GOERZ

PRICE LIST

OF

Double-Anastigmat Lenses Goerz' Anschutz Cameras Shutters, Etc., Etc. And Trieder Binoculars

MANUFACTURED BY THE

C. P. GOERZ OPTICAL WORKS

NEW YORK

52 Union Square East

L. J. R. HOLST, Manager

Berlin . 45-46 Rheinstrasse, Friedenau

London . . 4-5 Holborn Circus, E. C.

Paris . . . . . 22 Rue de l'Entrepôt

1903

TERMS

All prices are quoted in the currency of the United States. **Goods delivered f. o. b. New York.**

All orders should be accompanied by a remittance or will be filled c. o. d.

Lenses which are not approved of will be exchanged or their value refunded if returned in an intact condition within 10 days after arrival.

All goods are packed with the utmost care. We cannot therefore be held responsible for any damage during transport.

All goods contained in this catalogue can be obtained **from any good dealer in photographic supplies** in the United States and in Canada; or in all cases where this should not be possible, from our New York office.

When ordering by wire, please use the code word specified.

Telegraphic Address : — Goerz, New York.

The Goerz Photo-Stereo Binocular

A Combination of an OPERA GLASS, a FIELD GLASS, and a PHOTOGRAPHIC CAMERA, Single or Stereoscopic

THERE are two things before all others which the tourist likes always to have with him—a field glass and a photographic camera. Through the progress of modern science and mechanical skill, both these instruments have now been brought to a remarkable state of perfection; and without doubt, each, in its way, is destined to become the inseparable companion of the traveler.

Convenience, however, usually compels us to take only one of these instruments, and to leave the other at home; for to carry both together is generally found to be too cumbersome. "As little baggage as possible," is the motto of the tourist, causing him to reluctantly leave many things behind which he otherwise would like to take along.

Nevertheless, every tourist outfit, to be complete, should include both camera AND field glass. If only one is taken, the time will surely come when the absence of the other will be greatly regretted. The telescope expands our view, brings the distant object clearly before our eyes, and often affords us immediate instruction as to our surroundings. The camera fixes permanently the scenes before us, and awakens pleasant recollections in after days by placing them again before our eyes. The two instruments are supplementary to each other; the one without the other can in nowise be regarded as complete.

The traveling public will therefore welcome with satisfaction an instrument which combines CAMERA AND FIELD GLASS IN ONE. Such an instrument is the Goerz Photo-Stereo Binocular, which we are now placing on the market.

The Photo-Stereo Binocular has the appearance of an ordinary opera glass. It is small, light, strongly made and very powerful. It forms at once an OPERA GLASS, FIELD GLASS, SINGLE CAMERA and STEREOSCOPIC CAMERA. With this little instrument the tourist is equipped for all eventualities. In the country it serves him as a field glass (magnifying $3\frac{1}{2}$ times), and as a camera for snapshots or on the tripod; and in town, when visiting the theatre, the same instrument serves him as an opera glass (magnifying $2\frac{1}{2}$ times).

The Photo-Stereo Binocular is furthermore admirably adapted for the cyclist by reason of its extreme compactness. It occupies very little space, and can be conveniently attached by clips to the handle bar, where it is in no way an impediment.

This little universal instrument, far from being a toy, is produced with the greatest possible care and perfection of workmanship. It is intended to be the traveling companion of the tourist, the explorer, the officer on land and seas, the hunter, the sportsman and the cyclist, and to whomsoever has an eye open for what is beautiful in nature and at home.

The original photographs obtained by means of the Photo-Stereo Binocular are $1\frac{3}{4}'' \times 2''$; they are exceedingly sharp and admit of very considerable enlargement. The illustrations show that the enlargements are almost as perfectly sharp as the originals. Those, therefore, who so frequently expressed the desire to make small negatives, and yet obtain perfect, large images, find their wishes fully met by the

Goerz Photo-Stereo Binocular

DESCRIPTION

THE GOERZ PHOTO-STEREO BINOCULAR resembles much in appearance the ordinary opera glass. It consists principally of a pair of telescoping tubes, which serve as cameras or field glasses, as desired, according to the adjustment of the rotary lens holders, R R, fig. 5. At the lower end, the object-lenses are mounted in a hinged cover, D, which also

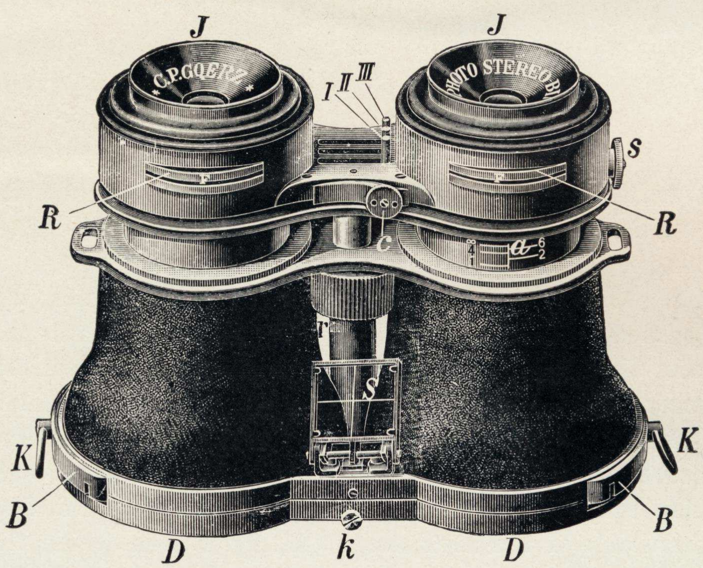


FIG. 5.

serves to contain and press the plateholders and the ground glass in proper position. At the upper, or eye-piece end of the instrument, the discs, R R, project outward sufficiently to revolve them, whereby either the theatre eye-pieces, the field glass eye-pieces or the photographic lenses can be placed in the axis of the instrument. The letters, T, F, and P, engraved on the edges of these discs, indicate which particular lens is set for use.

Fig. 6 shows how the ground glass and the plateholder are placed. Closing the cover, D, locks them firmly in position. To draw the slide of the plateholder, the rings, K, attached to the slide bars, B (fig. 5), are pulled outward,

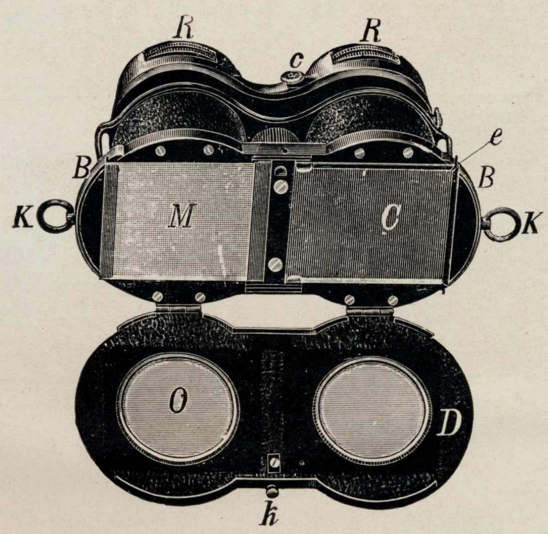


Fig. 6.

and fig. 8 shows this operation completed, indicating at the same time the notches, *n n*, made in the slide bars, B, for the purpose of engaging with the pins, e, projecting from the plateholders.

The shutter (see fig. 5) is provided with three setting pins, I. II. and III. Pin I., when pushed to the left, takes the two other pins automatically along with it, and sets the shutters of both sides as required for stereoscopic work.

When moving pin II. toward the left, pin I. will remain undisturbed at the right, but pin III. will follow in its course. This results in setting the shutter ready for exposure of the right hand plate, at the same time opening the left hand lens, which may now serve as a *focusing finder lens* on the ground glass inserted in the left side of the instrument (see fig. 6), on which the exact picture is visible up till the moment the exposure is made, and whereafter both shutters are closed.

Lastly, when moving pin III. to left, it will move alone, leaving both I. and II. at the right. The result is that both sides of the instrument are opened as required for its use as a theatre or field glass.

In whatever manner the shutter may have been set, it is released in all instances by a very slight pressure on the button, C (fig. 5).

The milled knob, s, at the right side of the shutter, regulates its speed, which is adjustable from 1-20 to 1-60 of a second.

Fig. 7 also shows at S a brilliant finder, by means of which the instrument may be properly levelled and the proper moment of exposure indicated. When

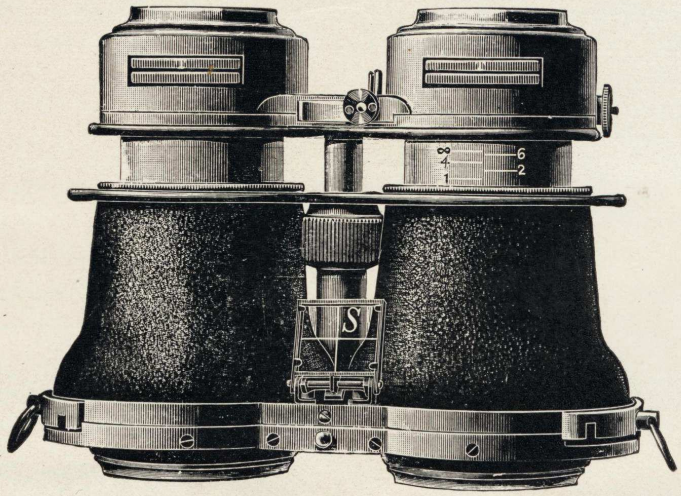


FIG. 7.

in use as a stereoscopic camera, the instrument is focused by means of a scale engraved in the right hand tube (see fig. 5).

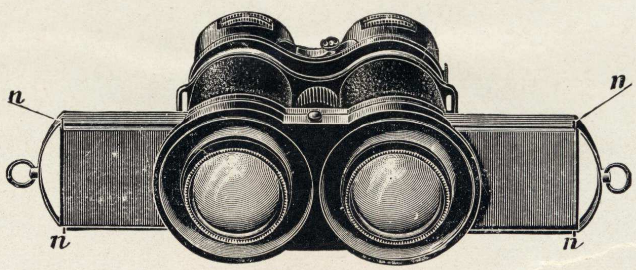


FIG. 8.

The plateholders, which are extremely light and absolutely light-tight are numbered in sets of 24 and carried in neat small leather wallets, in which they are arranged in lots of 3, each compartment being marked with the num-

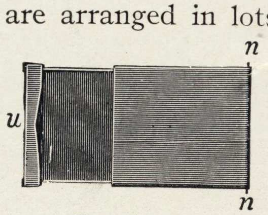


FIG. 9.

FIG. 10.

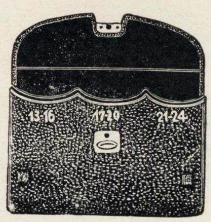


FIG. 13.

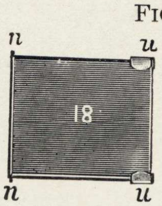


FIG. 11.

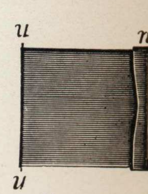


FIG. 12.

bers of the corresponding holders, by which means the risk of making two exposures on one plate is effectively eliminated.

Fig. 14 shows, at *m m*, the rotary stops which may be used in connection with the photo lenses. When the eye-pieces are in use, these stops are automatically locked. At *q* the nut for the tripod screw is visible.

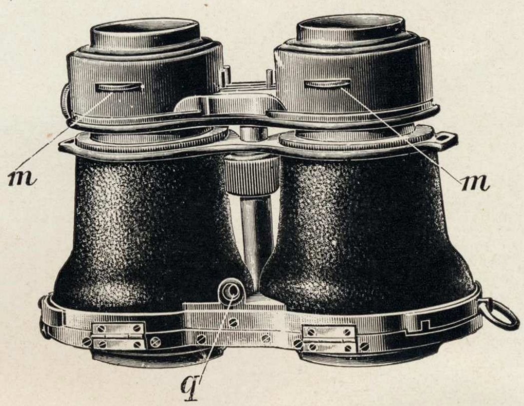


FIG. 14.

The Goerz Photo-Stereo Binocular

HAS

2½ times magnification as an Opera Glass,
3½ " " " a Field Glass,

and when used as a camera gives either instantaneous or time exposures for single or stereoscopic pictures, 1½" x 2".

The photographic lenses, accurately matched, are the well-known

Goerz Double Anastigmat Lenses

of 3" focus, especially made by us for these instruments.

The principal advantages are :

Very small size *Extreme lightness* *Perfect workmanship*
Simplicity *Universal utility and ease of manipulation.*

Weight, 9 ozs.; height, 3¾ in.

PRICES

Goerz Photo-Stereo Binocular, with two Goerz Double Anastigmat Lenses, 3" focus, magnifying as opera glass 2½ times; magnifying as field glass 3½ times; arranged for single and stereoscopic, time and instantaneous exposures, including finder, wallet with twenty-four plateholders and leather carrying case	$108 75
Code word........Stereostig.	
Extra wallets, each....................................	2 90
" plateholders, each	20
" wallet, with twenty-four holders complete..................	7 50
Walking-stick tripod, extra light, D. R. P. 111,368.....	12 50

INSTRUCTIONS FOR USE

A AS A THEATRE GLASS

In order to use the Goerz Photo-Stereo Binocular as a theatre glass, with $2\frac{1}{2}$ times magnification, pin III. (fig. 15) is pushed toward the left, whereby both shutters are permanently opened. The rotary discs, R R, in either side should now be turned until the letter T appears in the middle of the visible part of the

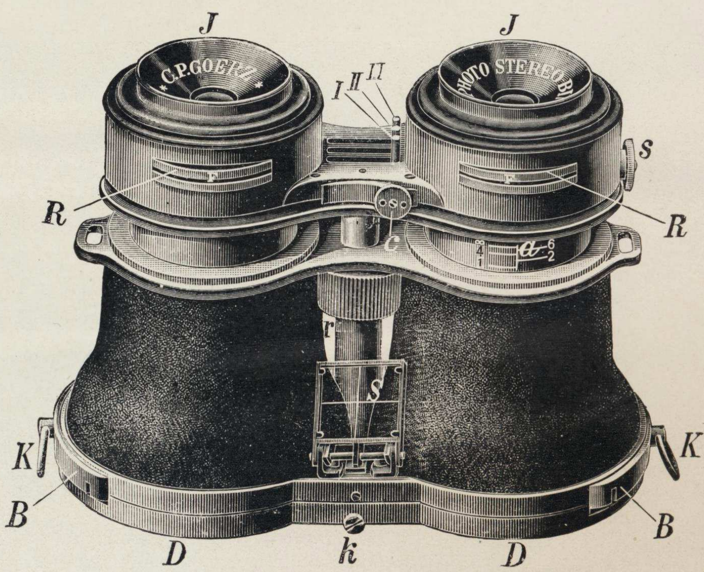


FIG. 15.

rim, in which position they will *snap* with sufficient resistance not to move by the ordinary use. The glass can now be focused by means of the little wheel, *r*, as any ordinary theatre glass.

B AS A FIELD GLASS

When the instrument is to serve as a field glass, with $3\frac{1}{2}$ times magnification, pin III. is moved to the left as described, sub. A. The rotary discs are turned until the letters F are in the middle of the visible part of the rim and the catch is felt to snap in. Focusing is effected as explained, sub. A, by means of the small wheel *r*.


ALTVATER

C THE GOERZ PHOTO-STEREO BINOCULAR AS A PHOTOGRAPHIC CAMERA

First bring the Double Anastigmat photographic lenses in position by turning the discs, R R, until the letter P appears in the middle of the visible part of the rim and the discs are felt to snap in. Now open the lower cover, D, by a light pressure of the knob, k, and insert the ground glass *with the ground side inwards* in the *left camera*. The side with the *wider* metal lining should be placed toward the middle of the instrument. Place a plateholder in the other side, being careful to turn the number outward and then close the cover, D. When the plateholder is properly inserted, its two little projecting prongs will engage in the notches, n n, of the slide bar, B. By means of the little wheel, *r*, located between the two cameras, the instrument should now be carefully focused either by means of the scale on the right tube, on which the distances are indicated in metres (1 Metre=$3\frac{1}{3}$ ft.) or by means of the ground glass on which the image will become visible by sliding pin II. toward the left, whereby at the same time the (safety) shutter on the other lens is set ready for operation.

Focusing should be done with all due attention, as the play-room for proper adjustment is only small, on account of the short focus of the lenses (3″). Their depth of focus, on the other hand, is enormous and when set on infinity (∞) all objects down to 20 ft. will be microscopically sharp. When using the smaller stops, sharpness reaches still considerably closer to the lenses.

When a *stereoscopic image* is required, the ground glass should now be removed and a plateholder (with the number outwards) inserted in its place, *and only in this case* pin I. should be moved also toward the left. For single pictures these latter operations are, of course, superfluous. By pulling the rings, K, of either or both plateholders away out until they are felt to stop, the plate or plates are ready for exposure.

The shutter is released in every instance, and whatever pin has been used for setting it, by depressing the little knob, *c*, which is attached to a small oscillating block. When the knob, *c*, is screwed out as much as it will go on this block it will give *instantaneous* exposures, whereas time exposures result when the knob, *c*, has been screwed all the way down in this block. In this case the shutter will remain open as long as the knob is kept depressed, and close directly on releasing the knob.

The duration of instantaneous exposures may be varied between 1-20 and 1-60 of a second, by means of the small wheel, s (fig. 5), at the right side of the instrument. When the screw on which this wheel is placed is flush with it, the exposure will be 1-20 sec., whereas it will be shortest when by turning the nut, s, the screw projects so far out that it will not move further. The middle position produces exposures of 1-40 sec.

As soon as the exposure is made the plate holder or holders are closed by pushing back the slide bars, B, and the cover can now be opened to remove and replace the holders for the next exposure.

We have constructed specially for use with the Photo-Stereo-Binocular, an extremely light and rigid walking-stick tripod, off which the handle is screwed and on which then the binocular can be supported. By simply drawing the tripod out of the walking-stick tube, the tripod legs are automatically extended and only need be spread apart to set it up. When placing the legs together again, sliding them back in the tube will again automatically telescope the legs. This construction is patented in Germany (D. R. P., 111,368) and applications in other countries are pending. When using the Photo-Stereo Binocular on this tripod it is recommended to lightly rest both hands on the instrument, keeping them there while making the exposure. This precaution completely prevents blurring by vibration of the camera.

The rotary stops are so arranged that they leave the lenses at full opening when turned aside to 0. They carry two smaller stops corresponding to F 11 and F 31 respectively. On bright, sunny days, or on the water, the use of stop F 11 is recommended; on overcast days the full opening should be used and the smallest stop should only be used for the purpose of increasing depth of focus when making time exposures. The relative times of exposure required for these three openings are—

0.	F 11.	F 31.
1.	2.	16.

The Goerz Photo-Stereo Binoculars are made of strong aluminium tubing neatly covered with fine grained leather, and are delivered in a sole leather carrying case with shoulder strap.

The eye-caps of all Photo-Stereo Binoculars are engraved as follows:

Photo-Stereo Binocle,
C. P. Goerz, Berlin.

And the side-bars carry the patent number

D. R. P., 101,609.

The **GOERZ TRIEDER-BINOCULAR**

IS BEYOND QUESTION THE SUPERIOR OF ALL OTHERS,

Optically and Mechanically,

AND ITS

DEFINITION AND DEPTH OF FOCUS

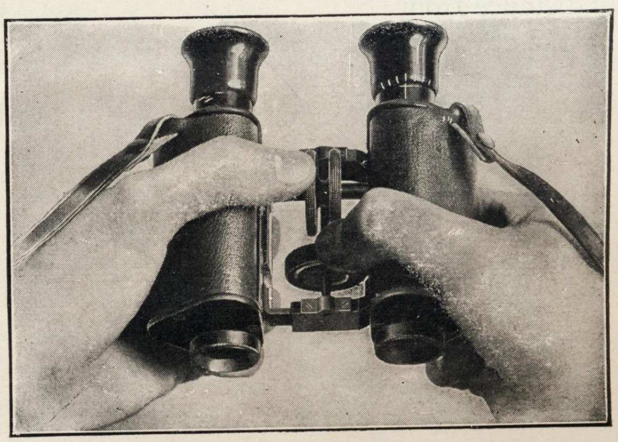
(Sometimes called stereoscopic effect) **is unapproachable.**

Note the rack and pinion adjustments for the focusing and the pupillary distance ; also separate adjustment on right eye piece.

GOERZ TRIEDER-BINOCULAR

UNDER the above designation I have placed on the market a type of binocular, widely different from those almost exclusively in use thus far, and as the advantages derived from the principles underlying the construction of the Trieder-Binocular can be best appreciated by comparing them with the other existing systems, I will preface the account of their detail by a short description of the systems hitherto in use.

The ultimate purpose of all telescopes is to produce, at the proper distance and with sufficient magnifying power to render every detail distinct, the image of objects too far away to be clearly distinguished by the naked eye. We require, therefore, of a good telescope not only the optical perfection and proper lighting of the image, but also a wide angle of view and the necessary magnifying power. Should the glass be intended for use in the hand, then size and weight are important considerations. Optical science has attained a high degree of perfection in any one of these considerations, taken individually, but not until very recently has it been possible to combine them all with any chance of success.



Optical science teaches us that the conditions above mentioned are interdependent, and that improvement in one line usually necessitates a deficiency in another. A greater magnifying power, for instance, implies a smaller field of view, and to increase the brightness of the image we must enlarge the diameter of the object lens, and, therefore, the length of the entire instrument, rendering it correspondingly unwieldy. An extended angle of view can only be obtained by a limitation of the magnifying power, and so on. To reconcile these and similar antagonistic properties constitutes the main difficulty in the perfecting of the telescopic system, and is the problem which has taxed the knowledge and inventive powers of the most prominent opticians for nearly three centuries. By a study of the various types of telescopes we will show in what manner modern optics have solved this problem. To a clearer understanding of the subject, we will first define a few technical expressions.

A distant object appears much smaller to our eye than it really is, and this fictitious size we call its "apparent magnitude." The "apparent magnitude" is determined by the "angle of view," which is the angle formed by the rays of light striking our eye from the extreme points of the object. We see the distant church spire in Fig. I., A B, at the angle A O B. We also see here how two objects of varying heights, as the church spire and the tree, C D, can appear to

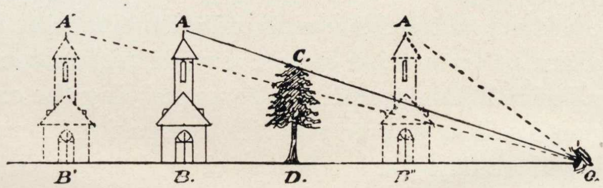


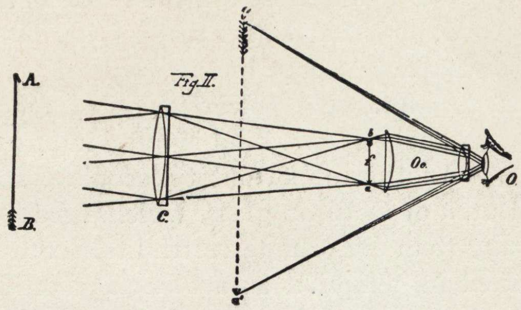
Fig. I.

us at the same angle when at varying distances from our eye. The apparent magnitude of an object is dependent upon its actual magnitude, as well as upon its distance from the eye, therefore we judge of the actual magnitude by comparing the other two qualities. Fig. I. shows us how the apparent size diminishes as the object recedes from the eye, and the angle of view grows narrower (angle A′ O B′ is narrower than A O B′) and how the angle widens as the object approaches.

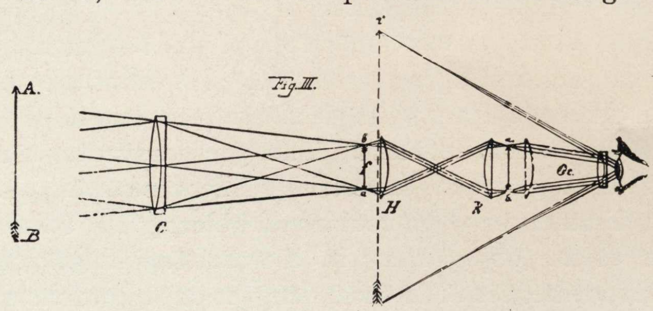
Any optical system which endeavors to render the image of distant objects even more distinct than when seen by the naked eye, must do so by widening the angle of view. This process can be expressed in figures. A telescope has a 4x magnifying power if the object seen through it appears four times larger than when observed at the same distance by the naked eye. This is linear magnification, the magnifying of one dimension only. But as the object appears increased in height as well as width, we speak then of the superficial magnification,—the enlarging of both dimensions at once. This equals the square of the linear magnification, so that a linear magnifying power of 4x produces an image of sixteen times the original surface area.

Fig. II. shows us the path taken by the rays of light within the telescope.

The telescope, in its simplest form, is a combination of lenses held together by a tube. The larger of the lenses, directed toward the object to be viewed and receiving the light emanating from it, is called the object lens or glass; the smaller lens, directed toward the eye of the observer, is called the ocular or eye lens. The object glass reflects, at its focal point, an image which is then magnified and transmitted to the eye by the ocular lens. The length of the tube must be adjustable within certain limits to allow of finding the proper focal length of the ocular lens to that of the image thrown by the object lens. The rays falling from the object, A B, on the object lens, C, meet at the focal point, f, where an inverted image, b a, of the object is formed. The image is then seen through the ocular, which, acting as a magnifying glass, reflects to the eye an enlarged picture of the original object. But the ocular, being in reality only an ordinary magnifying glass, does not change the position of the pictures it reflects, so the image transmitted to the eye will be an inverted one. This description of glass is called the astronomical, or Kepler telescope, and is used exclusively for astronomical observations, where the inverting of the image is of no great consequence. All large modern astronomical telescopes are constructed on the above principles. While the naked eye sees the object, A B, at a narrow angle, determined by the size of the object and its distance from the eye, so through the telescope the reflection, a′b′, of the object is seen at the far wider angle a′O b′. The proportion of the reflected image to the object itself is the sum of the magnifying power of the telescope, or more simply, the magnifying power depends upon the proportion of the focal length of the object lens to that of the ocular. Fig. II. shows the length of a telescope of this kind, *i. e.*, the distance between object lens and ocular must be about equal to their added focal length, for the focal point of both is at f, where the rays of light reflect the image of the object without. The good points of the Kepler telescope are its extended field of view and the great brightness of image shown ; its disadvantages lie in the inverting of the image and in the length of the instrument. This last renders it entirely impracticable for use in the hand.



In the endeavor to utilize the good points of the astronomical telescope for terrestrial observations, where a correct position of the image is necessary, the



opticians of the seventeenth century introduced a second system of lenses between the original two, thereby reinverting the image at the focal point, f ; for if the image at f is seen through another system of object glasses, instead of merely through the ordinary magnifying glass, the picture will make two revolutions instead of one, thereby regaining the original position of the object.

Fig. III. shows the path of the rays of light in the species of terrestrial telescope just described. The intervening lenses, H and K, the distance of which, then only a part of the picture will be enclosed in the frame, and the more we stretch the rubber the smaller the enclosed part will be.

The frame, then, represents the apparent field of view, the stretching of the rubber stands for the increasing magnifying power, and that part of the picture which is still enclosed in the frame is the actual field of view. The figures quoted above show that with a magnifying power of 12 diameters the field of view of the terrestrial telescope has an angle of 3.3°, and this is the minimum of construction. At a magnifying power of 15, or more, the field of view is so small that an instrument of this kind is quite impracticable for hand use.

Another important telescopic system is that used in the construction of the Dutch or Galilean glass, which produces a reinverted image in a much simpler way than does the terrestrial telescope. This is the oldest type of telescope, and since its adoption as a binocular or double glass—about the beginning of the last century—it has been in general use as a field, marine and opera glass.

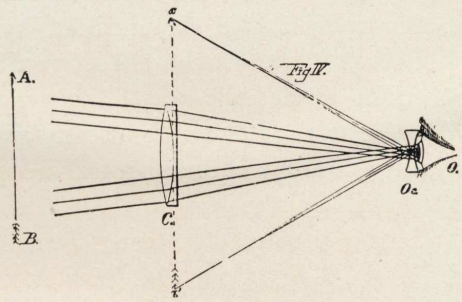


Fig. IV. shows the path taken by the rays of light in the Galilean glass. The light falling on the object lens, C, would reflect an inverted image of the object, A B, at the focal point of the object lens, which in this case is beyond the eye. But before this image can be formed, the rays of light converging toward it are caught up and broken by the Ocular Oc., a bi-concave or diverging lens, the form of which can be plainly seen in Fig. IV. The eye receiving these diverging rays sees at a point, a′, an image of point A, at b′ an image of B, so that the entire magnified image, a′b′, has the position of the object, A B. The image, a′b′, is magnified as many times as the focal length of the ocular can be contained in that of the object lens. The great advantage of a glass of this description over the Kepler and terrestrial telescopes can be seen at once. Its length, *i. e.*, the distance between ocular and object glass, is here even less than the focal length of the object lens ; in a word, the length of the Galilean is equal to the difference between the focal lengths of object lens and ocular, while the length of the astronomical telescope must equal the sum of these two focal lengths, and in the terrestrial telescope there is the added length of the intervening lenses. The smaller size of the Galilean telescope, combined with its use as a binocular glass, are the only reasons of its universal employment, for it has many and serious faults. The field of view of the Galilean glass is bounded by a circle of rays, which penetrate from the periphery of the object lens through the ocular, full into the pupil of the eye. The field of view, therefore, other conditions being equal, is exactly proportionate to the opening of the object lens, so it would seem easy to increase the extension of the former by a corresponding increase in the size of the latter. This, however, has its limitations. To retain the chief advantage of this system, its utility as a double or binocular glass, the size of the diameter of the object lens must be limited by the length of space between the eyes. Taking 60 mm. as a maximum of this space, the largest object lens allowable can have no greater diameter than 55 mm.—for we must allow a fraction of space for the setting. The field of view of an object glass this size is seen by the eye pressed close to the ocular at an angle of from 13 to 20 degrees. This is then the limit for the Galilean telescope, while the Kepler glass shows an angle of 40 degrees. But as it is not possible to place the ocular immediately at the eye of the observer, so the field of view of the Galilean glass diminishes exactly as the eye recedes from the ocular. Any increase of magnifying power increases this defect, so that the magnifying power of the Galilean telescope must, of necessity, be a very moderate one. At a magnifying power of 3 diameters an apparent angle of 18 degrees, therefore an actual angle of 6 degrees, can be obtained, but at a magnifying power of 10 diameters, the Galilean glass shows an apparent angle of little over 10 degrees, therefore an actual angle of 1 degree, an infinitesimal field of view. This places the Galilean glass at a great disadvantage when compared with other models. Other conditions being equal, an astronomical telescope, of from 4 to 6 diameters magnifying power, shows a field of view six times larger than that of the Galilean glass, at a power of 8 to 10 diameters, at least ten times larger ; that is, an astronomical telescope with a magnifying power of 10 diameters would reflect the same superficial area as a Galilean glass magnifying only 4 diameters. In consequence, most opera glasses have, at a very slight magnifying power, not more than 2 or 3 diameters. The field of view of the Galilean glass is deficient in point of brightness as well. As a consequence of the optical effect of this construction, the light grows fainter from the center of the image outward, and any increase in magnifying power renders this defect more noticeable.

As a result of our investigation we may assert, therefore, that the Dutch or Galilean telescope gives us a handy and useful glass at a slight magnifying power, say not more than 4 diameters. But if we wish to increase the magnifying power the faults of this instrument become so apparent as to exclude it from practical use, while the good points of the astronomical or terrestrial telescope do not come into play until a magnifying power of 15 diameters or more is reached. Then, of course, the great size of the instrument utterly precludes its use in the hand. What we need, therefore, is some method of construction which will permit of a magnifying power of 5½ diameters in a convenient and handy form. A glass of this kind would prove extremely convenient for use in the army and navy, for hunters, tourists, theatres, race-courses, etc.

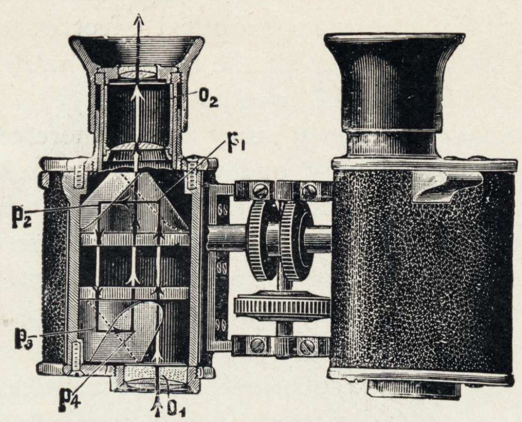
Our **Trieder-Binocular** fulfills these requirements in every possible way.

We have endeavored to combine the good points of the Galilean telescope (its small size and the binocular sights) with the more valuable optical qualities of the astronomical telescope, avoiding the deficiencies of either system.

The reinversion of the image, as obtained in the Galilean and terrestrial telescopes, is a primary consideration for an instrument designed for use in the hand. We will now explain how it has been possible to solve the difficulty and to combine two types so greatly at variance.

Experience teaches us that reinversion may be obtained by a system of prisms. Look at any object in a mirror lying flat before you, and you will find the reflection turned upside down. In a vertical mirror right and left are changed ; therefore a combination of mirrors will give a complete inversion of the reflected object. In optics such reflections are obtained by the far more effective prism surfaces. Therefore, if we combine an astronomical telescope, showing an inverted image, with a system of reflecting prisms, it is self-evident that the result will be a glass which, while retaining its good optical qualities, will give a reinverted image of the object observed. This idea of reinversion by means of reflecting prisms has been attempted some time ago in the construction of telescopes. The Geometrician and Optician Porro, who long understood the immense advantage of the prism system, endeavored, about the middle of the last century, to put his idea to practical proof. We say "endeavored" advisedly, for his trials were attended with no very great success, and many years of study and research in the overcoming of technical difficulties were necessary before the principles laid down by Porro could be put to practical use in their present perfection.

Goerz Trieder-Binocular No. 20



(One-half the natural size.)
Fig. V.

Fig. V. shows the inner construction and the optical effect of the **Goerz Trieder-Binocular.** O^I is the object lens through which the rays of light enter the telescope. This object glass is constructed especially for the **Trieder-**

Binocular and shows a decided advance on the lenses thus far in use (Ger. Patent A. No. 11322, III, and Foreign Patents). It consists of two lenses of great optical power, cemented together perfectly, and allows of an unusual clearness of the image up to the extreme edges of the field of view. By means of this glass the angle of view may be extended to its greatest size (40°) without any detriment to the luminosity or to the distinctness of the image on its outer edges.

The "apparent" field of view of the Trieder is 40°; it is therefore 11% wider than that of the prismatic binoculars of other makers, which have only a 36° field. The apparent field of view may be obtained by multiplying the "actual" field of view by the magnifying power; and conversely, the actual field of a telescope is equal to the apparent field divided by the magnifying power. Thus we have:

Apparent field of view......	40°	40°	40°
Actual field of view.........................	6.6°	4.4°	3.3°
Magnifying power..........................	6x	9x	12x

Or practically expressed: At a distance of 1,000 feet, the observer commands a circle, the diameter of which with a

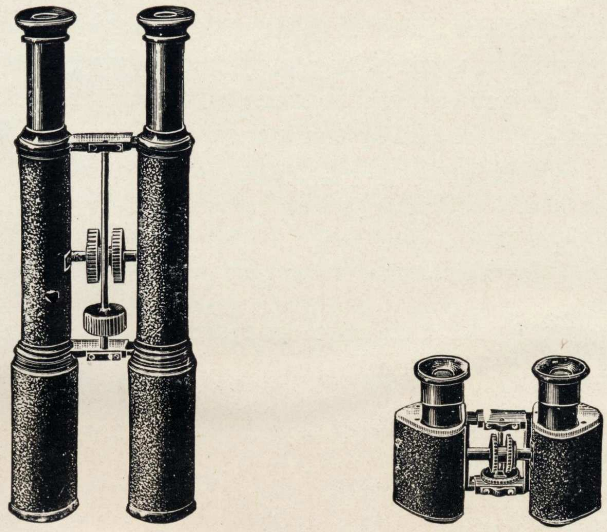
	Feet.
Magnifying power of	3 = 232
" "	6 = 116
" "	9 = 77
" "	12 = 58

The rays of light next strike through the object glass, or in the direction marked by the arrows, fall first on the uppermost of the two prisms, and are deflected by its surface, P^1 and P^2, at right angles to their previous course. This brings them to the lower prism, where two similar surfaces, P^3 and P^4, turn the rays upward again outside of the upper prism, directly into the ocular, O^2. The peculiar arrangement of the prisms, combined with the four-fold reflection, gives the desired reinversion of the image. The prism system allows of the future advantage of shortening the length of the astronomical telescope without the slightest deterioration of its optical qualities. We have explained that the length of the Kepler glass is equal to the sum of focal lengths of object lens and ocular or to the path of the rays between object lens and ocular. How this necessary length is reduced in the Trieder construction is shown by the arrows marking the path of the rays in Fig. V. The optical axis is drawn together in a zigzag line of right angles by the four-fold reflection, which reduces the distance between object glass and ocular by at least one-third.

Fig. VI. shows the difference in size between the terrestrial glass and a Trieder-Binocular of similar optical qualities.

The Trieder method of construction demands a high degree of technical perfection, as is shown by the fact that only until a few years ago was it possible to obtain the proper material for the reflecting prisms. Recent improvements in glass-making have at last given us a glass of sufficient purity and transparency.

For as the rays of light must pass not only through the two lenses, but through two double prisms (even more than the amount of glass to be traversed in the terrestrial telescope), there must be absolutely no absorption to weaken their intensity. But the construction of the prisms themselves demands as great technical skill as the making of the material. Those who have knowledge of practical optics know that the making of a perfectly even surface is one of the most



(Comparative size of the two types at equal magnifying power.)
FIG. VI.

difficult of all its problems. And this task has to be accomplished four times in every single Trieder glass, and the stronger the magnifying power the more noticeable does the slightest imperfection in the polished surface become.

Besides these difficulties, the Trieder glass requires an extremely exact concentration of the optical mediums, that is, a most perfect balancing of all its parts that the image thrown by the object lens may fall exactly vertical to the optical axis of the ocular. This is a most important consideration for the success of the glass. Naturally, the difficulty is doubled in a binocular glass, so that we can hardly wonder that the optical sciences of former years have not been able to cope satisfactorily with this problem of the reinverting prisms.

By the use of all the modern improvements in technical optics and mechanics, we have succeeded in overcoming these difficulties, and in manufacturing the Trieder-Binoculars in absolute perfection of construction. We believe that we here offer to the public a glass which will fulfil every requirement in a most satisfactory manner.

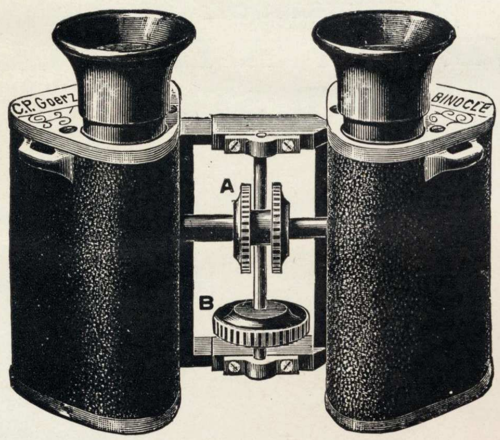
Every Binocular must bear this inscription:

C.P. GOERZ BERLIN

and this Trade Mark:

TRIËDER BINOCLE

Goerz Trieder-Binocular No. 30.



(½ the natural size.)

FIG. VII.

Goerz Trieder-Monoculars.

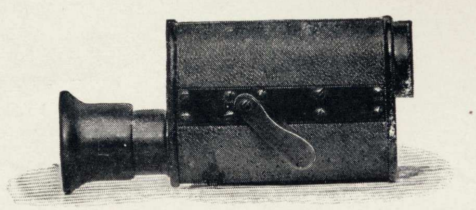


FIG. VIII.

BINOCULARS	No. 10	No. 20	No. 30	No. 40
Linear Magnification..................	3x	6x	9x	12x
Superficial Magnification..............	9x	36x	81x	144x
Actual Field of View..................	13.3°	6.7°	4.4°	3.3°
*Subjective Field of View............	40°	40°	40°	40°
Code-word	Trias	Tribus	Trigon	Trio
Price.................................	$38.00	$46.00	$54.00	$62.00
MONOCULARS.				
Linear Magnification..................	3x	6x	9x	12x
Code-word.............................	Motaras	Motribus	Motrigon	Motrio
Price.................................	$15.50	$18.50	$21.50	$25.00

The actual and subjective field of view of the monoculars is equal to that of the corresponding binoculars.

* NOTE.—Special attention is called to the greater apparent field of view of the Goerz Trieder-Binoculars. See page 78.

Comparison of the FIELDS OF VIEW OF A FIELD GLASS OF THE OLD STYLE

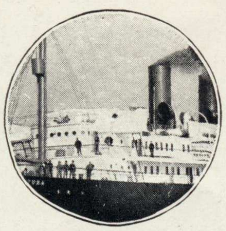


FIG. IX.

FIG. X.

AND OF GOERZ TRIEDER-BINOCULAR OF THE SAME MAGNIFICATION.

The Trieder-Binoculars

are also excellent for

ASTRONOMICAL OBSERVATIONS

in all those cases in which only a moderate magnification is required.

Nos. 10 and 20 are especially recommended for the matching of

Variable Stars,

In consequence of their very great real field of view.

On clear moonless nights the Trieder-Binoculars show the following magnitude of stars sufficiently distinct to allow the valuing of brightness according to Argolander's method :

No. 10, . .	Stars up to	magnitude	5
No. 20, . .	"	"	8
No. 30, . .	"	"	8.5
No. 40, . .	"	"	9

Directions for Use.

The Trieder-Binocular is focused by means of a double wheel, *a*, with milled edges, operating on a system of rack-pinions. The oculars are pushed toward or away from the object glasses by means of the little wheel, *a*. (Fig. VII.) This final focusing, for both eyes at once, is a great improvement on the separate ocular focusing occasionally found in similar systems. The latter require a separate focusing for each eye every time the glass is directed on objects at varying distances, which can seldom be accomplished correctly, so the image loses in distinctness, and the eyes become fatigued.

The **right ocular** can be focused by itself to correct any **inequality in the eyes** of the user. First focus (with the wheel *a*) the left ocular on some distant, sharply defined object (telegraph wire, sign, brick wall, and the like). Leave glass in this position, and turn the frame, *o*, of the right ocular with the hand, until the object is properly focused for the right eye alone. The right ocular may be left in this position, and a mark on the frame will render repeated focusing unnecessary; thus the position can always be found, even if the glass should have been turned by chance.

If the sight of both eyes is the same, then the right hand ocular must be kept in exactly the same position as the left. When this is the case, both oculars are even with the marks on the ocular tubes, or both touch the main body of the case. When the proper position of the oculars has been ascertained, the focusing of the entire glass can be managed by means of the little wheel, *a*.

These directions should be carefully read and followed, in order that a perfect image be obtained, and that no complaints of fatiguing the eye, or of showing blurred pictures may be made. As cases of eyes with differing sight are comparatively uncommon, the Binocular should always first be tried with the oculars in the same position. This is best in any case, except where a difference in the eyes is known to exist.

When the glass has been brought to a correct focus, the tubes can be pushed apart or together by means of the second wheel, *b*, until their distance one from another corresponds with the distance between the pupils of the eyes. When this distance is found, the circles seen by each eye separately will blend into a single one.

When the glass has been arranged properly for the eye of the owner, it may be left in this position, as the case holds the glass in any length.

N. B.—Any meddling with the Trieder-Binocular must be strictly avoided, as the position of the various parts are changed thereby, and the glass rendered unfit for use. If nothing of this kind is attempted, the solid construction of the Binoculars guarantees good wear. Should any slight repairs be necessary, return the glass to the makers for this purpose.

Original and enlargement, reproduced from negative made with Goerz Photo-Stereo Binocular.