-inclusive array of spherical and cylindrical lens values are added:

Two Risley rotating prisms of 30△ each.

Two Maddox multiple rods, one red and one white.

One Stevens phorometer, 5△ before each eye.

Two −1.50, −3.00 and −4.50 auxiliary sphericals.

Two +.50 ⊂ -.50 cross-cylinders, which place the *Refractor* in a class by itself.

No other single instrument embodies the means of making so wide a range of tests, subjective and objective, static and dynamic, of the intrinsic and extrinsic muscles of the human binocular apparatus as the *Genothalmic Refractor*.

Naturally, with such technical perfection go durability, fine finish and attractive appearance.

Instruments of this class require rigid support. The *Genothalmic Refractor* is designed for use with the Genothalmic Automatic Unit or the Genothalmic Unit Chair and when used with either the necessary rigidity is assured.

Figure 7 shows an ideal grouping of Refractor, Ophthalmometer, Visual Test Apparatus, Kratometer, Transformer, Ophthalmoscope, Trans-illuminator and Dynamic Retinoscope, with the Genothalmic Chair from which the patient need not be moved during a most comprehensive examination.

An outstanding feature of the Genothalmic Unit is that the Visual Test Apparatus may be set at the height of the operator's eyes when he stands comfortably at the chair, the patient raised so that his eyes come to the same plane, in which case the Ophthalmometer, Refractor and hand diagnostic instruments may be used most conveniently and most effectively at the same height.

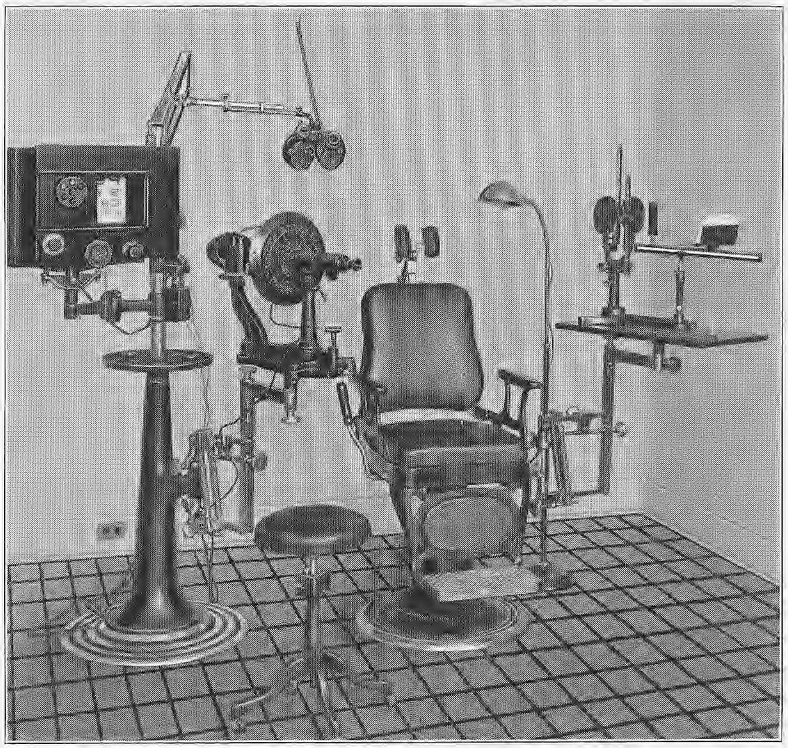


Fig. 7

No modern refractionist will be able to resist the temptation to work with the Refractor if he once tries it in connection with the Genothalmic Automatic Unit which includes the Genothalmic Visual Test Apparatus—an institution in itself—Universal Ophthalmometer, Red Free Ophthalmoscope and Dynamic Retinoscope. Now add a Kratometer and the ideal in refracting room Equipment is realized.

There it stands, willing to help you, as it has helped many of your confreres reach a far higher position, enjoy a far larger success in this noble field of service—the conservation of vision by prophylaxis through early and accurate diagnosis with truth-telling instruments.

THE REFRACTOR IN USE

A routine ocular examination will be outlined.

Those seeking a definite routine may follow it with the assurance that the case will be analyzed in a comprehensive manner.

The experienced refractionist may follow it with similar assurance or he may modify it to conform to his individual requirements. All Genothalmic instruments are designed with this principle of adaptability to individual technique always in mind.

Preliminary Procedure:

1. History of case—especially the kind of work patient expects to do with the glasses being sought and distance at which this work will be held. This becomes the working or fixation distance in dynamic retinoscopy.

2. Visual acuity, recorded, of O.D., O.S., and O.U. Without glasses if none have been worn or with the glasses being worn.

3. Ophthalmoscopic determination that condition is not pathologic.

4. Ophthalmometric measurement, observation, and record.

5. Accurate measurement and record of patient's interpupillary distance at distance and at near fixation.

Refractor Procedure:

6. Set P.D. of *Refractor* to correspond with patient's distance interpupillary distance and bring *Refractor* into position snugly against patient's face with pupils at the center of the lens openings.

7. With nothing before eyes if patient has not worn glasses or with old correction in place, bring Stevens phorometer into working position with prisms vertical, base up on right eye, base down on left, and in one of the following ways estimate horizontal phoria at distance and record results:

(a) Distance test chart, if small area can be illuminated as in modern forms, being doubled with the phorometer, can be aligned with the Risley prisms.

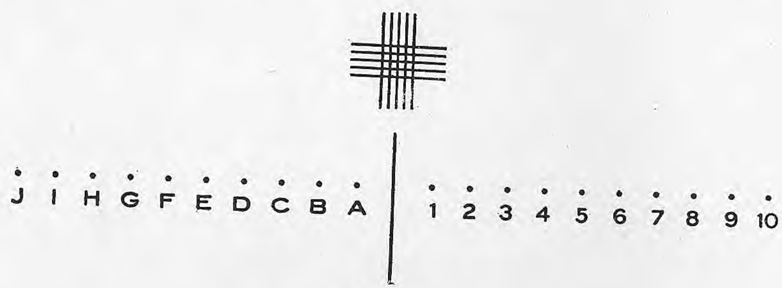


Fig. 8

(b) Distance tangent scale, Peckham design preferred, Fig. 8, doubled with the phorometer, prisms vertical, recording not only the amount of displacement but also the amount of prism power needed to align the images in orthophoria.

(c) Distance muscle light and Stevens phorometer.

(d) Distance muscle light and Maddox multiple rod with Risley prisms to bring alignment.

If test (a), (c) or (d) be used, swing prisms of phorometer in (a) and (c) to base in or rod in (d) to horizontal and estimate hyperphoria if any exist.

Fig. 9

This chart has been designed very carefully. The vertical lines are wider than the horizontal to offset the reducing effect of the minus power and the increasing effect of the plus power in the cross-cylinders.

8. Estimate horizontal phoria at near by placing in the reading chart holder at patient's working distance, say 16 inches, Chart No. 9, doubling the figure vertically with

Stevens phorometer, and aligning these double images with both Risley prisms, having set P. D. of *Refractor* to correspond with patient's near interpupillary distance.

These records of the distance and near phoria tests with old correction worn become of great value when compared with the phoria associated with the new correction, and no experienced refractionist feels safe in ignoring any accompanying discrepancies.[1]

9. Apply dynamic retinoscope, holding its fixation chart at patient's working distance, measured on the reading rod.

With this position established reading rod may be thrown up out of way.

When an error is indicated, correct it—the lenses are there at your finger tips. See Figure 3, page 9. Be careful to maintain definitely controlled fixation as this is the all-essential point in successful dynamic retinoscopy.[2]

Taking, as an example, the most common error, compound hypermetropic astigmia, plus spheres and minus cylinders are called for.

Use the strongest plus sphere which neutralizes but does not reverse the meridian of greatest error and the weakest minus cylinder which reverses the meridian of least error from "against" to "with," using plane mirror of course.

Work on each eye alternately because to place all the correction on one eye first may break up, unnaturally, the relation between accommodation and convergence.

11. If not indissolubly wedded to monocular testing, make the subjective test binocularly as follows:

The dynamic correction is in the Refractor. Tip down the Stevens phorometer, prisms vertical, base up in right eye, and have patient note the doubled images of the distance test chart. Reduce plus spheres alternately until the most satisfactory visual acuity is obtained for each eye. Keep direct-

[1] For detailed description of these important tests see "The Modern Treatment of Ocular Imbalances" by Peckham. A copy will be sent on request (Price $1.00).

[2] A copy of "The Genothalmic Dynamic Retinoscope" by Ryer will be sent free on request.

1	2	3	4	5	6
Good	Pen	Girl	Run	Book	Lay
When	Date	Coat	Cow	Hot	Field
Land	Man	Pipe	Look	Gray	Hurt
Chair	Glove	Dog	No	Lip	Got
Back	Paper	Play	Cold	Fat	Belt
Cab	Cat	See	Think	Busy	Under
Eat	Child	Yes	Broad	The	Free
Table	Jump	Tooth	Lazy	Are	Rush
Dress	Put	Black	Hour	Pit	Lame
String	Up	Thin	Can	Stone	Slow
Shoe	Many	Dumb	Quick	Lamp	Farm
Hat	Some	Bee	Over	Foot	Tired
Class	Too	That	Couch	Milk	Blank
Bay	Warm	It	Push	Side	Old
Desk	Nail	Stick	Barn	Your	Sleep
Box	Hand	House	Toe	Walk	Hurt
Nose	Green	Can't	Word	Son	Hay
Cloth	Smart	Egg	Hold	Also	But
Will	Pull	Water	Right	Took	Board
Blue	Tree	Was	Going	Ash	Been
.37M	.62M	1.00M	.37M	.62M	1.00M

Fig. 10

ing patient's attention alternately to the upper and lower chart.

Check cylindrical correction with cross-cylinder. If cylinder needs modification, as it usually does except with our retinoscope prodigies, retest the sphere, then go back to cylinder and so on until the correction cannot be further questioned. These changes with the *Refractor* are most simple, involving merely a quarter-turn of either the cylinder

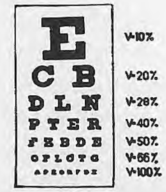


Fig. 11

or spherical lens knob. They become a complex undertaking with the loose trial case lenses and, therefore, often slighted.

12. With new distance correction thus obtained make the phoria test again as it was made with the old correction. Compare results. Be wary of any correction that causes a marked adverse change in the phoria.

13. With the above distance correction in place make any reading addition called for if case is an unquestionable presbyope. Use reading rod to hold at the working distance Chart No. 10 containing six rows of words in three sizes of type, testing monocularly. Or if a binocular test is desired use other side of chart, Figure 11, a greatly reduced copy of the regulation distance chart, and the Stevens phorometer to double it. In the latter case measure the phoria with the two Risleys aligning these double images of the small chart.

14. With the distance correction if that only is required or with any required reading correction measure the phoria at near, doubling the figure on Chart No. 9, and finding with the Risleys, using both, the power necessary to align the images. Compare this with the phoria reading with old correction in place and give due consideration to any appreciable disparity.

15. Test the positive and the negative relative convergence as follows:

Turn back Stevens phorometer. Use Chart No. 12 containing letters arranged in a single vertical line. Risley prisms, handles down, registering zero. Find highest power, divided equally between the eyes, prism

Fig. 12

base in with which single vision can be maintained; this represents what is known as the negative relative reserve convergence. The highest power base out with which single vision can be maintained represents the positive reserve convergence. The positive relative reserve should be well in excess of any exophoria. The ability to readily relax under base in prism is important.

If during either of these tests the vertical line of letters fails to remain in the center of the field and moves to the right or left suspect suppression or suspension in one eye. Such a case at once calls for Kratometric development.

16. If the positive and the negative relative convergence are satisfactory, proceed to measure the relative range of accommodation. Just because this is an arduous undertaking with the old trial case, do not think it is with the *Refractor*. Use Chart No. 10 or No. 11 and ascertain the highest additional plus that will still permit the words or letters to be read while convergence is maintained in that plane; this represents the negative part of the relative range of accommodation. Ascertain the highest additional minus that can be added to the correction and still permit the words or letters to be read and that will represent the positive part of the relative range of accommodation.

17. Next throw in the two cross-cylinders of the auxiliary discs and make what constitutes perhaps the most important corroborative test known today.

The use of these cross-cylinders here is not to be confused with the corroborative test for astigmia.

These cross-cylinders are fixed in position. The plus power remains vertical, the minus power horizontal. The small cross line chart, Figure 9, is used on reading rod at working range and the Stevens phorometer used to double it vertically.

If images of cross-lines are directly over each other and if the vertical and the horizontal lines of each image are equally black the case may be passed as one in which comfortable binocular balance has been established. Strictly speaking,

each set of lines is equally slightly blurred—equality, not sharpness is the criterion.

But if the horizontal lines are blacker more plus sphere is called for if eyes are to be comfortable at this distance, yet if this addition of plus spherical power increases the exophoria it will not be tolerated without the help of some prism power base in to re-establish convergence balance. When prisms base in are added to align the images (Orthophoria) the horizontal lines may be found to be darker once more, and this goes on alternately until balance is established. To get small amounts of prism power base in or out in case any considerable plus or minus prism is being used, all that is necessary is to narrow or widen the interpupillary distance and estimate result by the Prentice prism-diopter law.

Peckham has proved that by this test more latent hypermetropia can be uncovered in some cases than will show under atropine.

This test in itself is very simple, with the *Refractor*. For full details of the theory back of it we must again refer to Peckham's "The Modern Treatment of Ocular Imbalances." See foot note page 23.

This entire routine test can be accomplished in from 20 to 40 minutes with the *Refractor*. It represents a searching analysis and with the aid of the *Refractor* is not as difficult to carry out as the usual superficial test with the trial case.

The more important tests, made so easily with the *Refractor*, cannot possibly be made with a trial case. To omit these tests, as *must* be done if a trial case only is depended upon, is to deny a patient the benefit of superior diagnosis.

Yet this is only one of many routine examinations that may be carried out with the *Refractor*.

Bare mention has been made of such auxiliaries as the −1.50, −3.00, and −4.50 spheres that may be used in so many ways, or of the cyclophoric tests that are possible with the two different colored Maddox rods.

But to describe the hundreds of tests that may be made with the *Refractor* would require a text book, far beyond the limits of this present booklet.

Suffice it to say that with the *Refractor* anything is possible that can be done with a trial case and in a quicker, more convenient and more accurate way and then, on top of that, the *Refractor* makes many tests possible, and some of them of paramount importance, that have to be omitted if only a trial case is available.

It is the aim of this booklet to show not only the diagnostic superiority of the *Refractor* but to urge, with due reserve, the wisdom of the refractionist's availing himself of these advantages not only in the interest of his patient but in the interest of his own comfort, his reputation, and his financial status, all of which must be guarded if he is to serve in full measure.

Antiquated methods do not pay—anyone—anywhere—hence

The Genothalmic Refractor