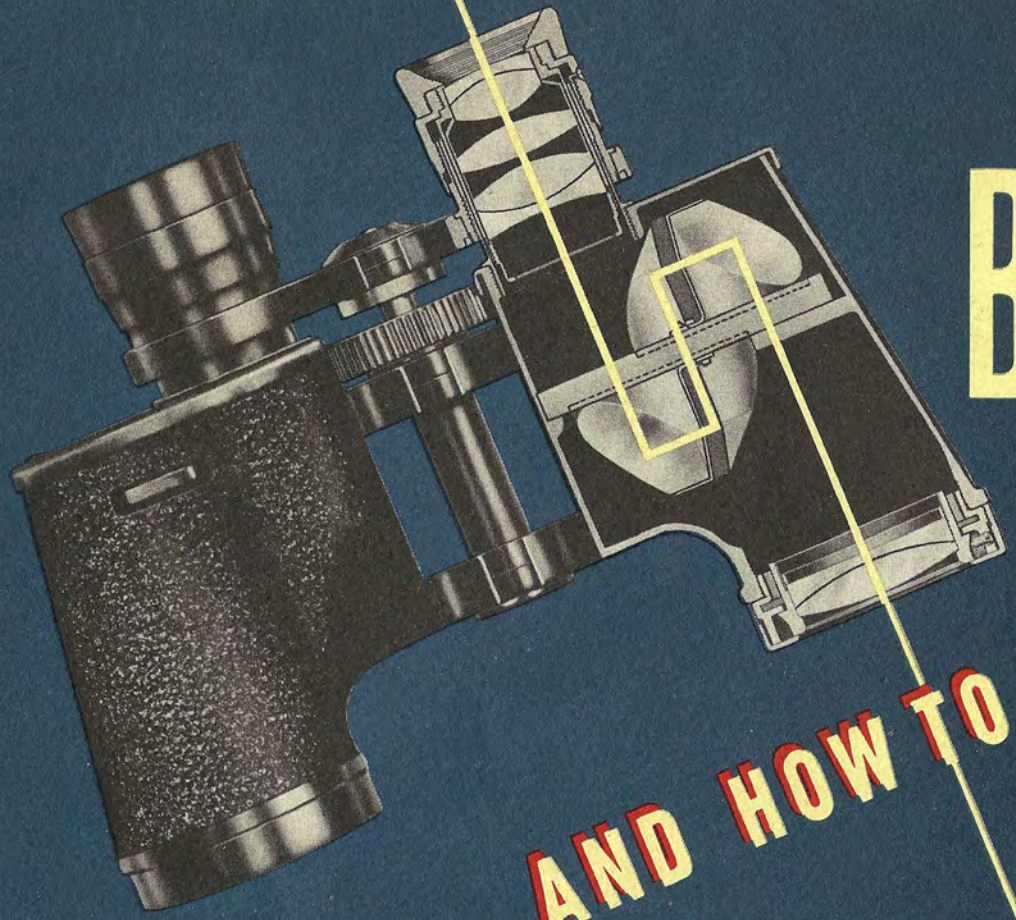
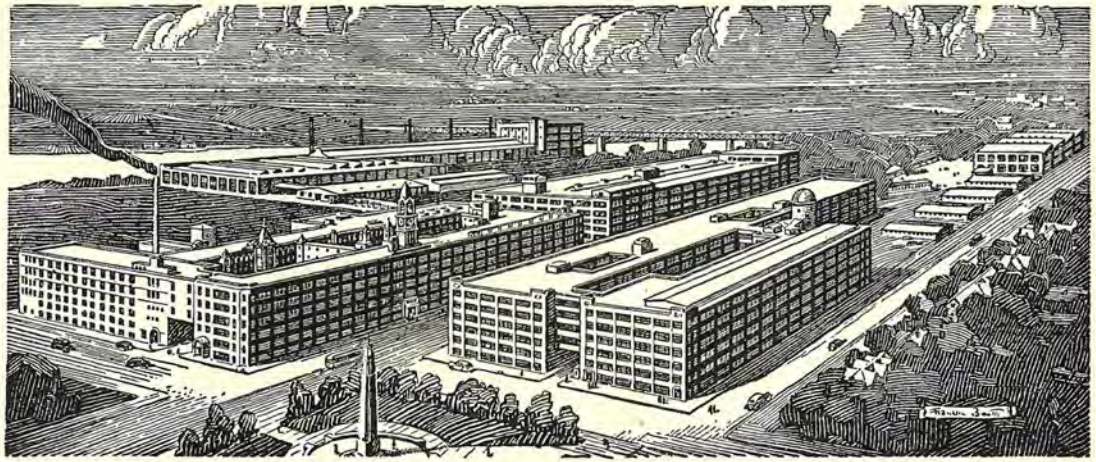


Binoculars

AND HOW TO CHOOSE THEM

BAUSCH & LOMB OPTICAL CO. • ROCHESTER • N. Y.



Genuine Bausch & Lomb Binoculars are backed by the research, engineering and manufacturing facilities of Bausch & Lomb Optical Co., Rochester, New York, founded in 1853. Here, in this American scientific institution, are produced the world's finest optical glass and precision optical instruments for research, education and the Armed Services.

BAUSCH & LOMB

OPTICAL COMPANY ROCHESTER 2, N. Y.

Your Binocular . . . a Lifetime Investment

When you go shopping for a binocular, you will find a variety of instruments available, throughout a wide range of prices.

After you buy one, you probably will keep it the rest of your life; therefore, you should choose carefully.

The purpose of this booklet is to tell you about binoculars, how good ones differ from poor ones, why utmost optical precision is necessary in an instrument for seeing, and a little about the mechanical problems to be solved in good binocular manufacture. Finally, a word about the necessity of knowing the organization behind the product—its reputation for knowledge, experience, and dependability.

We believe you will agree that in a binocular only the best is good enough for a lifetime of service and satisfaction.

BAUSCH & LOMB OPTICAL CO.

INSIDE INFORMATION ON BINOCULARS

What is a Binocular for?

A binocular is an extremely precise optical instrument designed to afford sharp, enlarged, stereoscopic vision of distant objects. With it you can get greater enjoyment from traveling . . . from watching your favorite sports . . . from your hunting trips . . . from nature study and other hobbies. In navigation, exploration, forestry, and military activities, a good binocular is considered a necessity.

Binoculars are manufactured in many styles and types. How well a specific binocular performs its function depends on many factors, some of the most important of which are not readily apparent to the inexperienced user.

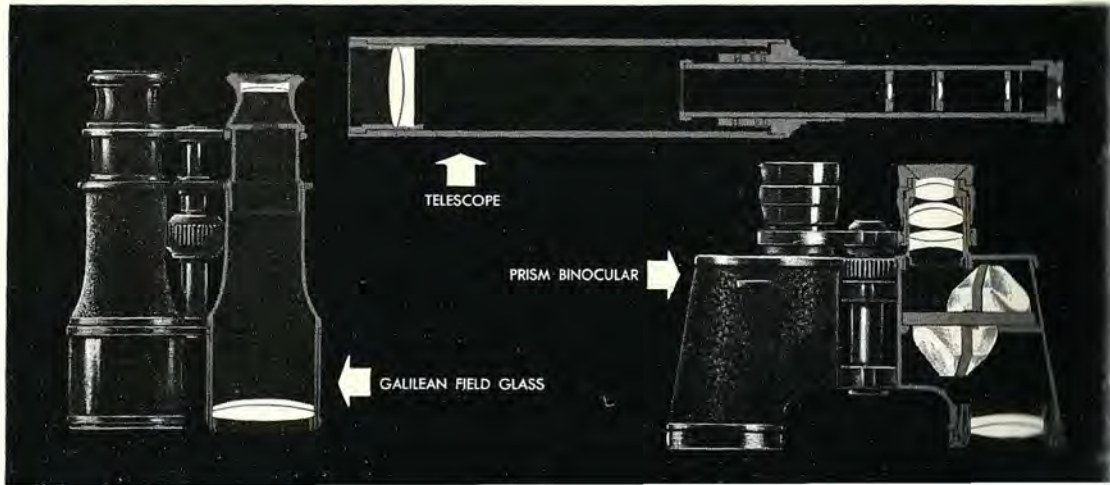
This book has been written to help you choose the binocular that will best fit your needs . . . that will give you *lasting satisfaction.*

What are Telescopes, Binoculars, and Galilean Field Glasses?

A telescope is usually designed for extremely long range vision. There are many kinds of telescopes, but they may be classified roughly into: the astronomical type—for observing stars, planets, etc.—which gives an inverted and reversed image; and the terrestrial type—for viewing objects on land or sea—which has an "erecting system" of prisms or lenses. This system makes the image right-side-up and correct with respect to left-to-right.

The term "Field Glass" is widely used to describe any hand-held double telescope. The non-prismatic, or Galilean, "Field Glass" is a double Galilean telescope, made with a convex objective, concave eye lens combination with direct vision through the lenses and an erect image. It is seldom constructed to magnify more than 5 times, because higher magnifications require excessive length and weight in this type of instrument. And, in the powers in which prism binoculars are usually built, the field of view of the Galilean field glass is so restricted that such a glass is of little general use. The illustration on Page 5 shows the field of view of a Bausch & Lomb 6X,30 binocular compared with that of a 5X,40 Galilean field glass.

A prism binocular, such as the Bausch & Lomb Binocular, is a pair of telescopes with prismatic erecting systems. The light passes through the objective lens—the large lens at the end of the binocular that points toward the subject. It is reflected by the first prism into the second prism, which is set at an opposing angle, and then is reflected through the eyepiece system, as shown on Page 10. This construction also shortens the length, permits compactness and light weight, makes it possible to place the



objectives farther apart for greater stereoscopic effect, and affords other advantages of optical significance which contribute to its performance.

A prism binocular offers, in most compact form, relatively large field combined with high power, excellent illumination, clear definition, and increased stereoscopic effect. Each of these qualities will be discussed shortly.

Motion, in the field, or of the binocular itself, is magnified as much as is the size of objects seen. At 10X and above, it is difficult to hold the glass steady enough for accurate vision. If higher magnifications are desired, a telescope, with a rest or other support, is recommended as the most practical solution.

How far can I see with a binocular?

Ask a binocular owner this question, and he'll probably answer, "You can see as far *with* a binocular as you can *without*."

All of which may sound confusing. But it *is* true that the range of your vision, with or without a binocular, is the same. For example, you can see to the horizon, or to the moon and stars with a binocular . . . *or* with the naked eye. But actually the *important* consideration in a binocular is not how *far* you can see, but how *well* you can see—how big an image you can get, how sharp and clear and bright that image appears. These are the factors that determine your choice of a binocular . . . that distinguish a fine binocular from a poor one.

To help you judge the performance of a binocular, a few simple tests you can make will be suggested in the following pages. In order to make these tests you will need to know first how to focus a binocular.

How do I focus a binocular?

Two adjustments other than the focusing adjustments are needed to make a prism binocular usable by any pair of eyes.

First, the barrels must swing on a hinge to provide for adjusting to the distance between the eyes. This distance between the eyes is known as "interpupillary distance"; the interpupillary adjustment makes it possible for the image seen by each eye to be correctly superimposed, thus forming a single clear image.

Second, to accommodate persons with eyes of unequal vision, one of the eyepieces (the lenses nearest the eyes) must be individually adjustable. Both adjustments should be graduated* for convenient resetting.

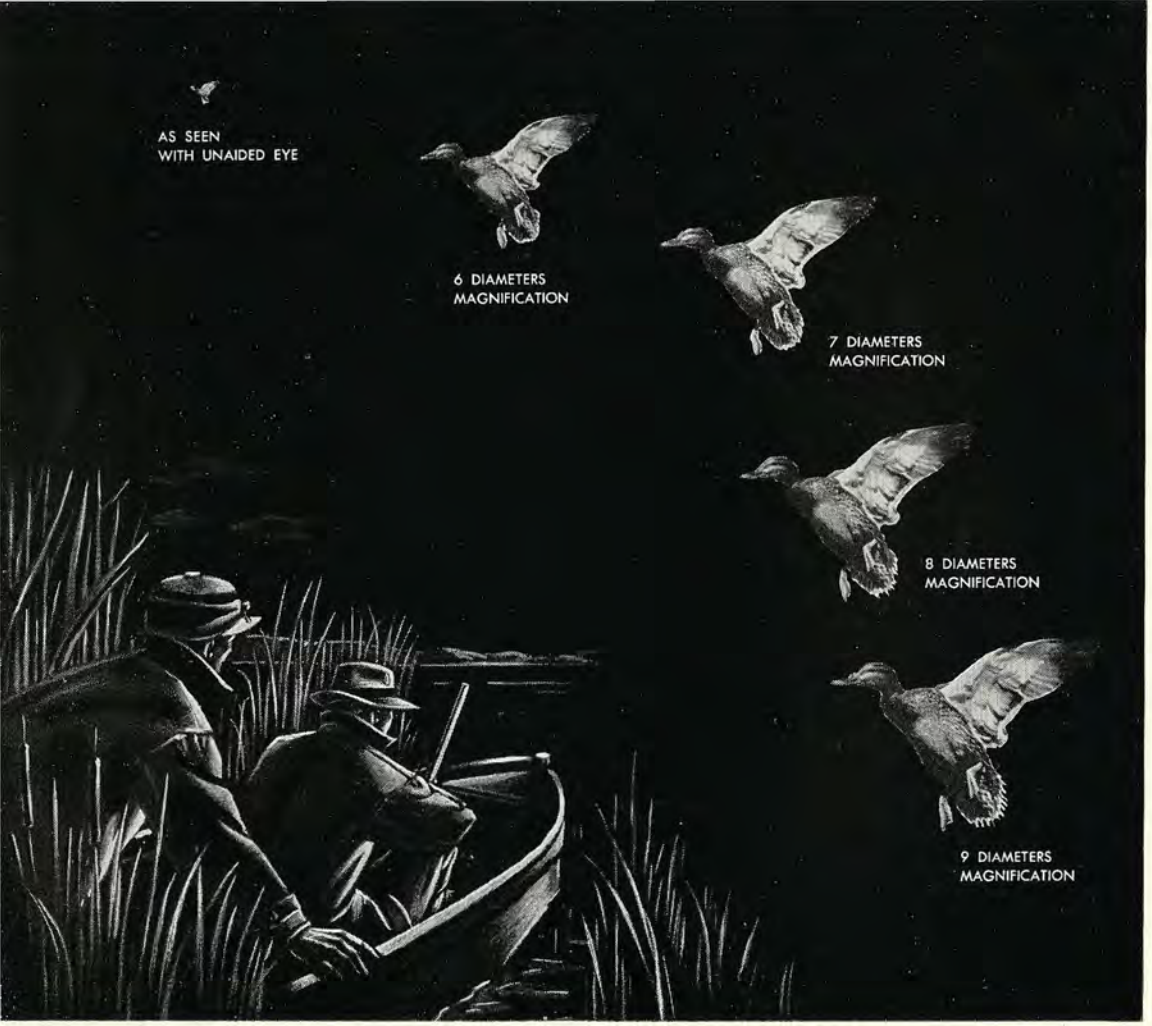
To adjust the binocular, hold it before the eyes and move the barrels together or apart until the view through the instrument appears as a single sharp-edged circle.

Next, because binoculars are used for varying distances, you must focus the eyepieces. If it is a central focusing model, cover the objective which is on the same side as the adjustable eyepiece and rotate the central focusing adjustment until the object is as clear as possible. Then cover the other objective and turn the individual eyepiece adjustment until the object can be seen distinctly.

In using the individual focusing type of binocular, each eyepiece must be adjusted independently by rotating.

By taking note of the readings which are on the interpupillary scale and the individually-focusing eyepiece scales*, you can at any time almost instantaneously reset the binocular to fit your eyes.

**The interpupillary adjustment is measured in millimeters (25.4 millimeters = 1 inch). The markings on the eyepieces are measured in "diopters," a unit of optical measurement used only for convenience in setting.*



What is magnification?

By magnification (or power) is meant the number of times the image seen through the glass is larger than the object appears to the naked eye. The power or magnification is indicated by X ("times," as in multiplication)—7X means 7 magnifications. The second number in the model description (the "35" of "7X,-35," for example) refers to the diameter of the objective lens. This is discussed on Page 6.

Magnification is a comparatively easy characteristic to obtain. However, to achieve the many other desirable qualities necessary to a good binocular, advanced optical design and skilled workmanship are required.

CAUTION: Don't take for granted the power stamped on a binocular. Glasses of obscure make are sometimes lower in power than they are claimed to be. Here's how you can check on the power of a binocular:

Select an object which doesn't occupy the entire field of view, about 100 feet away. Place the binocular on a rest, adjust it to your eyes and focus on the object.

Now, look at the object through one barrel only, having the other eye exposed so that it looks down the outside of the glass at the object. You will then see two images, a large one seen through the binocular and a small one beside it seen with the naked eye.

Next, move the binocular until the large image overlaps the smaller and compare the sizes. The number of times the large image exceeds the smaller in size is the actual power

of the glass. If the glass is 8 power, the large image should be 8 times the size, in height or width, of the small image.

What does "field of view" mean?

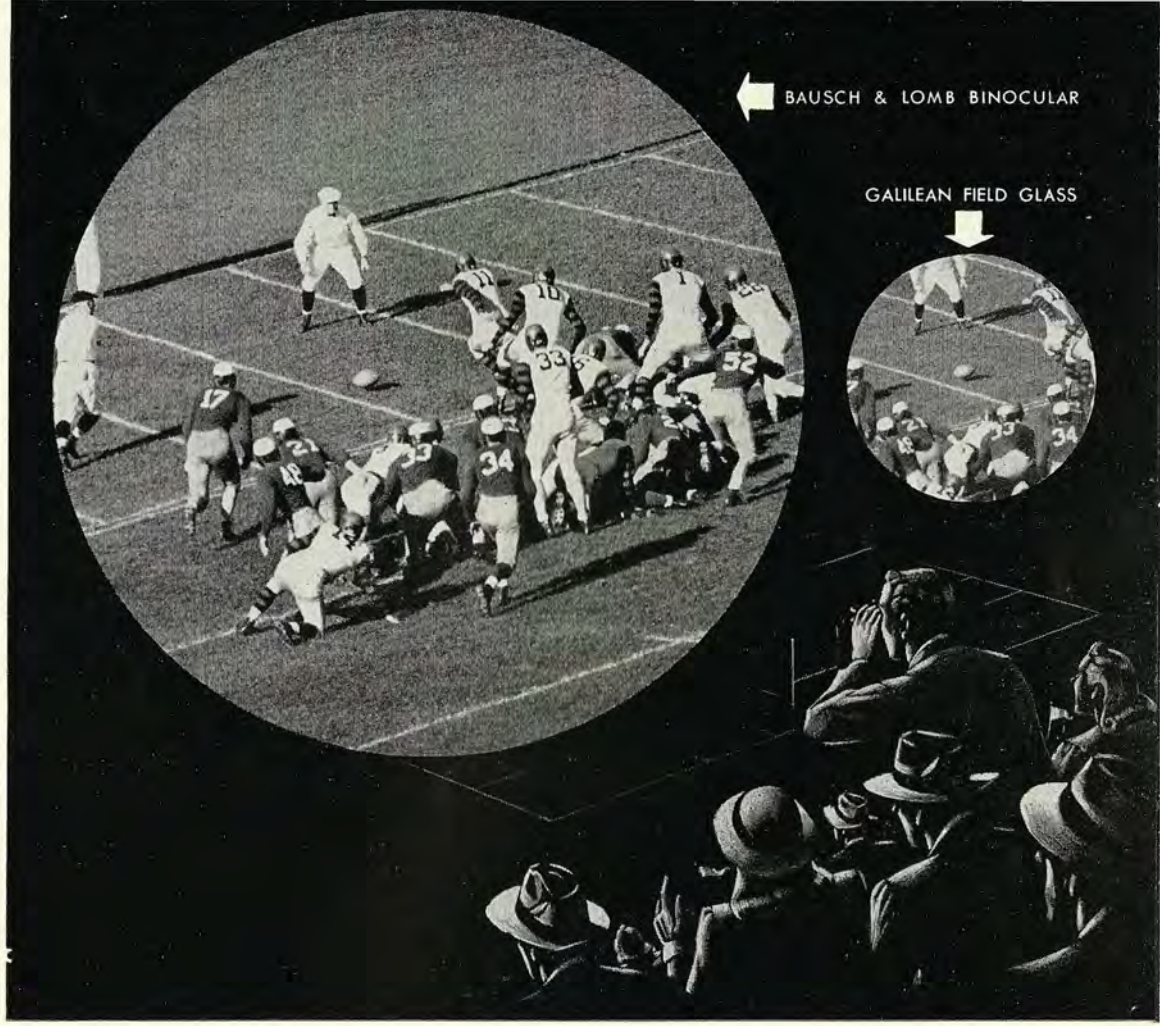
This term is used to describe the width of the view which can be seen through a binocular at a given distance. A wide field of view is highly desirable, both in making it easy to locate a specific object, and in enabling you to see more of a view without moving the glass. It should be remembered, however, that you can't get the widest field of view in a binocular of the highest power; when a wide field of view is the primary factor in your choice, a medium- or low-powered binocular should be chosen.

Field of view may be measured in two ways: *Angular field* refers to the angle between two lines drawn from the binocular to the two edges of the field of view. *Linear field* represents the diameter of the field at a certain distance, measuring from the objects as seen at one end of the field to objects seen at the other edge.

CAUTION: Sometimes a large field of view is obtained at the expense of definition at the edges. No binocular gives uniform definition center-to-edge, but a high degree of correction must be maintained for the glass to be of maximum usefulness. An instrument which achieves wide field at the expense of excessive "falling off" at the edge is not desirable. Note carefully the paragraphs regarding "correction."

Here's how you can quickly compare two binoculars for field of view:

First, be sure that the two binoculars are the



same actual power. A low-power binocular generally allows a greater field to be seen than a high-power glass.

Focus each binocular on any object or landscape larger than the area covered by the binocular. The binocular which shows the more widely separated objects has the larger field.

"Correction"

Crisp definition, minimum distortion, flat field, and elimination of strong color fringes are very important. In fact the designer is confronted with seven aberrations, correction for which characterizes fine optical equipment. A binocular's enlarged view is of little use unless it is also a clear view.

Good definition is the sharp and clear rendition of details. To test this characteristic, focus on a flat, textured surface such as a brick or concrete wall across the street. Note the ability of the glass to reveal the small imperfections in the surface.

A symptom of distortion is the bending of straight lines. Like other aberrations, it cannot be entirely eliminated, but it is practically unnoticeable in the best instruments. Compare glasses *of the same power* and note the accuracy of straight lines along the edge of the field.

Flatness of field refers to the ability of the binocular to satisfactorily focus objects in the center and at the edge of the field at the same time. Present in some degree in all binoculars, curvature of field is exaggerated in poorly designed instruments. To test, face a brick wall squarely and focus sharply on the bricks at the center of the field. Note whether appreciable refocusing noticeably sharpens the image of the bricks at the edge of the field.

Full correction of a binocular for color would result in an unsatisfactory increase in other aberrations. Through carefully balanced optical design, proper selection of glass, and skillful manufacture, good binoculars are corrected for those colors most noticeable to the eye. Any instrument which shows strong color fringes around dark objects viewed against a bright sky is a poor investment. Such color fringes actually surround all points in the image and degrade the definition.

What do "6X,30," "7X,35," etc., mean?

The first figure refers to the power of magnification. The diameter of the objective lens is indicated in millimeters by a figure immediately following the X. Thus, a 7X,35 binocular magnifies 7 times and has objectives 35mm in diameter. The diameter of the objective lens is the determining factor in the "relative brightness" of the instrument.

What is "relative brightness"?

"Luminosity" and similar terms are not properly used in connection with binoculars since they do not lend themselves to exact mathematical values. However, different binocular models *can* be compared by calculating a value known as "relative brightness."

To determine the relative brightness of a 7X,35 model, divide the diameter (35) by the magnification (7) . . . and square the quotient (5). The result is a relative brightness value of 25. Similarly, an 8X,30 binocular has relative brightness of 14.3, the relative brightness of the 6X,30 is 25, that of the 7X,50 is 50.4.

With a given objective diameter, the lower the magnification, the higher the relative brightness. With a given magnification, the greater the diameter, the higher the relative brightness. Naturally, the binocular with large objective lenses is heavier and bulkier than the one with small lens diameter.

Relative brightness expresses, for comparative purposes, the area of the exit pupil, a disc of light that can be seen by holding the binocular at arm's length, pointed at a bright view. If you are to get the maximum brightness obtainable with a specific model, your eye has to line up exactly with the exit pupil. That's why it's so important to adjust the binocular for correct interpupillary distance before using.

Under good lighting conditions, the high relative brightness of a binocular with the largest objectives is usually unnecessary; in fact, the eye is unable to use all the extra light. Too, the heavier weight and greater bulk of the larger binocular may make it an undesirable choice unless use under adverse lighting conditions is a primary consideration.

However, in dim light, the iris diaphragm of the eye—which controls the amount of light that can be received—opens so that all possible light can be accepted. Under such conditions, the eye can readily use the extra light collected by large objective lenses. Use of large objective

lenses distinguishes the so-called "night glass" (see Page 15). Such a binocular is of great value to professional navigators, Coast Guardsmen, yachtsmen, etc., who often have to use their binoculars in weak light.

For most sportsmen, a less expensive, lighter-weight binocular with somewhat smaller objectives and a relative brightness of at least 25 is usually preferred. In the West where the air is clear and the light more brilliant, binoculars like the 8X,30 and 9X,35 are often used, but the 6X,30 and especially the 7X,35 models are by far the more popular choice.

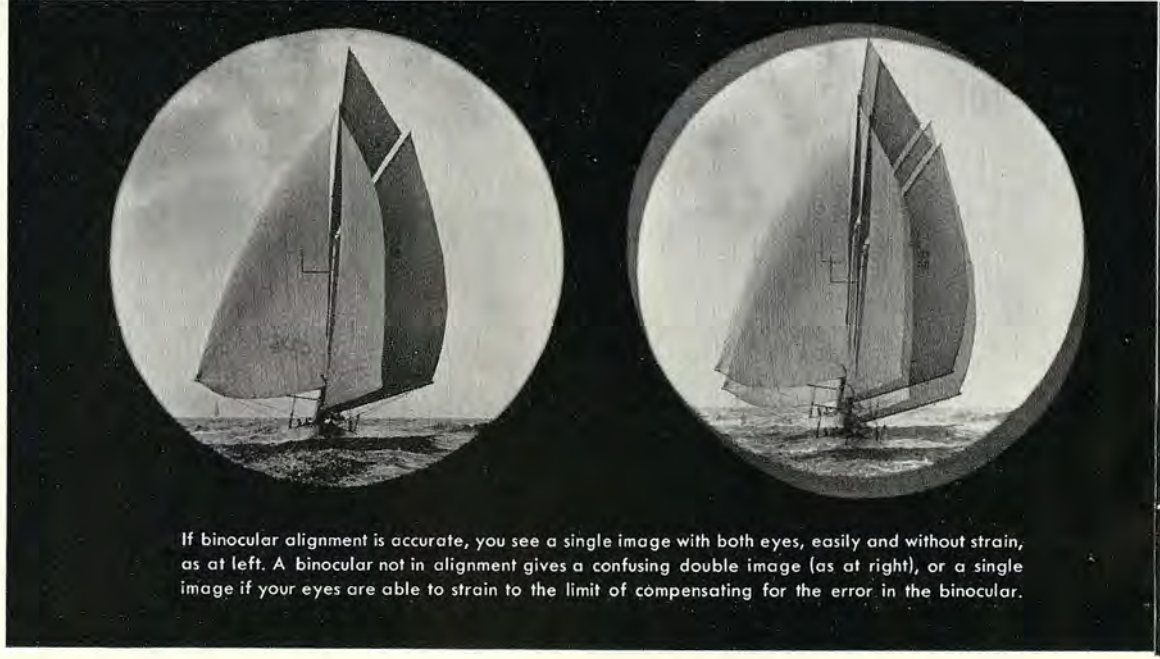
An important aid to brightness is the use of anti-reflection hard coating (see Page 13).

CAUTION: In an inferior binocular, poor design often reduces the effective lens aperture to a value lower than the apparent free aperture, thus reducing its actual image brightness.

How about "light transmission"?

Light transmission refers to the percentage of light that actually gets through the optical system to the eye. It depends on the number of air-to-glass surfaces in the optical system . . . the amount of reflection loss which reduces the light passing through the optical system . . . the absorption of the glass . . . the quality of the glass used in making the lenses and prisms . . . and the skill of the lens grinders and polishers who make these optical parts.

Of the greatest importance in connection with light transmission is the recent development of anti-reflection coating to reduce reflection losses; it is discussed on Page 13.

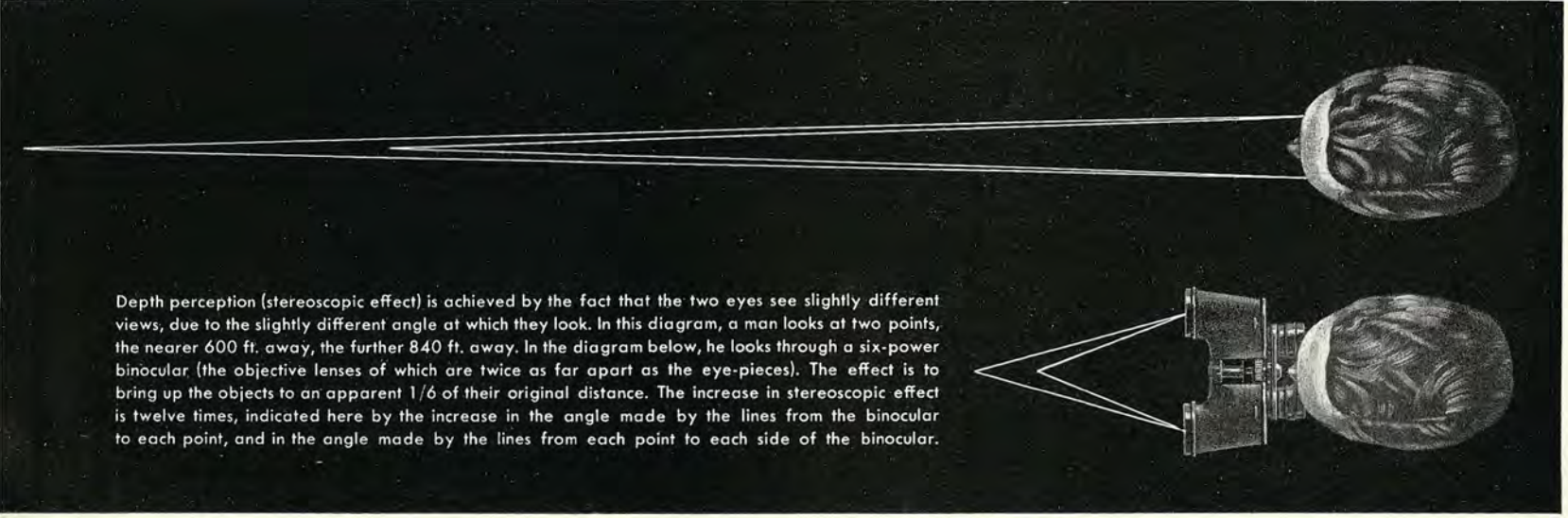


If binocular alignment is accurate, you see a single image with both eyes, easily and without strain, as at left. A binocular not in alignment gives a confusing double image (as at right), or a single image if your eyes are able to strain to the limit of compensating for the error in the binocular.

Why is "alignment" important?

"Binocular vision" means seeing a single image with both eyes. If the horizontal alignment of a binocular is imperfect, it is possible for your eyes, under considerable strain, to compensate. However, the eyes have no experience in compensating for vertical imbalances and cannot make a single image out of two images which are vertically out of alignment. Thus, for good binocular vision without eye-strain, extremely accurate alignment of both optical and mechanical axes of the binocular is necessary. In addition, the binocular must be designed to *retain* good alignment even under extremes of service. *This feature is probably the greatest single mechanical difference between an inferior binocular and one of top quality.*

To assure correct alignment at every inter-pupillary distance, extremely precise manufacturing methods must be used throughout, since practically every part has an effect on achieving and maintaining alignment. In an inexpensive binocular this accuracy may be attained initially by manipulating and adjusting the optical parts, but because of poor design or construction, alignment can be lost by bumps or



Depth perception (stereoscopic effect) is achieved by the fact that the two eyes see slightly different views, due to the slightly different angle at which they look. In this diagram, a man looks at two points, the nearer 600 ft. away, the further 840 ft. away. In the diagram below, he looks through a six-power binocular (the objective lenses of which are twice as far apart as the eye-pieces). The effect is to bring up the objects to an apparent 1/6 of their original distance. The increase in stereoscopic effect is twelve times, indicated here by the increase in the angle made by the lines from the binocular to each point, and in the angle made by the lines from each point to each side of the binocular.

jars in service. Unless proper alignment is built in, the owner of a binocular will find that his eyes tire easily when he uses his binocular . . . that his instrument needs frequent repairs because the prisms weren't securely mounted . . . or that other parts affecting alignment have not been properly made.

There is no easy test for checking alignment, because the eyes are capable of compensating for brief periods for these errors. If, after using a binocular for a while, there is any feeling of eyestrain, the probability is that the axes of the two barrels are not in alignment.

What about "stereoscopic effect"?

This is the quality of a binocular which gives depth—the third dimension—to the binocular image, and which is based on the fact that the view seen by each eye is different.

If you close one eye and look at several objects, you'll find it's difficult to determine their respective distances from you and from each other. Yet when you look with both eyes, the relative positions become apparent . . . because, with both eyes, you look at objects from two slightly different angles. The greater the angles, the greater the stereoscopic effect.

In a binocular, stereoscopic effect is extremely important in enabling you to determine the relative distances of objects from surrounding objects. Any binocular increases the stereoscopic effect by the power of its magnification, but beyond this, a prism binocular designed so that the objective lenses are twice as far apart as the eyepiece lenses doubles your ability to determine the relative distances of objects which are in your field of view.

What about construction?

Your binocular should be designed to incorporate all of the qualities discussed in this chapter. In addition to its high-precision features, it should be as light and compact as possible, easy to handle, easy to clean, and built sufficiently sturdy to maintain its alignment and original level of performance through a lifetime of dependable service.

Little wonder that, in such a high-precision instrument, experts agree that only the best is good enough . . . that anything *less* than the best is a poor investment at any price.

Why You Will Choose a *BAUSCH & LOMB* Binocular

Your "inside information" on binoculars has indicated the qualities necessary for good binocular performance. Let's see how Bausch & Lomb measures up to these exacting requirements.

First, let's consider:

Optical quality

Optical quality depends on three factors: design, material, and workmanship.

Bausch & Lomb binoculars are designed by the scientific staff which designs intricate optical instruments for research laboratories, high-precision military instruments, and other complex optical products. Bausch & Lomb binocular design is the result of the combined judgment of experienced members of the Bausch & Lomb Scientific Bureau, among whom are some of the world's most famous optical designers.

To make possible crisp, clear images, accurate color rendition, minimum distortion, and other desirable characteristics, the lenses and prisms of Bausch & Lomb binoculars are made of optical glass manufactured to exact specifications in the world-famous Bausch & Lomb Glass Plant. Then skilled lens makers grind and polish them to tolerances that are almost unbelievably precise. Surfaces of some lenses and prisms must be accurate to within a quarter-wave length of light—a dimension approximately six-millionths of an inch.

These same high standards are observed throughout every phase of Bausch & Lomb binocular production. Thus, magnifications are exactly computed—a Bausch & Lomb binocular *always* gives the full magnification for which it is rated. The field of view is as large as possible without sacrificing definition. Emphasized stereoscopic effect is obtained by use of the Porro Prism System. A bright clear image is assured by the application of Balcote Anti-Reflection Coating (see Page 13).

Next, mechanical quality

The superb optical quality of a Bausch & Lomb binocular would be of little value if its mechanical parts were less carefully built. Therefore, the mechanical parts of each Bausch & Lomb binocular are made of top-grade materials, fabricated to extremely close tolerances, and critically inspected.

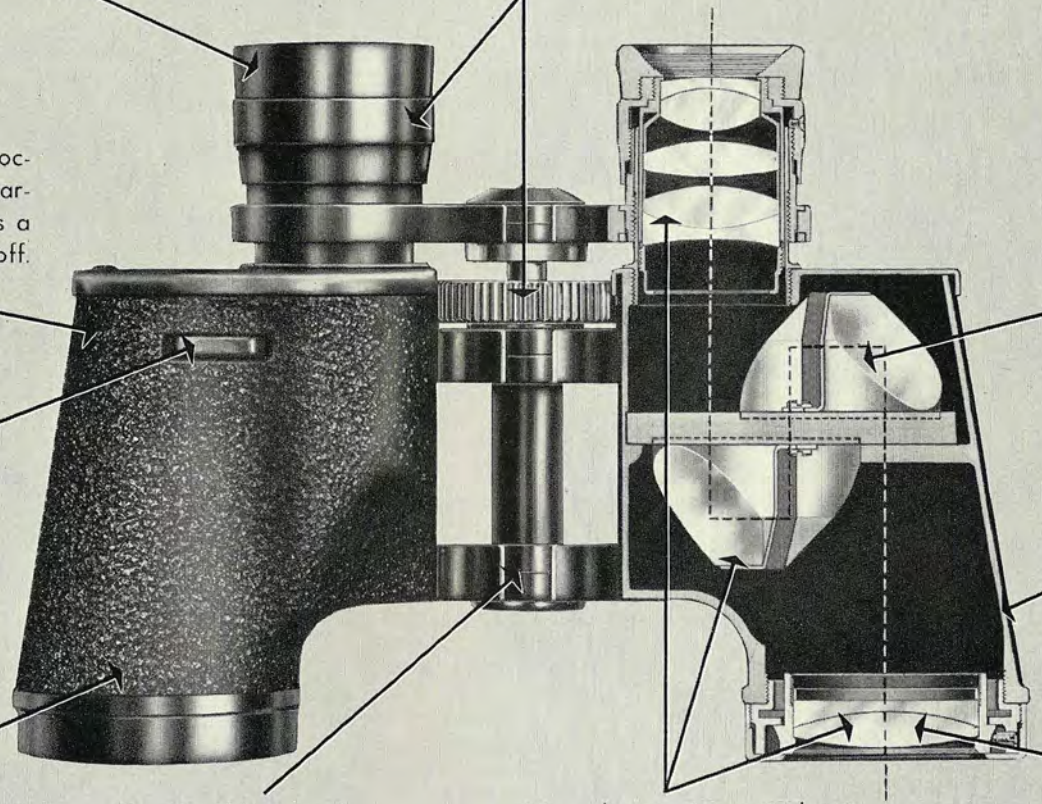
Optical glass for Bausch & Lomb binoculars, as well as for all Bausch & Lomb scientific instruments, is made in the Bausch & Lomb glass plant, pioneer producers of optical glass in America. More than 100 types of optical glass are regularly made in this plant, under conditions of most critical control of optical and physical characteristics. In the photo at right, a pot containing about 800 pounds of molten glass is about to be removed from the gas-fired furnace in which it has been heating for approximately 24 hours.

Bakelite eyepiece caps retain their smooth black appearance and are comfortable in cold weather.

Individual focusing or central focusing eyepieces are obtainable.

All air-glass surfaces are Balcote anti-reflection coated, for increased light transmission and greatly improved image contrast.

Plastic finish over body (morocco grain), weather-proof, wear-proof, attractive, furnishes a good grip. Cannot peel off.



Prisms are securely held in position.

Strap eyelets cast integral with body.

Strong, light, one-piece magnesium body.

Front is integral with body — eliminates one end cover — strong and weather-tight.

Precision hinge and diamond-turned axle maintain alignment.

Nine ultra-precise optical units, made from six kinds of B&L glass, are required in each side of the model illustrated.

Large objectives collect maximum light . . . are of extreme value in dark weather and twilight.

As noted in "Inside Information on Binoculars," one of the major factors in binocular performance and satisfaction is accurate alignment, or "collimation." Because of their superior design and construction, Bausch & Lomb binoculars remain in alignment and adjustment *even after hard use.*

In Bausch & Lomb binoculars, the alignment adjustments are made with the objective lenses. This means that the prisms can be permanently anchored in place. A new type of prism mounting developed by Bausch & Lomb assures that prisms will not get out of adjustment to impair the alignment of the glass. In cheaper or old style glasses, collimating is usually accomplished by shifting the prisms; thus they cannot be firmly locked in place, and are easily jarred loose by shock.

On Bausch & Lomb binoculars, the objective lenses are adjusted by a collimator designed especially by Bausch & Lomb optical engineers. The alignment of the optical axes of the binocular system and the mechanical axis of the hinge assures that light passing through the optical systems of both sides of the binocular is parallel . . . that images seen through the two telescopes are correctly super-imposed for true binocular, stereoscopic vision.

The accurate alignment process . . . the rigid mounting of B&L prisms . . . and the extreme precision employed in every step of binocular design, manufacture, and assembly . . . assure that your Bausch & Lomb binocular will enable you to see clearly—without eyestrain —at all times.

Then, ease of handling

Bausch & Lomb binoculars are as compact and lightweight as is possible without reducing optical quality. The Bausch & Lomb "Zephyr-Light" Binocular represents an important step in the continual improvement of the world's finest binocular.

The extreme light weight, which is a source of amazement to anyone who picks up a Zephyr-Light Binocular for the first time, is due to two factors. Great precision and maintenance of close tolerances in manufacturing have permitted redesign for reduction of size, thickness, and weight, in optical and mechanical parts. In addition, the body is made of a light, high-strength magnesium alloy, such as is used in aircraft construction.

Nearly 40% of the total weight of the "Zephyr-Light" Binocular is represented in the optical system—the lenses and prisms. This model may truly be said to be of lightest possible weight, consistent with highest-quality performance and sturdiness.

The binocular is shaped to fit the hand comfortably; the plastic covering is *grained* to afford a firm grip on the binocular even when your hands perspire or are wet.

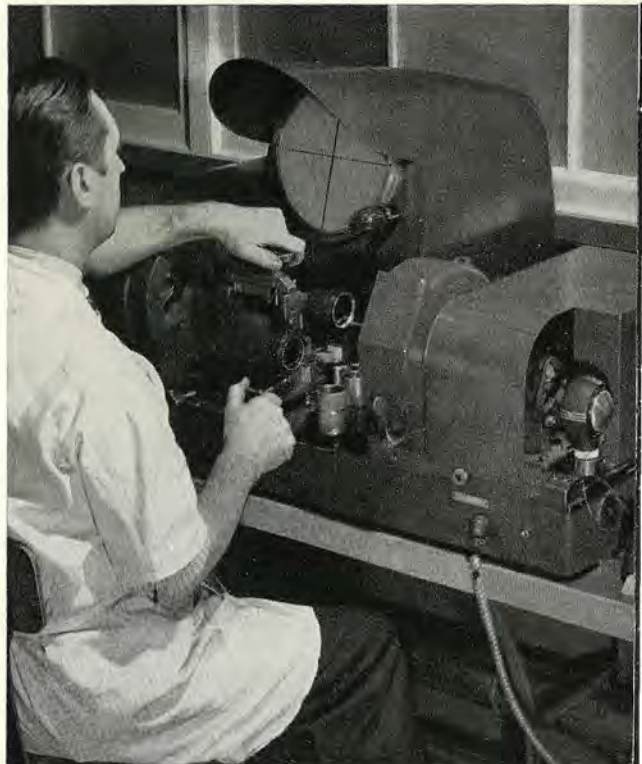
Bausch & Lomb specifications require maintaining very close tolerances in alignment. At right, specially-built, ultra-precise optical collimating equipment is being used to check alignment. From one extreme of interpupillary adjustment to the other, maximum deviation permitted is three minutes of arc (1/20 of a degree) in the vertical, six minutes in the horizontal.

And, of course, sturdy construction

Every Bausch & Lomb binocular part is built for lifelong, trouble-free use.

The glass surfaces of multiple-part elements are cemented together with a superior war-developed thermal-setting plastic-base cement which prevents lens separation due to weather and extremes of hot-and-cold.

Every precaution is taken to keep moisture and dust from entering the binocular body



247,000 miles on a merchant vessel, frequently under enemy attack. That's the wartime record of this 7X,35 Zephyr-Light Binocular. After nearly four years of hardest day-and-night use, this sturdy binocular was reported by its owner "good as new."

during manufacture. The binocular is assembled in air-conditioned assembly rooms.

By means of a special chemical process, a tough, hard finish is given to the metal parts. As a result, the interior finish is unlikely to chip off onto any glass surface and obscure it. On the outer binocular surface, this chemical finish provides a wear-resisting base for the black plastic baked-on enamel.

An attractive, durable leather case, with neck straps, is provided for maximum protection in carrying or for storage (see Page 27).

Next, appearance

Bausch & Lomb binoculars are a lasting source of pleasure to the owner who prizes a handsomely styled instrument. It's easy to keep a B&L binocular looking its best—because the attractive finish resists wear, is easily cleaned.

Finally, guaranteed satisfaction

Since 1853, Bausch & Lomb has been serving the world in optical science. Every Bausch & Lomb binocular is built to give lifetime satisfaction. If at any time it should need readjustment, replacement parts and servicing facilities are always available at the factory. No Bausch & Lomb instrument is ever an "orphan."

A guarantee certificate is contained in the instruction book which accompanies each binocular leaving the Bausch & Lomb factory. This certificate also serves as a registration of the serial number of your binocular, a Bausch & Lomb service which might help you recover your glass in case of loss or theft.

BALCOTE Anti-Reflection Hard Surfacing

The lenses and prisms of every new Bausch & Lomb binocular are treated with Bausch & Lomb Balcote anti-reflection hard surfacing. Why is anti-reflection coating necessary and how does it work?

Each air-to-glass surface of an uncoated binocular reflects some of the light passing through. In total, almost half the light entering the binocular is lost. A further reduction in binocular efficiency results from the reflected light which bounces from surface to surface and reaches the eye as "flare" and "ghost images."

By applying a thin (four-millionths of an inch) Balcote transparent surfacing to all air-to-glass surfaces, Bausch & Lomb is able to cut the light loss by as much as 50% . . . effectively reduce the internal reflections which cause flare . . . increase image contrast and help you get clearer, sharper vision. The brighter image is an especially important factor when binoculars are used under poor lighting conditions.

Explains Dr. A. F. Turner of Bausch & Lomb, one of the scientists who pioneered the development of hard coating:

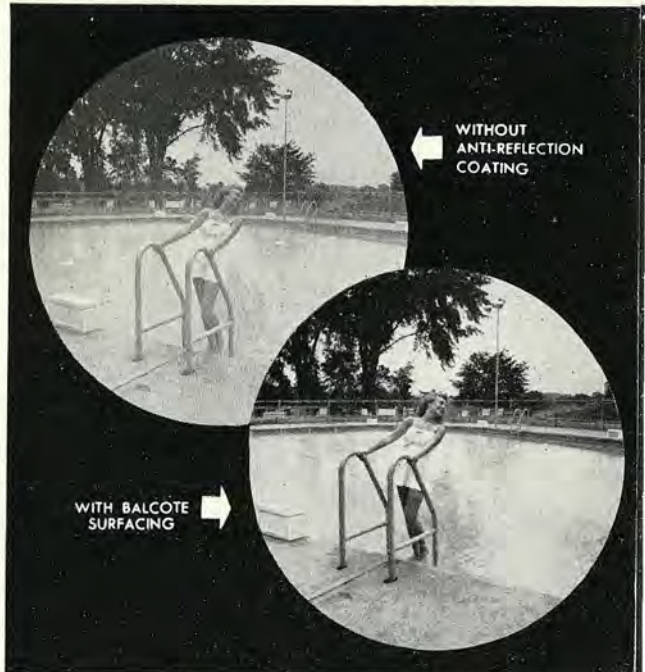
"A ray of light striking the coated surface is partially reflected, the remainder passing through the coating. At the second surface of the coating, it is again partially reflected. The latter reflection is one-half wave length behind the first. The reflections interfere with one another, canceling each other out. This reduces reflection and decreases flare considerably. Not only that, but more light is transmitted by the lens."

You can "see" Balcote surfacing in the form of a straw-to-purplish tint on the objective lens of your B&L binocular, despite the fact that the coating is actually colorless. Because the coating is made to transmit most effectively the yellow-green rays of light, which most affect sharpness of detail, visible reflection is greatest in the complementary part of the spectrum.

To a large extent Bausch & Lomb research has been responsible for the development of anti-reflection coating. In 1939, Bausch & Lomb made the first commercial use of coating when it supplied coated projection lenses for the full-color motion picture, "Gone With The Wind." By 1941, Bausch & Lomb was making Balcote-treated optical instruments for our armed forces. Throughout the war Bausch & Lomb supplied thousands of coated binoculars and other gunfire-control instruments to the Army and Navy, meanwhile working steadily to improve Balcote surface quality.

Today's Balcote treatment is a hard, durable surfacing that will last indefinitely if given reasonable care. The increased light transmission it makes possible . . . the more faithful rendition of color values . . . the improved image contrast and detail . . . the greater brightness it affords under poor illumination . . . are sufficiently important to the performance of a binocular, that it would be an unwise choice indeed to buy any instrument without this performance-improving feature.

These photographs were made to demonstrate the superiority of binocular performance with Balcote treatment. With a binocular not anti-reflection coated, the best possible image is grey and flat, lacking in contrast, by comparison to that of a binocular with Balcote anti-reflection hard surfacing.



USES	6X,30	7X,35	8X,30	9X,35	7X,50
Nature Study	x	**X**	x		
Traveling	x	**X**	x		
Spectator Sports	**X**	x			
Bird Study	x	**X**	x	x	x
Hunting					
Mountain			x	**X**	
Prairie			x	**X**	
Wooded Areas	**X**	x			x
Deer	x	**X**	x	x	x
Mountain Goats				**X**	
Coyotes		x	x	**X**	x
Big Game	x	x	**X**	x	
Wildfowl	x	**X**			
Vermin		**X**	x		
Exploration		x		x	**X**
Navigation					**X**
Yachting	x	**X**			x
Race Tracks	x	**X**			
Forest Ranger		**X**			x
Control Tower Airport	x	**X**			
Air Plane	**X**	x			
Field Trials	x	**X**	x		x
General Use	x	**X**	x		
Mountain Climbing	x	x	x	**X**	
Target Work	A Spotting Scope should be used.				
Night Use					**X**

WHICH MODEL TO

Your choice of a binocular model revolves around a question which must first be answered: "What will I use my binocular for?"

In any one model it is impossible to include maximum magnification, maximum field of view, and minimum size and weight. Also, remember that motion is magnified just as is the size of objects viewed. The higher the magnification of the binocular, the harder it is to follow motion, and the harder to hold the glass steady while looking through it. The advantages of each model must be weighed against its relative disadvantages and the decision made as to which type offers the greatest combination of advantages for the specific needs of the person who is to make most use of the binocular.

For example, let's say you plan to use your binocular for navigational purposes mainly aboard ship. Because of the motion, you'll want a model of medium magnification. And because you will occasionally need to use the glass under poor light conditions it will require greatest possible light-gathering power; hence the desirability of a model with large objective lenses. Naturally, this will be heavier than a model of lower magnification; but, since you

At left, the preferences of experts. Black x's are primary choice; white x's are secondary choice.

CHOOSE...

won't have to carry it around very much, the extra weight offers little disadvantage.

On the other hand, suppose you want to use your binocular for watching sports events. Here weight is an important factor, because you'll have to carry your binocular most of the time. On the other hand, you won't want especially high magnification because contestants will seldom be far away and you'll often want to follow fast action. So—you choose a model that combines moderate power with compact size, light weight and large field of view.

From the experience of thousands of binocular owners, it has been possible to work out a chart listing the best models for each binocular use. Usually a number of models are satisfactory for a specific purpose. However, if the binocular is to be used *principally* for this purpose, there is generally a preferred choice of *one* model which offers certain distinctive advantages.

Bausch & Lomb offers a wide choice of binoculars in a complete range of the most useful powers. If an instrument of higher power than that available with these binoculars is desired, an observation telescope should be used, with tripod or other fixed support.

For General Use

Because of its generous field of view, extra magnification, bright illumination, comparatively small size and light weight, the 7X,35 has become the most popular binocular model for general and all-round use.

"Night Glasses"

Actually there is no binocular manufactured with properties or characteristics which make it exclusively appropriate for use at night. Magnification by itself contributes to ability to distinguish objects at night; but the term "night glass" traditionally refers to binoculars which give maximum image brightness when used under poor light conditions or at night.

The Balcote treatment on Bausch & Lomb binoculars increases the image brightness offered by *all* models; however, models featuring the largest possible objective lenses usually prove most satisfactory, since more light can be admitted. Particularly, the 7X,50mm, with its large objective lenses and tremendous light-gathering ability, is recommended for use under conditions of dim or adverse lighting.

Which Focusing Model to Choose

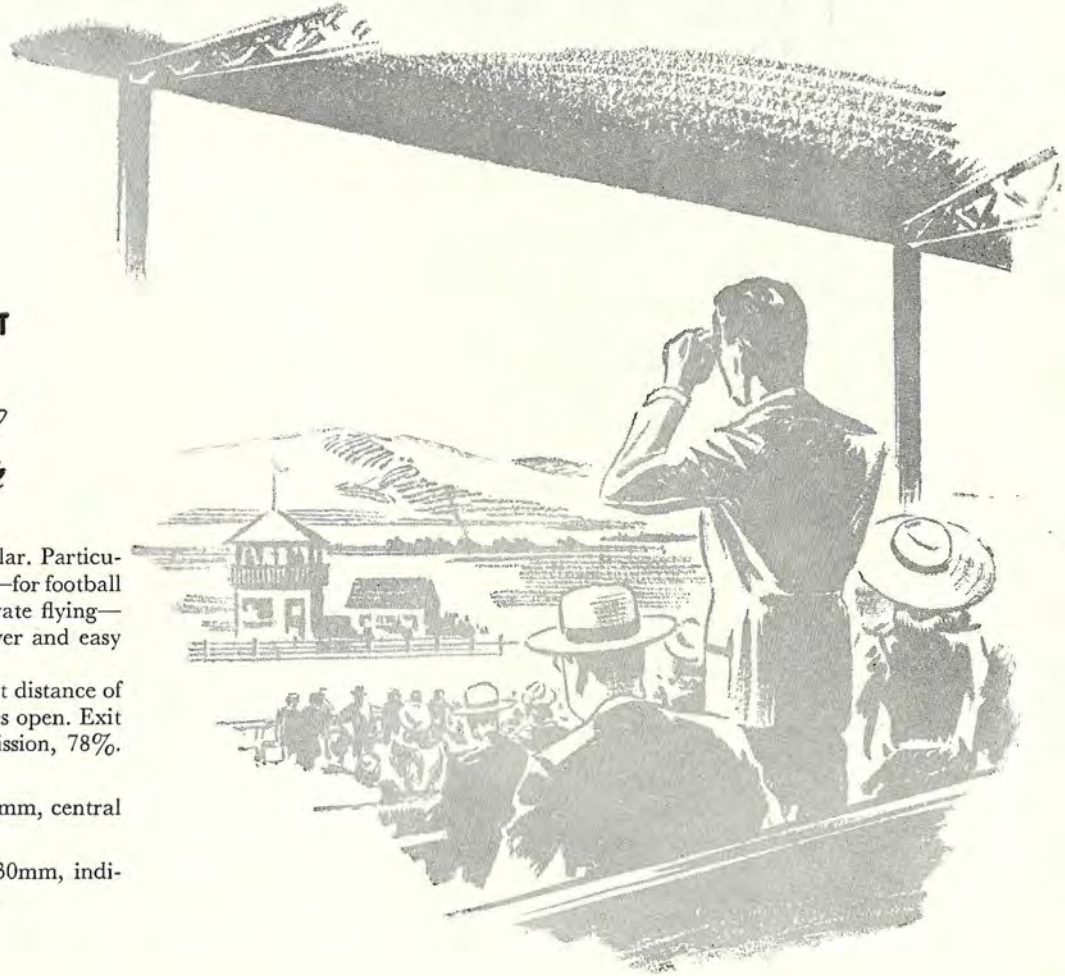
Bausch & Lomb binoculars are made in central focusing and individual focusing eyepiece models.

The central focusing type is made with the right eyepiece adjustable to compensate for any visual difference between the two eyes. This model is most popular, and is recommended for its convenience.

The individual focusing model is the choice of the sportsman who intends to be the sole user of the binocular. With it he can focus each eyepiece in the correct position for his eyes; then, for future use, either note the setting on the eyepiece scale or securely strap the eyepieces in position with adhesive tape.

Because of its more nearly moisture-proof construction, simplicity and sturdiness, the individual focusing type is preferred by the Army and Navy.

Top: Individual focusing model. Bottom: Central focusing model.



THE BAUSCH & LOMB ZEPHYR-LIGHT

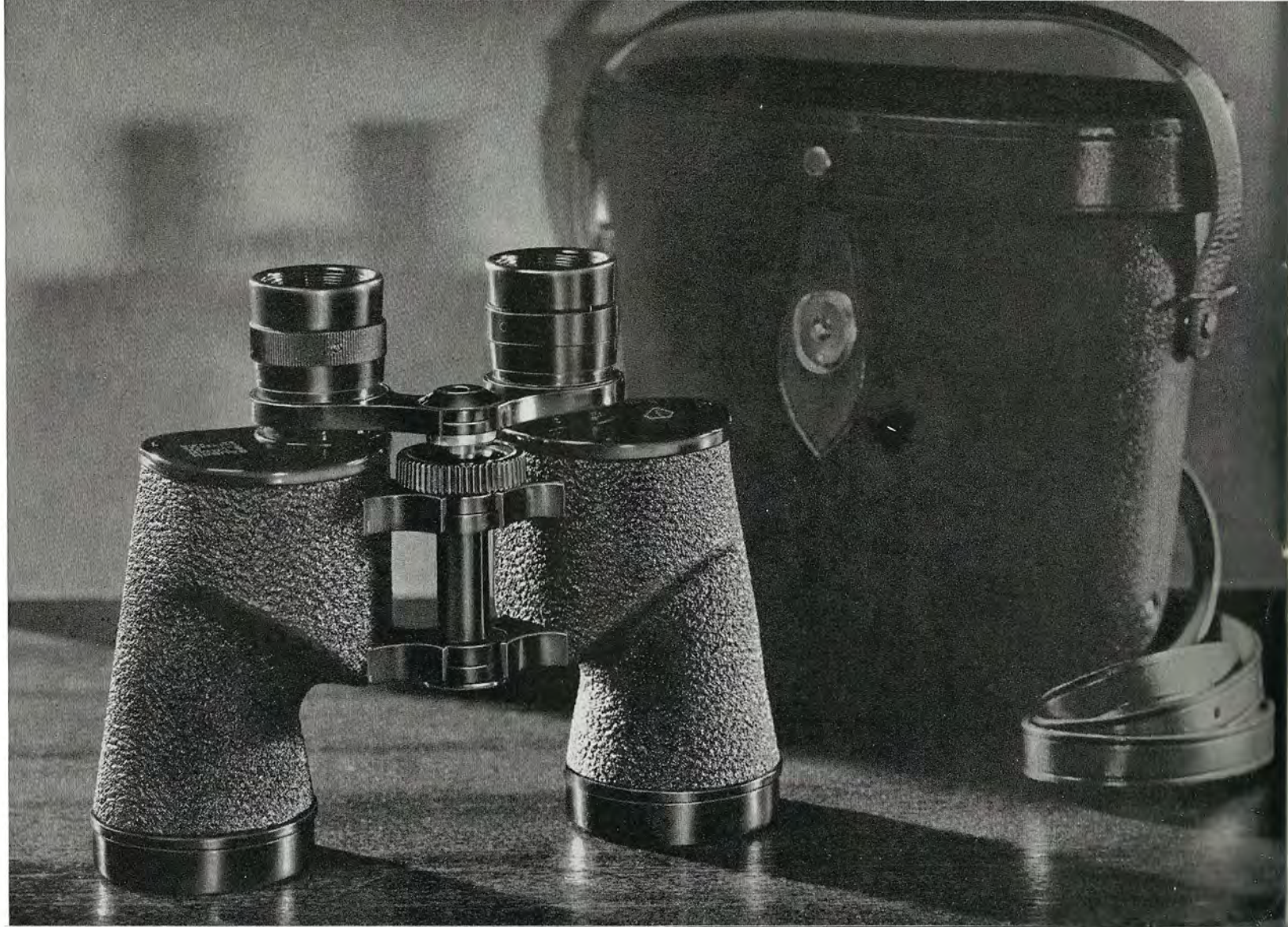
6X,30 Binocular

Lightest in weight, most compact Bausch & Lomb binocular. Particularly recommended for viewing fast action—at the race track—for football and other spectator sports, hunting in wooded areas—private flying—wherever a brilliant image, moderate, easily-controlled power and easy portability are important. Balcote anti-reflection surfaces.

Magnification, 6 times. Angular field, 8°29′. Linear field at distance of 1,000 yards, 445 feet. Length, 4¾ inches closed or 5⅛ inches open. Exit pupil, 5mm. Relative brightness, 25. Average light transmission, 78%. Weight 17 ounces.

61-21-11 Bausch & Lomb Zephyr-Light Binocular, 6X,30mm, central focusing, in leather case with straps, $155.00, plus tax.

61-21-12 Bausch & Lomb Zephyr-Light Binocular, 6X,30mm, individual focusing, in leather case with straps $155.00, plus tax.



THE BAUSCH & LOMB ZEPHYR-LIGHT

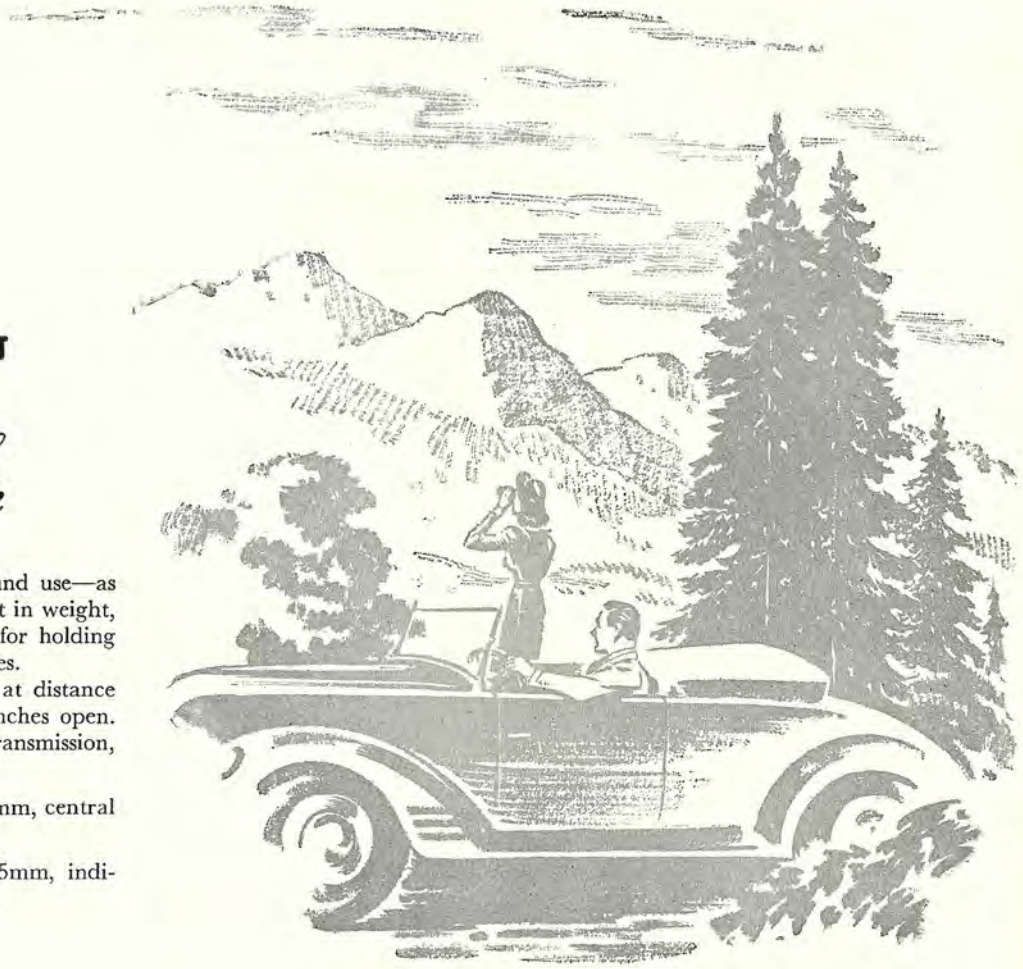
7X,35 Binocular

The most popular Bausch & Lomb binocular for all-around use—as well as a variety of special uses (see table on Page 14). Light in weight, power high enough for a well-enlarged view, low enough for holding steady. Perfect fit and balance. Balcote anti-reflection surfaces.

Magnification, 7 times. Angular field, 7°17′. Linear field at distance of 1,000 yards, 381 feet. Length, 5⅝ inches closed or 6 inches open. Exit pupil, 5mm. Relative brightness, 25. Average light transmission, 78%. Weight, 20 ounces.

61-21-21 Bausch & Lomb Zephyr-Light Binocular, 7X,35mm, central focusing, in leather case with straps, $155.00, plus tax.

61-21-22 Bausch & Lomb Zephyr-Light Binocular, 7X,35mm, individual focusing, in leather case with straps, $155.00, plus tax.



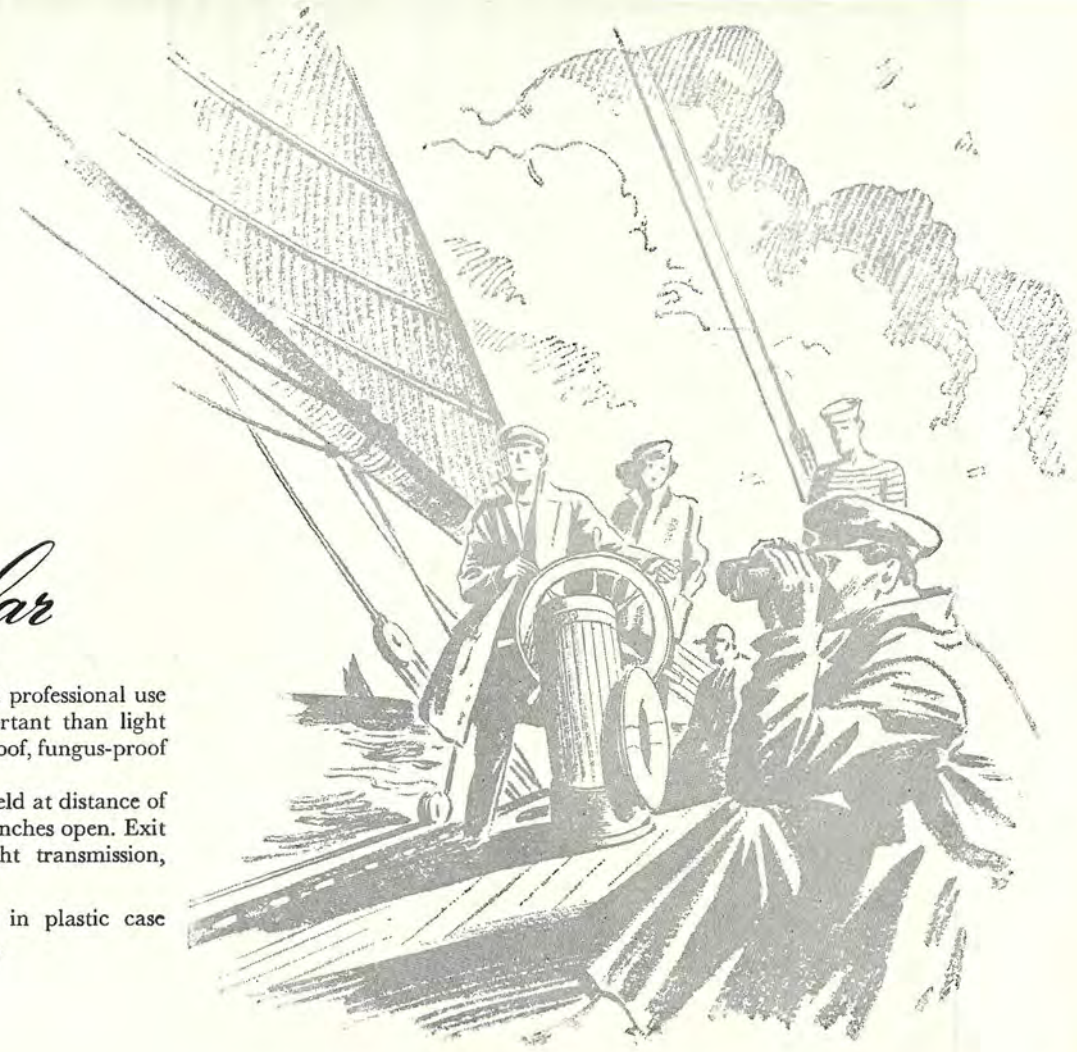
THE BAUSCH & LOMB

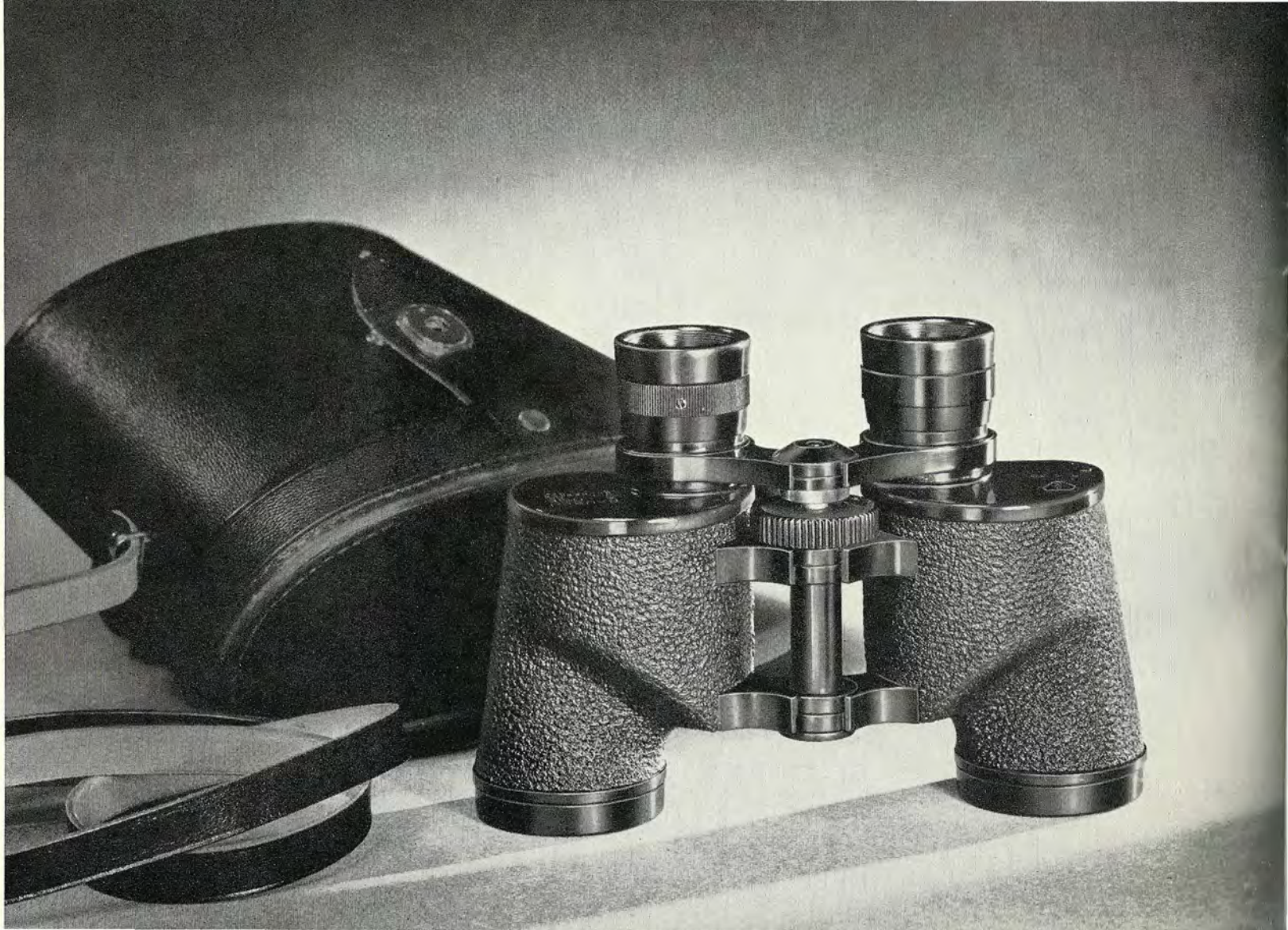
7X,50 *Binocular*

Navy model. Superb performance for navigation and professional use —wherever maximum image brightness is more important than light weight and compactness. Completely water-proof, fog-proof, fungus-proof construction. Balcote anti-reflection surfaces.

Magnification, 7 times. Angular field, 7°16′. Linear field at distance of 1,000 yards, 381 feet. Length, 7⅛ inches closed or 7 $\frac{7}{16}$ inches open. Exit pupil, 7.1mm. Relative brightness, 50.4. Average light transmission, 78%. Weight, 50 ounces.

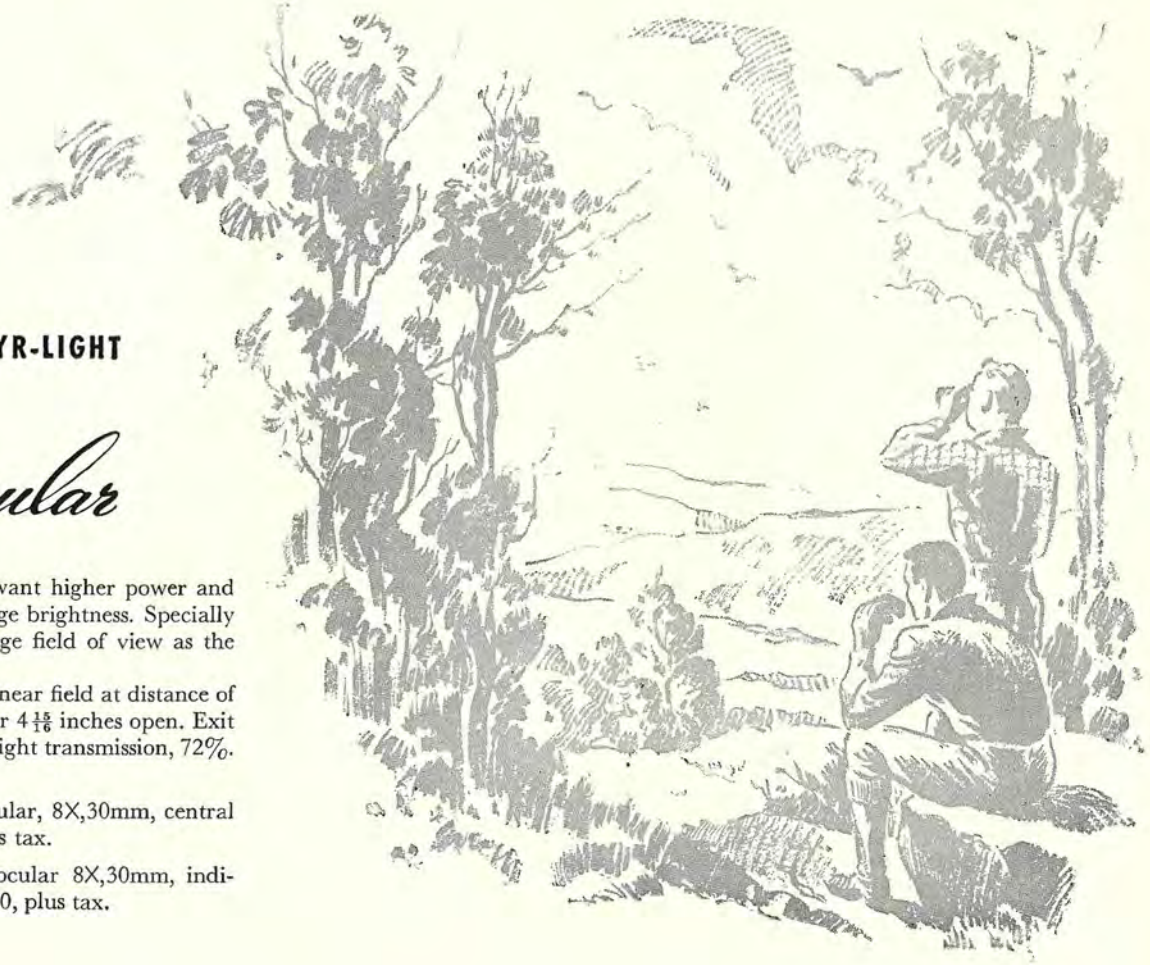
61-21-58-05 Bausch & Lomb Binocular 7X,50mm, in plastic case with straps. Individual focusing only, $175.00, plus tax.





THE BAUSCH & LOMB ZEPHYR-LIGHT

8X,30 Binocular

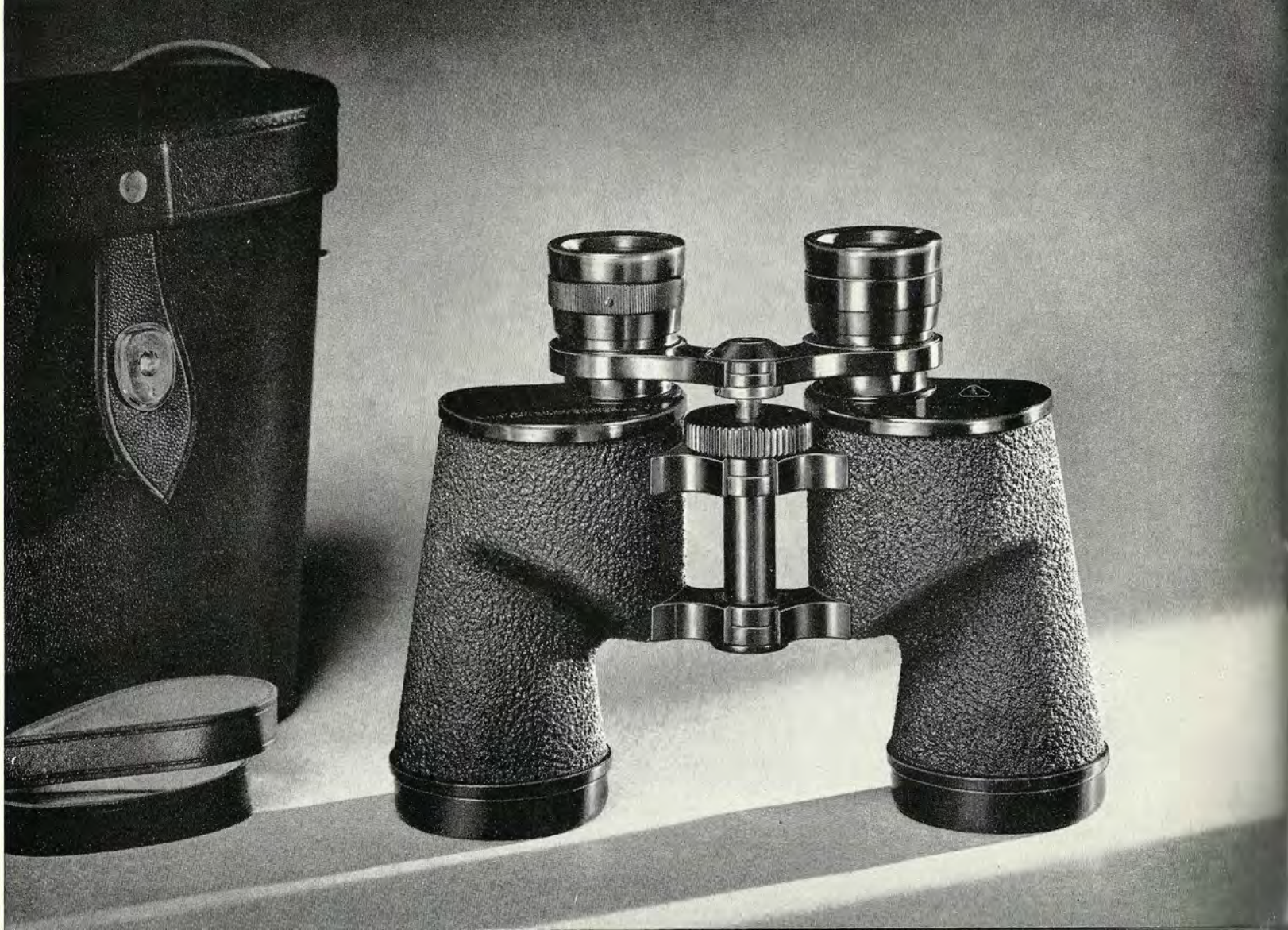


General purpose glass selected by those who want higher power and extreme compactness, even at the expense of image brightness. Specially designed wide-angle eyepieces give the same large field of view as the 6X,30mm. Balcote anti-reflection surfaces.

Magnification, 8 times. Angular field, 8°29′. Linear field at distance of 1,000 yards, 445 feet. Length, $4\frac{9}{16}$ inches closed or $4\frac{15}{16}$ inches open. Exit pupil, 3.8mm. Relative brightness, 14.3. Average light transmission, 72%. Weight, 18 ounces.

61-21-31 Bausch & Lomb Zephyr-Light Binocular, 8X,30mm, central focusing, in leather case with straps, $170.00, plus tax.

61-21-32 Bausch & Lomb Zephyr-Light Binocular 8X,30mm, individual focusing, in leather case with straps, $170.00, plus tax.



THE BAUSCH & LOMB ZEPHYR-LIGHT

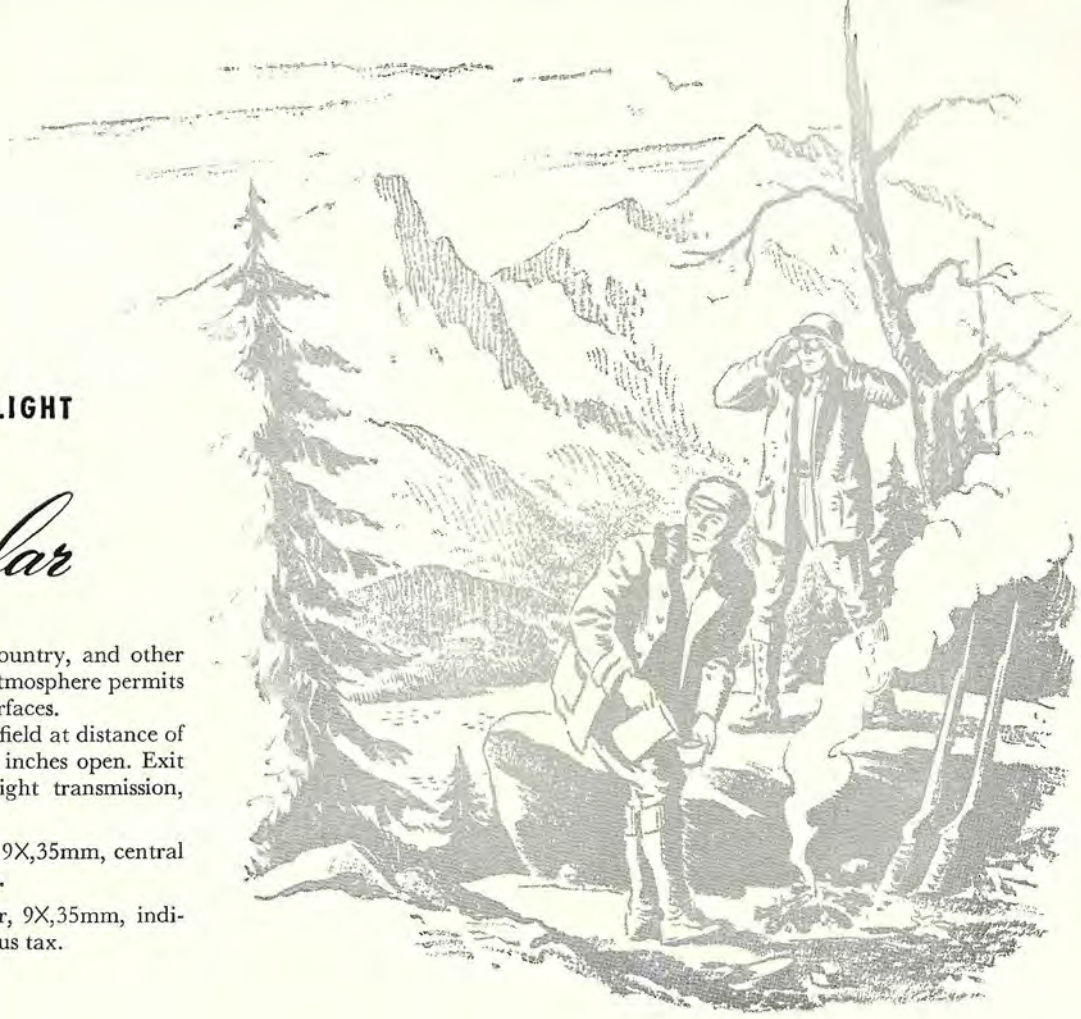
9X,35 Binocular

Particularly designed for hunting in mountainous country, and other use where distances are great and where clearness of atmosphere permits use of a powerful binocular. Balcote anti-reflection surfaces.

Magnification, 9 times. Angular field, 7°17′. Linear field at distance of 1,000 yards, 381 feet. Length, $5\frac{7}{16}$ inches closed, $5\frac{13}{16}$ inches open. Exit pupil, 3.8mm. Relative brightness, 14.4. Average light transmission, 72%. Weight, 20 ounces.

61-21-41 Bausch & Lomb Zephyr-Light Binocular, 9X,35mm, central focusing, in leather case with straps, $170.00, plus tax.

61-21-42 Bausch & Lomb Zephyr-Light Binocular, 9X,35mm, individual focusing, in leather case with straps, $170.00, plus tax.



THE BAUSCH & LOMB ZEPHYR-LIGHT

7×, 35 Monocular

For use where weight, space, and price are the important features. Essentially, one-half of the popular 7×, 35 Binocular and retaining the same high qualities, optically and mechanically. Balcote anti-reflection surfaces.

Magnification, 7 times. Angular field, 7°17′. Linear field at distance of 1,000 yards, 381 feet. Length, 5⅝ inches closed or 6 inches open. Exit pupil, 5mm. Relative brightness, 25. Average light transmission, 78%. Weight, 9 ounces.

61-16-22 Bausch & Lomb Zephyr-Light Monocular, 7×, 35mm, focusing eyelens, in leather case with straps, $77.50.

For Added Convenience and Enjoyment

BAUSCH & LOMB BINOCULAR ACCESSORIES

Carrying Case, Neck and Shoulder Straps

A sturdy yet lightweight carrying case is supplied with every Bausch & Lomb binocular. Leather-covered over a rigid frame, the case provides utmost protection for the binocular, yet is attractive in appearance. An adjustable shoulder strap for the case and a neck strap for the binocular are also provided.

Eye Caps

The eye caps on a Bausch & Lomb binocular provide maximum comfort even during prolonged observation. They do not exert pressure against or irritate the eye, but fit snugly against the brow. They retain their smooth black finish and are comfortable in cold weather.

Flat Eye Caps

For binocular owners who wear glasses, use of regular eye caps reduces the width of the field of view. Flat, instead of the regular deep eyecaps are available for all models, either with binocular or in exchange for regular, at no extra charge. Extra caps are available at 50 cents each from dealer or factory and are interchangeable by unscrewing caps from eyepieces.

Rubber Eye Guards

To get a brighter image, tight-fitting, light-excluding rubber eye guards may be attached to the binocular eyepieces. Available for all models except 7X,50mm, at $1.00 per pair.

Rotating rubber eyeguards are available for 6×,30mm, and 7×,35mm, only, at $3.50 per pair. These replace regular Bakelite eye caps, turn freely, and do not interfere with adjustment of individual focusing eyepieces.

Rain Guard

This black leather rain guard is placed on the neck strap as shown. When the binocular is not in use, the guard slides down to protect the eyepieces. Price $2.50.

Above, all-leather carrying case is provided with every Bausch & Lomb binocular.

Far left, rubber eye guards exclude rain and light, improve binocular performance.

Left, rain guard protects eyepieces, is easily slipped out of position when binocular is used.

Bausch & Lomb

60mm Telescope

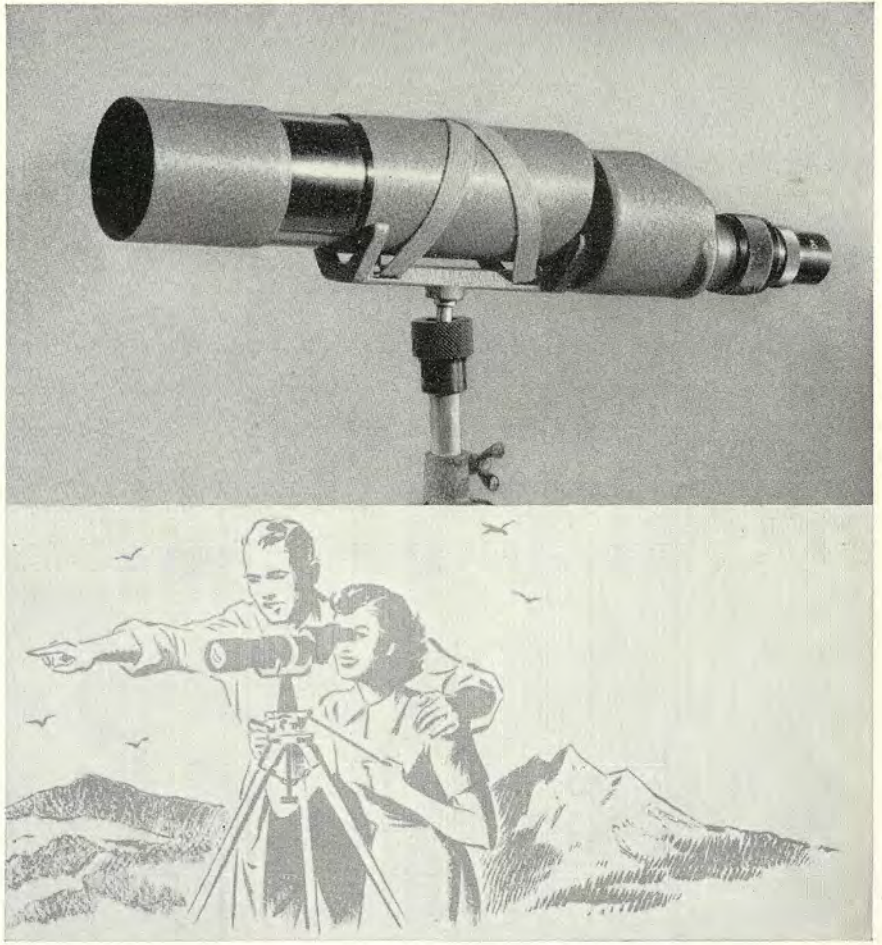
B&L 60mm Telescopes have long enjoyed preference among champion target shooters—both rifle and pistol. Their exceptionally high order of optical excellence provides for quick, positive spotting of shots in the target, and for reading wind conditions. They are designed to avoid eye-strain, so that shooting efficiency can be maintained even over long hours on the range.

These scopes are also widely used for general observation where higher power is desired than is possible with a binocular. Like binoculars, they are built with a prismatic erecting system.

With the adapter, furnished at extra cost, they can be used with any ordinary panhead camera tripod for sports, bird watching, on travels, in camp, amateur astronomy.

The Bausch & Lomb 60mm Telescope offers a full 60mm aperture—Balcote anti-reflection treated optical surfaces—long eye distance, especially valuable to those who wear glasses—compact size. Eyepieces in five powers are offered—13×, 20×, 27×, 35×, and (for celestial use) 60×. Price $95.00, with 20×, eyepiece.

Write for descriptive folder and specifications.



Bausch & Lomb Hunting Sight . . . variable power

Pioneers the newest advance in hunting sights : : : a turn on the knurled ring changes the power from 2½× to 4× without change of zero, focus or eyepoint.

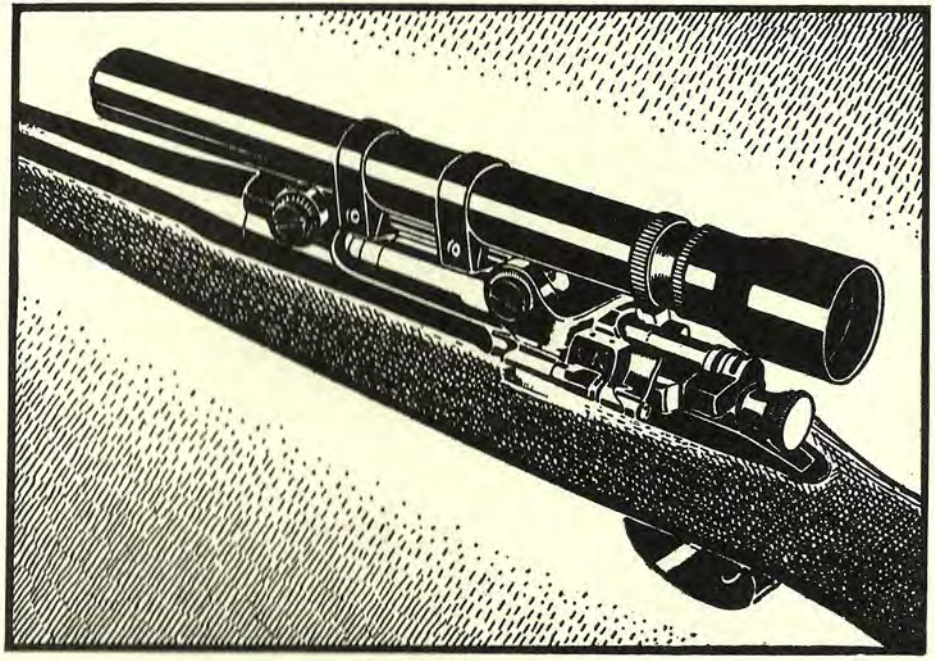
Designed by B&L engineers and manufactured to the usual B&L highest standards of precision, this Hunting Sight is without peer for performance advantages. Unquestionably, it is the most durable scope ever offered the hunter.

By providing each gun with a mount, properly zeroed, this scope can be changed from gun to gun. The zero is constant, whichever gun the sight is on.

Mounts are available for Winchester, model "70"; Remington, models "721" and "722"; Mauser, model "FN"; and 375 H & H Magnum on a Winchester "70" frame (mount can be installed by the owner in tapped holes already in these rifles), and for Savage, model "99"; Springfield, and Enfield actions (which require drilling and tapping).

2½× and 4× fixed power sights are also available.

Send for literature giving complete description and specifications of the various types.



G-19,25,August'50

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