

Einstein and the Great Household Refrigerator

by George Colpitts

In November 1936, a *New York Times* headline announced "Einstein Inventor of Camera Device," the reporter surprised that the man of "abstruse sciences," who reigned in a cosmos of high-level mathematics and theoretical physics had been caught — well — tinkering with technology.

The report certainly went against popular perceptions of Einstein. Newspaper coverage, which the scientist found irksome, generally implied that guru-like wisdom emanated from the him perpetually. Both North American and European society looked to him for answers to global questions and philosophic dilemmas, especially with the late '30s rise of European Nazism.

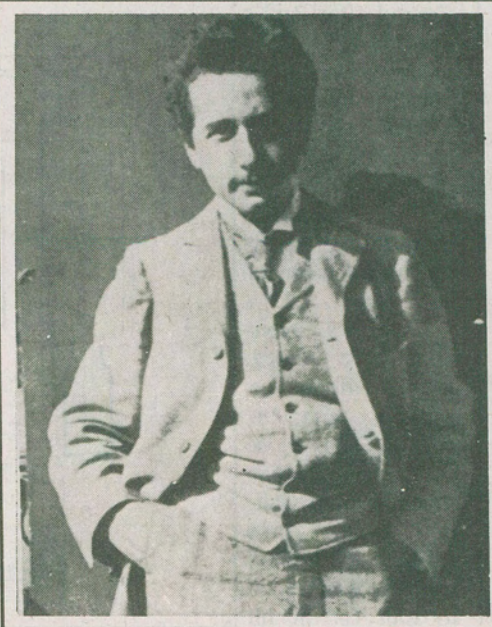
And this was the next revelation? Not the grand unifying theory, but a new camera device?

Actually, it was an auto-exposure camera, with a photoelectric cell which sensed light intensities. When too much light was entering the camera, a screen of varying thickness dropped over the lens. Nonetheless, the camera's awkward mechanics were disappointing: a "simple gadget" as the *Times* called it, "all the amateur need do is to press the button, secure in the knowledge that the screen will let in the proper light."

Whether true or not, the newspaper stressed that the camera's creators, Einstein, and his close friend Dr. Gus-

tav Bucky — himself a leader in X-ray technology — were a little embarrassed at being caught tinkering with rude machinery and household electricity.

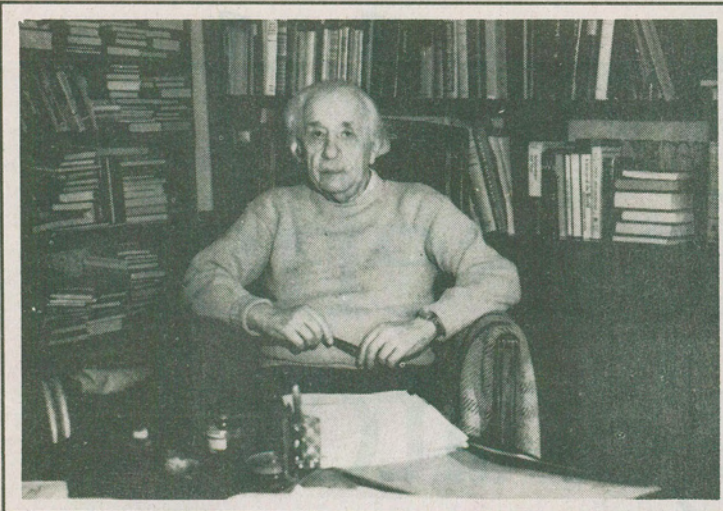
But with Einstein one couldn't really separate the theorist from the tinkerer, whose adroit creativity saw him balancing cutlery at dinner tables or speculating on how solar energy could be captured. If anything, the camera's design reflected more clearly the far-reaching scope of a mind which thrived on men-



A young Albert Einstein photographed prior to joining the Bern Patent Office. He began planning his voltmeter shortly afterward.

tal — and mechanical — innovation. "Every great advance in science has issued from a new audacity of the imagination," he said at one point. Like his revolutionary physics, Einstein's inventions had a spirit of great audacity but were virtually unknown to his public. As Bucky had said when questioned about the new camera: "A man must have some private corner in his life." Einstein's private corner, hazy with pipe smoke, was cluttered with designs for new refrigerators, hearing aids, and linear action motors.

Roots to Einstein's inventive spirit may be traceable to his upbringing. Late 19th-century excitement for electricity had prompted his father Hermann and uncle Jakob to design and manufacture electrical products. Some of Einstein's adolescence was spent in their world of fascinating invention, if not revealed in the Einstein's workshop or at the kitchen table where his uncle most likely unrolled blueprints, then certainly at the German exhibitions where the Einsteins promoted their products which ranged from arc lights and circuit breakers to dynamos. Moreover, from 1889 to 1890, the Einsteins and a collaborator, Sebastian Kornprobst, developed an electrical "clock meter" which measured ampere-hours as well as watt-hours. Unlike contemporary electrical meters — remember that metering electricity use was one of the biggest problems facing the new in-



Einstein in his Princeton study where he did some work on his refrigerator.

dusty — the Einstein-Kornprobst patent measured either direct or alternating current and used, centrally in its design, two clocks: one keeping regular time and another keeping time relative to the amount of current used. Some writers — perhaps stretching the analogy — have asserted this meter, comparing clocks in different frames of reference, possibly influenced Einstein's interest in relativity.

For Albert Einstein, the idea of measurement appeared later in a 1907-1910 collaboration with the Habicht brothers, Johann Conrad and Franz Paul, to develop a highly sensitive voltage meter. Einstein had become interested in voltage fluctuations in condensers and whether he could prove his theories of Brownian motion with an instrument to measure potential differences to 5×10^{-4} volts. The meter he devised used multiplying techniques in a series of condensers of varying capacities, an electrostatic method which he thought might also be valuable in studies of radioactivity. He called the system, affectionately, his "Maschinchen" or little machine.

Einstein's affiliation with the Habicht brothers went back a number of years to when he was working at the Bern patent office, when some of his most important papers on relativity were written. In 1905, for instance, he had written to Conrad urging him to join "the patent slaves", and hinted at his capacity for hard work: "Bear in mind that beside the eight hours work

each day there are eight hours for mischief, and besides there is Sunday."

It is clear that Einstein dedicated much time to his little machine when he and the Habichts began work

a number of years later. In a letter he wrote that "I am very curious how much can be achieved [with the machine] — I have rather high hopes. I have dropped the patent, mainly because of the lack of interest of the manufacturer...." Later, he found a "clever mechanic" who attempted to build it and later still, in 1910, a working model with a set of six rotating condensers was demonstrated by the Habichts in Berlin. To Einstein, tinkering was a source of great pleasure. He wrote Conrad after Paul's death in 1948, "The memory awakens of old days in which I worked with your brother on the ... little machine.... It was wonderful, even though nothing useful came of it."

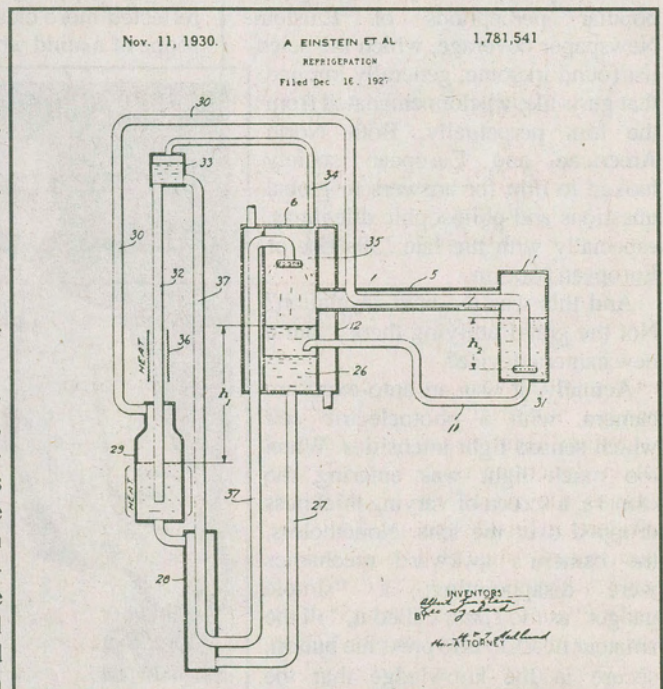
Einstein's inventions were created, almost without exception, with his friends and close colleagues. One can imagine them visiting amidst pipe smoke (until Einstein was forced to quit for health reasons; then he relinquished his tobacco pouch to their custody, with

the proviso that they let him sniff it occasionally), sharing ideas, and sometimes constructing imaginary devices in the room's smoky air. Gustav Bucky, who moved to the U.S. about the same time Einstein had, spent many hours with Einstein in such camaraderie. They not only struck upon the camera idea, but speculated on using gravitation to measure altitude and creating a "proportion description of sound waves by magnetic means," as Einstein writes in one letter to Bucky.

Perhaps Einstein's most intriguing patents were developed with fellow-physicist and friend Leo Szilard, who, over a five-year period, worked with him to develop a new household refrigerator.

In 1929, hints of the device appeared in a *Times* story announcing that Einstein had constructed "a miniature refrigerator capable of producing artificial ice or cold air for domestic use." The story reported, erroneously, that the refrigerator used a "current of light" to achieve refrigeration. Actually, the Einstein-Szilard pump, a central feature of the refrigerator, was much more complicated.

"By means of an alternating electric current," Einstein explained, "a mag-



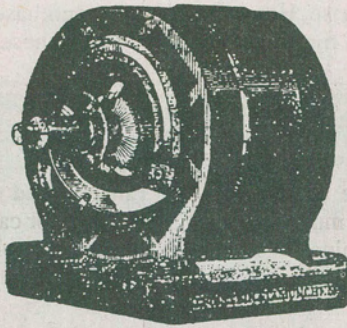
The 1930 Patent for the Einstein/Szilard refrigerator. Intrinsic to the pump's design is a capability to transform waste heat into useable heat.

Elektrotechnische Fabrik

J. Einstein & Cie.

München.

Ausführung
elektrischer
Beleuchtungs-
anlagen
in jedem Um-
fange.



Ausführung
elektrischer
Kraftüber-
tragungs-
anlagen
jeder Grösse.

Fabrikation

von

Dynamo-Maschinen

für

Beleuchtung, Kraftübertragung und Elektrolyse,
Bogenlampen, Elektrizitätszählern,
Mess- und Regulirapparaten.

The 1891 advertisement J. Einstein & Co. ran in a number of German Electrical Publications.

netic guide field is generated which moves a liquid mixture of sodium and potassium. This mixture moves in alternating directions inside a casing and acts as the piston of a pump; the refrigerator [inside the casing] is thus mechanically liquified and cold is generated by its re-evaporation."

Although the refrigerator's design was in many ways successful and models were sold, Einstein noted that "such refrigerators were never commercially utilized because of the rapid advances made in mechanical refrigerators which eliminated their ob-

jectionable noise, the dangers from leakage of the poisonous refrigerant, and erratic operation[?!]"

The heat pump, however, has a number of redeeming features, most of which are only now being adapted for modern use. Underlying the system is its ability to transform waste heat into usable heat, appealing now in a society more interested in energy conservation. Einstein and Szilard spent many years improving their refrigerator's electromagnetically driven liquid-metal pump, which now has application in sodium-cooled nuclear reactors and

solar towers. Most interesting is the system's electromagnetic motor that produces linear oscillatory motions instead of rotary motions, again, a feature with growing application in modern transportation systems such as Europe's high-speed rail development.

The time and energy spent on the refrigerator was impressive and Einstein most likely took a personal interest in its progress. Walter Gerlach wrote that he had met Einstein on one occasion just after the great scientist had learned one of the refrigerator's earlier designs had been rejected by the patent office. The idea Szilard and Einstein wished to patent, apparently, had already been known to exist. Gerlach said that Einstein was quite dejected and said, "If this would have happened to the theory of Special Relativity[!]"

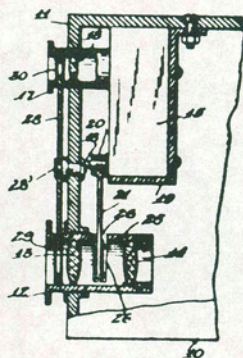
Other flights of imagination were grounded in audio work with Einstein's friend, Rudolf Goldschmidt. Goldschmidt, a former Westinghouse engineer, had returned to Germany to be a university professor and inventor of high-frequency apparatus used in trans-Atlantic wireless technology. In the 1920s, Einstein had collaborated with the engineer on a resonator later used in one of Goldschmidt's inventions, demonstrated in 1927 as a "Pulse Reader," which attached to a patient's wrist with a cuff and read heart beats.

In 1928, Einstein wrote Goldschmidt to ask him to help him develop a hearing aid for a friend, a singer, who had become hard of hearing. Their final patent was entitled: "Device, especially for sound-reproduction equipment, in which changes of an electric current generate movements of a magnetized body by means of magnetostriction", and was issued January 10, 1934.

Einstein's original letter to Goldschmidt asking him for help is worthy to note. It contains a telling glimpse of Einstein's creative muse in

see *Einstein*, page 46

2,058,562
LIGHT INTENSITY SELF-ADJUSTING
CAMERA
Gustav Bucky, New York, N. Y., and Albert
Einstein, Princeton, N. J.
Application December 11, 1935, Serial No. 53,884
9 Claims. (Cl. 95—10)



1. In combination with a camera having an objective, a shaft, and a photo-electric cell unit including a drive for oscillating said shaft in correspondence with the variation of the light impinging the photo-electric cell, a ring segment shaped screen of a transparency decreasing from one of its ends to the other end, rigidly connected with said shaft and adapted to swing in the path of the light rays passing said objective.

Einstein's and Pucky's Auto-Exposure camera, as it appeared in a 1935 Patent Journal.

Einstein, cont'd. from page 34

the form of a poem (translated from German):

"A bit of technique now and then
 Can also amuse thinkers.
 Therefore, audaciously I'm thinking far
 ahead:
 One day we'll produce something good
 together."

Einstein found great amusement in his electrical and mechanical inventions. Whether they failed or set in motion modern-day electrical design is really not as important as the mindset they reflect. They certainly don't represent a departure from theoretical physics: Einstein produced, concurrent-

ly with the amusing devices, an impressive life's work in quantum, statistical and philosophical theory. But the patents are significant nonetheless. Between the ages of 45 and 50, Einstein's name appeared more often in patent journals than in scientific publications. The patents' sometimes-crude, sometimes-impressive technology allows a glimpse of Einstein at an unguarded moment. He once said it is more important how a person *thinks*, than what he or she *does*. The patents — artifacts of Einstein's dextrous creativity — reflect a fantastic and diverse thought process, which still defies complete description.

The author would like to thank Steven Baljkas for the great help he provided in the writing of this story. □