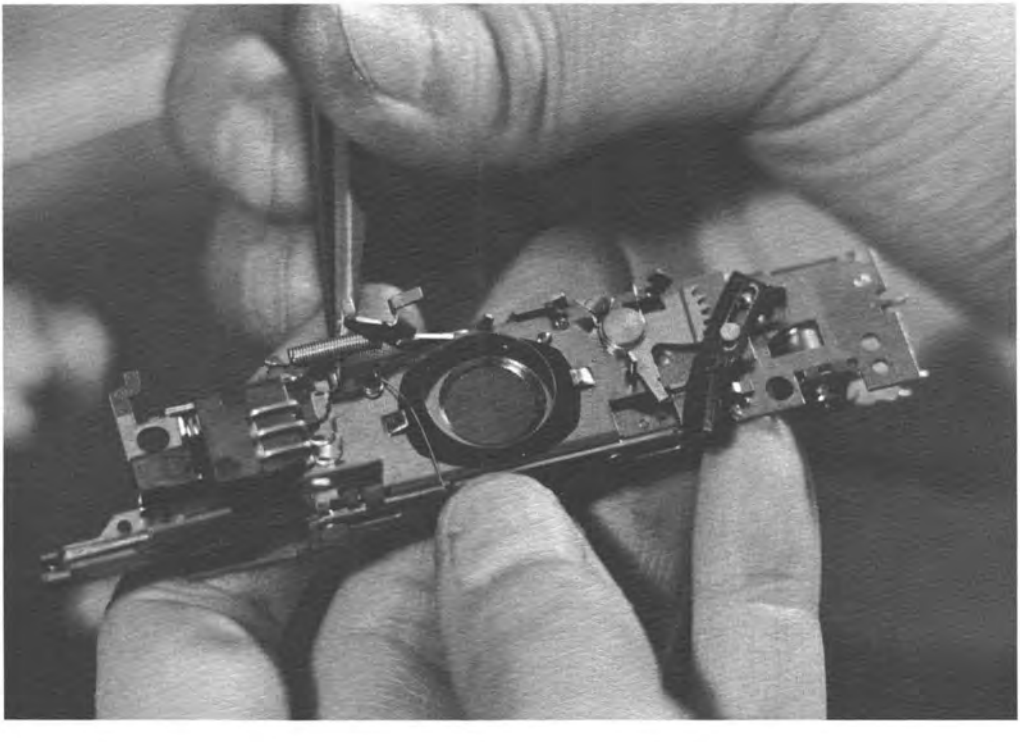
About Kodak Cameras



Images are Important to Man

Down through the centuries, man's impressions have been recorded—on the walls of caves, in oil paintings, with sculpture, and more recently by film in cameras.

Photography serves us in an infinite number of ways. Your personal camera preserves treasured memories for the future . . . a birthday party, a toddler's first steps, a trip to the mountains, special moments throughout your life.

But photography affects us in many other ways. Pictures communicate—thus, photography is a remarkable teaching medium. More than 90 percent of what we learn originates from images. We see the impact of visuals in newspapers, in magazines, and on television. Pictures are all about us.

Picture-taking is fun! With a KODAK Pocket INSTAMATIC® Camera, you can share your experiences with friends.

Less apparent to most of us are the far-reaching implications of medical, scientific, and industrial photography. Just as doctors and dentists use X-ray film as a diagnostic tool, quality control specialists apply nondestructive X-ray testing techniques to search for potential product defects that normally would be beyond visible detection.

To trace changes in the earth's surface, to study vegetation patterns, and to document cloud formations for weather analysis and prediction, scientists analyze aerial photographs—taken from airplanes and space satellites.

Nearly every check that passes through a bank is recorded on microfilm, and, more than likely, your birth certificate has been preserved on microfilm, too.

In essence, photography—the use of cameras—touches many facets of our lives. Cameras serve us . . . and they make our days more interesting, memorable, and happy.

In the following pages, we will show you how Kodak cameras are made.

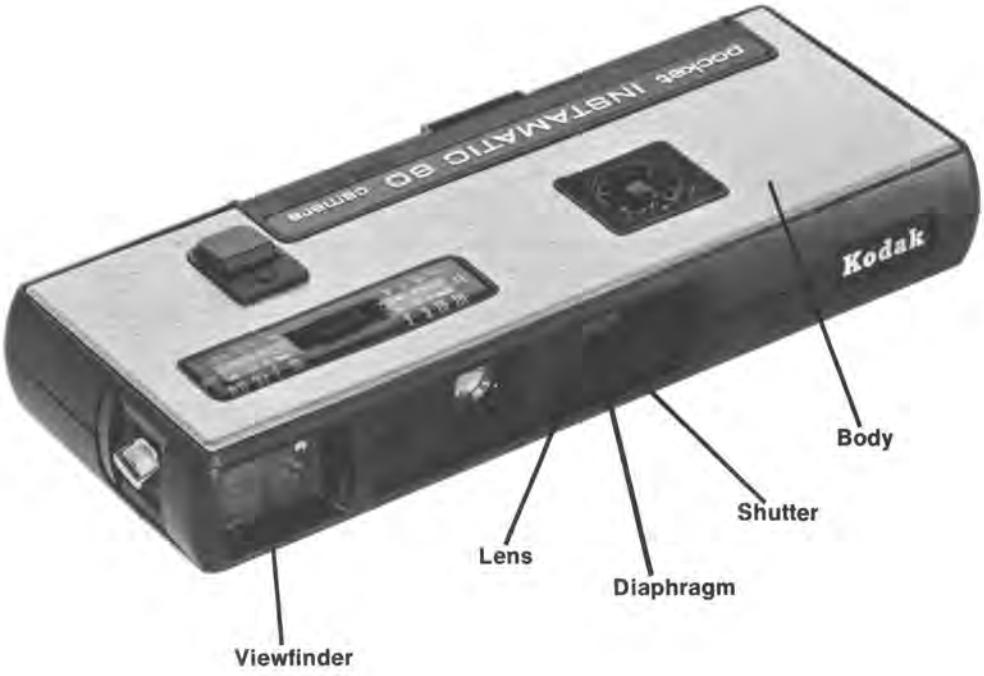
At speeds up to 120,000 characters per second, the KODAK KOM-80 Microfilmer transfers computer data directly onto microfilm.

What is a Camera?

A camera is an optical-mechanical device that controls the amount of light reaching sensitized film within the device itself. When exposed properly, photochemical changes occur in the photographic film. Later, special developing and processing techniques reproduce the captured image in pictures (prints) or transparencies (slides).

Cameras come in many costumes. Some glitter with shiny metal or anodized surfaces; others are dressed in more formal dark hues. Cameras can be incredibly simple or a marvel of complexity outfitted with an array of mechanical controls and 20th century optics and electronics.

Despite variety in shape and size or degree of sophistication, all cameras have certain common features.



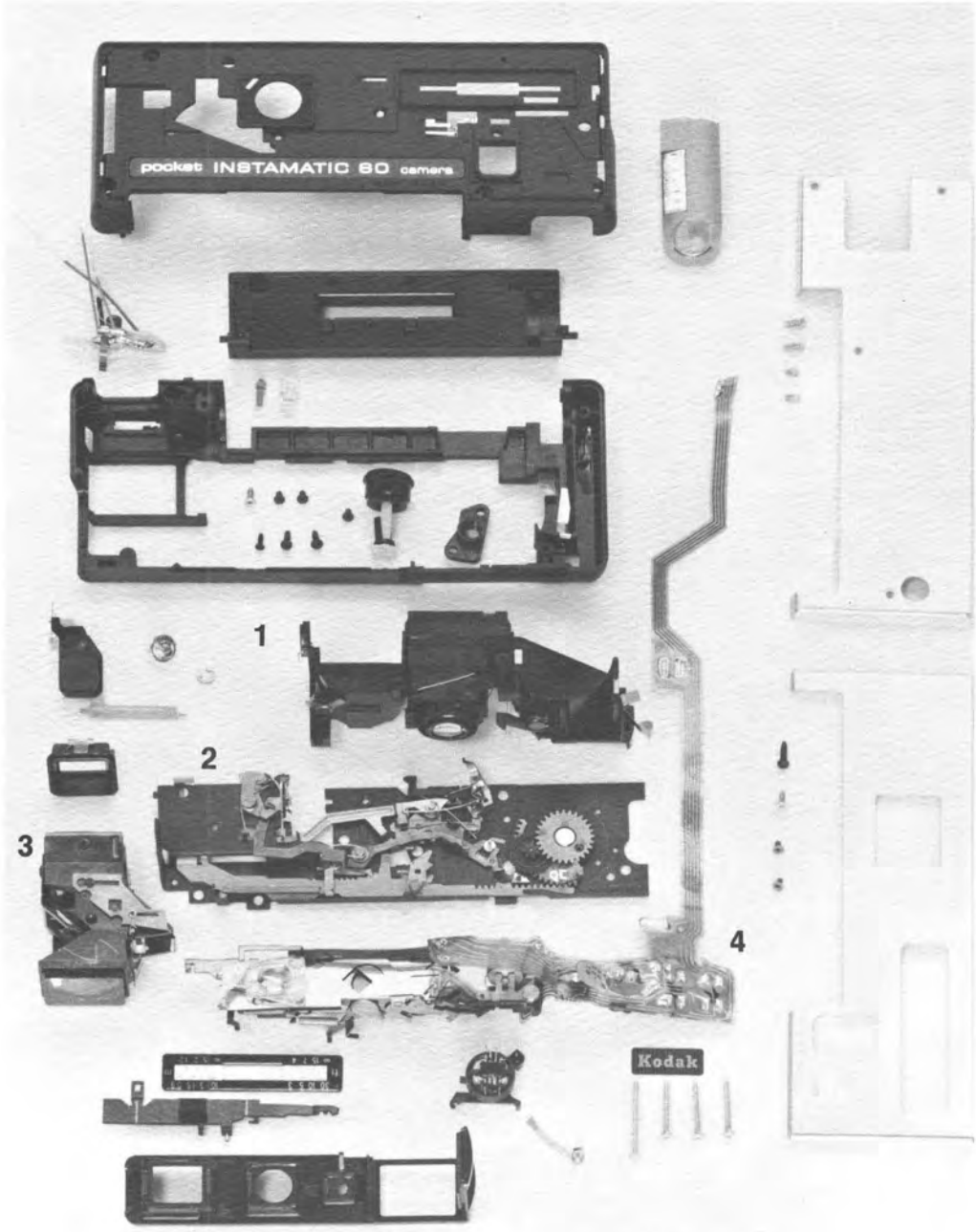
Lens — A single or multielement light-collecting and focusing unit that projects images onto film. Lenses may be fashioned from precision-molded acrylic or optically pure glass.

Diaphragm (or lens opening) — Regulates the light quantity entering a camera. This aperture can be manually adjusted or automatically controlled, in some cameras, by a photoelectric cell to meet varying light conditions. Simple cameras usually have a fixed lens opening.

Shutter — Determines the length of time light exposes the film. More sophisticated cameras feature variable-speed shutters. Fast shutters, in most instances, can freeze picture-subject movement to prevent blurs.

Body — A lighttight box housing the camera mechanism. Most camera bodies include a film transport system for cartridge or roll-type film. Some cameras, however, accept sheet film and, thus, do not require a transport, only a film holder.

Viewfinder — Lets the photographer see the content of the picture he will be taking.



From miniature parts and intricate subassemblies, KODAK Pocket INSTAMATIC Cameras grow. Pictured among these parts are: (1) core and lens, (2) lower mechanism plate, (3) rangefinder assembly, and (4) flex circuit assembly.

How a Kodak Camera is Made

Camera Design

Design begins with questions. What innovations will make picture-taking easier for consumers? What features will produce better pictures? Marketing research provides some of the answers—with your help. New camera owner cards that customers mail to us help provide answers to questions such as: What do customers like about our cameras? What don't they like? What can be improved? What can be changed?

Further design ideas are offered by equipment service and quality control staffs. In this way, manufacturing and design engineers begin to translate your needs into reality.

The first step is a feasibility study. Some of the factors that must be evaluated include: Is the design marketable at a popular price? Can technology be made available to achieve our design goals? Do we need more manufacturing equipment or plant space? How much will it cost to make special tools? How will our people be affected? Do we have enough manpower?

After the feasibility study is completed and the proposal approved, artistic renderings are prepared along with a nonfunctional "appearance model," complete to the finest external detail. This solid-block camera allows design members to consider human factors in camera handling and use. Does the model handle properly? Should a control knob be repositioned for operator convenience?

As the design progresses, attention increasingly focuses on smaller details until finally a prototype evolves. This creation and the production-run camera develop from hundreds of man-hours and countless give-and-take discussions among design engineering, manufacturing, and quality control people.

The horizontal, binocular-style KODAK XL Movie Camera evolved from industrial design drawings.

Parts Fabrication

Camera quality relies upon precision parts. In attempting to assure this accuracy, our metrology laboratory constantly monitors the standards against which part tolerances and tool precision are measured. Just one device among many, a gauge-block calibrator is so sensitive a heat shield must be positioned between the operator and the standard being checked. The shield prevents the operator's breath from influencing measurements.

These parts are manufactured by a wide variety of general-purpose machines and special tools. Special tooling for high-volume production of a camera may cost several million dollars.

Metal-stamping machines, equipped with progressive dies, cut and form sheet metal quickly into intricate shapes. One small shutter component, for example, is stamped out at the rate of 400 per minute on a punch press. Automatic screw machines turn solid metal rods into parts that meet exacting tolerances. In other areas, injection-molding machines form complex plastic camera bodies and produce optically precise acrylic lenses used in many Kodak cameras.

A skilled individual modifies a four-cavity mold that will form plastic camera components.

Glass Manufacture

Optical properties of glass vary with chemical ingredients and glass manufacturing techniques. To be sure of desired light-bending properties from the start, Kodak produces much of its own special optical glass.

Boric oxide and other rare chemicals are melted and mixed in platinum or gold crucibles to ensure purity. About 12 pounds of molten glass per container is heated to over 2500 F, then cooled several hundred degrees before pouring onto a metal casting plate. Refraction properties are tested by glass samples from each "melt," again to be sure of quality.

After cooling, glass slabs are scored and carved into cubes or cut into circular lens blanks with diamond core drills.

Molten glass must be carefully and consistently poured upon the casting plate to prevent bubbles from forming.

Lenses are inspected to ensure quality. Precision lens-making is a complex process, and meticulous care is essential at every stage of manufacture.

Lens Making

Lens blanks that have been coated with a pitch adhesive are inserted into multiple lens-block forms. Induction heat then melts the pitch as a pressing tool precisely aligns each glass blank.

Next, the lens blocks are placed on a "generator" where diamond ring cutters grind initial lens curves. From the generator, lens blocks move to a fine grinder where industrial button diamonds perfect the first grind. This step is followed by rouge polishing.

Lens blanks are then reversed into other lens blocks. Shaping, fine grinding, and polishing are repeated for the opposite lens side. When completed, finished lenses are removed from the lens block and degreased (cleansed). For many lenses, this concludes the manufacturing and polishing cycle.

Multielement lenses for more advanced cameras must be perfectly seated in lens barrels. Thus, lens edges may be ground and beveled down to minute dimensions when necessary. On an automatic centering machine, the lens perimeter is brought into agreement with the lens' true optical axis. Lenses are sonically cleaned and rinsed before mounting in lens barrels.

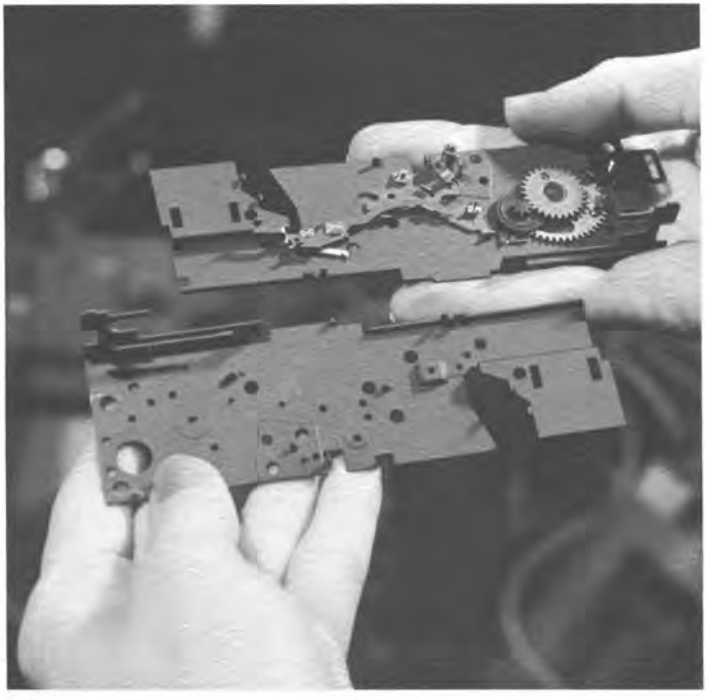
Antireflection coatings can dramatically increase the ability of a lens to transmit light. Therefore, lens surfaces exposed to air must be coated. Lenses in trays are loaded into bell jars mounted on a rotary coating machine. After a vacuum is created within the bell jar, lenses are heated and bombarded with electrical energy to remove impurities. A chemical pellet is then vaporized, dispersing a uniform layer to lens surfaces.

This tray holds tiny lenses for KODAK Pocket INSTAMATIC Cameras.

Camera Assembly

Major subassemblies (lower mechanism plate; rangefinder; core and lens; servomotor and electrical flex circuit) that have been constructed elsewhere in the plant arrive at a central assembly area. Skilled people deftly add springs, flanges, bolts, and a multitude of other intricate parts. Simpler cameras receive equal care and attention, but require fewer manual operations. Progressing down the assembly line, the cameras grow as subassembly joins subassembly. Adjustments and quality control checks take place at regular intervals, and cameras receive complete inspection at the end of the assembly line.

This special loading station prepares electronic exposure-control parts for wave soldering, a technique that solders many components in one rapid operation.



An automatic assembly machine installs parts on the lower mechanism plate without human assistance.

Checking lens focus during camera assembly is only one among many quality-control functions.

Cameras That You Can Count On

Over the years, quality has become a tradition at Kodak. Although quality control is downright expensive, quality is important to us. We want to live up to the high standards that you expect.

Quality control is a team effort that starts with design and continues at virtually every stage of camera development and manufacture. And it doesn't stop there—throughout a camera's life cycle, our service representatives offer suggestions based upon customer experience.

High quality parts contribute to high quality products. To meet these standards, strict quality specifications have to be met in all parts, whether manufactured by Kodak or purchased from vendors.

In the laboratory—and in the field—quality control members act in the role of customers. To simulate actual use, cameras are actuated thousands of times under different environmental and use conditions. Temperature extremes, humidity changes, shock tests, and every conceivable use and misuse are explored. Picture evaluation is especially helpful in diagnosing and assessing camera strengths and weaknesses.

Packaging

As cartons advance down a conveyer line, cameras, instruction manuals, and accessories are added. The filled cartons then are enveloped in protective overpackaging before insertion into corrugated shipping cartons. Flaps are closed step by step and sealed, as the cartons pass through automated packaging machines.

Gravity soon takes over, and cartons speed down the line toward a collection area where shipping pallets wait. Pallets stacked high with camera cartons are transported from Kodak's Elmgrove Plant to the company's Distribution Center warehouses in Rochester. From there, camera outfits will be dispersed to Regional Distribution Centers serving photographic dealers throughout the United States.

A camera "outfit," complete with accessories and film, lets you take pictures without delay.

Elmgrove Plant (Top Photo)—Kodak Apparatus Division headquarters. Camera research, design, manufacturing, assembly, and support activities are housed in this suburban Rochester facility.

Hawk-Eye Plant (Above)—Camera lenses are manufactured in this plant. In addition, a variety of optical-mechanical-electronic equipment is assembled here.

Like to learn more about film? Ask Corporate Information Department for a free copy of *About Kodak Photographic Film*, publication number CR-7.

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