DESIGN News

ENGINEERING ACHIEVEMENT AWARD

Lone Wolf of the Sierras

One of the most prolific inventors in U.S. history--Jerome H. Lemelson--captured the most reader votes in the Eighth annual Design News "Engineer of the Year' competition

Reno, NV-"Is there any more feverish dream of glory in the world, outside of Islam, than the dream of being an inventor? Certainly not in the United States; and probably not in Japan or any other industrial country. An invention is one of those super-strokes, like discovering a platinum deposit, or a gas field, or writing a novel, through which an individual, the hungriest loner, can transform his life overnight, and light up the sky. The inventor needs only one thing which is as free as the air: a terrific idea." -Tom Wolfe

On the mean streets of Manhattan in the early 1950s, fledgling inventor Jerry Lemelson began pursuing just such a dream. Like many in those days, he tried toys. What could be a better product category, now that the first of the baby boom generation had arrived, along with the mass-marketing potential of television?

Lemelson, then in his late '20s, had an idea for a face-mask kit for children that could be printed on the back of a cereal box. He prudently filed for a patent but also showed his design to a major cereal manufacturer. They weren't interested.

Three years later, the inventor went grocery shopping, and there on the shelves was a cereal box with a face-mask kit, manufactured by the very company that he had visited.

The angry inventor sued the cereal company for patent infringement, only to have the judge dismiss the case. In those days, few judges were familiar with patent law and fewer still understood the technical issues that surround such cases.

It was an experience that Jerry Lemelson would see repeated again and again, particularly during the '50s and '60s. He would conceive an idea, apply for a patent, approach a big company for licensing, and get the door slammed in his face. Then he would watch in agony as the company proceeded to build a product based on his ideas.

"Those were frustrating days for Jerry," recalls Jack Gilstein, a retired General Electric engineer who has known Lemelson since the two worked together at New York University in the late '40s. "It would strap him financially just to build a model of an idea, but most big companies weren't interested in dealing with independent inventors. Their attitude toward Jerry was: "Go away, and don't darken our door again.'"

True grit. But what separates Jerry Lemelson from thousands of other inventors who dreamed of making it big was that he did not go away. He kept inventing, and, just as importantly, he kept on fighting. Result: Some 40 years after that cereal box incident, the Staten Island native now counts nearly 500 U.S. patents. He lags only Thomas Edison, with 1,093, and Polaroid founder Edwin Land, with 533.

Think of a product, and there's a good chance Jerry has a patent on some aspect of the technology: robots, machine vision, fax machines, bar code readers, automated teller machines, camcorders, magnetic tape drives, cordless telephones, safety helmets, coordinate measuring machines, injection molding, crying baby dolls, and Velcro® dart games-just to scratch the surface.

Friends and associates describe Lemelson as a "pure inventor" who can't stop himself from coming up with ideas on how to improve things-whether it be a simple object, like the lighted tongue depressor he once invented for his physician father, or a complex machine vision system.

"I've never met anyone who can come up with as many ideas in an hour's time as Jerry," notes Gregory Smith Prince, president of Hampshire College in Massachusetts. "He is always inventing."

Adds Donald Costar, president of the Nevada Inventors Association: "The man's mind is so busy. He's always looking at how things can be made better for people."

Over the years, Lemelson has routinely carried notepads with him wherever he goes. He can fill up scores of pages in a single day, say friends who have signed and dated the notebooks as witnesses to his ideas. "I've even dreamed inventions, though four out five aren't worth beans," chuckles Lemelson, a wiry, almost fragile-looking man with sharp features and piercing eyes.

And, at 71, he's still going strong. In the past year alone, Lemelson, who in 1990

moved from Princeton, NJ, to a spacious Nevada mountain home overlooking Lake Tahoe, has filed more than a score of patents. These include new ideas for: medical instrumentation, cancer detection and treatment, diamond coating technology, and consumer electronics.

Moreover, it has been years since Lemelson has let himself be trampled by the legal armies of large corporations. He has successfully negotiated licensing agreements with companies in fields ranging from automation to consumer electronics to toys. Or he has used the courts to force such settlements, which have often run into the tens of millions of dollars.

Those legal battles have left him with a rather colorful image. "There's a tendency for people to focus on the controversial aspects of Jerry's life," says Denis Prager, director of the Lemelson Foundation. "Critics see him as a monster who manipulates the patent system to squeeze money out of big companies. Others romanticize him as a talented, lone-wolf inventor who stands up for the rights of the individual. But what I see is a very sincere guy who really cares about his country and is fully committed to using his own resources to help it regain its creative edge."

Giving back. Now, rich beyond his dreams, Jerry Lemelson over the last 18 months has made one of the largest financial commitments of any individual to fostering invention and innovation in America. Among the new programs funded by the Jerome and Dorothy Lemelson Foundation

- College programs to stimulate technology-based businesses.
- An annual $500,000 innovation prize to be awarded for the first time in late March and administered by the Massachusetts Institute of Technology.
- A major new multi-million-dollar center for invention and creativity at the Smithsonian Institution in Washington.

In addition, Lemelson has funded technology reporting for National Public Radio and stepped up his campaign to strengthen the U.S. patent system-long a special cause of his-by taking out full-page ads in such papers as the New York Times and the Washington Post.

Still other programs-including a student innovation award-are in the works. Says Lemelson: "Most engineers today are creative and innovative, but what I'm really concerned about is our future economy. Unless we get more of our young people interested in engineering and technology, our country will face serious problems."

Where Jerry Lemelson once dreamed of making it big as an inventor, he now dreams of an American economy strengthened by a rich and growing network of technology-based but highly entrepreneurial businesses.

Economic engine. The catalyst to make this economic vision a reality is a concept he calls "E-Teams" (E = excellence and entrepreneurial endeavor). Based in colleges throughout the U.S., E-teams will focus on a technology or product developed by members of a team while in college or selected by the team from an outside source, such as an independent inventor, company, research lab, or government agency. Not only will they earn college credits for their efforts, but the students will make realistic plans for developing, manufacturing, and marketing a product. This will include building prototypes, as well as establishing relationships with venture capital companies and other financial sources.

In short, the goal of the E-team concept is to nurture entrepreneurs who will leave school prepared to move ahead on a business conceived during their college years.

In August 1993, Lemelson set his plan in motion with a $3.2 million grant to Hampshire College in Amherst, MA. Lemelson was well acquainted with Hampshire, since his son Robert graduated from the school. The liberal arts college requires that students design their own curriculum by negotiating contracts with faculty, a process that promotes an entrepreneurial spirit.

Lemelson notes that the school's unique approach has produced graduates who have made innovative contributions in fields ranging from business to health care. For example, he cites the example of a new company called Aquafuture, started by a Hampshire graduate, which uses new technology to raise mahi mahi cheaper and faster than traditional fish farming methods. "That's the kind of technology that you can transport to almost any area of the country," says Lemelson. "And it is something the country really needs."

The first E-teams funded under the Lemelson program at Hampshire College began their work in the fall of 1993, and now seven teams are at work on projects involving technologies in such fields as farming, health care, and aquaculture. One team has developed a device to apply an organic pesticide oil to control corn ear worms, a major cause of crop damage. Tests proved that the new method is cheaper and more effective than pesticide sprays, and the E-team has applied for additional funding through the Massachusetts Agro-Tech program.

But the Hampshire program is only the beginning. Through the National Collegiate Inventors and Innovators Alliance (NCIIA), also funded by Lemelson, Hampshire College sponsored a special seminar last summer designed to promote the E-team concept throughout the country. Some 30 schools were represented, including key engineering and business professors from such institutions as Princeton, Northwestern, Case Western Reserve, Cal Tech, University of Texas, Cornell, and MIT.

The NCIIA, which Lemelson hopes will one day be as recognizable to young people as the NCAA is in sports, promotes the E-team concept and supports other college-based invention programs through the following tools:

- A database of mentors and advisers for student E-teams.
- A database of inventions that students can develop.

- Curriculum models and faculty seminars for teaching innovation.
- Technology licensing support and perhaps seed grants to E-teams.
- A National Inventors' Symposium, where students can exhibit projects and attract venture capital.

For evidence of the job-generating potential of colleges, Lemelson points to an MIT study showing that its alumni had founded more than 600 companies in Massachusetts alone and were responsible for generating about 300,000 jobs in the state.

"Jerry is really passionate about this idea of nurturing a new generation of inventors and entrepreneurs," says Brenda Philips, director of the Lemelson National Program in Invention, Innovation, and Creativity at Hampshire. "He's a great motivator for all of us."

Adds Hamspshire College President Gregory Smith Prince: "Jerry's goal is to fill the pipeline with new businesses generated by America's young people. This is really the wave of the future because people increasingly are going to have to create their own jobs in America."

Transportation project. One potential business that has caught Lemelson's eye is an "instant rent-a-car" (IRAC) system developed by engineering students at the University of Nevada, Reno, one of the participating schools in the NCIIA program. The students were part of a senior-year "Capstone" course designed to simulate real-world projects.

IRAC proposes to create a pool of fuel-efficient, low-emission vehicles, such as electric cars, that commuters can reserve anytime by calling a central processor. The processor locates the vehicle nearest to the consumer and reserves it against the individual's credit card. Charges commence when the consumer activates the vehicle. When users reach their destinations, they leave the vehicle there and "check out" with their credit card. The central processor then locates the car and lists it as available for the next user.

The project is the brainchild of Nevada engineer and business owner John Chisholm, who holds several patents in navigation systems. In addition to giving many hours of time to work with the students, Chisholm donated $10,000 to the project. The project also received a $60,000 grant from Lemelson and $100,000 in seed money from the Transportation Research Board of the National Research Council. More government funding is on the way, and the University of Nevada at Reno will soon test the IRAC concept as part of its own motor pool operations.

"The IRAC system is entirely possible using current technologies," says Chisholm. He adds that some Lemelson patents could be useful in implementing a commercial IRAC system, such as a "breathalizer" that would prevent an intoxicated individual from using one of the cars.

Science supporter. Although Lemelson is relatively new to Nevada, he has been quick to participate in important issues vital to the state's economy. For example, in early 1994 he contributed $100,000 to help establish a new Nevada state Office of Science, Engineering and Technology. "He's been an incredible asset to this state," says Chisholm. "He's honest, he's technically oriented, he's got money to invest, and he's interested in young people. That's an unusual combination."

Across the country-in Massachusetts-MIT is benefiting from the same blend of Lemelson qualities. Early last year, the Lemelsons donated $6.5 million to the university to support several programs:

- An annual $500,000 innovation prize-the largest ever given in America for invention.
- Endowment of the Jerome and Dorothy Lemelson professorship.
- Funding of 10 fellowships to support students researching ways to foster innovation in the U.S.
- A $30,000 invention prize for students, to be awarded for the first time this spring.

The programs will be administered by noted MIT economist Lester Thurow, who will serve as the first Lemelson professor. Lemelson selected MIT because of its commitment to fostering technological innovation. Thurow, for instance, has established a program called Regaining the Productive Edge, devoted to understanding the competitive challenges faced by U.S. industry.

In part, the Lemelson commitment to MIT-particularly the innovation prize-is designed to rebuild the image of the inventor in U.S. society. "Television has driven out the inventor as a figure of popular mythology," says Thurow.

Other than specifying that the $500,000 innovation award go to a U.S. citizen, Lemelson has attached no strings to the prize. It could be an independent inventor, an engineer at a company, or someone at a government or university lab. Yet he hopes it will go to someone whose invention "has had the greatest positive effect on the greatest number of people."

In addition to the innovation prize, Lemelson has asked the MIT committee to identify a person to receive a Lifetime Achievement Award at the same ceremony in March. A prime example of the kind of person whom he envisions for such an award: California's Paul MacCready, creator of the Gossamer Eagle and other cutting-edge aeronautic and energy projects.

Capital attraction. Still another vehicle to bring technology front-and-center in U.S. society is Lemelson's five-year, $10-million commitment to Smithsonian Institution for new exhibits and programs on invention and creativity at the National Museum of American History.

The new attraction is still being developed, but it will include a "hands-on" center for young people and their teachers featuring interactive learning experiences.

"What is valuable about Jerry's contribution, which is one of the biggest we've

ever had, is that it will allow us to reach out to the public in ways we've never been able to do before," says Arthur Molella, chairman of the Museum's Department of History of Science and Technology. For example, he envisions programs and information delivered via the Internet, or CD-ROMs with such information as history's greatest patents.

"Can you imagine how many young people go through the Smithsonian's museums every year?" asks Lemelson. "What I hope will happen is that these new exhibits will help kids understand what it means to be an engineer or inventor. If we can show them how exciting this work really is, then maybe we'll get more youngsters interested in becoming engineers."

Toys to technology. Lemelson himself was interested in technology almost as far back as he can remember. Like many future engineers, he fell in love with model planes-designing, building, and flying them in competitions in the then still open fields of Staten Island.

That love affair continued into manhood, when he served in the engineering department of the Army Air Corps during World War II, designing weapons systems and materials handling equipment for aircraft. Vision problems ended his hopes of being a pilot.

After the war, Lemelson earned master's degrees in both aeronautical and industrial engineering at New York University. His first post-graduate job also was at NYU, working for the Office of Naval Research's Project Squid, a post-war effort to develop rocket and pulse jet engines.

He continued his aeronautical work at Republic Aviation in New York, where he was a design engineer in the guided missile division. But the inventor bug was already starting to bite, and Jerry soon set up his first toy business. "It didn't work out, and I lost my money," he recalls.

It was about that time that he met his wife Dorothy-or "Dolly" as her friends call her. And more than once during those early years, her income as an interior decorator helped the couple ride out Jerry's setbacks as a struggling inventor.

While he continued to spawn ideas for new toys, such as a magnetic target game patented in 1955, he grew increasingly interested in automation. For four years, he worked as an engineer with a metal refining company in New Jersey, then got hands-on work installing automated production systems for a plastics molding company.

By the close of 1954-at age 31-he had filed for several automation patents, including an automated warehousing system, a flexible manufacturing system, and a 150-page application for a "universal robot" patent submitted on Christmas eve. The robot design allowed many functions, including welding, riveting, painting, assembling, and handling. Equipped with probes or scanning devices, the robot could also do measurement and inspection tasks.

Lemelson recalls that the inspiration for many of these automation ideas came to him in 1951 when he witnessed a demonstration of a punch-card controlled lathe. "I said to myself, "This is a fantastic concept. How can I apply it in other areas of manufacturing?' "

Also during the '50s, Lemelson submitted his first patent applications for facsimile machines, injection molding machines, spray robots, and a video filing system, which could store thousands of printed pages on a reel of tape and replay them later on a television screen. That last invention developed out of Lemelson's frustrations as he hunted endlessly for paper copies of old patents in the cavernous search room of the Patent and Trademark Office in Washington. Indeed, the whole patent filing process consumed huge blocks of his time, since he prepared the patents himself, including the drawings, to save money.

Still, because so many of these ideas dealt with emerging technologies, it would take years for the automation patents to issue. Meanwhile, Lemelson kept going peddling toy ideas, many of them used as premiums or prizes. Typical example: Buy a Purolator filter, get a free inflatable space-capsule toy designed by Jerry Lemelson.

In 1958, Jerry invented a target game, which, instead of darts, featured ping-pong balls encased in a new substance called Velcro®. He got the idea after his wife bought a belt made of the new material. This ability to see relationships between seemingly unrelated objects or phenomena lies at the heart of Jerry's inventive approach. For example, after observing how oxidation formed on the space shuttle's protective tiles on reentry, the inventor got the idea for a new process-patented in 1969-to apply an oxide film to printed circuit boards for insulation.

During this period, Jerry and his wife lived first in a garden apartment, then a modest single-family home in Metuchen, NJ-only a few miles from the birthplace of Thomas Edison, Lemelson's idol and role model.

Taste of success. By the mid 1960s, Lemelson was finally starting to see the fruits of his labor. In 1964, he received his second patent for an automatic warehousing system that employed computer-controlled stacker cranes and an overhead monorail for guidance. He licensed the technology to the Triax Co. of Cleveland for $100,000, plus a 1% royalty. At the time, it was by far the biggest deal of his career, since his earlier licenses had been primarily limited to toys and novelties. Today, thousands of these stacker systems operate throughout the world.

By the close of the '60s, Lemelson had organized a licensing company, primarily to market his own patents but also those of others. For a time, he represented NASA in an effort to license spinoff technologies from the space programs. As the '70s and '80s unfolded, he began to enjoy more success, though legal fees to defend his patent rights ate up much of his income. Among the significant milestones of those years:

- In 1967, he received the first of his patents for flexible manufacturing systems, which featured coded pallets and computer controls to automatically transfer work pieces from machine tool to machine tool. He licensed the

technology to Molins, a British company, though U.S. tool builders turned him down.

- By the early '70s, several of his robot patents had issued, and he licensed such companies as AMF, Unimation, and Sweden's ASEA.
- In 1974, Lemelson made one of the most lucrative deals of his career when he licensed his patents for an audio cassette drive mechanism to Sony Corp., which in turn sublicensed it to more than 100 companies in Japan and the Far East. This technology gave birth to one of the most successful consumer-electronics products ever-the Sony Walkman®. About the same time, he invented the camcorder, several years before the Japanese brought the first such electronic cameras to market.
- Another major victory came in 1981, when IBM licensed some 20 patents related to data- and word-processing technology. For example, Lemelson had early patents for employing magnetic memory to store, play back, and display still-image information. This licensing deal, which ran into the millions of dollars, finally gave Lemelson financial security. He was age 58.

A year later, Lemelson-and all inventors-got a significant boost with the establishment of the U.S. Court of Appeals for the Federal Circuit. The Washington-based court brought a much- needed stability and consistency to patent cases. Before its establishment, expertise on patent policy varied widely from region to region, and rulings tended to favor alleged patent infringers. "With the new court, inventors now have a 50 to 70% chance of upholding their patents, versus about 15% under the old system," claims Lemelson.

Despite these victories, however, Lemelson recalls with disappointment that his ideas for automation technologies were turned down by most of the American companies he contacted during the 1970s and early 1980s. He also lost a tough infringement case against Bendix and Brown & Sharpe over his computer-controlled coordinate-measuring machine technology.

In contrast, Japanese companies were quick to accept robots, machine vision, flexible manufacturing systems, and coordinate-measurement machines. And these technologies, Lemelson believes, played a significant role in the resurgence of Japan as an economic power.

No pushover. The financial successes he enjoyed in the '80s enabled Lemelson to defend his patents as never before. He negotiated licenses with major companies-or won court settlements-in a whole range of technologies, including fax machines, bar code readers, video cassette recorders, injection molding, and processing methods for microchips.

Finally, in 1992, came the biggest payoff of all: settlements with Japanese auto and electronics companies totalling about $450 million dollars. These agreements primarily involved Lemelson's 15 machine-vision and barcode patents, the applications for which go back as far as the 1950s. Industry experts say it was the biggest series of licensing deals ever negotiated by an independent inventor.

Ironically, the machine-vision victory came in the same year that Lemelson suffered his biggest disappointment. The Court of Appeals in 1992 overturned a lower court decision that had awarded him $71 million in a case against the Mattel toy company. Lemelson, who has patents on a flexible track toy, accused the toy firm of pirating his concept for use in its wildly popular Hot Wheels® product.

Increasingly, proceeds from licensing and legal settlements support the activities of the Lemelson Foundation. In 1994, for example, Lemelson reached multi-million-dollar settlements with both Motorola and Apple Computer over his machine-vision patents. Both companies agreed to channel funds-and in Apple's case computers-into the foundation's educational programs.

Similarly, Lemelson, who is still in litigation with the Big Three automakers over alleged patent infringement, has offered to license his entire patent portfolio to the car companies. And he has suggested that half of the proceeds from this licensing would go to a charitable foundation to benefit auto employees and their families. For example, substantial financial awards might go to engineers responsible for the best safety-design contributions of the year. So far, the Big Three have shown no interest.

Helping Lemelson achieve the settlements he has won since the late 1980s is Nevada attorney Jerry Hosier, widely recognized as one of the best-and toughest-patent attorneys in the U.S. He's also one of the few who specialize in patent litigation on a contingency basis.

When Hosier first looked at Lemelson's patent portfolio in the mid-1980s, he couldn't believe the scope of the inventor's ideas. "It was like a surfeit of riches," he recalls. Among ideas that were never even patented: a 1960s design for a patch for administering medicine through the skin and a fiber-optic cystoscope conceived long before the first one reached the market.

As for Lemelson's frequent legal skirmishes, Hosier says: "Big companies do not part with their money cheerfully. And Jerry's experience isn't unusual. If you look at history, you'll find pages and pages of legal documents showing Thomas Edison versus some company or other. What Jerry is doing is standing up for the civil rights of inventors."

Companies that have battled Lemelson and Hosier over the years in patent cases say the inventor files broad patents on complex technology, rarely taking the time or money to build a working model. Then, their argument goes, years later, when companies are actually building a product, Lemelson surfaces with his "submarine" patents to claim infringement.

Notes one critic: "Lemelson has piles and piles of paper patents, and he has won settlements in the tens of millions of dollars because companies don't have the stomach to take him on."

For his part, Lemelson argues that the attitude of many big companies is to litigate, rather than license the technology of independent inventors. As he sees it, the "not invented here" syndrome continues strong in the U.S., particularly among big companies. "Most independent inventors are simply out-gunned when they face the legal armies of giant corporations," says Lemelson, who sees himself as a "champion" for inventors.

Lemelson spends about 20% of his time in court and recently endured 66 days of depositions. What's more, more than a third of his income goes to legal fees.

The inventor gets particularly upset over charges that he deliberately tries to slow the patent process to increase his chances of settlements. "That's ridiculous," says Lemelson. "Every inventor wants to get a patent as quickly as possible. The problem is that patent examiners can take years to analyze applications involving new technology."

Former Patent Commissioner Donald Banner agrees, noting that it can take 10 to 20 years for a patent to issue on a breakthrough technology. "I've been in the patent field for 40 years, and I've never encountered an instance of a submarine patent. The problem, if it exists, is minuscule."

As for criticism that most of Lemelson's ideas are only on paper and not in hardware, MIT's Thurow says: "Do you really need to build something before you're taken seriously? Einstein never built a device to prove out his theories."

Lemelson says he has spent "hundreds of thousands of dollars" over the years to build prototypes of his inventions. He also has contracted for the services of engineers who assist him in proving out and perfecting his technology. One of them is Chris Grund, a Colorado engineer who does occasional projects for Jerry to supplement his work with the National Oceanic and Atmospheric Administration. Among the projects he has worked on for Lemelson: security devices for autos, bar code readers, remote-control toys, and a video telephone.

Says Grund: "On a practical application level, Jerry's the most creative person I know. He's got a very acute sense of what is required to implement a new technology and is able to see many years down the road."

Future directions. In addition to such collaborate relationships, Lemelson recently set up a Chicago company whose sole purpose is to develop and market products based on his patent portfolio. Called Syndia Corp., the company is focusing initially on Lemelson's 15 patents in synthetic-diamond- film technology, but will pursue other technologies as well.

"Jerry's patent portfolio is a tremendously underutilized asset," says company president Roger Hickey. "Until recently, too many of his patents just sat on the shelf because he lacked the resources for R&D."

In the future, Lemelson also wants to focus more attention on medical technology. For example, he is very interested in boron neutron capture therapy for the treatment of brain cancer. In the BNCT process, non-toxic boron injected into the bloodstream surrounds the tumor but not adjacent healthy tissue. The boron-soaked tumor is then exposed to a neutron beam that penetrates the boron and kills the cancer cells with minimal harm to surrounding tissue. Lemelson received a patent in 1987 involving new combinations of materials used in this procedure. His medical inventions already run the gamut from a computer-controlled tourniquet used by surgeons to a talking thermometer.

Clearly, though, Lemelson's greatest concerns now are promoting the vital importance of invention and innovation in U.S. society. He bristles at recent proposals in Congress to change U.S. patent policy to favor those who file their applications first, rather than the current system in which patents go to the inventor who conceives the idea. Still another proposal, favored by the Clinton administration, would recognize "prior-user rights." Under this provision, companies would not have to pay any licensing fee to an inventor if they could show that they were using a technology prior to the filing of a patent application by the inventor.

National legacy. Such changes, says Lemelson, would spoil the climate for invention that has made the U.S. an economic superpower. He explains that it costs thousands of dollars to file a patent. Consequently, independent inventors, who work without the support of large corporations, often spend years developing an invention before they invest in filing for a patent. During that time, under our current system, inventors feel free to exchange ideas with peers and discuss their notions with relevant industries. "Under a first-to-file system, these inventors will have to work in complete secrecy for fear their inventions will be stolen by someone with the resources to patent it first," warns Lemelson. The U.S. is virtually the only country in the world with a "first to invent" patent system, which dates back to 1790, and Lemelson believes this approach is responsible for making the U.S. the world leader in creativity. Indeed, the founding fathers in the U.S. Constitution set forth language expressly protecting the rights of authors and inventors.

But while invention fueled the growth of the U.S. in the 19th century and early 20th century, Lemelson believes that the country in recent decades has squandered the contributions of inventors. From VCRs to robots, he points out that inventions conceived in the U.S. were applied far more extensively by foreign companies-particularly the Japanese. Similarly, great American companies, many of which were started by inventors, now are the ones that tend to disregard the contributions of independent inventors.

These deep beliefs propel Jerry Lemelson in his one-man crusade to raise the profile of the inventor in U.S. society and to stimulate invention among the nation's young people. Says Lemelson: "New inventions create new businesses, and new businesses create new jobs. A nation that cannot create and manufacture new products based on inventions is destined to decline."

A LITANY OF CREATIVE IDEAS

'60s	Illuminated highway marker...Toy gun with ricochet noise mechanism...magnetic recording system...Facsimile apparatus...Recording and reproduction apparatus...Automated warehousing system...Process for making multi-layer electrical circuit...Article manipulation device...Automatic inspection apparatus...Thermoplastic recording and reproducing apparatus with selective beam erasure...Toy trackway and vehicle...Method of positioning and modeling a preform integral with plastic material by rotational casting... Multi-speed control system for a load carrier in a warehouse. Magnetic target game...Toy mine detector...Hollow sheet metal rivet with reinforcing work-engaging shoulders...Crying doll...Toy constructional mask...Inflatable toys.
'70s	Composite sheet forming apparatus and method... Tape cartridge and reader...Extrusion die apparatus...Irradiation method for producing fiber-reinforced polymeric composites...Document scanning apparatus...Credit verification apparatus... Video transducing apparatus and method for editing...Electro-optical circuits and manufacturing techniques...Propeller-driven toy.
'80s	Method for automatically setting timepieces in a time zone...Video telephone...Automatic vehicle identification system...Rechargeable electric battery system...Fire detection and warning system...Injection catheter and method...Speech recognition control system...Composition and method for detecting and treating cancer...Contact lens containing light sensitive material...Methods for forming synthetic diamond coatings.
'90s	Internal combustion engine components...Educational toys... Method for treating blood clots... Radio-frequency controlled interrogator-responder system with passive code generator...Diamond-coated fasteners...Spark plug electrodes...Apparatus and method for automated observation of three-dimensional objects...Gears and gear assemblies...Automated pot hole sensing and filling apparatus... Surface shaping and finishing apparatus.

Rocky Road to recognition

History is full of examples of inventors who either faced long years of frustration in getting their ideas accepted-or had to endure bitter court battles over patent infringement.

Take physicist Chester Carlson, father of xerographic printing. It took presentations to more than 20 business machine companies before Carlson could interest the Battelle Development Corp. in his invention in 1944. Three years later, the Haloid Co.-renamed Xerox Corp.-negotiated rights to xerographic development. Then it took 11 more years before Xerox introduced its first office copier.

Other inventors encountered even tougher barriers-

Charles Goodyear invented the vulcanizing process for rubber, a step that vastly increased industrial applications for rubber. Goodyear himself, however, was unable to profit financially from his discovery, and his numerous patents were constantly infringed. Although he was able to establish his rights legally, he died a poor man.

Edwin Armstrong, the inventor of FM radio technology, turned down a $1 million offer from RCA for his FM patent rights. Eight years later, he sued RCA and several other corporations for patent infringement. At the time, Armstrong was quoted as saying, "They will stall this thing until I am dead or broke." On January 31, 1954, Armstrong committed suicide by jumping from the tenth-floor window of his Manhattan apartment. His widow wound up accepting a $1 million settlement, a fraction of the value of his invention.

Gordon Gould, one of the three principal holders of patents for laser technology, battled the Patent and Trademark Office and laser manufacturers for many years over the recognition of his laser patent rights. Since his original patent application contained many different inventions, it was put through a series of five separate interferences by the PTO. Result: It took 20 years before the first patent issued in 1977. By then, Gould had retired. However, he was able to reach licensing agreements with AT&T, Xerox, and others.

Robert Goddard, the man recognized as the father of American rocketry, ran his own testing program in the New Mexico desert to prevent the government and private companies from pirating his patented technologies. Fifteen years after his death, the U.S. government finally gave his wife a $1 million payment to settle the many infringement claims on his 214 rocketry patents.

Robert Kerns invented the intermittent windshield wiper in his basement in the early 1960s. He shared the technology with Ford engineers in Detroit in hopes of marketing the product and establishing his own company. The wiper system soon showed up in cars produced by every major automaker. Kerns fought for his rights in a protracted legal battle with the auto companies. Along the way, he suffered a nervous breakdown in 1976. Finally, in 1991, he won a $10.2 million judgment against Ford and $11.2 million against Chrysler. Much of the money went for debts and legal expenses incurred over the years.

So you want to be an inventor?

While design engineers bear responsibility for creating technology at their companies, many wonder whether they could succeed in the uncertain world of the independent inventor.

With nearly 40 years of experience, Jerry Lemelson gives this advice to engineers pondering such a leap:

- Make an intelligent and unemotional study of your invention and its market potential. Every inventor thinks he has a million-dollar idea, says Lemelson, but take care because technology may be advancing faster than you think. And you may be investing $3,000 to $15,000 on a patent that will yield you nothing.
- Get a competent patent attorney to help you prepare your patent applications. "Don't try to do it yourself," cautions Lemelson. "I did, and I made too many mistakes." Still, ask potential attorneys for copies of patents that they've prepared, and be ready to guide the attorney during the patent-filing process.
- Build a working prototype of your invention. That will give you an edge when you approach a venture capital firm for financing or a company for licensing.
- Approach small to medium-sized companies with your inventions-those with sales volumes in the $10 million to $100 million category. Research the background of these companies to see if they have licensed technology from independent inventors before-or been involved in suits involving inventors. Big companies, with large staffs of engineers, are much more reluctant to deal with independent inventors.

Lastly, says Lemelson, don't be afraid to ask others for assistance, be it for legal, technical, or marketing assistance. In many cities, for example, there are inventors' clubs that exchange information and ideas. "It's the rare individual who has everything it takes to be a successful inventor," concludes Lemelson. "Get to know people who can give you a helping hand."

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