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"WHEN THE LIGHT IS BRIGHT, THE LAMP IS *STRONG*"

The namesake of STRONG INTERNATIONAL is Harry H. Strong (1887-1956), a self-educated inventor from Toledo, Ohio. Strong began his career repairing doorbells in his neighborhood. He later operated an electrical repair shop, from which he maintained equipment in Toledo movie houses. He became interested in the problems encountered by the early projectionists, in particular the constant attention paid to maintaining the arc in the carbon arc lamphouses. The carbons had to be carefully monitored in order to maintain the correct arc gap in the correct position.

By experimentation, Strong developed motor windings which were very sensitive to the voltage across the arc so that the feed motor would automatically speed up whenever the arc became too long, or slow down if the arc shortened. Thus, a uniform arc gap was maintained without the operator's constant attention.

An experimental model was developed and installed in the Hart Theatre in Toledo. It worked surprisingly well, and became the subject of enthusiastic discussion among the local operators. At a time when operators made up a new show daily, cared for projectors, threaded, hand-cranked, changed over, rewound, tended critical arcs, and ran song and advertising stereopticon slides, any labor-saving device was a true Godsend.

Strong thereupon built 18 pairs of the controls, quickly sold them, immediately installed them, and slowly collected for them. The invention of the automatic arc control, however, was acclaimed throughout the industry.

In 1923, a German invention was introduced to the American theatre — a hand-fed carbon arc burner pan which included a small nickel plated metal reflector. Installed in place of the vertical mechanism used in lamphouses at that time, the elliptical reflector helped produce more light output at 15 amperes than a vertical condenser lamp could generate at 50 amperes. Strong conceived the idea of developing a complete lamphouse incorporating these two innovations.

The first lamps were installed in the East Side Auditorium in Toledo late in 1926. Strong organized the Strong Electric Corporation, and opened a shop in a loft building. The first 20 lamps were assembled in a rectangular sheet metal box resembling a wood stove; lamphouse "#1" is presently on display at Strong International's Omaha home office.

Lacking capital, Strong had to sell each lamp as it was built in order to build others. An investment of $20,000 in his project by a far-sighted neighbor who had just inherited this tidy sum launched Strong into a field already crowded by over 30 competitors. This infusion of fresh capital enabled Strong to move to larger quarters, purchase additional machinery, and develop an eye-catching, streamlined enclosure for the lamphouse. The addition of two mechanics and a salesman led to the manufacture and installation of the first production run of 25 pairs of Strong Standards. The first Standards utilized a 6-5/8 inch glass reflector; later models used an 8 inch reflector.

Exhibitors quickly realized that a Strong Standard rapidly paid for itself in savings in current and carbons. Soon Strong lamps were selling faster than they could be built. By adding another half dozen employees, Strong boosted production to six or more lamps a day.

In 1927, Strong developed a scaled-down model of the Standard. Designed for the small neighborhood theatre, the Junior was priced within the reach of the many "shooting galleries" still using vertical arc lamps.

The large movie palaces of the era were commonly equipped with high current, high intensity condenser type lamphouses. These lamps produced sufficient light for the large screen, but were very expensive to operate. Strong reasoned that since the elliptical reflector principle had so increased the

efficiency of low intensity lamps, the same principle should apply to high intensity. Putting the theory into practice, in 1928 Strong introduced the Hy-Lo (High Intensity-Low Current). The Hy-Lo projected as much light at 60 amperes as the condenser lamps produced at twice the current. This lamp used a 12 inch reflector, and introduced the angle trim required for stable burning of larger carbons.

Although many theatres used motor generators or utility-supplied DC power, concurrent to the development of each lamp, Strong designed a companion power supply with load characteristics specially engineered to match each particular arc.

Development of a high intensity AC carbon in 1931 naturally led to a new Strong lamphouse. Since AC carbons burn at the same rate, a simple, low-cost feed mechanism was possible. The arc, used with a reflector, produced a high intensity effect in a volume considerably higher then the low intensity vertical lamp. Add the fact that AC current was available to most neighborhood movie houses, so no generator or rectifier was required. The sum of these parts was the Mogul AC, introduced in 1932 — giving small theatres high intensity light at very low cost, but probably contributing greatly to the term "flickering fotos" ("flicks") among movie patrons.

The copper-coated "Suprex" high intensity carbon was introduced in 1933. Within a year, Strong released the Mogul — a 60 ampere DC lamp using these new carbons. Featuring a 14 inch elliptical reflector, the Mogul produced a tremendous volume of light (twice as much as the Mogul AC), at very low operating cost, and requiring little operator attention.

Since the optics are such a major factor in attaining high efficiency in projection lamps, in 1936, Strong established its own optical department. The correct size and curvature of glass reflectors could be coordinated with lamp design, and the manufacture of the reflector held under direct observation and control. Strong's "glass house" controlled every step from cutting glass blanks through forming, tempering, finishing, silvering, polishing and final inspection. Later reflectors were available with a first-surface "cold" (dichroic) coating, called Tufcold, which filtered the invisible infrared heat, allowing a cooler, white light to be projected to the film plane. Strong became a major aftermarket supplier of reflectors for competitors' lamphouses.

The Mogul, and the later 1 kW Utility Suprex lamp (1940), established Strong Electric as the leading manufacturer of projection lamps. The Utility lamp was later manufactured for distribution by other leading names in the industry, the foremost being Simplex, the undisputed leader in projectors.

Strong set the pace as the industry evolved, supplying more, bigger, and brighter lamphouses. As the diameter of arc carbons increased, Strong added a rotating positive feature to further enhance more even burning. Legendary Strong carbon arc lamps include the Mighty 90 (1949), the Super 135 (1955), the 35/70 Special (1959), and the Futura (1963). The Jetarc (1958), using a 21 inch reflector and a blown arc, was the most powerful projection arc ever developed, and was honored by an Academy Award for Technical Achievement.

The Peerless Magnarc was added to Strong's product line in 1954 after Strong Electric acquired the J.E. McAuley Manufacturing Company of Chicago. Magnarc production was moved to Toledo, and continued until March 1978.

In 1948, the ice show industry approached Strong looking for a lightweight, high intensity follow spotlight which would be easy to "troupe" with their traveling shows. Strong already had a small AC lamp, used for 16mm and slide projectors, which seemed to lend itself to this use. The optical system, however, was new territory. What resulted was an ingenious lens mechanism which provided a convenient means of changing spot sizes, intensifying the light as the spot size was reduced. The Trouper spotlight projected an intense white spot even when the arc was burned at low current. Plugging into any 110 volt convenience outlet, the spotlight made use of a large motor generator set unnecessary.

Using a similar lens system, only with a 1000 watt incandescent bulb as a light source, the Trouperette spotlight was introduced in 1950. The Trouperette has evolved over the years as new and better bulbs

were developed, and the Trouperette III is still in production. Designed for schools, night clubs, and small auditoriums, the Trouperette operates on normal household current. A smaller incandescent spotlight with a simplified optical system, the Troupit, made a brief appearance from 1961 to 1967.

The Strong Super Trouper spotlight was the brightest in the world when introduced in 1956. The lamphouse is a modified 1 kW Utility, lengthened for a longer positive trim, thereby increasing its operating cycle. Designed for arenas, stadiums, and large theaters and auditoriums, the Super Trouper soon became the standard of this venue. Numerous big name entertainers were so impressed by the superior performance of the Super Trouper that they would appear under nothing less — and stated so in their contracts. Amazingly enough, this high intensity, long throw spotlight plugged into a 110 volt convenience outlet.

As arenas and stadiums increased in size, so did Strong spotlights. When the Gladiator was introduced in 1968, it was called, quite simply and very honestly "The Brightest Spotlight in the World." The lamphouse was a Strong Futura, burning an 11mm positive carbon and using an 18 inch Tufcold reflector. This powerful light source permitted throwing a 100 footcandle spot over 500 feet. Designed for permanent installation, the Gladiator required a 208/230 V.AC three phase rectifier, which was built and supplied by Strong.

By this time, Strong was located in a modern factory on City Park Avenue in Toledo, and employing over 100 people. The American theatre industry swore by Strong carbon arc lamps, but in 1954, a theatre in Kiel, West Germany, lit a screen with an Osram xenon bulb. The relatively high cost of a xenon bulb was offset by "zero" carbon consumption, and the xenon bulb produced equivalent light output with much less electrical power. By the 1960's, the xenon bulb had crossed the Atlantic and was making American friends.

The introduction of the xenon short arc bulb as a projection lighting source was the beginning of the end for the carbon arc lamphouse, but not for Strong Electric. Whether a light source is a ball of gases burning between two carbons, or a point of intense light between two tungsten electrodes, an efficient optical system is required to exploit the source. Strong engineers immediately set out to design xenon reflectors — and Strong in now the only (former) manufacturer of carbon arc lamps still in business.

In 1962, the first pair of X-16 lamphouses were installed in the Maumee Theatre, Maumee, Ohio. The first Strong xenon lamphouse featured a vertical 1600 watt xenon bulb mounted in front of a 14 inch glass reflector. A smaller auxiliary reflector was mounted in front of the bulb. The Peerless Magnarc housing was adapted as an enclosure. Strong, once the standard in *carbon arc* lighting, was now producing more lumens per watt than other *xenon* lamps.

Development of a xenon bulb which burned in a horizontal position permitted better light collection of the arc by a deep-ellipse reflector, yielding higher light output. Plus, the American manufacturer, Westinghouse, developed a 6000 watt horizontal bulb. Strong responded in 1968 with the introduction of the X-60 lamphouse. The X-60 met or exceeded light output of the largest carbon arc lamps then in use, and was able to illuminate the largest indoor or drive-in screens. The X-60 underwent modifications to adapt to changes in xenon bulb designs, and production continued through 1983.

A smaller lamp, designed for the 2500 watt horizontal bulb, was introduced in 1971. The X-25 met the needs of large and mid-size indoor theatres, but construction trends of the time leaned toward small, "mini" theatres. Equal to the challenge, Strong introduced the popular Lume-X lamphouse in 1972. This versatile little lamp used 700, 1000, 1600, 2000, or 2500 watt bulbs, and produced an incredible field of light, using a 10 inch deep ellipse metal reflector.

Xenon lighting was not to be limited to the motion picture industry. In 1971, Strong introduced the Xenon Super Trouper, using an X-25 xenon lamphouse behind its now famous optical system. This unit threw a 100 footcandle spot over 350 feet. It also introduced a new element to spotlight operation — continuous duty cycle. There was no need to shut down and re-trim. Also, since the lamp required no

operator attention after ignition, stagehands could devote 100% of their attention to their cues.

For all its advantages, the first Xenon Super Trouper had drawbacks. In physical size, it was almost as large as a Gladiator, and it required use of a large, three phase xenon power supply. Realizing the potential of the little powerhouse, the Lume-X, Strong engineers went back to work.

The introduction of the new Xenon Super Trouper (Type 83050) in 1975 began rewriting the standards for follow spotlights. Comparable in every way to the size and performance of the original Super Trouper, all the advantages of continuous operation, plus the inherent economical advantages of xenon versus carbons, were retained. By simply reversing the bulb in the Lume-X, the lamp that worked wonders in the mini theatre went on the road with the show. Reversing the bulb enhanced the cooling of the bulb in a lamphouse which is normally pointed in a severe down angle.

Originally, the Lume-X type Xenon Super Trouper used a 1600 watt bulb, but is now available in the more popular 2000 watt model. By October of 1978, production ratio of Xenon Super Troupers to carbon arc Super Troupers was one-to-one. By 1980, the year that the Swedish rock group ABBA immortalized the Super Trouper in song, production of the Xenon Super Trouper so far surpassed the carbon arc model that the carbon arc Super Trouper was discontinued in 1981. The present Xenon Super Trouper continues to fulfill the requirements of the famous "Super Trouper Clause" still appearing in entertainers' contracts.

Carrying this concept onward, the Xenon Trouper was introduced in 1977. Again using a modified Lume-X lamphouse, this time with a 700 watt bulb, smaller auditoriums began to benefit from the advantages of xenon lighting. History repeated itself, and the carbon arc Trouper was discontinued in 1982.

Combining two good ideas to make a still better one, the Xenon Super Trouper lamphouse was combined with the Xenon Trouper optical system in 1982 to create the Short Throw Xenon Super Trouper. Designed originally for Las Vegas show rooms, it projects an small, intense, flat field of focused light at throws under 100 feet.

As new light sources were developed, Strong was ready to adapt them for follow spot use. The HMI bulb was first used in the mid-size Strong "575", introduced in 1979, and later in the Trouper 1200 in 1986. The 400 watt HTI bulb was used in the Super Trouperette (1985) and again in the ***"roadie"*** (1991).

Strong's most popular xenon lamphouse began as a joint project of the Sales and Engineering Departments. The Strong Sales Department surveyed equipment dealers, theatre owners, and operators to discover exactly what features were most desirable in a xenon lamphouse. This input was given to engineering, and the result was the Super Lume-X, introduced in 1978. The Super Lume-X replaced the Lume-X, and remains in production, unchanged, to this date. The wide range of bulb wattages was, of course, retained. The 11 inch deep ellipse metal reflector projects more light than the 10 inch Lume-X reflector, and is dichroic coated to reduce heat at the film plane.

The Super 80, introduced in 1983, combines the ease of operation and service of the Super Lume-X with the outstanding optics of the X-60. The 15 inch dichroic metal reflector, first used in the X-60, delivers maximum light output from high wattage (3000 - 4200 watt) xenon bulbs needed to light large screens. The Ultra 80 (1990) features the superior optics of the Super 80, but with enhanced cooling for 7000 watt operation (70mm and larger).

These popular lamps found their places in the spotlight industry also. The Super Lume-X, with a 2500 watt bulb mounted cathode forward, was the light source for the Gladiator II, introduced in 1979. Designed like the original Gladiator for arenas, the Gladiator II throws a 100 footcandle spot almost 400 feet. Larger auditoriums are offered the 3000 watt Super 80 Gladiator III (1983), throwing a 100 footcandle beam over 450 feet.

The construction boom of new theatres dictated something new in the industry — an all-in-one

package of projection booth elements. Strong answered in 1982 with the introduction of the Highlight Console. The Highlight combined the lamp, the power supply, the soundhead, the projector, and sound and automation in a pedestal requiring only seven square feet of floor space. The Highlight was designed to accept all the popular bulb wattages, and features the 15 inch cold metal reflector.

In 1984, Strong lamphouse and spotlight production was moved to Omaha, Nebraska, to combine operations with Ballantyne of Omaha and Simplex. All product lines are manufactured under one roof at 4350 McKinley Street, Omaha. This combination permitted Strong International to begin shipping projection systems and spotlights pre-assembled, pre-wired, and factory tested to theatres worldwide.

To accommodate more elaborate sound systems, and to simplify installation, the Super Highlight was introduced in 1986. The Super Highlight features 30 inches of rack space below the lamphouse enclosure for sound and automation gear, and includes a distribution panel which feeds all required branch circuits from a single three phase AC input.

Demand for a smaller console was met in 1988 by the introduction of the X-90. This compact unit includes the efficient 11 inch reflector long used in the Super Lume-X. Although smaller than a Super Highlight, the X-90 features 36 inches of rack space.

In 1988, Strong also introduced the first truly new power supply since Harry Strong wound his first transformer. Weighing in at only 65 pounds, the 62-80000 Xenon Power Supply uses solid-state switching logic to supply virtually ripple-free DC current at 88% efficiency. Three models power xenon bulbs from 700 to 7000 watts.

When Ballantyne purchased the Cinema Products Division from the Optical Radiation Corporation in 1993, the Optimax Console joined the Strong family of xenon lamps. Featuring a vertically-mounted xenon bulb, the Optimax promises longer bulb life than possible from *any* horizontal bulb lamphouse. Strong International therefore became the one lamphouse supplier with a product to suit anyone's priority — maximum bulb life or maximum light output.

The introduction in 1995 of the Super Trouper II follow spotlight marks a new direction in the ongoing progression of the Super Trouper family. A need for a smaller, lighter, and brighter 2000 watt xenon followspot has been indicated by Strong customers for some time — a need which is addressed by the Super Trouper II. Currently in use in facilities from coast to coast in the USA and Canada, it has received favorable reviews from some of the leading players in the television lighting market, and is being specified for an increasing number of events and venues.

Strong's lighting division became the nation's largest manufacturer of xenon fixtures with Ballantyne's acquisitions of Xenotech and SkyTracker in 1997. Xenotech and SkyTracker production was relocated to Ballantyne's Omaha facility in January 1999 to improve manufacturing efficiency and to take advantage of Nebraska's central location.

Rental offices have been established in Seattle, Orlando, and North Hollywood to offer Xenotech, SkyTracker, and Strong follow spotlight equipment for architectural lighting, film productions, and limited-use applications such special events and grand openings.