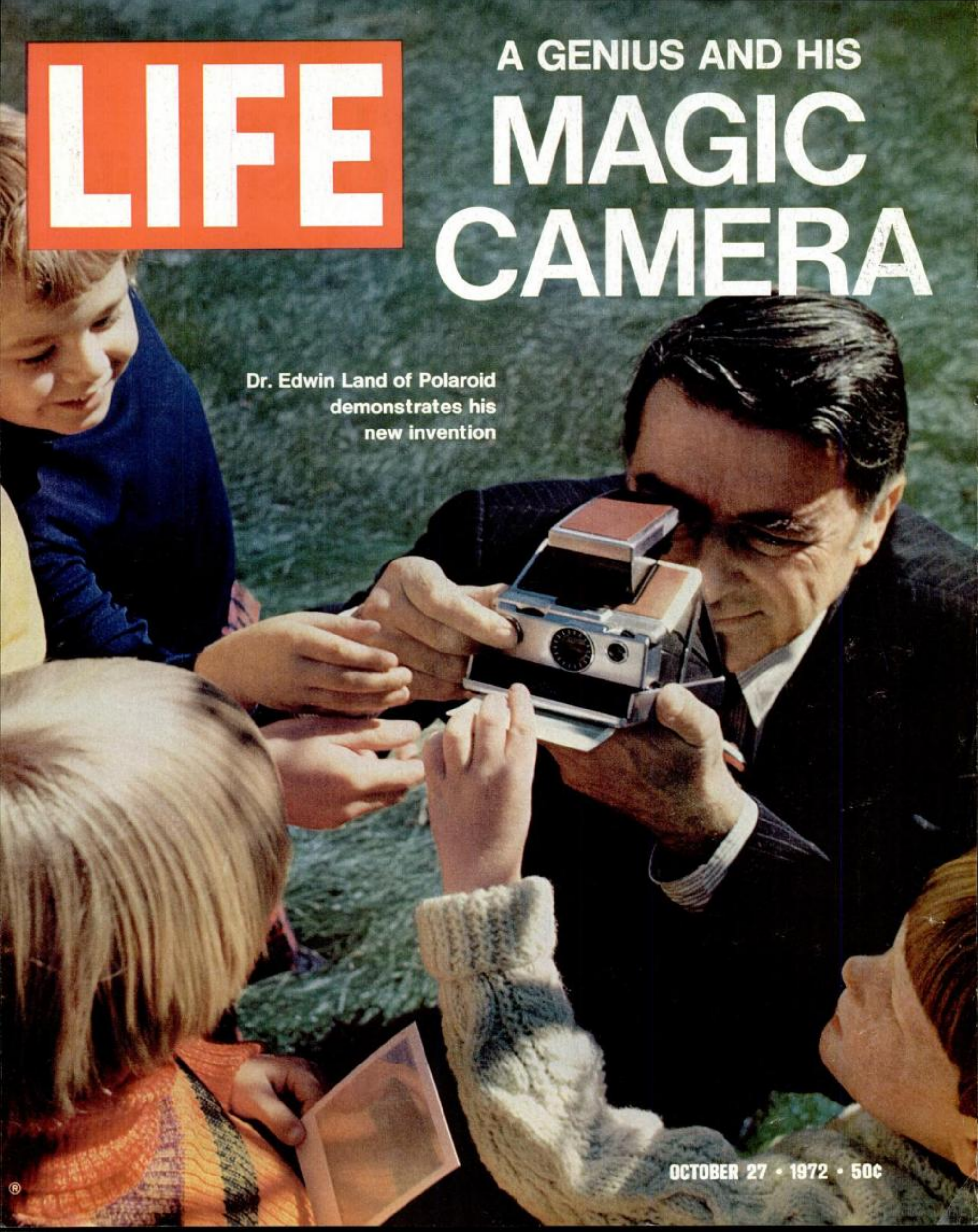
LIFE

A GENIUS AND HIS MAGIC CAMERA



Dr. Edwin Land of Polaroid demonstrates his new invention

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LIFE

Editors' Note

Discovering who's what in the wilderness

The picture essay that begins on page 60 describes what happened when 51 of Oregon State Hospital's sickest mental patients were taken on a 16-day field trip into the wilderness. The experiment was designed to break down the institutional distinction between patients and doctors. When LIFE correspondent John Frook and photographer Bill Eppridge joined the group, they faced an unexpected problem: sorting out the patients from the staff. "Each person wore a tag bearing only his first name," recalls Frook, "and several times someone we thought might fit into our story as a patient turned out to be a staff member.

Frook with wilderness beard

"Once we'd worked out who was who, it took time to get used to sharing our campsites with people who had histories of violence and even homicide. I woke up one night and began wondering about these still shapes around me. I had started off with a kind of keep-your-back-to-the-wall wariness. But we had spent an exhausting week of forced interdependence, and I decided I just wouldn't worry anymore. For the most part the patients were composed and extraordinarily tender. By the end of the trip, I'd fallen into a number of easy friendships."

The patients, Frook and Eppridge found, never tired of talking of their own cases, describing with a strangely detached air the first time they went berserk, or the occasion when they tried to commit suicide. And their condition was to them a source of endless amusement and mocking deprecation of themselves and others. One young man tried his best to convince Frook that they had once been ward mates at Eastern Oregon Hospital. Eppridge's own slightly mad antics delighted them. "At each stop," Frook recalls, "Eppridge—an avid fisherman—would be down on his hands and knees, hunting for grasshopper bait, calling to the insects in what he imagined to be an inviting voice. Gazing at this spectacle, one patient turned to me and asked sympathetically: 'Are you quite sure he's all right?' "

Ralph Graves

RALPH GRAVES, *Managing Editor*

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A new Polaroid camera develops color pictures while you watch

DR. LAND'S

1 MINUTE

3 MINUTES

5 MINUTES

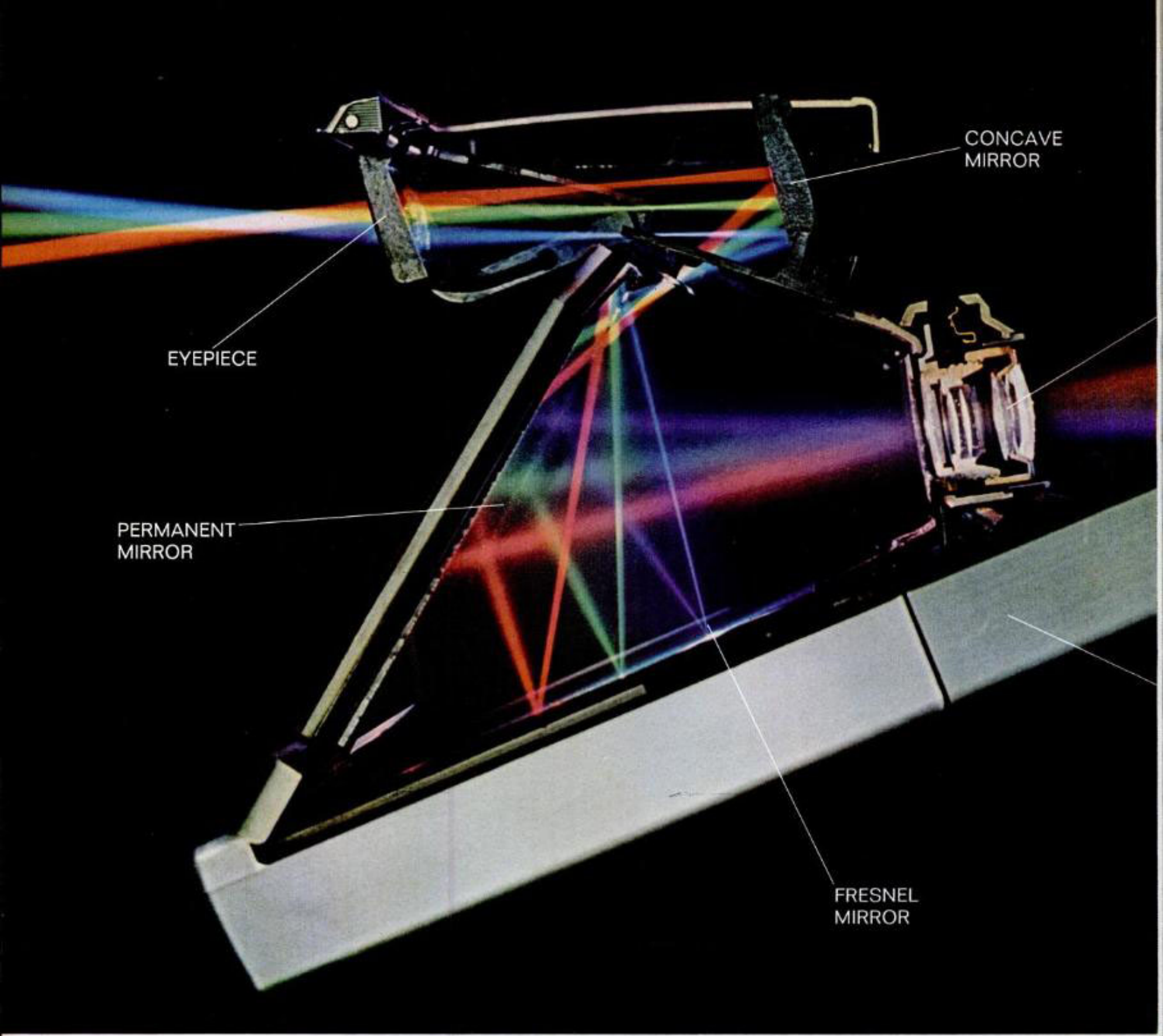
Push the button and less than two seconds later, with a buzz and a clunk and a whir, the oddly folded machine ejects a blank card. In 30 seconds an image slowly appears, emerging out of a blue-green fog and becoming within minutes a fully developed color photograph. The SX-70 camera, the latest piece of wizardry from Polaroid and its guiding genius, Dr. Edwin Land (right), is both a marvelous toy and a stunning technological achievement. It is also a daring challenge to Kodak for supremacy in the $4 billion-a-year U.S. photo industry. Kodak is a giant compared to Polaroid because of its interests in chemicals and fibers (Kodel) as well as photography. Yet Polaroid sells more cameras over $50 than all other manufacturers combined. Of the five billion pictures snapped by amateurs in the U.S. annually, 20% are already Polaroid prints.

The SX-70 should increase that share. It eliminates the litter of gooey chemical pods and negatives that used to trail the Polaroid photographer. The reflex viewing system has a lens that focuses to ten inches for close-ups, and yet the whole thing folds to a 4x7-inch size. To develop what is the most complicated simple camera ever, Polaroid had to make new advances in optics, electronics, film chemistry and precision plastic molding. The company also had to build new manufacturing facilities. The total effort has cost $250 million. But as the SX-70 goes on sale for the first time (in Florida, next month) for $180, Polaroid officials are highly optimistic. They expect to sell several million during the first year alone.

10 MINUTES

In the hands of inventor Edwin H. Land (opposite) an SX-70 camera automatically emits a dry, newly shot picture 1.5 seconds after he pushed the red shutter button. Protected from the light by a blue-green chemical shield, automatic processing begins inside the film. As the minutes go by, the image becomes clearer and brighter, emerging from the chemical shield.

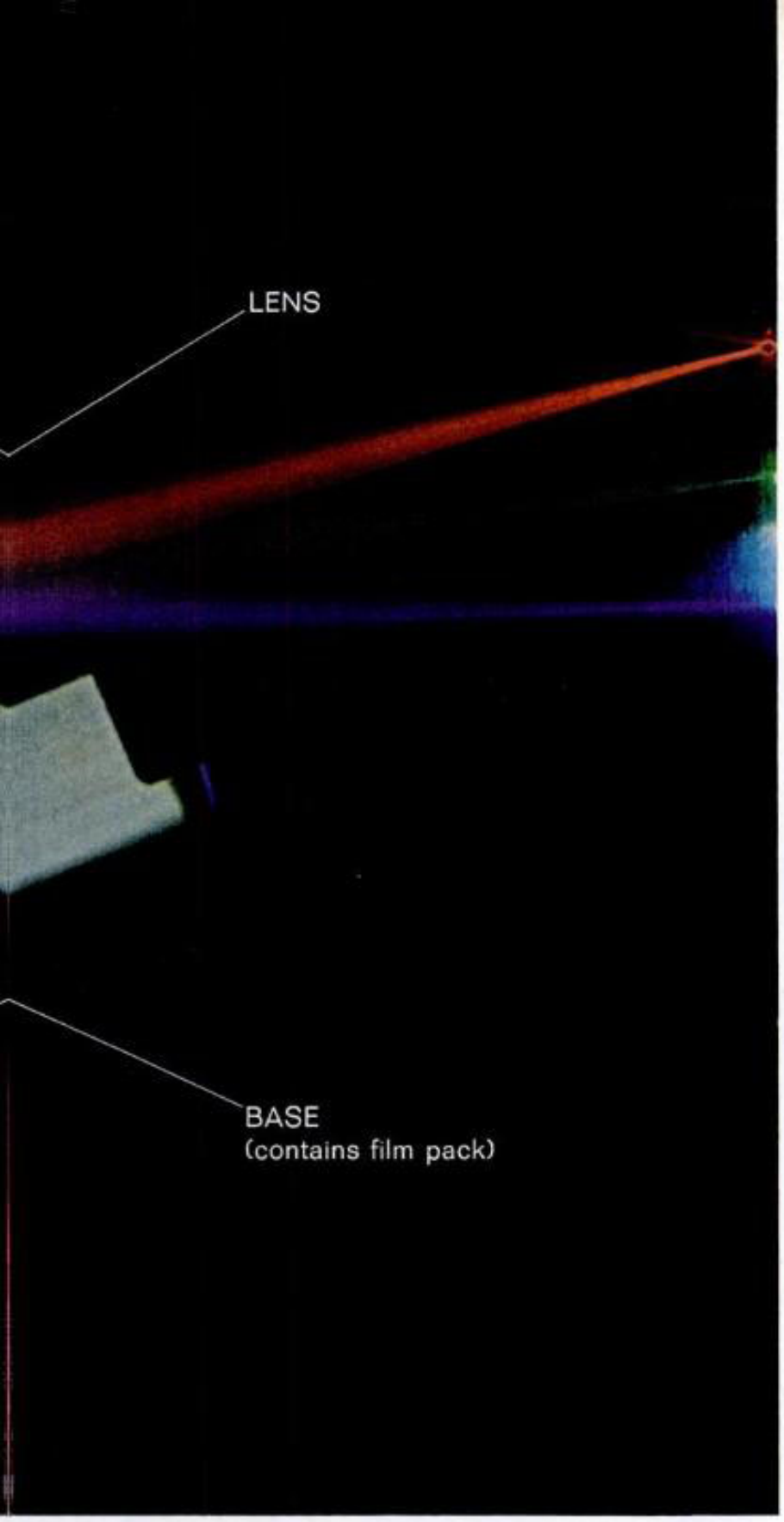
LATEST BIT OF MAGIC



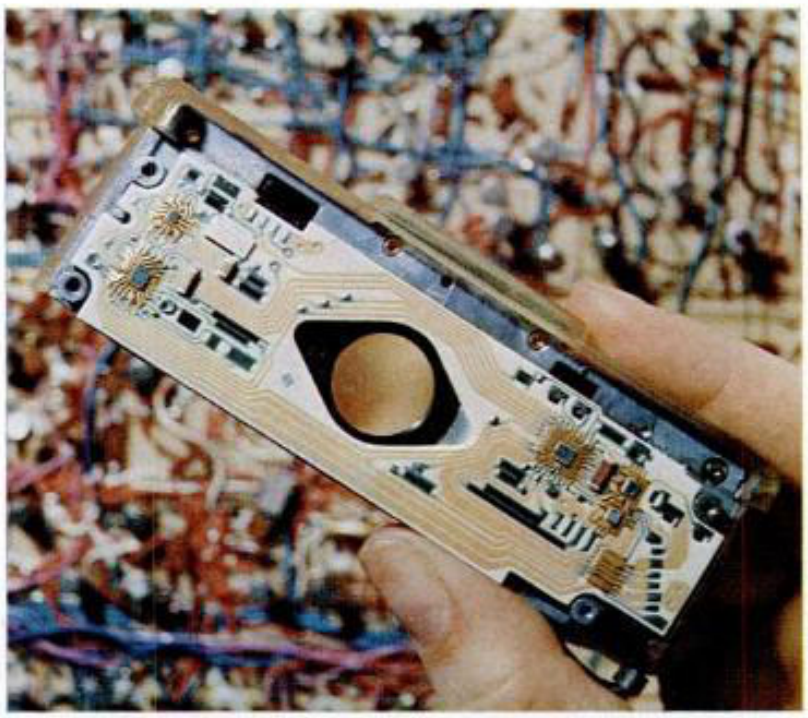
IT'S DONE WITH MIRRORS AND ELECTRONICS

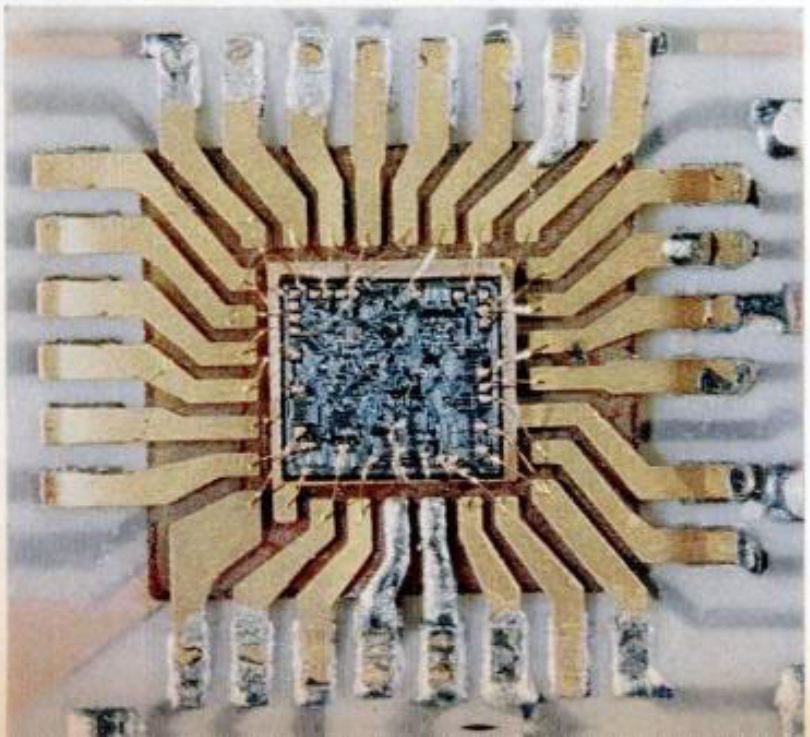
In Land's original memo setting out his hopes for the SX-70, the main points were "no garbage, no imbibing time and small-size camera." Doing away with the "garbage"—the paper and chemical debris necessary to the old system—meant Polaroid scientists had to invent a new self-developing print, with all the chemicals built in. This eventually added up to 17 layers of compounds, some a few ten-thousandths of an inch thick. To reduce "imbibing time" (the time needed to develop the picture inside the camera), the print was ejected from the camera before processing. But to make exterior processing work, the scientists had to come up with a workable "opacifier," a substance that would form an "instant darkroom" and protect everything from light while the developing went on. To keep the camera small, Land decided to bounce the light off a series of precision mirrors. Yet no optical system in existence could operate in so small a space. Physicists sat down with a computer and built one. To discover the proper curve of the concave mirror alone (see cutaway above) required two and a half years of full-time computer work. With the eyepiece, its development cost $2 million. Polaroid now turns out 10,000 such mirrors a day at a cost of 36¢ each.

Inside, the SX-70 is a maze of mirrors. Above, beams of colored light trace the path of the image. At right is the light source. Passing through the lens, the beams strike the permanent mirror, are deflected down to a grooved Fresnel mirror that helps focusing, and bounce up to the permanent mirror again. Here they go to the concave mirror, out the eyepiece and into the photographer's eye. On exposure the hinged Fresnel pops up to deflect the image onto the film in the base.



A Polaroid employee inspects one of a group of plastic concave mirrors that have just been coated with aluminum. Most complex of four mirrors built into the SX-70, the concave mirror took years to design. Polaroid then had to invent a precision molding process to produce it.





The front panel of the SX-70 camera, seen from the rear above, contains the lens and five tiny blue integrated circuits—one shown enlarged at left. They do the job of 300 transistors like those in the background above. "Consumer electronics will never be the same," says Land.

Children at a school in Lancaster County, Pa.

A farm in the Amish country

A PROFESSIONAL SHOWS WHAT THE CAMERA CAN DO

High fashion model in New York

LIFE photographer Co Rentmeester experimented with the SX-70 camera, and a gallery of his pictures is reproduced on this page. The SX-70 camera has an electronic shutter system for automatic exposure control. Film will cost about 50¢ per 3⅛x3⅛-inch print and comes in packs of ten—with a small battery built into each pack which powers the camera.

Nude was photographed with a 15-second time exposure

SX-70 lens can be focused down for close-ups

From overhead, a study in motion of two dancers from the Joffrey Ballet

'IF YOU ARE ABLE TO STATE A PROBLEM, IT CAN BE SOLVED'

Recently, seated in his Cambridge office, Dr. Land talked with LIFE's *Sean Callahan about creativity, science and photography.*

When I meet someone for the first time, often I can tell right away whether he may be a potential scientist. In talking to this person, how much is he ahead of you? When you draw a breath to say the next thing, does he know what you are going to say before you say it? Does he delight in the construction you are making? Does he turn the conversation quite subtly because he perceives where it is going and wishes it to go somewhere else? Not all scientists are that alert. There are many scientists who, for all their marvelous training, are just plain dull. You sit with them and nothing is happening. They have been stultified somehow and the world is going by them.

When Arthur Ashe plays tennis, his purpose each day is to play the game in a way he has never played it before. It may be a backhand he uses, one that he may never have used before in that circumstance. His play is a fresh integration of his world at the instant of action. A really great scientist has the whole past at his disposal. At any instant he is rebuilding the world, molecule by molecule, in his subconscious. That is what you want in an athlete or a scientist.

An essential aspect of creativity is not being afraid to fail. Scientists made a great invention by calling their activities hypotheses and experiments. They made it permissible to fail repeatedly until in the end they got the results they wanted. In politics or government, if you made a hypothesis and it didn't work out, you had your head cut off. The first time you fail outside the scientific world you are through.

Many people are creative but use their competence in ways so trivial that it takes them nowhere. Their kind of creativity is not cumulative. True creativity is characterized by a succession of acts each dependent on the one before and suggesting the one after. This kind of cumulative creativity led to the development of Polaroid photography. One day when we were vacationing in Santa Fe in 1943 my daughter, Jennifer, who was then 3, asked me why she could not see the picture I had just taken of her. As I walked around that charming town, I undertook the task of solving the puzzle she had set for me. Within the hour the camera, the film and the physical chemistry became so clear that with a great sense of excitement I hurried to the place where a friend was staying, to describe to him in detail a dry camera which would give a picture immediately after exposure. In my mind it was so real that I spent several hours on this description. Four years later we demonstrated the working system to the Optical Society of America. All that we at Polaroid had learned about making polarizers and plastics, and the properties of viscous liquids, and the preparation of microscopic crystals smaller than the wavelengths of light was preparation for that day in which I suddenly knew how to make a one-step photographic process. I learned enough about what would work in enough different fields to be able to design the camera and film in the space of that walk.

If you are able to state a problem—any problem—and if it is important enough, then the problem can be solved. Long before he puts the problem into words, the scientist knows how to confine his questions to ones that he thinks are answerable. He wouldn't be able to formulate them otherwise. His taste, discernment, wisdom, shrewdness and experience have established within him an inner knowledge of what is feasible. However, you must pick a problem that is manifestly important. It must be important to you and your colleagues, and more important than anything else. You can't necessarily separate the important from the impossible. If the problem is clearly very important, then time dwindles and all sorts of resources which have evolved to help you handle complex situations seem to fall into place letting you solve problems you never dreamed you could solve.

Some people feel that the Polaroid camera is strictly an amateur product that does nothing to develop the artistic expression of photography. What I contend is that far from taking creativity away from people, we provide an opportunity for creativity that other photography doesn't allow. Previously the only people who could become good photographers were those who had the time to teach themselves to record the image, develop the negative and make the print, embodying their own visualization of the world. Photography is unlike any other art form. In the other arts there is always a continuous interplay between the artist and his art. He has the painting or sculpture before him. What we have tried to do is to provide a medium for "artistic expression" to anyone with only a reasonable amount of time. By giving him a camera system with which he need only control his selection of focus, composition and lighting, we free him to select the moment and to criticize immediately what he has done. We enable him to see what else he wants to do on the basis of what he has just learned. The only reason I did all of this is because I knew I loved to take pictures and there just wasn't any good way of doing it. ■