

Easy to Operate.

The 'golf ball' typewriter.



The IBM Selectric typewriter, introduced in July 1961, turned out to be one of IBM's most popular products—and the industry standard for office machines.

Except for IBM's Personal Computer, the Selectric was used by more people and generated greater unit sales than any other IBM machine. Almost everybody knows this product as the "golf ball" typewriter. The element that holds the embossed characters for printing is about the size of a golf ball, and the characters are reminiscent of its dimples.

The inspiration for using a single printing element, rather than traditional type bars, came from H.S. "Bud" Beattie, a manager of engineering for IBM. In 1946, he had invented a high-speed, single-element printer for data-processing applications and was always motivated to apply this technology to a typewriter.

The excitement the Selectric generated was unusual. People would crowd around a machine being demonstrated, amazed by the rapidly rotating and tilting print mechanism. Unlike the

well-known type-bar typewriters, it was hard to understand how the Selectric worked. For example, if two keys are pressed simultaneously on a type-bar machine—electric or manual—it is likely that the bars, in moving toward the paper, will strike each other. This jams the machine or produces uneven print. With the Selectric, only one key can be pressed at a time. There are no overstrikes.

The Selectric print mechanism was ideal for IBM's data-processing machines. Modified type-bar electric typewriters were used as input/output writers on computer consoles. In most cases, fan-fold or continuous-form paper was used. However, the moving carriage of the type-bar machines could cause the paper to get out of alignment or tear. Though IBM also made pin-feed platens to better hold the paper in place, the stationary carriage of the Selectric eliminated the problem of the paper being dragged back and forth.

So innovative and dramatic was the single-element technology that once secretaries and their bosses saw the Selectric in operation, the machine became the definitive product of choice for a generation of typists.

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The information on this page was adapted from C.E. DeLoca's and S.J. Kalow's book, *The Romance Division: A Different Side of IBM* (Wykoff, NJ: D&K Book Co. Inc., 1991). To learn more about Selectric typewriters, go to www.ibm.com.

The Typewriter: A Timeline

- 1868** Inventor Christopher Latham Sholes invents a “writing machine” in Milwaukee.
- 1874** E. Remington & Sons introduces the Sholes & Glidden Type Writer. Its essential mechanism consists of a type bar that swings upward and strikes a platen when a key is depressed. A foot pedal returned the carriage. It was called a “blind” typewriter, since it was impossible for the typist to see the words as they were being typed. The hinged carriage had to be lifted to see the typed words. Around this time, Sholes developed the QWERTY keyboard. Though the layout seems whimsical, the key arrangement was actually set up to prevent type-bar jams. Noting that typing certain letter combinations, such as “th” and “ed” caused most jams, Sholes wired those type bars far apart. Jams still occurred, but less frequently. This allowed typists to work faster, despite false rumors that the layout was purposely designed to *slow* typists down.
- 1878** The Remington No. 2 typewriter was introduced with a shift key, which allowed for lower-case letters. In an effort to capitalize on the innovation, numerous companies offered a wide array of designs, many of which failed. By the end of the century, typewriters with type wheels, type strips and type shuttles had appeared. Some had double keyboards, one for upper-case letters and a separate one for lower-case type.
- 1883** Mark Twain, an early enthusiast of the typewriter, submitted the first typewritten manuscript, “Life on the Mississippi” to a publisher.
- 1895** Ribbon maker John Thomas Underwood, angry after a dispute with Remington over his supplier’s contract, purchased the patent on a new type mechanism that allows the typist to see letters as they are typed. The Underwood No. 5 is offered.
- 1908** Most every typewriter manufacturer has switched to the visible-type format. In addition, the 4-row keyboard had become standard.
- 1932** Dr. August Dvorak introduces a new keyboard layout. In the Dvorak layout, the most-used letters are placed in the middle row, with vowels on one side and consonants on another. By then, however, the QWERTY layout had been firmly entrenched and resistance from teachers and typists prevented acceptance of Dvorak’s layout. That same year, the Olivetti Co. introduces the first portable typewriter.
- 1935** IBM markets the first successful electric typewriter, the Model 01.
- 1961** IBM introduces the Selectric typewriter, which has a single-element “golf ball” print mechanism. Though not the first successful single-element typewriter, the Selectric set an Industry Standard in the ’60s and ’70s, eventually commanding a 75 percent share of the office-typewriters market. The smaller typing mechanism allows the carriage to remain in place, paving the way for faster typing. In addition, the mechanism presaged other typewriter and computer-printer developments, such as the daisy wheel and dot-matrix printers.
- 1978** The Exxon QYX is introduced. This is the first typewriter with a microprocessor and a daisy-wheel typing mechanism. Other manufacturers follow and the daisy wheel becomes standard. It is also the last high-speed typing mechanism offered before the eventual displacement of typewriters by word processors and laser printers in the late ’80s.

This material was adapted from Darryl Rehr’s article, “The Typewriter,” which appeared in *Popular Mechanics*, August 1996, and “100 Years of Design” by Carroll Gantz, at www.idsa.org/whatis/100yr/selectric.htm, a Web site of the Industrial Designers Society of America.

Muscle. Dominance. Hemi.



Few words in the automotive world are more recognizable than Hemi.

The 426 Hemi engine — the industry standard for muscle car engines — has left an indelible stamp on automotive history.

Chrysler produced its first V-8 engines with hemispherically shaped combustion chambers in 1951. But these early motors (with 301-, 331-, 354- and 392-cu.-in. displacements) have nothing in common with the 426-cid version, except for spark plug location and basic valve train arrangement. The “old style” Hemis were primarily for passenger cars. Today, these engines are difficult to find, and those not in restored vehicles are mostly found in top fuel dragsters and funny cars, running on alcohol.

When Chrysler introduced the 426 Hemi in 1964, it was strictly a racing engine. On Feb. 23 of that year, four Hemi-powered Mopars swept the Daytona 500. This event caught the racing world by surprise and eventually prompted NASCAR to impose stricter production rules on Chrysler. Instead of making only a few blueprinted Hemis each production year, Chrysler would have to produce several thousand for “ordinary” production vehicles. The result was the slightly detuned street Hemi, which appeared in 1966.

The street version differed from its racing cousin

by virtue of a lower compression ratio (10.25:1 instead of 12.5:1), milder valve timing and alternate intake and exhaust manifolds. And, for reliability, the heads were made of cast iron instead of aluminum.

Throughout its 8-year production life, Chrysler never changed the 426’s advertised horsepower and torque ratings, which stood at 425 hp at 5,000 rpm and 490 ft.-lbs. of torque at 4,000 rpm.

Although the Hemi was basically legislated out of NASCAR, and stricter emissions laws, high production costs and the insurance industry combined to stop production of the street version in 1971, the motor still dominates the top drag racing classes.

In 1993, Mopar began manufacturing a new Hemi block. In addition, the new 5.7-liter Hemi is under the hood of the 2003 Dodge Ram 2500 and 3500 pickups.

Although vehicle design has radically changed since the Hemi was introduced, with one under the hood, a driver dominates the road or track.



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The information on this page was adapted from an article by Steve Boelhouwer, which is posted on www.allpar.com.

Hemi engine design has roots in World War II aircraft

According to information from the recent “Hemi Power” exhibit at the [Walter P. Chrysler Museum](#), Auburn Hills, Mich., “Chrysler began developing a liquid-cooled aircraft engine in the late 1930s.

“For their Xi 220 aircraft engine, Chrysler engineers developed a supercharged and turbocharged upside-down

V-16, the ‘i’ in the design stood for

inverted. For the best performance, the engineers chose a hemispherical cylinder head design because two spark plugs could be placed in the middle of the cylinder head, between the valves, making for a uniform flame upon ignition.

“The valves, placed on opposite sides of the cylinder head, could be larger and permit a better port shape with two results: The intake of the fuel-air mixture and the removal of exhaust gas improves, termed ‘high-volumetric efficiency.’ And the area of the cylinder head functioning passively in the combustion process was reduced, improving efficiency by reducing heat loss. Although the Xi 220 engine never went into production, the research would benefit Chrysler’s automotive products after the war.”



Chrysler’s work in the 1930s on its Xi 220 aircraft engine later benefited its automotive products, such as this 426 Hemi cylinder head.

Scott Moseman



King of the Hemi

Specifications are for the Hemi engine in the 2003 Dodge Ram 2500 trucks

Power (SAE net): 345 bhp (257 kW) @ 5,400 rpm

Torque (SAE net): 375 lb.-ft. (508 Nom) @ 4,200 rpm

Displacement: 345 cu. in. (5,654 cu. cm)

Valve system: Pushrod-operated overhead valves, 16 valves, hydraulic lifters with roller followers

Fuel injection: Sequential, multiport, electronic, returnless

Construction: Deep-skirt cast iron block with cross-bolted main bearing caps; aluminum alloy heads with hemispherical combustion chambers

Maximum engine speed: 5,800 rpm

Fuel requirement: Unleaded mid-grade, 89 octane (R+M)/2 (recommended); Unleaded regular, 87 octane (R+M)/2 (acceptable)

Oil capacity: 7 qt. (6.6L)

Coolant capacity: 18.7 qt. (17.7L)

Specs from www.allpar.com



INDUSTRY STANDARDS

Rugged. Sleek.

“A work of art
that works.”

Anthony Maglica transformed the humble flashlight into a streamlined, elegant tool when he introduced the Mag-Lite® flashlight in 1979. Users, accustomed to cheap flashlights with non-adjustable and often unsteady beams, recognized the Mag-Lite's superior performance and its simple, functional design.

Maglica produced his flashlight from the same anodized aluminum used to manufacture many aerospace components. Black with a sleek, unmistakable shape, the Mag-Lite allowed the user to adjust the beam's shape from a pinpoint to a floodlight by twisting a ring near the light source. The tail compartment stored an additional halogen lamp.

Maglica first marketed his invention to emergency-response personnel and mechanics. It didn't take long though, before the Mag-Lite became hugely popular with mainstream consumers.

Besides consumers' approval, Mag flashlights have won numerous industrial-design awards and been acclaimed by a number of high-profile publications. *Money* magazine, in 1987, named the Mini Mag-Lite® flashlight one of the “99 things that Americans make best.” *Fortune* and *Forbes* bestowed similar accolades.

Mag Instrument set a new standard for flashlights. And, at the same time, Maglica reinforced the importance of vision to a manufacturing company. He saw that a need existed for a new, high-performance product in a crowded commodity market flooded with cheap imports.

Born in New York City during the Great Depression, Maglica grew up in Croatia, where he trained as a machinist. He returned to the U.S. in 1950 and began machining precision parts for the military and industrial sectors.

With \$125 that he had saved as the down payment for a lathe, Maglica launched Mag Instrument in 1955 in a Los Angeles garage. He now heads a 900-employee firm with global sales and products that others continually try to imitate.

Mag Instrument has won several major lawsuits it brought against companies selling Mag-Lite knockoffs or infringing on its patents. One instance of imitation that the company didn't contest, though, was when a former Apple Computer CEO said that he wanted his company to become the “Mag-Lite of computers.”

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To learn more about Mag-Lite flashlights and Mag Instrument Inc., go to www.maglite.com.




Mag Instrument Timeline



In 1955, with \$125, Anthony Maglica establishes Mag Instruments in a Los Angeles-area garage. The job shop soon earns a reputation for making sophisticated aerospace, industrial and military parts.




In the 1970s, Maglica sees the opportunity for a niche flashlight product. In 1979, Mag introduces the Mag-Lite[®] flashlight for police, firefighters and mechanics. Mainstream consumers buy the product as well.




In 1982, Mag Instruments and its 80 employees set up shop in Ontario, Calif. Within 15 years, the company has 850 employees and is operating out of a 450,000-sq.-ft. building.




In 1984, the Mini Mag-Lite[®] flashlight is introduced and becomes a huge success.



In 1987, an even smaller version of the Mini Mag-Lite is introduced for medical, industrial and consumer applications.



In 1988, the Solitaire[®] flashlight, a compact Mini Mag-Lite is introduced. The light fits on key chains and in purses.




In 1989, Mini Mag-Lite flashlights are used to symbolize the “thousand points of light” theme of President George Bush’s inaugural ceremony.



In the 1990s, Mag becomes a corporate sponsor of the fallen police officer monument in Washington. Mag-Lites are used by Allied troops in “Operation Desert Storm.”




In 2001, Mini Mag-Lites are part of President George W. Bush’s inaugural ceremony.



In 2002, Mag sues a would-be competitor, Bison Sportslights, for trade-secret infringement. Mag wins.



In 2003, Mag sues Asahi Electric Co. in Japan and wins a landmark trademark and patent-infringement case.



Currently, about 25 percent of annual sales come from exported product. The company plans to raise that to 50 percent and add another 2,400 employees.

This information comes from Mag Instruments and from “California, Golden Past, Shining Future, A Sesquicentennial Celebration,” by John A. Maynard. For the complete timeline, visit Mag Instrument’s Web site ([www. maglite.com](http://www.maglite.com)).

INDUSTRY STANDARDS

CLICK!

A moment saved.



The Brownie camera was innovative, brilliant in its simplicity, cheap to produce and—most notably—changed how the world took photographs. It also demonstrated the

marketing genius of its originator,

Eastman Kodak Co. founder George Eastman.

He introduced the Brownie in 1900, selling it for \$1. A roll of film cost 15 cents. These prices made photography affordable for virtually everyone for the first time. Prior to the Brownie's introduction, cameras from Kodak and its rivals were made of wood. Prices started at around \$8 for a box-type camera—a cost-prohibitive amount for the average person at the beginning of the 20th century.

Eastman recognized this. And since selling film generated most of his company's revenue, he sought a way to assure future film sales. He reasoned that by lowering the cost of the cameras, more people, particularly children, would take up photography as a hobby.

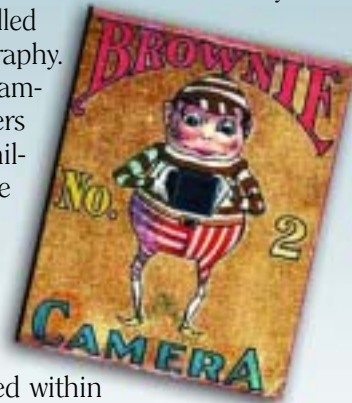
Eastman charged his designer, Frank Brownell,

with developing a camera that was inexpensive to manufacture. Brownell came back with a prototype that met the requirement. His design called for the new camera to be manufactured of heavy cardboard, a material that was cheaper than wood. The Brownie had no settings to fiddle with, making it simple to use, and it produced excellent photographs and was reliable. These characteristics made the Brownie the industry standard for what's now called "point and shoot" photography.

Eastman named the camera after cartoon characters that were popular with children during the 1890s. He developed an advertising campaign based on the characters, which contributed to the Brownie's immediate success. More than 150,000 were shipped within the first year—a record-setting number.

During the next 80 years, Eastman Kodak introduced 125 different Brownie models and sold millions of cameras bearing that name.

— Chuck Baker



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To learn more about Brownie cameras, go to Chuck Baker's site at members.aol.com/Chuck02178/brownie.htm; and www.kodak.com.

Additional information about George Eastman and the Brownie camera

George Eastman is born July 12, 1854, in Waterville, N.Y.

Joins a local insurance firm at 14, working as a messenger for \$3 a week.

At 24, Eastman buys his first camera. It's the size of a microwave oven, and the "film" consists of an emulsion that was spread on a glass plate in a darkroom. With a wet-plate camera, a photograph had to be taken and developed before the emulsion dried.

By 1880, after 3 years of experimentation, Eastman patented a dry-plate formula and a machine that could prepare large quantities of plates. He established a business called Eastman Dry Plate Co. that sold the plates to photographers.

Further experimentation led to a process whereby the formula was applied to paper and wound on a roll. The company begins selling rolls of film in 1883.

Eastman introduced his first camera in 1888. He called it Kodak, a name he made up. It sold for \$25 and was loaded with enough film for 100 photographs. Customers returned their Kodaks, with the spent film inside, to the company. The company developed the prints, reloaded the camera and returned it to the customer. Eastman's slogan for the camera was, "You push the button ... we do the rest."

In 1892, the company's name was changed to Eastman Kodak Company of New York.

Eastman introduced the Brownie Camera in 1900. It cost \$1 and made photography accessible to the masses. Approximately 150,000 Brownies were shipped the first year, triple the previous 1-year record for a camera.

The name "Brownie" was taken from a popular series of stories written and illustrated by Palmer Cox in the late 19th century. Brownies, according to Scottish legend, were goblins and elves that helped human beings.

"Official" Brownie camera clubs and giveaway promotions kept sales high.

Kodak eventually manufactured 125 different models of Brownie cameras. The original cardboard construction gave way to metal. And many of the later models were made of Bakelite, a hard plastic. Flash and folding models were introduced, too.

In 1951, Kodak introduced Brownie 8mm movie cameras and projectors. They dominated the home-moviemaking market for two decades.

Kodak produced the Brownie line of cameras and equipment for 80 years. Throughout that period, the mission remained the same: Provide the public with a low-cost, reliable, easy-to-use camera.

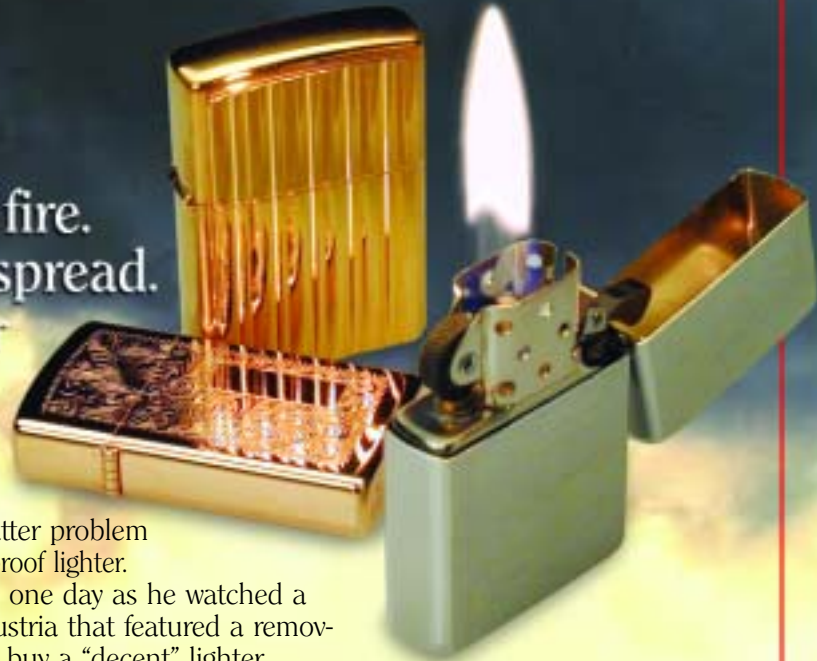
The above information was culled from the Eastman Kodak Co. Web site:

www.kodak.com/US/en/corp/aboutKodak/kodakHistory/kodakHistory.shtml

A wealth of additional material is available at the site.

WIND.

It doesn't mix well with fire.
It causes forest fires to spread.
And, on a much smaller
scale, it can extinguish
a lighter's flame.



George G. Blaisdell did something about the latter problem 70 years ago, when he invented the Zippo windproof lighter.

The idea for the Zippo occurred to Blaisdell one day as he watched a friend struggle with a windproof lighter from Austria that featured a removable lid. Blaisdell asked the man why he didn't buy a "decent" lighter.

The friend shrugged, "It works."

Despite his initial criticism, Blaisdell was impressed by the simplicity and robustness of the lighter's design. So much so that he acquired the U.S. distribution rights. Shortly after, he redesigned the lighter. He made the case rectangular, so it fit comfortably in the hand. Then he devised a clever cam and hinge arrangement for the lid. It permits one-hand operation and is the source of the lighter's distinctive "click" when opened and closed.

The key design feature, though, was Blaisdell's windscreen. It surrounds the wick and contains a series of holes. These are arranged so that air passes through while preventing gusts of wind from extinguishing the flame.

Blaisdell opened Zippo Manufacturing Co. in Bradford, Pa., in 1932. The first Zippo windproof shipped in January 1933. Currently, about 50,000 lighters a day leave the plant, which is still in Bradford. An estimated 375 million were shipped from that location between 1932 and 2002.

Producing a lighter requires approximately 40 steps. Among the main processes are stamping and drawing, welding, buffing, plating and assembly. Actual production time is very short, due to automation.

Little of Blaisdell's original design has changed. Of the 22 parts the lighter incorporates, only three have been modified over the years. The lifetime guarantee hasn't changed, either. "It works, or we fix it free," Blaisdell pledged in 1932.

Though not the first windproof, Zippo quickly became the industry standard for such lighters. In the process, it became an icon of American ingenuity throughout the world. Zippo consistently scores 98 percent in brand-recognition studies. Few products enjoy such a remarkable level of recognition.

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Zippo Fact Sheet

Zippo Manufacturing Co. provided the following information (www.zippo.com).

- > George G. Blaisdell founded Zippo Manufacturing Company in Bradford, Pennsylvania, in 1932. The first Zippo lighter—now housed in the Zippo/Case Visitors Center and Museum—was manufactured in January 1933.
- > In 1932 George Blaisdell pledged—“It works, or we fix it free™.”—the Zippo lifetime guarantee that remains true today.
- > Blaisdell created the Zippo lighter after obtaining the rights to an Austrian windproof lighter with a removable top. He redesigned it, making the case rectangular and attaching the lid to the bottom with a welded hinge allowing for easier one-hand use.
- > Blaisdell liked the sound of the word “zipper”—another recent product—so he called his new lighter “Zippo.”
- > An estimated 375 million Zippo lighters have been produced in Bradford over the past 70 years.
- > Thousands of different designs, logos or artwork have graced Zippo lighters over the years. Present Zippo artwork depicts activities, companies or personalities ranging from professional sports teams to rock bands.
- > The Zippo lighter has been featured in more than 1,400 movies, live stage plays and on television.
- > Upon America’s entry into World War II, Zippo suspended all production of lighters for consumer or retail sales. The company’s entire production was dedicated to the U.S. military. From 1942-1945 the lighters were made of steel, and finished with black “crackle” paint. This proved highly popular to service personnel who were able to etch their names, important dates, or messages into the finish. The company gave all Bradford-area soldiers a Zippo windproof lighter. The remaining production was shipped to PX and ship stores for sale.
- > The use of Zippo lighters during World War II is largely credited with making the lighter popular internationally, and it has become an icon of American ingenuity.
- > The Zippo name consistently scores a brand recognition rate of 98 percent, meaning that 98 of every 100 people questioned mentioned the Zippo name without prompting. Few if any other products enjoy such astonishing recognition.
- > The original Blaisdell design remains virtually unchanged today, with the exception of improvements in the flint wheel and modifications in case finishes.
- > Over the years Zippo produced a variety of line extensions, including:
 - > *Slim lighters*
 - > *Table top lighters*
 - > *Money clips*
 - > *Belt buckles*
 - > *Key rings*
 - > *Tape measures*
 - > *Writing instruments*
 - > *Pocket knives*
 - > *And ZipLight™ pocket flashlights*
- > In 1993 Zippo bought another Bradford company, W.R. Case & Sons Cutlery Company (Case Cutlery), manufacturers of high-quality, pocket, outdoor and utility knives. The acquisition led to the production of commemorative knife/lighter combination sets. Case knives have been called the most collected knives in the world by Blade Magazine.
- > In 2002 Zippo introduces the company’s first ever multi-purpose, or wand, lighter fueled by

butane. The refillable MPL, like the Zippo windproof pocket lighter, carries the famous Zippo lifetime guarantee.

- > The original price for a Zippo lighter was \$1.95.
- > Zippo started engraving initials and providing metal insignias in 1936.
- > The first patent (number 2032695) for the Zippo windproof lighter was granted March 3, 1936.
- > The first corporate logo was decorated on 500 lighters in 1936 for Bradford's cross-town neighbor, Kendall Refining Co.
- > Zippo ran its first national advertising in Esquire magazine in December 1937.
- > Between 1934 and 1940, Zippo sold more than 300,000 lighters through the use of punchboard advertising. Considered a game of chance, punchboards were ruled illegal in 1940.
- > George G. Blaisdell was nicknamed "Mr. Zippo" by World War II correspondent Ernie Pyle.
- > GIs have carried Zippo windproof lighters in every war from WWII to Desert Storm. Americans in Vietnam used more than 200,000 Zippo lighters, and today, these Vietnam-era Zippo lighters are highly prized collectibles.
- > Every U.S. Navy ship, from a small auxiliary vessel to a nuclear-powered aircraft carrier, has her own custom designed Zippo lighter.
- > In the late 1950's, a Zippo lighter was removed from the belly of a fish. The lighter lit the first time. Forty years later, history was repeated. A hunter lost his Zippo lighter, which subsequently landed in the belly of a bear. When the lighter was retrieved from the bear, it lit the first time.
- > Every Zippo lighter is guaranteed with an unconditional lifetime guarantee: "Any Zippo lighter, when returned to our factory, will be put in first-class mechanical condition free of charge." Zippo has yet to charge a cent for the repair of a Zippo lighter, regardless of age or condition. The finish, however, is not guaranteed. Consumers have never been charged a cent to repair a Zippo lighter.
- > Zippo introduced:
 - > *Loss-proof lighters in 1947*
 - > *Slim lighters in 1956*
 - > *Tape measures in 1962*
 - > *Pocket knives with money clips in 1964*
 - > *Golf Greenskeepers™ in 1969*
 - > *Writing instruments in 1982*
 - > *Multi Purpose Lighter in 2002*
- > A regular size Zippo lighter weighs 2.05 ounces. A slim Zippo lighter weighs 1.50 ounces.
- > There are 17 lighter clubs around the world.
- > Thirty percent of the people who own Zippo lighters are lighter collectors.
- > Zippo has produced more than 375 million windproof lighters since 1932. If these lighters were laid end-to-end they would:
 - > *Stretch from the North Pole to the South Pole.*
 - > *Reach from New York City to Los Angeles 3.5 times.*
 - > *Pave the streets of Zippo's hometown, Bradford, PA, 1.8 times.*
 - > *Fill 122 football fields, including end zones.*
- > Some items, once important in the Zippo product line, are no longer made. The list of "products from our past" from Zippo and its subsidiaries include:
 - > *Zyrene, sunburn and diaper rash ointment*
 - > *Zip slip, a zipper lubricant*
 - > *Imprinted golf balls*
 - > *Out-o-matic ash trays*
 - > *Pill boxes*
 - > *Letter openers*
 - > *Magnifying glasses*
 - > *Table lighters*
 - > *ZipLight® pocket flashlight*

R.D. Hull loved to fish.

“If I’d been caught on the Ark with Noah, I’d probably have looked upon it as a chance to get in two straight months of fishing,” he once told a reporter.

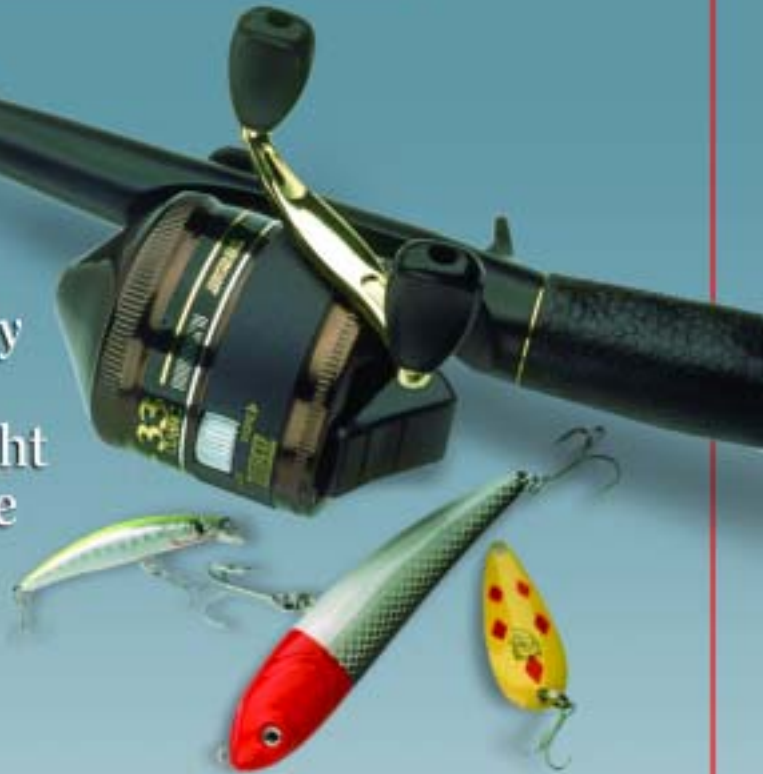


As much as Hull loved fishing, though, he hated backlashes—those tangled nests of line that form when a reel’s revolving spool spins faster than the line puts out during the cast.

Hull, a West Texas watchmaker and tinkerer, identified the revolving spool as the cause of backlashes. He tried to solve the problem by modifying casting reels to control the flow of the line during the cast. Then he had the radical idea of eliminating the revolving spool altogether. If the line were attached to a fixed spool, backlash would be impossible, he reasoned.

Hull worked up a crude model. It consisted of an irregularly shaped piece of plywood with six nails in a hexagon shape that served as the spool. To the plywood he fastened a lid from a Folger’s coffee can with notches cut along its edge. The lid was fastened to the center of the plywood with a long screw so it could spin freely. A line guide was attached to the lid.

In the autumn of 1947, Hull took his concept to the Zero Hour Bomb Co., a Tulsa, Okla., manufacturer of exploding devices used to start oil flowing in wells. Company officials challenged Hull to create a working prototype. The inventor returned in less than a month with a working model.



Hull worked through 1948 perfecting the reel and the machinery to manufacture it. Zero Hour Bomb, which later changed its name to Zebco, agreed to invest \$25,000 to produce the reel.

In June 1949, a small team of assembly workers built 25 handmade reels during the first day of production. That same month, the reels also made their public debut at a Tulsa sports show. The response was overwhelmingly positive. At last, there was a reel that made it easy for anyone—adults, children and novices alike—to cast light lures and bait without any backlash.

Hull, who designed 26 different reels, was inducted into the Sporting Goods Industry Hall of Fame in 1975. At the time, an estimated 70 million Zebco reels had been sold.

The popularity of Zebco reels spread quickly. They became the industry standard for spincast reels, a category of reels R.D. Hull also created.

Zebco still makes many of the reels Hull designed. Among them is the Model 33 (large photograph), introduced in 1954 and known as “America’s favorite reel.” Also shown is the Model 55, for saltwater and large freshwater fish.



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America Casts Its Vote for Zebco

BY PAUL WINSTEAD

Of the main types of fishing reels — bait casting, fly, spinning and spin cast — spin cast reels were introduced most recently, in 1949. Therefore, they — and their inventor — are the easiest to trace back to their beginnings.



The prototype of R.D. Hull's no-backlash reel consisted of a piece of plywood, six nails and a coffee can lid. The production version of Hull's invention soon became "America's favorite reel." By 1975, the year Hull was inducted into the Sporting Goods Hall of Fame, 70 million Zebco reels had been sold.



R.D. Hull loved to fish. He is quoted as saying, "If I'd been caught on the Ark with Noah, I'd probably have looked upon it as a chance to get in two straight months of fishing."

However, as much as he loved fishing, he hated backlashes. A backlash is a tangled mess of line that happens when a bait-casting reel's revolving spool spins faster than the line puts out during the cast.

Hull, a West Texas watchmaker and a born tinkerer, thought it was the revolving spool that was the cause of backlashing. Thus his earliest attempt to solve the problem of backlashing was to try to modify casting reels to control the flow of the line during the cast. However, he had the radical idea of getting rid of the revolving spool altogether, and that was to be his greatest discovery.

The light bulb came on one day as Hull watched a grocery store clerk pull some string from a large fixed spool to wrap a package. All of a sudden it hit him — the problem with fishing reels was the use of a revolving drum. If the line were attached to a fixed spool, backlashing would be impossible, wouldn't it? He decided to go home and find out.

Fortunately for Hull, he didn't know that "fixed spool" reels, i.e., spinning reels, already existed, and had been used in England and Europe for over 50 years. However, by not knowing about those reels, he had no preconceived notions. He started on a mission to build such a reel. It didn't take him long to prove that the fixed spool concept would work for a fishing reel. The line came off the spool freely, without getting tangled. He also figured out how to get it back on the spool after the cast. His biggest concern was trying to come up with a cover to keep the line from

spilling off the spool by itself. Later, Hull stated, "When I figured out that problem, it was all down hill from there."

Hull worked out a crude model of his idea of a fixed spool reel. It consisted of an irregularly shaped piece of plywood with six nails in a hexagon shape that served as the spool. To the plywood he had fastened a lid from a Folger's coffee can, with notches cut along its edge. The lid was fastened to the center of the plywood with a long screw so that it could spin freely. A line guide was attached to the lid.

On an autumn morning in 1947 Hull took his new concept of a fishing reel that wouldn't backlash to the Zero Hour Bomb Company in Tulsa, Oklahoma. They liked the concept, and challenged Hull to create a working prototype.

In less than a month Hull was back in Tulsa with a working model. Zero Hour Bomb Company officials rounded up a couple of employees who were fishermen and had them try out the reel. The results were outstanding as one cast sent a lure (a set of car keys) through a plant window, and the other cast



An early promotion touted that Zebco reels were easy enough for a "monkey" to use.

completely over the building. Hull was hired on the spot at a salary of \$500 per month.

Hull worked all of 1948 perfecting the reel and the machinery to manufacture it. On May 7, 1949, Hull and an assistant built five reels in a single day as a test of the production process. In June, a

small team of assembly workers built 25 of the hand-made "standards" on the first day's production run. That same month the reels also made their public debut at a Tulsa Sports Show to an overwhelming response. Here was a fishing reel that made it easy for children and novices to cast light lures and bait without the backlash problem.

It's possible that President Dwight D. Eisenhower had a hand in naming the company Zebco. Zero Hour Bomb Company had sent a reel to Eisenhower. When the package arrived a security agent saw the word "Bomb" on the package, and it was immediately seized and thrown into a tub of water as they awaited the arrival of the bomb squad for defusing. After this incident it took very little time to change the name of the company to Zebco.

In closing, all I can say is "thank you R.D. Hull for taking your dream and making Zebco a reality."

Thanks to all the people at Zebco for all the help they have given me. —P.W.



Fishing reels and time bombs for starting oil flowing in wells were made at Zero Hour Bomb Company in Tulsa.

Trailblazer. Moneymaker. Warrior. Workhorse.

Those are just a few of the superlatives used to describe the DC-3 since its inaugural flight on December 17, 1935.



Douglas Aircraft Co. built two versions of the DC-3 for American Airlines. The first, the DST (Douglas Skysleeper

Transport), entered service in the summer of 1936. It was designed to comfortably transport passengers from one coast to the other quicker than other airliners of the day. Equipped with sleeping berths for 14 passengers, the DST cruised at 192 mph and had twice the range (1,500 miles) of its contemporaries. The DST traveled coast to coast in 17½ hours—8 less than existing aircraft.

The standard DC-3, delivered 2 months after the DST, was configured with seats for 21 passengers. The additional seating contributed to the DC-3 becoming the first commercial airplane to turn a profit without hauling mail.

From a design perspective, the DC-3 incorporated the latest technologies. Among them were retractable landing gear; a single elevator and rudder;

variable-pitch propellers; two Wright Cyclone 1,200-hp, radial engines; two sets of instruments; and an autopilot control.

From 1936 to 1939, air travel in the U.S. increased 500 percent. An estimated 95 percent of U.S. passengers flew on DC-3s in 1938. And a year later, 90 percent of all passengers in *the world* flew on them. The DC-3, within just 3 years, had become the industry standard.

Prior to the U.S. entering World War II, the DC-3 was adapted for military duty. Among the designations given the militarized versions were the C-47 (Army) and R4D (Navy). The “go anywhere, do anything” planes hauled troops and cargo, airlifted wounded, pulled gliders and served in every theater of operation. Gen. Dwight D. Eisenhower called the C-47 one of the four pieces of equipment most responsible for the Allied victory.

Douglas Aircraft halted production of the DC-3 and its variants in 1944. The company built roughly 800 commercial airplanes and more than 10,000 military ones. Hundreds of these marvels of U.S. manufacturing still fly today, nearly 7 decades after the first one took to the sky.

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Competition gets DC-3 airborne

The Great Depression choked the growth of most business sectors in the 1930s. An exception was the airline industry. It flourished, especially during the latter years of the decade.

The Boeing 247, developed in 1933, was the first modern aircraft. The twin-engine, all-metal airplane accommodated 10 passengers, cruised at 190 mph and had an 800-mile range. United Air Lines—a Boeing subsidiary at the time—placed an order for 60 of the aircraft. The move effectively prevented competitors from acquiring any.

TWA (Transcontinental & Western Airlines) responded by ordering 25 of Douglas Aircraft's new DC-2, predecessor of the DC-3. The DC-2 was larger and more powerful than the 247. Its twin engines developed 650 more horsepower than the 247, and it boasted a range of 1,000 miles. In 1934, TWA began hauling passengers coast to coast on its DC-2s.

American Airlines introduced the DC-3/DST (Douglas Skysleeper Transport) in mid-1936. The DC-3's wider cabin accommodated sleeping berths for 14. Plus, the "3" developed 650 more horsepower than the DC-2 and, most importantly, had a range of 1,495 miles. This let the DC-3 cross the country in 8 fewer hours.

Reporting for duty

With the onset of World War II, Douglas readied the DC-3 for military duty. The first militarized version was the C-41, built in 1938 to transport Army personnel. The best-known derivative, though, was the Army's C-47, affectionately called "Gooney Bird." Other versions were the C-53, R4D and the Dakota, operated by Britain.

Among the changes made to the C-47 were the addition of double cargo doors and bench seats arranged parallel with the walls. Though designed to transport 32 passengers, the C-47 routinely handled many more.

Douglas built 10,000 militarized DC-3s during WWII. At peak production, workers assembled 1.8 aircraft per hour.

Variants of the DC-3 also saw action in Korea and Vietnam. They hauled cargo and troops, but the most memorable version is probably the AC-47. Used in Vietnam, these attack-cargo planes were dubbed "Spooky" and "Puff, the Magic Dragon." They were equipped with three 7.62mm electric guns, each capable of firing 6,000 rounds per minute. The Army retired the last AC-47 in 1975.

Gone, but not forgotten

The last DC-3 Douglas Aircraft built began life as a C-47. It was finished in 1946 as a commercial aircraft and delivered to Sabena Airlines, of Belgium.

Douglas built a total of 10,800 commercial and militarized versions of the DC-3. In addition, thousands were built under license by Japan and the Soviet Union.

Many still fly today. Among them is the entire fleet of DC3 Airways, a "virtual airlines" that can be found at:

www.dc3airways.com

The development of airplanes with four engines marked the beginning of the end for the DC-3, as well as other twin-engine models. But, arguably, no plane in history has as faithful a following as the DC-3. There are hundreds of clubs and Web sites devoted to its history and lore.

Find more details on the Douglas DC-3 at these Web sites:

www.pbs.org/kcet/chasingthesun/planes/dc3.html

www.centercomp.com/dc3

DC-3 SPECIFICATIONS

Inaugural Flight: December 1935

Entered Service: June 1936

Wingspan: 95'

Length: 64'5"

Height: 16'11"

Max. Altitude: 20,800'

Range: 1,495 miles

Weight: 30,000 lbs.

Engines: (2) Wright Cyclone, 1,200-hp, cowled radial

Speed: 192 mph (cruising); 216 mph (top)

Crew: 3

Passengers: 14 overnight/sleeper; 21-28 day flights