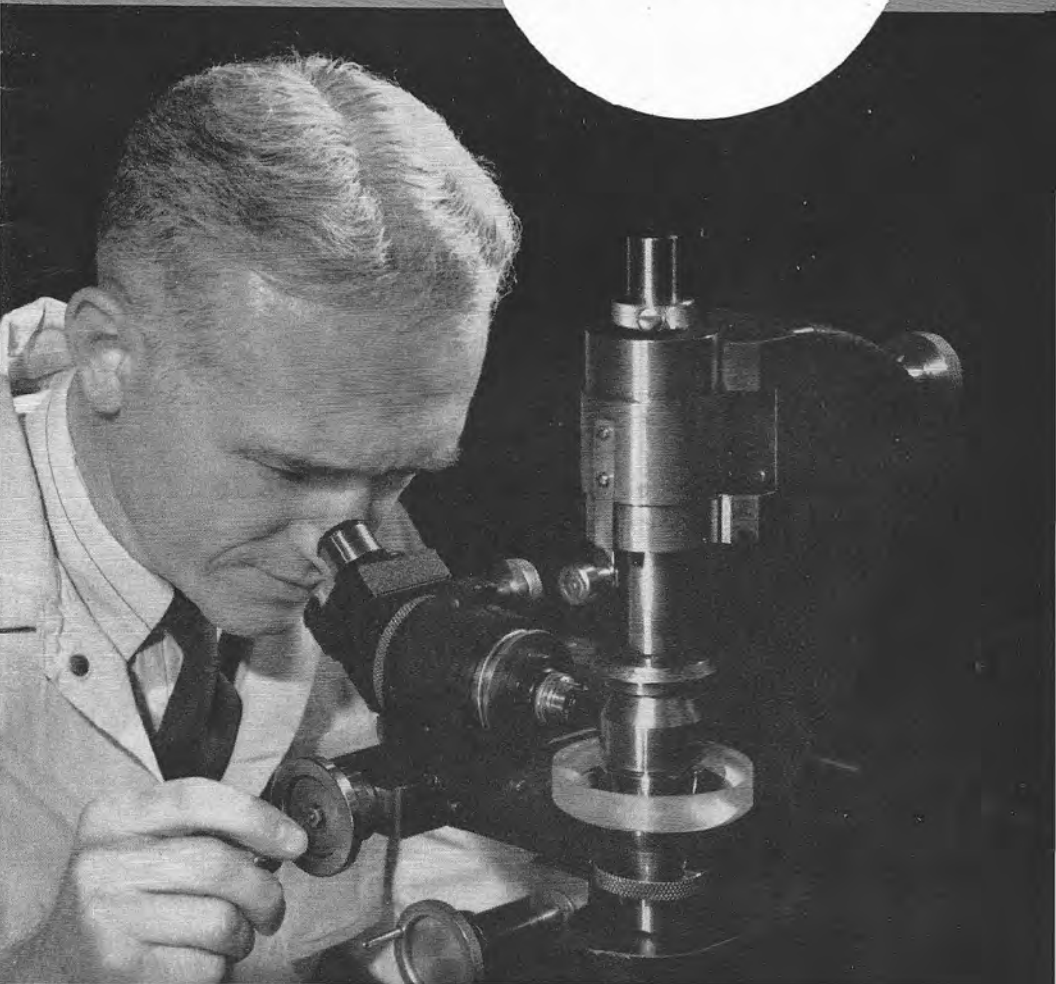
HAWK-EYE .... Kodak's Optical Works



THE "EYES OF PHOTOGRAPHY"...
new horizons through optical progress

Snapshot with a chuckle—or a key aid in science and industry. These pictures indicate why *today's photography is an all-around performer.*

Yet there's more to modern photography than meets the eye. Photography is helping you to enjoy life and to learn new things. But it's also a part, perhaps in ways unseen by you, of your daily work.

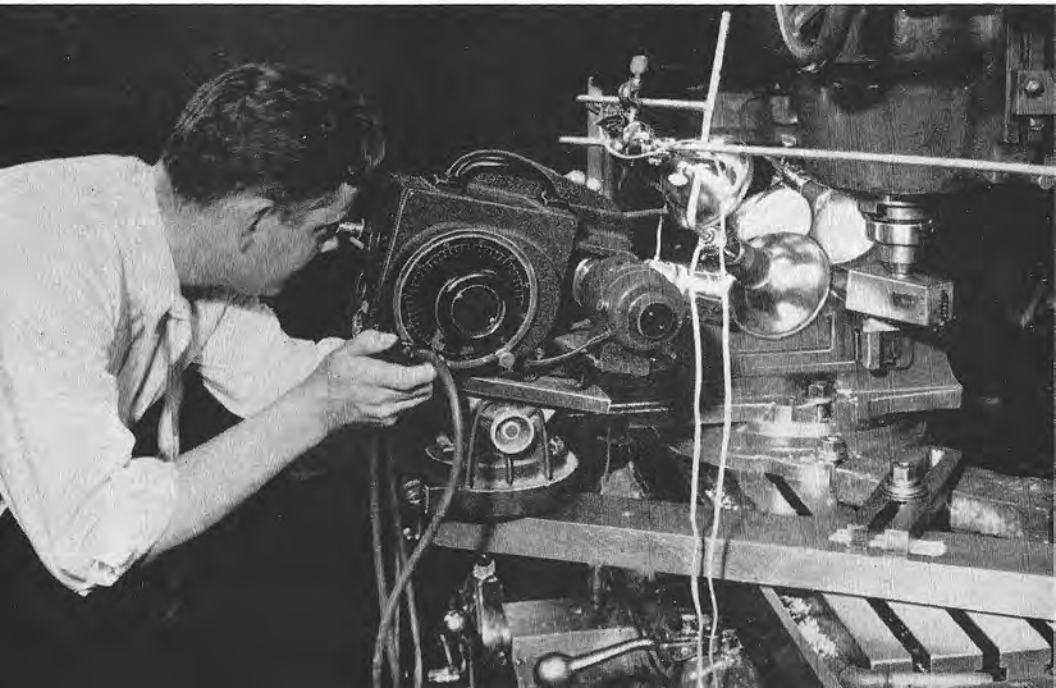
The businessman and the scientist, the doctor and the factory production man—all of them and countless more are using photography or its by-products every day. Yes, in more ways than you might imagine.

Your car, for example, couldn't be mass-produced and sold without photography's aid in research, engineering, advertising.

Vital to this progress of photography is the science of optics. And through this booklet we'd like to tell you the story of Kodak's optical plant, the Hawk-Eye Works, one of the finest of its kind in the world.

COVER PHOTO: Inspecting a lens at Hawk-Eye with an instrument designed and built by the plant's people.

Above: Motion pictures of an operation are helpful in medical studies.
Below: High-speed movies of a metal-cutting machine assist the engineer.



HAWK-EYE...and the products we make here

Our visitors often exclaim, as they view Hawk-Eye from across the Genesee River gorge, "What a beautiful plant!" But the people of Hawk-Eye—which is named after a camera once made there—can be even prouder of their optical trail blazing.

Before World War I most of the nation's optical glass was imported. Our own high-grade camera lenses came chiefly from Germany. American schools paid scant attention to the study of optics. And in this country we had few, if any, photo-lens designers with the experience and fame of those across the Atlantic.

Into this highly technical field Kodak ventured in 1912. By 1914 Hawk-Eye was producing one type of good lens in small numbers. Today, Hawk-Eye enjoys a reputation for unexcelled lenses and allied optical goods. For at Hawk-Eye they have combined the craftsman's touch with the machine's speed and precision. The result: optical products for photography, industry, science, and the armed services.

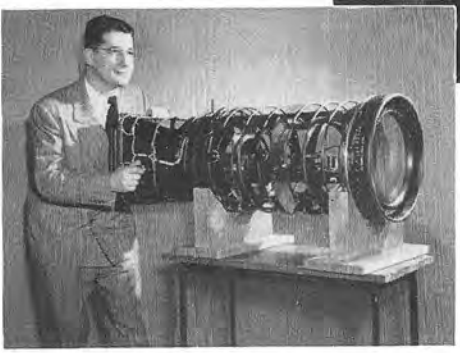
Kodaslide Table Viewer 4X *(right)* for viewing Kodachrome slides.

Hawk-Eye produces lenses for Kodak still cameras *(below)*.

Lenses for Kodak 8mm and 16mm movie cameras *(left)* are made at Hawk-Eye.

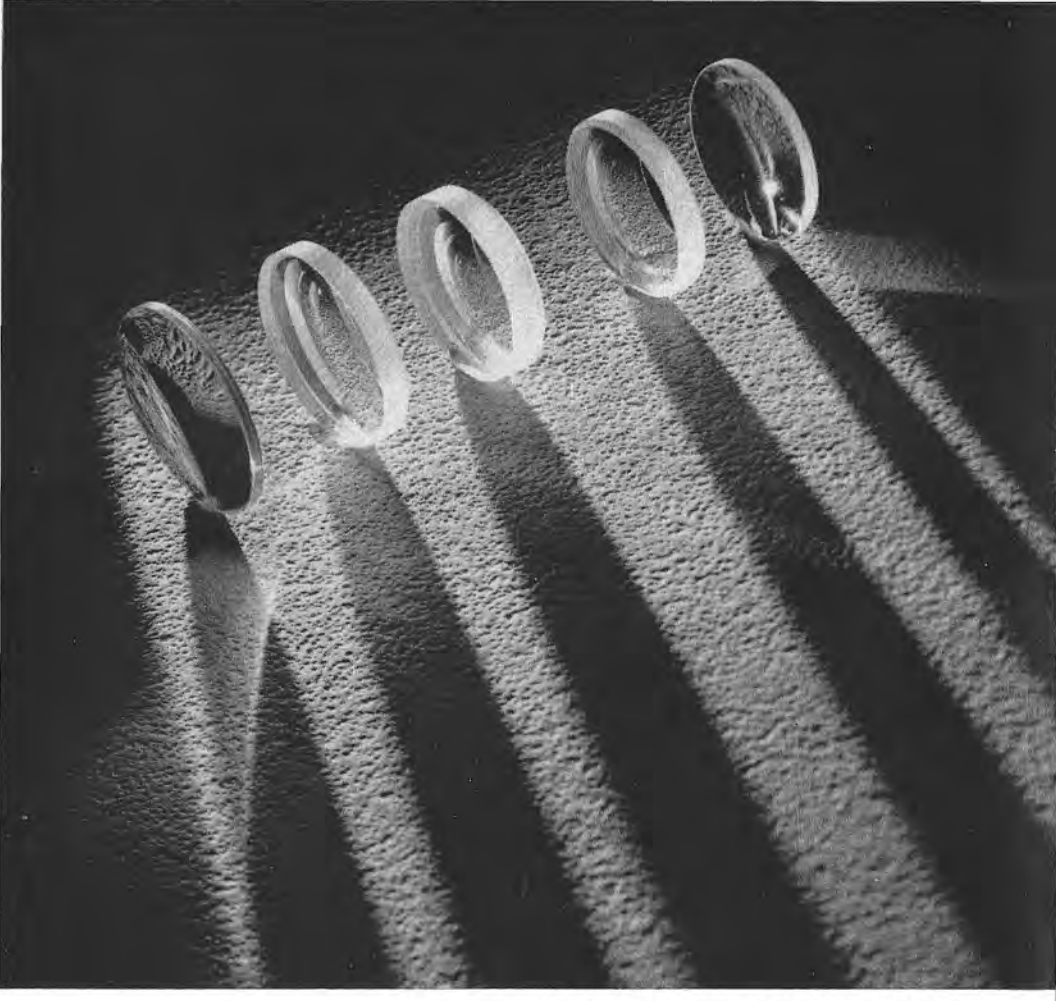
Contour Projector *(right)* quickly checks small machine parts for accuracy of manufacture. Gear teeth, e.g., are enlarged on a screen for easy inspection.

Kodak Hobbyist Enlarger *(above)* is made and assembled at Hawk-Eye.



Hawk-Eye makes large military lenses *(above)* for use in aerial photography.

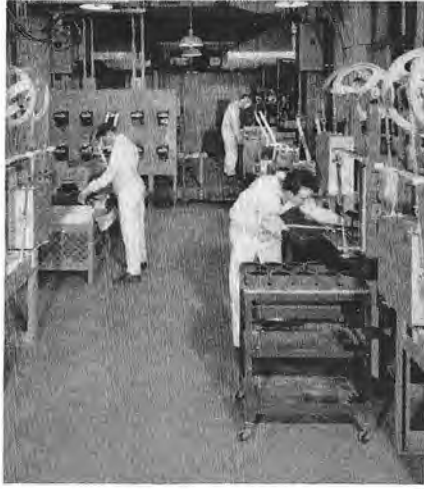
The plant also produces Recordak microfilming units *(above)* used widely in banks and offices to photograph checks, order slips, and documents.



The five glass elements of one Kodak Ektar Lens

GLASS . . . prime ingredient of optics

One of the milestones in optical history is Kodak rare-earth glass. It's made without sand, which is about like producing steel without iron. But amazing as this is technically, this is the important fact for us: the new glass is a better material to help our people make the very best in lenses for many uses.



This is Hawk-Eye's all electric glass plant. Hawk-Eye began commercial output of Kodak rare-earth glass in 1939.

Standard optical glass is made of sand (silica) with small amounts of alkaline earths and elements such as boron and lead. Our rare-element glass contains, instead, materials such as barium, tantalum, and lanthanum.

What advantage does the new type of glass have? It has greater light-bending power than other optical glass. At the same time, the new glass has less dispersion—the colors making up "white" light don't spread so much.

These new Kodak glasses are as valuable to the lens designer as new alloys are to the engineer. They enable him to design optical systems with higher apertures, covering a wider field of view with better definition.

Another basic optical advance of recent years is lens-coating. A thin (1/250,000th inch) hard film of magnesium fluoride is applied to reduce surface reflections. This permits more light to go *through* the lens. Clearer, sharper pictures with better color purity result. It's a further example of some of photography's "unseen progress."

Asbestos-clad man removes a melt of Kodak glass from the furnace. The pot is made of platinum to avoid metallic impurities.

HOW A TYPICAL OPTICAL PRODUCT IS MADE . . .

1. Flat parts are stamped out and shaped in this big punch press.

2. Parts such as lens mounts, are made in automatic screw machines.

3. Meanwhile, the viewer's case is buffed to a smooth finish.

7. Optical parts, like these condenser lenses, are then inserted.

8. Mirrors, coated now, are next added to the viewer.

9. Assembly continues with the insertion of a slide changer.

Applying modern methods to produce a Kodaslide Table Viewer

4. For a protective coating, case is dipped into the solution.

5. Viewer's mirrors are coated with aluminum in this dome.

6. Assembly gets under way. Here parts are assembled to the base.

10. Kodak Ektalite Field lens, to brighten viewing screen, is put on.

11. Finished viewer is then carefully inspected before shipment.

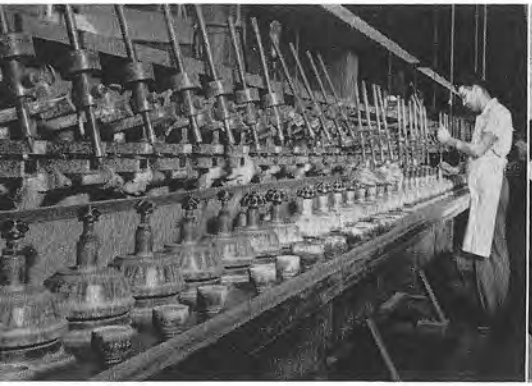
12. How product works. It enables you to view slides in daylight.

1. DESIGN of lens requires long experience in complex field of optical mathematics.

2. GLASS sheets are scored with a diamond, then broken into squares of right weight.

3. SQUARES of glass are heated in this furnace, then pressed into rounded shape for rough grinding.

4. ROUGH grinding of the curved surfaces of rounded pieces is done on these machines.



5. POLISHING the rough-ground lenses with rouge and water further shapes the surface.

6. LENSES go into high-vacuum unit for coating, which improves their optical qualities.

7. FINISHED lenses are assembled in mounts, which hold the glass parts in precise position.

8. INSPECTION of finished lenses is a final check before they are made ready for shipment.

PRECISION . . . to the millionth of an inch

Our lens-makers and testers are sticklers for accuracy. It's routine for them to deal in measurements of a few millionths of an inch.

The pictures here show the main steps in producing that fundamental optical part, a lens, from design to final inspection. But you'll have to use a little imagination to get the full meaning of Picture 8, for example. Pretend you're the girl behind the microscope. Here's what you'd do:

Set the lens in line with a bright pin-point of light perhaps 200 feet away. Then, with the microscope, study the star-like image formed by the light in passing through the lens. The star you see has to be just right—uniform and symmetrical. If it's not, you reject the lens. For the distorted star would indicate a lens that wouldn't do its job well.

That's only one test a Kodak lens undergoes. It indicates, however, the care demanded in our optical work.

Hawk-Eye's chief products are photographic lenses and projection systems, and optical instruments for our armed forces. As pictured on page 5, these include many types, as varied and as broad as photography itself. Besides lenses, filters and similar products, Hawk-Eye also makes optical tools for industry.

And all these draw upon the know-how that has made Hawk-Eye a pioneering leader in its field.

A LENS . . . it guides light along a path

A look at the picture on the facing page will show you what a really fine camera lens involves. The finished lens has seven precisely shaped pieces of glass (lens elements). All are held in a mount machined to spider-web accuracy.

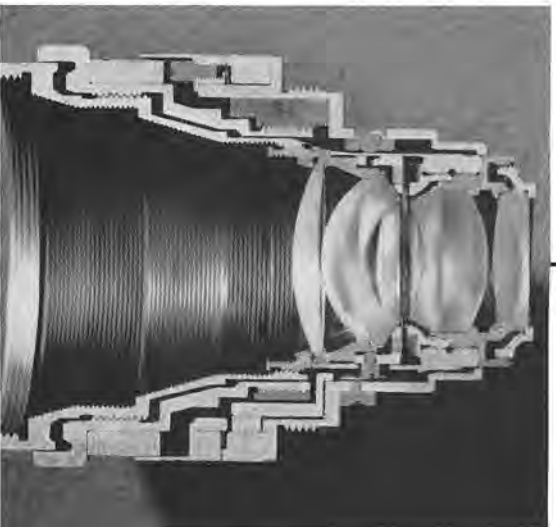
Some simpler cameras, such as a box Brownie, need only a one or two-element lens. (*See diagrams below.*) They're easy to produce, compared with a complex lens, and low in cost. Under good lighting conditions, they'll do good work.

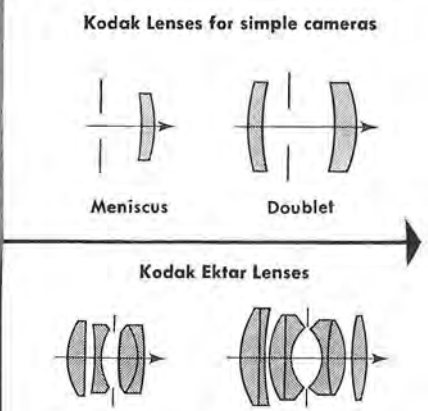
But the more advanced cameras need "fast" lenses—ones that will let in a lot of light in a short time. These lenses, coupled with swift shutters, permit pictures of rapid action, for example. Why do they need the several elements? So they'll be "corrected"—so they won't cause such errors as fuzzy edges in color pictures.

A photographic lens is thus a "light funnel." It pours the rays, reflected by the scene you're shooting, onto the film.

To make sure you don't get a distorted picture, our lens designers work out the exact paths those rays take through the lens elements. They have to consider element shapes, glass types, wave lengths of light, and so on. It often takes years to perfect one lens formula.

Girl shows a finished Kodak Ektar Lens. Before her are its parts, in approximate order of manufacture and assembly. A cross section of this lens is shown at the left, below.





These diagrams show the more complex structure of two typical "fast" lenses.


Diaphragm parts
Lens caps
Lens adjusting rings
Semi-assembled lens
Finished, polished lens elements
Rough-ground lens elements
Square glass lens blanks
Lens barrel

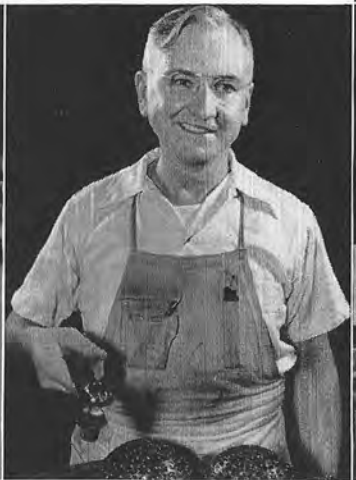
THE PEOPLE of Hawk-Eye

As you've leafed through this booklet or walked through the plant, you've seen how Hawk-Eye operates, how some of our products are made. Like the men and women in other Kodak plants, the people of Hawk-Eye take part in a number of employment benefits. These include wage dividends, sickness allowances, liberal vacations with pay, six paid holidays, low-cost group life insurance,

certain free medical care during working hours, and a retirement plan.

We hope you've enjoyed your visit to Hawk-Eye and wish you could meet more of the folks of the plant. On these pages are just a few of the people of Hawk-Eye. They're representative of the men and women who do hundreds of different kinds of work—from lathes to stock room, from office to glass furnace. We hope you'll visit us again.

Eastman Kodak Company, Rochester, N. Y.



Rows and rows of spindles — bending and twirling with the grace of dancers — are being tended in this air-conditioned lens polishing room at the Hawk-Eye Works, Eastman Kodak Company, Rochester, N. Y.

EASTMAN KODAK COMPANY • Rochester 4, New York

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