WA Technology

Competing with Low-Cost Producers!

By Jerry Uttrachi 2020

PROLOG: *long, through page 5:*

(*Skip if you read Tailor, Ford, Lincoln Business Ideas*)

Background:

When I started in Welding & Cutting R&D in 1964, Linde was a leader in Industrial Gases, with a history of innovation. Our Welding & Cutting Laboratory had ~125 professionals with a wide range of engineering and scientific backgrounds. The Lab Manager, Bob Gage was a brilliant physicist and had invented plasma welding and cutting with his first patent in 1953.

The company had its beginnings in 1892 when Morehead and Wilson accidentally discovered how to make acetylene. It was found that combining acetylene with oxygen produced the hottest known flame temperature. In 1917 the US owned Linde Air Products company started by Carl von Linde in 1907 used his process of separating air into Oxygen, Nitrogen and Argon by air liquefaction and distillation, acquired the rights to the Germany company. The German Company, Linde AG (who recently purchased what was US Linde (*renamed Praxair in the 1980's*) was required to divest of their business in the US because of WWI.

The combination of acetylene and oxygen in a concentrated flame produced a temperature of 5720 F, well above the melting point of most metals. This allowed the oxyacetylene welding process to develop into a leading metal joining technique. In addition to marketing industrial gases in cylinders, Linde developed the required regulators, torches and accessories needed for the oxyacetylene welding and cutting process.

Linde became a pioneer in welding research and innovations including an inventor and/or developer of many metal joining and cutting processes including Submerged Arc, Heliarc, Plasma, Electroslag and MIG.

In 1911, Lincoln Electric introduced the first variable voltage, single operator, portable welding machine in the world. In 1914, James F. (called J.F.) Lincoln then President of the company, established the Employee Advisory Board, which included elected representatives from every department. His incentive management system helped Lincoln to become a leading producer of electric welding equipment and filler materials. They were instrumental in promoting welding as a reliable, cost effective metal joining process. The unique management techniques employed by J.F. Lincoln had an influence on the development of welding history.

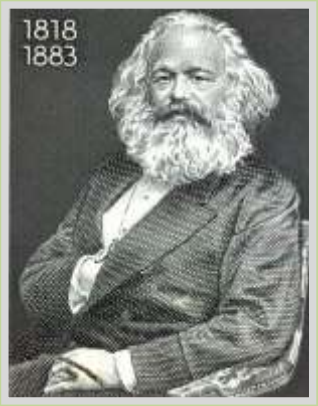
The "Oxyacetylene Welding process" was in direct completion with "Electric Welding" using welding generator power and "Stick Electrodes." This led to decades of completion between the two companies. Actually, very healthy competition that spurred innovation. This paper will review some of those innovations. The sidebars presented in red type are input from my experiences and observations.

Worked in Linde R&D Welding Lab, on a welding process the company introduced and developed in the mid 1930's, Submerged Arc Welding. My boss showed me a Lincoln Confidential Document that started my curiosity about their business philosophy. It was a 10-step trouble shooting guide for Submerged Arc Welding. Lincoln was our only significant competitor. The first point was "Check the Voltage" followed by "Check the Amperage," the last was key to understanding who they wanted as customers. It stated: *"You have spent enough time; Linde can have that account!"* Wish there were copying machines available in 1964!

Read and often reread the J.F. Lincoln business management books, the last written when he was in his '80's but still sharp as a tack! He made it clear the company's strength was based on making the same product cheaper! In his opinion that was doing the best for the "customer." Although a very "Capitalist business philosophy" several areas had some "Communistic or Socialistic traits!" They are mentioned in this paper!

For that reason, some years later I read a detailed biography of Karl Marx!

Karl Marx: Recall when reading that thick paperback, I removed the front cover with his picture as I was far from a "communist" and didn't want "looks" from those around me (often in airports!) The author quoted a reporter who interviewed Marx in his apartment. He talked about the squalor, and I recall the author's vivid description of the wood chair he sat on. It had dried pus from all the boils that were visible on Marx! Thought at the time, that must have affected his thought process and life attitude.



No wonder he didn't understand mankind did not function efficiently with his "Work According To Ability- Be Paid Only To Need!" Fred Taylor's iron ore shoveling example (discussed below,) which J.F. Lincoln no doubt read and understood, motives people.

Of interest it has recently been found that Karl Marx suffered from a skin disease that can cause severe psychological effects such as self-loathing and alienation!

(PROLOG CONTINUED)

"The father of communism's life and attitudes were shaped by hidradenitis suppurativa," said Sam Shuster in the British Journal of Dermatology. One symptom is alienation - a concept that Marx, a martyr to boils and carbuncles, put into words as he wrote Das Kapital.

The condition was described in 1839 by French physician. Nina Goad, of the British Association of Dermatologists, saying: "It is fascinating to discover that such an influential figure suffered from hidradenitis, especially considering how it might have affected his work.

As J.F. Lincoln noted, relating to his football *background: "Pay the most productive folks more. Train them to push themselves beyond what they think is their ability."*

Lincoln Electric Business Philosophy and Employee Incentive System:

if you have not read the paper on Lincoln business philosophy from J.F. Lincoln's Business books, See Link: *http://netwelding.com/Taylor_Ford_Lincoln_Business_Ideas.pdf*
The following are some excerpts from that 12-page document:

Fred Taylor: Father of Scientific Management

Fred Taylor is regarded as the father of scientific management, and the first employing systematic observation and study to management. In 1911, he published "The Principles of Scientific Management," where he described how the application of the scientific method could greatly improve productivity of workers.

Example, the "Science of Shoveling"

Taylor conducted time studies and developed optimum methods to shovel iron ore at Bethlehem Steel. He paid workers by the amount shoveled versus straight time. They typically earned 60% more.

Hearing of his results, a steel mill in Pittsburgh offered a higher pay/ton shoveled. Many workers left but in about six weeks, most of them were back in Bethlehem unloading ore at the lower old rate.

Taylor interviewed one of these men after he had returned and he said, *"Well, sir, I'll tell you how it was. When we got there, we were put on to a car with eight other men. We started to shovel the ore out just the same as we do here. After about half an hour, I saw the fellow alongside of me doing pretty near nothing, so I said to him, 'Why don't you go to work? Unless we get the ore out of this car we won't get any money on pay-day.' He turned to me and said, 'Who in the (heck) are you?' 'Well,' I said, 'that's none of your business'; and he stood up to me and said, 'You'll be minding your own business, or I'll throw you off this car!' 'The rest of the men put down their shovels and looked as if they were going to back him up; so I said to all of them, 'I will throw a shovelful whenever this fellow throws one, and not another shovelful.' So, I watched him, and only shoveled when he shoveled. When payday came around, we had less money than we got here at Bethlehem*."

Henry Ford's $5-a-Day Revolution

Henry Ford applied Fred Taylor's ideas to his factories and probably read his 1911 paper, Principles of Scientific Management. In 1914, Henry Ford started an industrial revolution by more than doubling wages to $5 a day—a move that helped build the U.S. middle class and the modern economy.

The business model that Ford developed increased production on a grand scale, performed by well-paid workers. It spread throughout the world and became the manufacturing standard for everything from vacuum sweepers to cars, and more.

Transforming the Assembly Line/ $5 day

Henry Ford startled the world by announcing that Ford Motor Company would pay $5 a day to its workers. The pay increase would also be accompanied by a shorter workday (from nine to eight hours.) While this rate didn't automatically apply to every worker, it more than doubled the average autoworker's wage. Henry's primary objective was to reduce worker attrition—labor turnover from monotonous assembly line work was high. He also reasoned that since it was now possible to build inexpensive cars in volume, more of them could be sold if employees could afford to buy them. The $5 day helped better the lot of all-American workers and contributed to the emergence of the American middle class. Although Ford was not the first to build a self-propelled vehicle with a gasoline engine, he was, however, one of several automotive pioneers who helped this country become a nation of motorists.

Perhaps Henry Ford's greatest achievement was not the assembly line, but rather that he understood the power of productivity.

"Incentive Management" by James Lincoln

J.F. Lincoln wrote "Incentive Management" in 1951 when he was 69 years old. He continued as the main company guiding light until his death at 82 in 1965. These are some interesting insights about the Company presented in the book.

New Age in Industry: In early civilizations, people were placed in classes whose positions and rewards were known and accepted. Under the feudal system, the lower classes did have a few rights the lord would consider.

When the industrial revolution came, the worker was still subservient to the boss. With industrialization, competition forces progress in efficiency and workers developed abilities the boss doesn't have. It was recognized that individual ability is of most importance and does not depend on birth or wealth. The nation has been slow to accept that that man can develop into almost any person that his ambition and opportunity allow. With incentive management, a developed person is a genius compared to an environment where incentive is lacking, and they are completely underdeveloped.

(PROLOG CONTINUED)

One reoccurring comment discusses that lowering costs by developing a person's skill, occurs since many overhead jobs become unnecessary. Foremen, inspectors, and clerks become needless as producing at top speed and accuracy is inherent in an effective system.

SIDEBAR

Other Incentive System issues

Although not mentioned in this book, the following presents my recollection and information obtained over the years about the success of the Lincoln incentive system through ~1990. Lincoln Electric has a successful incentive system by following the basic concepts that J.F. Lincoln outlines in his books and by having individual rewards based on their easily measured output. Where possible, each day a worker knows what they produce and can see how far above the standard was achieved. A product may be labeled with their initials and if it is returned defective, the cost of the product is deducted from the annual bonus.

If employed more than 3 years workers were guaranteed 30 hours of work in lean times. That way they were willing to work harder and help the company with ideas to increase productivity without the concern of being laid off! In peak demand times, overtime work is expected. If a worker exceeds their piece rate, makes a quality *product, their end year bonus is based on annual earnings, included the time and a half extra, pay for the longer workweeks. I recall a Cleveland newspaper article in the mid/late 1970's indicating a number of hourly workers earning over $100,000 that year!*

However, there was no paid vacation and health insurance, if desired, it was paid by the employee. Another interesting "flaw" in the system is not mentioned in the many Harvard Business Review articles about Lincoln's business system. Some of it smacks of "Communism" which I always found interesting! The employee bonus was based on how the company did finically overall at the end of the year. The "owner's" per J.F. Lincoln's philosophy, only took a "reasonable percentage" just a small amount over bank interest and the remainder shared with the employees. It was not only frowned upon to not be working hard but a fellow employee could turn you in for sleeping, etc. and earn extra bonus. Comments from a person who had been an hourly worker and then promoted showed he was very upset at the new office building area built when Don Hastings became President! That was "his money" being used. He was concerned "salesman and execs were 'eating high on the hog' on expense accounts!"

What Should Be Done With Increased Profits?

There are some interesting "Socialistic type" features that the "Capitalistic company Lincoln thinking!" An important J.F. Lincoln business philosophy states the real and ultimate boss is the consumer who pays all wages, taxes, profits and costs. If the customer is to be pleased, he must be continually given lower prices and a better product. Product cost must continually reduce. Workers accept the customer getting a better deal so they will purchase more from their increased output. Workers can accept management and stockholders obtaining a fair return on their contribution and investment. (*Not like some CEOs, top Execs and Wall Street types who now get very high pay and unlike an entrepreneur talking big financial risks - risk nothing!)*

He goes on to say the primary goal of industry is to make better product to be sold to more people at a lower price. He indicates a price policy of *"all the traffic will bear"* is historically unsuccessful. He notes the proper way to manage an economic slump is to lower prices and thereby increase demand. Increased productivity is a very important way to lower costs. In addition, with the Lincoln incentive management system, salaries will necessarily decrease in slow times with decreased bonus pay due to lower profits and possibly lower work hours since guaranteed employment, only promised to employees with over 3 years' service, and 30 not 40 hours a week. If product demand is low, work hours, not jobs are decreased.

Abilities Must Be Developed: J.F. Lincoln equates developing a person's latent skills to developing those of a football player, relating to his football experiences. He notes a person's abilities remain latent forever unless there is sufficient drive and an intense desire to develop them. A person must be continually challenged to do better until they feel they have arrived. He states, a leader is needed to bring the best out of anyone.

The Incentive: Selfishness and ambition are interdependent and must be guided by intelligence to be satisfying. Foolish selfishness such as gluttony, drinking, and laziness are wrong and lead to disappointment and sorrow. Money alone is not the incentive that drives workers. As with an unpaid amateur athlete, pride and the competitive spirit are of prime importance. The real incentive is *"recognition of our abilities by our contemporaries and ourselves."*

"Lincoln Electric- a history" by Virginia Dawson

There is additional information about the Lincoln Electric business philosophy in a 1990 book written by Virginia Dawson entitled "Lincoln Electric, a History."

Incentive System: The Company showed a strong profit in the middle of the depression and J.F. Lincoln offered a generous bonus program that became legendary. The advanced reward for performance system was a key part of the Lincoln Electrics success, however with the difficulties encountered with overseas acquisitions in the 1990's the companies' profits declined and the bonus pool severely reduced. This created employee discontent. After hiring a consulting firm, a revised system was developed having several key differences. First, there was a new formula-based system for defining what had been less than transparent bonus amount. It took the mystery out of what it would be each year.

Second, base pay was revised to be more congruent with comparable wages for given positions. Third, the merit-based rating system for hourly workers was felt to be satisfactory and retained. Fourth, a comprehensive overhaul of the benefits was crafted, such as health care, retirement, and improved vacation policy. The changes were effective, and the company has performed very well in recent years.

(PROLOG CONTINUED)

Limiting New Products¨ Perhaps the biggest reason my old company and its successor L-TEC (and ESAB before being purchased,) succeeded in competing with Lincoln's low-cost producer successful business was the very ridged policy started by J.F. Lincoln. After his death it was followed by his successor Bill Irrgang who ran the company from 1965 until 79 years old in 1986!

J.F. Lincoln believed the effort to develop different products increased overhead and resulted in lower output per employee. He preferred to stake the company's reputation on product quality and trained sales engineers. As an example of how this affected the business direction, the engineer who developed their most successful stick electrode would often lock horns with J.F. Lincoln over the issue of new product development. Lincoln insisted for every new product introduced one had to be removed! Another example is the purposeful delay in entering the gas shielding MIG business so as not to support anything that could assist the gas producer competitors. Both J.F. Lincoln and Bill Irrgang, believed in the development of a flux cored wire that did not use shielding gas. This product, which they called Innershield, was thought to be the key to achieving the unique creation that would set them apart from those selling products needing shielding gas. This myopic focus on that product development permeated all of the company for over 20 years. A conflict between Lincoln and their Industrial Gas business partner in Scotland, Big Three, and British Oxygen Company in England reinforced Bill Irrgang's belief that they should not build products that support the use of shielding gas.

SIDEBAR

Focus on Existing Products- Innershield

*Virginia Dawson quotes Lincoln personnel noting that in the 1970's Lincoln's most loyal customers were switching to gas shielded, solid wire MIG welding. Dawson writes: "It also strengthened the market positions of competitors Miller, Hobart, and L-TEC (a company I named!) An interesting anecdote about the development of self-shielding cored wire mentions a reported comment by J.F. Lincoln, who remained as the head of the company bearing his name until his death in 1965 at age 82. "When folks from R&D working on Innershield told J.F. they had a product that worked in CO_2, he reportedly said "**If I wanted a product that worked in CO_2, I'd have asked for that!"***

Review: "A New Approach to industrial Economics" by James Lincoln

J.F. Lincoln wrote this book in 1961 when he was 79 years old. It reinforces his lower cost and lower pricing ideas, limiting product expansion and incentive management concepts.

Price Cutting: When prices are negotiated between a supplier and user, the customer has distrust and still looks at the supplier as a potential crook. Did I get the best price? If a producer can cut the price on one case, he should be able to cut the price in every case. The seller has the responsibility to tell the buyer the truth since he is the expert. This is equally true if the proper item has to come from a seller's competitor. In the end, salespersons will change from peddlers to consultants and advertising will be changed to instruction. Both the number of salespersons and quantity of advertising will decrease.

Limiting Product Range: No company should go into business producing a product unless they can offer the user a better product at a better price using their inherent skills. If a company is best at engineering and development of new products, that should be their expectation to outdistance the competition. If production is their strongest area, then manufacturing methods and cost should be the foundation on which success is based. Industrialists forget Henry Ford gave the customer an excellent standardized car at a continually lower price from nearly $1000 to less than $300. Making one product consistently better and cheaper is relatively easy compared to doing the same thing for many products.

"Behind the Mask" 2014 by Don Hastings

Don Hastings was a salesman, District Manager, VP Sales, President than CEO of Lincoln Electric. The first Lincoln CEO not from a manufacturing background! He made significant changes in the company. Some because the market was changing faster than the company and some he had to because of the financial problems when he became CEO.

His book points out some of the flaws in the Lincoln system. Keeping a focus on making an old product cheaper is fine but may keep them from perusing a new opportunity and industry direction.

William Irrgang Era: Bill Irrgang became CEO when J.F. Lincoln died and remained until 1986, when 79 years old. Don indicated he had difficulty getting Irrgang to listen about the need for new products. Quoting Don; "I could not persuade Mr. Irrgang to direct our talented design and manufacturing engineers to jump into (obvious) marketing opportunities." "In fact, the doors to the engineering department were kept locked during business hours and everyone else (particularly the sales department) locked out!"

SIDEBAR

Of interest, have a friend Wayne Hoffman who worked for Lincoln at that time as a manager in equipment engineering. He said when Don was still District Manager in the Mid-West he came to Cleveland and asked Wayne if he could put a gas solenoid on their "gasless Innershield wire feeder." Wayne did that and when Don was visiting took him in his Lab area and under a cover showed him what he had done.

Wayne said if Irrgang knew; first that he had brought a District Sales Manager into his Lab and second had put a gas solenoid on a wire feeder designed for only Lincoln Innershield- he would have been fired!

Don Becomes President in 1986: Things changed at Lincoln Electric when Don Hastings became President. Irrgang was replaced with George Willis as CEO. Willis was also from a manufacturing background, so it was not all easy for Don, but the product line changed.

(PROLOG CONTINUED**)**

I recall Lincoln added a line of TIG welding torches! Frankly I chuckled, as under J.F. Lincoln and maintained by Irrgang only one person could add a part number- the CEO, who also controlled *all pricing*!)

J.F. Lincoln often asked to have a product removed when one was added. Managing part numbers is not easy, just for our equipment business in 1986 we were managing 125,000 finished part numbers (not well!) TIG torches in lengths of:12 ½ feet, 25, 50 and some 100 foot each for the many air-and water-cooled torch types.

TIG collets and collet bodies for each torch for each different size tungsten. Gas lenses collet bodies for each, and oh yes, long and short tungsten caps - many thousands of part numbers. Had to forecast sales of each or be out of stock for one ordered!

I met Don Hastings for the first time at a NEMA welding committee meeting soon after he became President. I was a substitute for my boss, the CEO of our new company purchased from Linde, that I named L-TEC. We purchased the equipment, filler metals, cutting machine and scarfing machine businesses in the US, Canada and Germany.

Don shook my hand and *"clenching his teeth*" said, *"Always good to meet someone who beat me!"* I asked what that was and although he would not say (***I knew***) we discussed the issue years later when we were both retired and Board members of the AWS Foundation.

SIDEBAR

The area *"I had beat Don"* was supplying submerged arc welding wire and flux for the manufacture of over 16-inch OD gas and oil transmission pipe. A two-pass weld, one on the OD, one ID, is made in the 40-foot-long seam in what is called UOE pipe. That was an area where we (Linde) enjoyed well before I started in R&D from college, in 1964. A few years after I developed a 3000-amp SAW system that used 3 electrodes, all AC (avoiding arc blow,) one behind the other that doubled the welding speed! I used a partial factorial experimental statistical design to define the best combination for over 10 variables.

I spent a lot of time at the 9 UOE pipemills in the US and Canada, owned by steel mills. More important, in addition to using a statistically designed experiment to optimize the many variables in this 3000-amp, all AC power proprietary system, I brought back the latest pipe steel requirements and helped our flux developers invent new fluxes when needed. We would evaluate various flux/wire combinations including experimental fluxes to optimize mechanical property and performance requirements on the higher strength pipe steels being developed as well as sample plate. I also visited US Steel, Bethlehem Steel and Stelco R&D Labs. As soon as I returned from a trip to a pipemill or steel mill R&D LAB we tested wire/flux combinations in our Lab on new steels and had answers for customers in a few weeks! If a new flux was needed we worked to develop one.

Our proprietary 3 wire SAW systems were in use by US Steel, Armco Steel, Bethlehem Steel, Kaiser Steel (who built 3-wire mills for Mexico and the Middle East,) Stelco in Canada, British Steel in the UK, Italsider in Italy, a pipemill in South America and even Japan bought a system (which they copied!) In peak gas and oil pipe production years; half our submerged arc flux sales were to these mills at a ~30% premium over Lincoln's flux prices; shipped in truckload and RR boxcar quantities.

Don Became CEO in 1992: Things got worse for Don 24 minutes after he became CEO! Quoting, *"At 5:01 PM I became Chairman and at 5:25 PM our CFO marched up and said, 'I've got some bad grim news.' The numbers just came in from the European operations, they are bad. Very bad." They lost 7.5 million in June and we'll have a quarterly loss. We'll violate our covenants and the banks and default on our loans."*

Fortunately, the banks agreed to relax the covenants.

Don said they were concerned that ESAB had come in and purchased two US Companies, ours, L-TEC and Alloy Rods. When he was President, Don and the Board, thought they would expand overseas, to counter ESAB's strength. He and the board thought they could transplant their successful US incentive system anywhere. Quoting Don, "Big Mistake. I felt I was handed the keys to the Titanic!"

He asked the US Team to increase profits to help offset overseas losses. They did!

He closed the largest European acquisition, Messer Griesheim and shut down operations in Brazil, Venezuela and Japan.

Don also said when at a European Trade show a competitor whispered, if you raise prices 5% you'll generate 50 million in profit! He said, "I raised prices and they stuck!" (*I know who that competitor was!)*

A bonus was paid to US workers but not nearly what the employees had hoped. It created a lot of unrest.

They hired new Board members and one encouraged Don to hire Tony Massaro. Quoting Don, "I had misgivings about hiring Tony but could not put my finger on why." "It was clear to me from the start that Tony wanted my job."

"Then the Board instituted a mandatory retirement age of 65 for executives. They could of course make exceptions and they did for me "by only one year!" "*I had no intention of retiring. After bringing the company back from disaster I was looking forward to continuing. In my opinion, from the time Tony came on Board their intent was to replace me. I was 68 and by bringing in outside directors I had unwittingly become the catalyst for my own destruction."*

END PROLOG

Surviving while Competing with Low-Cost Producers

(Note: This section will cover when Linde welding and its successor L-TEC existed, through 1990. It emphasizes several marketing approaches that significantly increased market share with very profitable, leading edge products. These did not conflict with the "low-cost producer's" building the same "old product" cheap.)

In his book *"A New Approach to Industrial Economics,"* J.F. Lincoln defines what we were best at and following that strength allowed us to compete!

He notes: ***"If a company is best at engineering and development of new products, that should be their expectation to outdistance the competition." If production is their strongest area then manufacturing methods and cost should be the foundation on which success is based."*** Industrialists forget Henry Ford gave the customer an excellent standardized car at a continually lower price from nearly $1000 to less than $300. Making one product consistently better and cheaper is relatively easy compared to doing the same thing for many products.

J.F. Lincoln believed their success depended on progressively improving existing products and making them more economical. *"If this continual improvement stops, completion will overtake and pass the company's efforts."* He also notes a new product will become the center of attraction for management and existing product lines will have less of the needed improvement attention. He mentions that progressive improvement of existing products is easier than with new ones since you know the product better. He states, "*Our salesman will often bring in orders for special products which are departures from our standard line, they seem attractive because the price they bring seems higher. "If we follow any will-of-the-wisp we will get the usual will-of-the-wisp penalty."*

Freedom to Innovate in R&D

Two comments in the above statements also show how at Linde and subsequently L-TEC we had an environment conducive to our innovations.

Quoting Don Hastings: *"In fact, the doors to the engineering department were kept locked during business hours and everyone else (particularly the sales department) locked out!"*

My friend Wayne Hoffman, who had worked at Lincoln for many years until becoming the Engineering Manager at Airco (*became ESAB*) said: *"When Don Hastings was still District Manager in the Mid-West he came to Cleveland and asked me if I could put a gas solenoid on their "gasless Innershield wire feeder." I did and when Don was visiting took him in my Lab area and under a cover showed him what I had done.*

He said*: If Bill Irrgang (CEO) knew; first I had brought a District Sales Manager into my Lab,* ***AND*** *I had put a gas solenoid on a wire feeder designed only for Lincoln Innershield- I would have been fired!"*

Our Linde Lab: When I started in 1964, Bob Gage was the Lab Manager, a brilliant physicist who had the first plasma welding/cutting patent in 1953. Recall his statement to the group of younger Lab engineers who started about when I did. *"10% of the time here is yours. Do whatever you think might be of interest or could lead to a new product or process."*

We also had a large library and a Librarian (*no Internet at the time!)* I remember when one of the young engineers said he couldn't fine some information and Bob said, *"Why do you think I have a #&@% library? - Go use it!"* Never told Bob I didn't know something I could research and find out! Bob was a WWII Navy officer and his language could be salty! Recall one of his favorite sayings if he saw someone in the Lab doing what he thought was irrational, which often included an explicative delegated: *"You're Solving a Problem, Not Known to Exist, Using a Method Know Not to Work!"*

Submerged Arc Welding: Linde, was a Division of UCC that had some innovative folks at a corporate level. Starting in the early 1930's a California Inventory, Harry Kennedy, worked on a process, more open arc than "submerged" arc to weld the long seam in gas and oil transmission pipe. Kennedy and two others finally developed a flux that could completely surround the arc. Patent 2,03,960 assigned to UCC was purchased by them from Kennedy. UCC started a separate Division to develop and market the process and products. It was licensed on a pound of material deposited basis. I recall the flux sold for about $0.05/lb in the 1940's. The license fee was higher, and Kennedy was getting royalties of about a $0.05/lb of metal deposited! In WWII it was rumored Roosevelt sent a letter to Churchill, which he read aloud to Parliament, that; said; *"We have a welding process that can weld ships fast enough for our and your war needs."* (or some such words.) The process was kept proprietary and then Lincoln introduced a fused flux. A famous lawsuit ensued that went all the way the Supreme Court. The fused flux patent was upheld but the process patent was not. That caused Lincoln to make bonded flux!

Of interest, when I started working on SAW we only made fused fluxes, many types and sold it for all critical applications such as welding heavy vessels used for power plants including Nuclear as well as the very large volume sold to the 9 large diameter gas and oil pipemills in the US and Canada. That flux sold for about a ~30% premium over Lincoln bonded flux. Fused flux cost us less than the bonded fluxes we started to make since bonded flux required expensive ferro alloys.

Perhaps the best example of a very profitable flux was one sold to the manufacturers of the ~10-inch thick Nuclear containment Vessels. Working with those fabricators, special fluxes were developed to meet the very stringent mechanical property and performance requirements. It sold for $0.67/lb when Lincoln and our boded fluxes sold for ~$0.12/lb. Don't recall how it got to that price as it cost less to make that our bonded flux! For that price we made very large lots of product so the fabricator could minimize their required 24-hour stress

relieve property weld tests! We'd store 100,000+ lbs of those special qualified lots for one customer and shipped then billed whenever the fabricated needed. Something, at the time, Lincoln would not do! We also had many plant audits. We had free heat identify on any wire sold, something that did not fit the Lincoln low cost manufacturing system. Recall for one fabricator we had to pull the bottom wire from a 1000 lb drum to the top so they could check both ends to be sure it was all from one heat. Something again Lincoln would not do! In fact, I used heat identity as a way to keep our premium priced wire business in pipemills and RR Tank Car shops, etc. After all, they had to keep the steel mill chemistry of the plate. I'd ask; "*Why not keep the welding wire exact chemistry on file?* It's easy just give us the heat number on the wire package and we'll send the chemistry free of charge! I knew Lincoln could not do that!

TIG Welding: Russel Meredith, working for Northup Grumman, was issued a very broad patent in 1942 that was TIG welding. Northup Grumman used the process for welding aluminum but had no incentive to exploit the process where Linde did, to sell Helium and Argon. They bought the patent and the Heliarc name from Grumman. Linde put engineers to work developing the many air and water cooled TIG torches used and often copied today. I shared an office with the inventor of the "gas lens." Although the torches and consumable torch parts were profitable, Linde's incentive to promote the process was Argon and Helium sales!

As the torch and consumable patents, like gas lenses, expired a number of "copiers" made and sold them cheaper. As far as Linde was concerned, they all used Argon! When I moved from R&D to Corporate Office in CT to start and run a Market Development Group, we had 50% of the US and Canadian production of Argon!

As any company based on innovation must recognize, you either invest to become a low-cost producer of a product or milk it and move to the next innovation! Until we became a separate company, L-TEC, that required move or investment was not often acknowledged!

MIG Welding: Airco, who had a similar welding R&D Lab to ours, was also in the Industrial Gas Business. Like ourselves, selling Argon and Helium was much more profitable that Oxygen and Nitrogen. They had the early patent on a viable MIG welding process. That patent issued in 1949. Throughout the 1950's MIG power sources, guns and wire feeders were developed. By the late 1950's, as Don Hastings noted, his customer in Northern California showed him the process that had replaced the Stick Electrode that was Lincoln's bread and butter consumable. Through the 1960's serval process variants were developed, like "Short Arc" for welding out-of-position/sheet metal and Airco's Pulsed MIG used on heavy sections and that was specified by the Navy for use on submarine hulls and aircraft carriers.

Quoting Virginia Dawson's interview from her book, stated: "*Bill Irrgang, followed J.F. Lincoln's beliefs, resisting development of a line of gas-shielded products fearing having to introduce many new products thereby diluting improvement efforts on existing products and diluting the efforts to develop and promote Innershield gasless cored wire. "It also strengthened the market positions of competitors Miller, Hobart & L-TEC!"*

As Don stated, Lincoln was late to develop MIG machines and filler metals. When I started in R&D in the mid 1960's the process was well developed and probably represented 20% of the filler metals deposited, most coming from Lincoln's bread and butter Stick Electrodes. By the time Lincoln got into the business we had develop many MIG welding machines and had a variety of MIG wires for welding from mild steel, high strength steel used to manufacture submarines and aircraft carriers a well as being the main process for welding aluminum and the preferred process for welding stainless steel. MIG was probably ~40% of the market including gas shielded flux cored wire by mid-1970.

Plasma Cutting: Although oxyfuel was the dominant process for manual cutting through the 1970's, Thermodynamics introduced air as the plasma gas and manual plasma cutting took off. For machine cutting we had a strong position in Nitrogen and Nitrogen/Oxygen machine plasma torches. Most important we also had a leading position in very profitable cutting machines.

I recall a question Dick Sabo, a VP at Lincoln, asked when we were at a NEMA statistical committee meeting. He asked what percentage of our business was cutting? Thought about our oxyacetylene apparatus, plasma systems and added cutting machines and our scarfing machine business, which by then was small for new machines but was an excellent consumable contributor and said ~50%! He said, "I thought it might be that high." Lincoln had no cutting at the time and although they bought Harris gas apparatus it was not significant, our market share was larger, and Victor had over 50%!

Market Decline: The late 1970's and early '80s were a depression for the fabricating and welding industry. I recall talking to the Lincoln Pittsburgh District Manager who told me his area sales declined 50%! From Don Hastings comments he managed the decline in sales by increasing distributors by 50%, and as he notes "pissing-off" many of the existing 400!

Linde did not have a choice of adding distributors for the welding/cutting and filler metals business as it was tied directly to the gas disturber franchise. You bought our gas you got access to our equipment and filler metals, whether you offered them for sale or not!

But the real problem was not that the, equipment and filler metal sales were down (*or not very profitable*) or the Linde owned distributors were not making money - it was funding for the bulk gas business!

My Market Development Group was funded 1/3 by the bulk gas business, 1/3 by the packaged gas business and 1/3 by what was called the welding and cutting business. Being in corporate office I had to go to each of those business overview meetings twice a year!

The issue was clear, the bulk gas business generated the majority of the Divisions profits. Packaged gases were having difficulty as they operated many filling stations that were in place to fill cylinders. Initially, filled cylinders were rented to distributors then when forced to fill distributor "owned cylinders" they dragged their feet so many distributors put in their own filling stations and were treated like a bulk gas customer, just having their liquid tank filled when needed.

That left the filling stations way underutilized. In addition, the "specialty gas" business was growing and needed capital to expand.

I recall one meeting where the bulk gas business requested ~$300 million to expand. Their main competitor at the time, Air Products, would just get a large customer to commit to a long-term supply contract, go to bank with that contract and get the ~50 million for the plant! Linde could not do that as all finance was at the corporate level. If chemicals had just ordered ships or built new chemical plants that may have consumed the corporations borrowing power. I recall all the bulk gas business could get was ~$200 million leaving some potentially very profitable new gas plants unbuilt!

L-TEC: As Bill Lichtenberger (then Senior VP Marketing future Praxair President) said when we announced the divestiture of the welding hard good businesses, *"Jerry, you'll be better off as we don't have the capital or manpower for that business."* Recall he said to the business manager of the Packaged Gas Business, *"I'd sell that as well if it wasn't needed to support the bulk gas business."* That manger along and other senior Linde folks bought welding distributorships they sold soon after our welding leveraged buyout was formed!

Our new welding company, L-TEC President had come from Carbon Products where he had run plants in the US, UK then the business in Europe from Geneva SUI, Pete Johnson, He had been in charge of our US business for about 8 years and made significant improvements in the equipment factory and stripped the cutting machine group back from side distractions and money losers to building market leading CNC cutting machines. He knew what was needed as in addition to facilities in OH, IN, NJ, SC and Canada we acquired the business in Germany. Recall he said we will have only German's run that operation. When the German PhD, who we thought would be that President, decided to stay with the gas business there was a dilemma. There was a strong plant manager and a strong sales manager. But one would not fit working for the other. So, Pete solved it quickly- we had two equal Managing Directors!

That was unlike what George Willis, CEO of Lincoln did with his purchase of the German MG welding hardgoods business. Their idea was to implement the Lincoln incentive system! As Don Hastings said in his book, *"Big Mistake!"* Divesting that business had a high cost!

Product Line and Personnel Restructuring at L-TEC: I'll cover the main areas where we made major changes.

First personnel: Always had some conflicts between product managers and our market development effort. Solved easy! The Product Managers would also perform the Market Development task! Where the Equipment VP they had been working for didn't allow much travel, I was the opposite. How could you understand what a fabricator needs unless you visit and talk with them? Recall most liked the change and one I asked a Regional Manager to help train for the task- he did!

There were also transfer pricing (wire and Plasma parts) and other conflicts with the "business managers" of equipment, filler metals and cutting machines.

Solved that by eliminating the business manger position! Cutting machine and scarfing facilities were closed, and production integrated in the much larger equipment facility. Marketing included Product/Market Development Managers and the cutting machine service organization consisting of 30 folks, most located in the field. That manager was put in charge of all service support including welding machines. Even the welding materials product managers, although they stayed at the OH plant, worked for Marketing Department. Made it very easy to put MIG wire with each welder, which was a "big issue" prior! Just like you might get Tide with you washing machine it helped sales of a special MIG wire we were promoting, an ER70-S7 few suppliers had! There was no longer a Filler Metals Business Manager to object; transfer pricing issues were eliminated!

Engineering: We kept new product development engineering, intact. That allowed us to continue innovation in *"Star Products."* More about that follows.

Plant Operations: We hired a new equipment VP Operations who changed the production system from an MRP system requiring long term demand forecasts to cellular manufacturing that was more *Just-In-Time.* I had seen assemble-to-order work in smaller welding supplier companies and pushed to have that in several areas. It was a real help, so we didn't have finished product in stock but in the wrong packaged kit!

Marketing*:* Since I came from R&D, when I moved to corporate office in CT my boss suggested an AMA marketing course, I came back with a strong belief we needed to conduct more market research. Recall my first effort as L-TEC was to hire a marketing consultant to discuss our business plans with 3 business managers as they were called the time (those jobs were soon eliminated.) After a day of listening he said nothing. I was the moderator and finally said, what do you think? He was very tall and had a Swedish accent. He picked one of the business plans that was in a 2-inch binder. Dropped in on the table with a bang and said: *"This is ridiculous, even IBM could not implement such a broad range of activities!* He then said*, "Folks in the US think all marking programs must start country wide! Foolish, you don't even know if they will work! Start in one region, test the program then modify as needed and move to the next!"* Remembered that advice and implemented that "regional approach" successfully in one area.

Frank Lynn: With L-TEC we knew major changes in products, offerings and perhaps distribution were needed. Evaluating distribution knowledge, Frank Lynn and Associates (*who exist today*) presented several day seminars to introduce their concepts.

It was clear after listening to their logic, our distribution treated welding hardgoods, equipment and filler metals as secondary products and in some cases ternary! Their main product focus was gases and renting cylinders! This was reinforced with my knowledge from not only working with welding distributors for ~20 years but knowing that for some of the Linde owned distributorships, 105% of their "profits" came from gas sales! Therefore, they considered selling hard goods as a "necessary evil" to "support" their gas business!

After attending their seminar decided it would be useful to hire them to present a several day overview to our Product Management with also now having a Market

Development role as well as for our Sales Management. From that we hired them to do the basic research to define our current situation and suggest alternatives.

Frank Lyn Research: They used an interesting approach of surveying user buying influences. It's broken into three parts. We did this by product line: ***The Breath of Line****;* ***Presence to the Sale,*** was it offered by in our case by our distributors; ***Hit Rate,*** if offered with other brands, was what percentage of the time did the end user pick our product.

The results varied by product group:

For Gas Apparatus, we had a broad line so rated high for ***Breath of Line***. However, our distributors did not offer our products as often than another, mostly Victor. However, where offered equally, we had a good hit rate. They used simple math and essentially multiplied the percentage of each. For example, if full product breath it was 100% and if it was shown 30% of the time the best you could hope for is 30% market share. Then multiple by Hit Rate, say 50% and you would have a 15% market share. Our issue with gas apparatus was ***Presence to the Sale***. It was about 30%. Our known market share fit their research and analysis.

For MIG, our overall market share was higher because of our strong filler metals presence. But our machine presence to the sale was much lower than 25%.

For Stick Welding, we had no products.

For Plasma Cutting, as might be expected since most small Plasma cutters distributors might carry used compressed air. Most their preferred industrial gas. Therefore, it did not get much sales attention.

Results, it was obvious from what we found that adding distributors, ***as some in the company wanted*** (*because we could now, no longer tied to their gas purchases*,) ***our Presence to the Sale*** would likely be no different or perhaps worse by making existing distribution, mad!

Boston Consultants: Knowing the Boston Consults concepts, that a company can't develop and promote all their products equally, we had a decision to make. The graphic below best defines their approach.

Considering our limited resources, we placed our product lines into these categories. Unlike some past thinking, all could not become Stars!

Gas Apparatus was clear, it was profitable but was treated by distributors as a secondary product and unseating the low-cost producer with ~50% share (Victor) would be difficult. If we cut price, they could beat us at that game! It would become a ***"Cash Cow."***

TIG, torches were high priced and now with "gypo" competitors and our power supply offering weak- overall a problem. Decided to see if we could buy some of the torches instead of producing. Developing and producing low volumes of power wasn't logical. It also supported little ongoing filler metal sales. It would be considered a "***Problem Child"*** and some products, even a ***"DOG."***

MIG, was a growing process and was a support for our higher market share, filler metal business. We had to devise a way to get a ***"Presence"*** in the Distributor showroom. The equipment was a bit of a ***"Problem Child"*** but MIG welding wire had good sales and most sold through distributors was a significant profit contributor, more a ***"Star."***

Plasma, was clearly a "***Star."*** The large machine torches supported our leading market share in cutting machines. We had a new patented small torch. The key with both was they had a very profitable wear, really a consumable torch part. Our patents allowed very high margins while the end user had significant benefits.

These Are the MIG and Plasma Strategies That Allowed Selling the Leveraged Buyout L-TEC Business in 4 Years at Double the Purchase Price!

Plasma: From when my old boss, Bob Gage had the first plasma patent in 1950's we were focused on high current machine torches that used Nitrogen plasma gas. The company was in the "gas business." We always had a strong plasma R&D effort. One of our engineers had developed a very innovative product. It doubled the life of a high current machine plasma torch electrode! Although it cost somewhat more to produce, using a small amount of silver, it allowed the user to operate their half million plus dollar CNC cutting machine twice as long before shutting down to replace the torch nozzle and electrode. It would not only allow more than double the consumable selling price and much higher profit, it would increase plasma cutting machine sales!

Another very cleaver engineer had devised a way to make an inexpensive electrode and nozzle for a low current air plasma machine that fit the distributor range of products. Sold consumables for ~$20 with ~$2 cost!

Somedays you also get lucky and my Plasma Product Manager, an old friend, told me he had an order from a company in Japan for 3000 small torches that used this new low-cost consumable nozzle/electrode. We could not find out what they were going to do with them. By luck, when at our first Essen Welding Fair as L-TEC in German I saw the torch being used on a small inverter plasma cutter! We had no inverter Plasma power at that time and no plans to develop one. It was very light and portable. I asked questions about the machine, but the fellow only spoke some German and Chinese! I found someone who spoke Chinese and English and hired him to translate! The machine was made by SanRex in

Japan! When researching the company found out we were purchasing MOSFETs from them. Turned out after some effort they admitted they made some welders and plasma cutters for customers, like Panasonic using their power transistors, BUT did not sell them themselves. I asked if we could get the 30-amp plasma inverter made I saw in Germany. I was clearly told, *"We will not share another's technology.* You MUST specify what you want." So, I wrote out a specification for a product similar to what I saw in Japan and had drafting make an external layout of the unit with an L-TEC logo.

Within a month we received a green machine with L-TEC logo including the torch we had sent them! That started a great relationship that ended when we sold the business to ESAB! Frankly, we made sufficient profit on the torch consumables that we could sell the machine at close to our cost and within months the consumable sales had a steady stream of income. In fact, in some promotions giving distributors a big discount for buying qualities we did just about that! Distributors had an incentive because it was an economic benefit to their gas customer or more important for them, gaining the gas business from their competitors gas customer!

What happened in our German business was interesting. Under UCC it was run as part of UCC Europe with little influence from the US and our R&D. They had a strong presence in Plasma cutting but designed their own torches. While their machine technology was good their torch design technology was fair at best. But they had some unique German safety rules to meet. I was put on their Board and convinced our Present that they should use our torches (*wanting the very high margin of our patented superior products, which we would share with them*.) Recall in one Board meeting they showed me a new power system and said our matching capacity torch did not meet the German "safety finger rule," re size of cup opening. Recall coming back and asking our very smart plasma engineer what it would take to redesign that torch. He said it would only take him a few days but to get it through the plant would take months! My first experience in dealing with the bureaucracy! I asked the Product Administrator to get anyone who would need to touch this project in engineering, drafting, production control etc. in a meeting. He did and I was amazed it was in our large conference room. I was expecting perhaps 6 to 8 folks and found ~25! I gave my speech about the problem and how important this was to the business and to prove our large plant could respond like they do in Germany- quickly. I asked them not to just put the required paperwork from their in-mail slot to their out BUT to carry it to the next person. It was done in 2 weeks not the usual 2 months. It was accepted in Germany and we were producing all torches and replacement consumables and allowing Germany to do what they did best- build power systems and sell.

In the 4 years it existed, L-TEC Germany increased their sales volume 3-fold! That was a big contributor to the business selling to ESAB at twice the purchase price.

MIG SYSTEMS: This was a more difficult area as Miller had a leading market share with the Millermatic 200 and Lincoln's SP200 was cheapest. We had the MigMaster 250, more capacity but more expensive.

But we were fortunate since Miller decided to replace their well-established, good arc quality welder with a single-phase SCR design. No way can an arc be as good with a single-phase input SCR power welder. Too much inherent power ripple. The Lincoln SP200 never had a good arc with argon-based gas, it was designed for Innershield where the arc quality was fair at best. Not even as good as when using CO_2 gas. We had the only lower amp, compact MIG welder (*with wire feeder in the power case*) with a great arc in Argon based gas!

In addition, The Lincoln welder looked cheap. They worked but were built with point to point wiring where our MigMaster had all internal wiring neatly in a wire harness. Inside the Lincoln welder was sprayed with a red "glyptal" insulating varnish. Looked difficult to repair!

We had about a 15% market share when we started a "Look Under the Hood" campaign! Our objective was to get this small industrial welder in distributor showrooms. Our goal was 25% market share matching our MIG wire market share. When a distributor bought a welder for their showroom they got a clear plastic cover that replaced the sides. There was a photo comparison display showing the inside of the Lincoln and Miller discussing our superior performance with the distributors *"preferred"* Argon based shielding gas.

Each MigMaster 250 came with a 10-pound spool of our exclusive AWS ER70S-7, 87HP welding wire. Where in Market Development we had difficulty getting wire from the material business "sold" to the equipment business- that was no longer an issue! There was only one business and my groups product managers-controlled pricing. Turns out the 44-pound spools tried were too heavy to be shipped inside the machine, so we had the wire plant made short weight, 10-pound sample spools. They were put on the wire spool spindle when shipped!

It worked! Distributors bought them and put them in their showrooms! It promoted ***"what they wanted,"*** very profitable Argon based shielding gas. The quantity needed to get the plastic sides and display was up to our Region Manager. In weak market share areas, it was less. In many it was with a baker's dozen price!

We achieved the ~25% market share in that size welder. We also increased the sales of ER70S-7 wire! It sold for a premium price and was mostly sold on 44 lb (20 Kg) spools. That was profitable for us and the distributors!

We were reporting sales though the NEMA Statistically Committee by AWS wire Classification. One quarter our ER70S-7 sales exceeded the very popular ER70S-6 that all welding wire supplies provided. We were the only significant manufacture producing ER70S-7! I decided to combine that volume with the ER70S-6 so not expose that high sales volume!

HIGH END MIG: We had introduced the first microprocessor based MIG Wire Feeder called the DigiMig and were in the process of designing an inverter power source and software combined with a variant of the DigiMIG Feeder. We coined the combo DigiPulse. The first easy to set Pulsed MIG system. It used 50,000 hz MOSFET transistors allowing a very fast rise time. John Deere research defined that fast pulse rise time reduced welding fumes by 50%!

We sold over 100 systems to John Deere and over 200 to Newport News Ship. As important, we advertised the Digipulse providing a high-tech image for L-TEC as an innovator!

ADVERTIZING: Of importance to our new company was our image achieved with advertising. We out-advertised all competitors and earned the back-cover position in the AWS Welding Journal. We typically had two full page color ads in that publication. In addition, WD&F magazine went to more smaller welding shops with distribution controlled by distributors! They paid for the right to define who would get the magazine and had put their selected ad on the back cover. We uniquely supplied both B&W and color versions of our new ad program! Although they could have selected any vendor's ads, our broad offering of new creative ads was usually picked!

Our new small creative ad agency come up with a good idea for gas apparatus. Although it was being treated as a "cash cow" we were the industry first to use a 4-color photographic packaging making an attractive box for our gas outfits and regulators! The market leader Victor was using one color printing on white box material, as we had. Ours was a glued 4 color photographic quality sheet bonded to a lower cost box! Turned out instead of the "bleached white carboard" printed by the box supplier we could use cheaper brown carboard that they just glued on the cover photo paper before die cutting the shape. Very little extra cost.

With no corporate overhead taking half the available advertising funds, I was meeting my commitment to our President of NOT exceeding what we have been spending as Linde and getting twice the impact!

When selling the business after 4 years for twice the purchase price (*it was required in 5 years per the terms of our leveraged buyout investors*) L-TEC had become a well-known name! Distributors were a big help displaying our MigMaster 250 and innovative 30-amp plasma cutting inverters in their Showrooms.

GAS APPARATUS: Although being treated as a ***"cash cow,"*** we tried several things to help increase sales without poking the market leader with a stick by cutting prices (Victor was the market leader with ~50% market share and the low-cost producer!) Although they probably made cutting nozzles at half our more complex cost, method, their financial position required selling at a high price. Cutting nozzles listed for ~$10 and distributor cost was ~$5. Our production cost was ~$1.50 and theirs probably ~$0.75! Was very happy playing *"the game"* at those margins! We used the suggestion of our ad agency and put gas apparatus outfits in a 4-color printed display box. It replaced the single color printed on white paper box that was similar to Victor. That was a help in getting distributors to display our product along with Victor who had high market pull.

Also tried the idea of the consultant we had hired when we first formed L-TEC. With his European background he told us in the US we were crazy launching marketing programs "Nationwide," try in 1 location first! A person I had worked when in Linde's corporate office had become President of the large, multistore distributorship, one of the few we had in North and South Carolina. Visiting their main store in NC I looked at the gas apparatus promotion display and said it needs to have many more outfits staked-up to get attention. He objected, as expected, to increased inventory, so I used a technique I learned and an early marketing experience, *"working part time for 7 years in a Supermarket while in high school and college!"*

I offered what the Eveready Battery person *"taught me"* one day when he was setting-up displays at our 14 registers. I questioned the amount of inventory (*my job was to sign for the volume!)* He said, *"Just sign here kid! You're only billed after 60 days for what is sold and in 30 days I take back whatever is not sold from these displays!"* I offered the similar terms and sent in several pallets of gas apparatus outfits at a discounted price if they would pass on the discount for a promotion. Gave 60-day terms and in 45 days, would take back whatever was not sold. At the end he said he'd send what was left over to another store and I delayed that invoice!

He also said if you provide the training help, I think my delivery truck drivers could sell gas apparatus as they have great relationships with the customers where they deliver oxygen and acetylene! Told my boss, the CEO that I wanted a fellow who was a technician in our gas apparatus engineering group as he did a great job in our distributor training courses. He and the Engineering VP agreed. He did such a great job that distributor President offered him a job! He turned it down but stayed in that activity for 6 months and the distributors gas apparatus sales increased by ~$500,000!

Submerged Arc: An interesting opportunity occurred that increased sales of SAW flux and wire. When we formed L-TEC the sales force was given a significant

bonus ***IF*** they increased territory sales 20% over prior year's sales. One very knowledgeable salesman found medium size SAW accounts in his territory. He was successful getting them to switch to our flux and wire. But unlike Lincoln who had warehouses in some 30 districts, we had only 2. But in our new organization the solution was easy compared to trying to convince a product manager, then the business segment manager he needed a few pallets of flux and wire close to his territory to support the new direct sale customers. (*Most distributors had no interest in SAW or sales and we and Lincoln sold most products directly*.) I made a phone call to the welding materials logistics manager and he located an independent warehouse! That salesman increased his territory 20+% in all 4 L-TEC years. That earned a ~25% Bonus, a "higher level car" and "recognition by his peers at a National Sales meeting!"

BOTTOM LINE SUMMARY

Linde had been an innovator in welding and cutting from the early 1900rds. They developed high productivity products and procedures for gas welding through the 1940's. The main "competition" was other industrial gas produces and Lincoln Electric (also Hobart) mostly promoting "Stick Electrode" welding.

***Linde & L-TEC** innovations through 1990*

1915 to 1930:

Leading brands, ***Oxweld, Purox, Prest-O-Lite*** *for* welding and brazing

1930's:

introduced and developed: ***Submerged Arc Welding***

1950's:

introduced and developed ***Heliarc TIG Welding;*** *invented* ***Plasma***

1960's:

leading developer of ***MIG and CG Electroslag Welding***

1970's:

introduced ***Argon Shielded All-Position Flux Cored Wire***

1980's:

developed ***Long Life Plasma Consumables; Small Inverter Plasma Cutter, DigiMIG, DigiPluse Microprocessor MIG***

Lincoln also started in the early 1900rds and sold engine and motor generators that were used for welding and the consumable, Sick Electrodes that they used. When MIG welding was introduced, perhaps influenced by of the long "competitive fight" between gas and electric welding, they resisted supplying products that used gas! As Don Hastings noted, they were concerned that steel mills could make solid wire cheaper than themselves. Since being a "low cost producer" was the key element in their business philosophy that is an understandable concern. In fact, US Steel tried!

In the early '60's it is reported their development folks, who were working on shelf shielded flux cored wire, told J.F. Lincoln they had a flux cored wire that worked with CO_2 shielding. J.F Lincoln supposedly said, ***"If I wanted a product that worked in CO_2, I'd have asked for that!"***

In fact, had J.F. Lincoln allowed the use of CO_2 it would have been of little help to the Industrial Gas Producers. CO_2 was not controlled by the industrial gas companies at the time as it mostly comes from chemical waste streams NOT from liquifying air and distilling Oxygen, Nitrogen and Argon!

An interesting note relative to the low-cost producer of flux cored wire; "Alloy Rods." They started with Arthur Bernard's 1954 patent for CO2 shielded flux cored wire coined DualShield. It was assigned to National Cylinder Gas in 1967 and later became "Alloy Rods."

While managing the Linde filler metal Lab in Ohio I was able to get about a third of my group funded by the gas businesses! The Argon product manager was located at corporate office in NYC. We had about 50% of the US & Canada Argon production capacity and it was so profitable it was not difficult to get funding for anything that might increase demand! Although we were a minor player in flux cored wire production, I convinced the Argon product manager if we developed flux cored wires that welded better with Argon based gases, Alloy Rods, who developed their DualShield cored wires to work with CO_2 because it was cheap, would follow!

It worked! We developed several flux cored wires that welded much better, especially out-of-position far superior than when used with CO_2. Alloy Rods, the market leader and low-cost producer, followed!

As Don Hastings clearly outlined, Lincoln waited too long to get into the MIG business for both solid and gas shielding flux cored wire. They were hurt financially by the initial overseas acquisitions such as the MG welding businesses in Germany. That was costly to close-down and pay for the bank debt it had required to purchase.

Yep, similar to how Chevrolet was able to compete with Henry Ford's, *"make the same simple, low priced, no frills design in only black,"* with colors etc.; we offered "features and innovations" customers appreciated!

After 1990:

The marketplace changed significantly after ESAB was bought by a UK based, financial company so it's difficult to compare companies beyond early 1990. It is now owned by a US industrial business acquisition company.

Lincoln had changed as well. They no longer follow a strict, the low-cost supplier philosophy with few new products etc. . That required the added discipline of "*only the CEO adding part numbers and pricing product!"* They have added thousands of new product part numbers and recently acquired many smaller companies. Even when they started selling TIG torches with all the variants, lengths, different consumables, they added may more part numbers than J.F. Lincoln or William Irrgang would every have allowed. All required sales forecasts, added inventory etc.

Miller Electric, who was a leader in MIG and TIG welding equipment, was purchased by ITW as was Hobart, Bernard MIG torches, Weldcraft TIG torches, Tragaskiss MIG torches, Smith gas apparatus, Jetline welding systems, and several other small companies. ITW had an interesting business philosophy of keeping business units small even though it meant redundant management, sales force, accounting, purchasing, engineering etc. However due to financial issues that has changed, and they are integrating some of the businesses.

Cost, Customers, Intelligence Also Factors

Lincoln Electric used methods to lower costs that had implications affecting customer, particularly distributor attitudes about them, that were not immediately obvious.

Also, Intelligence as Sun Tzu outlined in "The Art of War" was useful in developing end use customer/distributor programs to compete with the predictable responses of J.F. Lincoln's low-cost producer philosophy. Not the "spies" as Sun Tzu advocated but "inside information" and manufacturing details found by "carefully searching."

COSTS:

The Lincoln system required discipline to maintain his reduce the cost of exiting products rather than adding new unproven products. As he noted, new products diverted management attention. Born in 1883 J.F. Lincoln doubtless followed the success Henry Ford had with his philosophy of building cars with minimal changes and always producing them cheaper. In 1910 the Model T sold for $900, in 1919, $500. In 1925, 1.9 million of essentially the same car sold for $260! From 1914 when he introduced the assembly line to 1925 you could have any color "as long as it was Black!" It was inexpensive dried fast and was easy to apply.

1925 Chevy Ad with Green Car Superimposed. *They used a DuPont quality paint that came in many colors. Blue, Red etc. Even two tone paint with pin stips were often.*

From 1914 to 1925 Ford Offered the Model T in Only Black Lacquer!

It was cheap and dried quickly! They sold 1.9 million with the lowest cost $260 in 1925.

Chevy was successfully competing with Ford at higher prices offering customers more options and improved performance features. In 1925 Chevy offered cars painted with a higher quality DuPont paint that sold for ~$5/gallon. The also used 11-inch brakes on the rear wheels while Ford still used just a brake on the transmission! Where the Model T had a 20 hp 4-cylinder flathead engine, Chevy used an overhead valve engine rated at 26 hp.

Fords approach obviously influenced J.F. Lincoln.

Some of the cost discipline is evidenced by comments about part numbers and pricing. It was said only the CEO set prices or add a part number. In a NEMA statistical meeting, Dick Sabo, a Lincoln VP mentioned only two people at Lincoln manage prices. I said I thought only the CEO could price products and he replied yes but someone must bring him the coats and have the prices he sets implemented. That's me!

In the mid 1970's, our company had a project to start manufacturing stick electrodes that yielded another anecdote about ***part numbers*** relayed by our Welding Division President, Bob Conkling. (*Of Interest, I was managing the R&D welding LAB for shielding gases and welding wire, but my boss told me to stay far away from that project. I agreed with him, it was a foolish idea*!) Conkling was asked by a Corporate VP to see if Lincoln would supply us electrodes as an alternative to this venture. In fact, Lincoln hated Unions so much when there was a 3-week strike at our welding wire plant, Lincoln produced wire for us and put it in our boxes, so the thought of asking had merit. Bob visited Irrgang, the CEO at the time, and asked if they would be willing to brand label stick. Bob said Irrgang asked what specifically did we want? So, Bob listed most standard steel products, 6010, 6011, 6013, 7108, etc. Then he asked what sizes. Bob replied 3/32, 1/8, 5/32 and 3/16. He relayed that Irrgang went to a large loose-leaf book behind him, made some calculations and said we could not possibly handle that many new part numbers!

At the time Lincoln did not use computers! I recall our business folks would get new Lincoln price sheets that typically came out annually and see a product where we had an equivalent that was low margin hoping to see and increase and it would, but only $0.001/lb! It was foolish to irritate a customer with a new price that was only $0.001 more. Why bother? Pricing was obviously a simple formula of cost and a multiplier!

Another indicator of the manufacturing focus was their salesman training. All had to spend 6 months in the Factory working in production. They also had a specific project during that time, designing an old part cheaper- like the ubiquitous Lincoln stick welder case, referred to as a "tombstone." They presented their suggestions directly to the CEO.

Recall a person who I worked with in our R&D Lab when I started was working for a company Lincoln bought that built welding manipulators. He called me to ask for some prices for submerged arc equipment, which I gave him. He also wanted prices for various length interconnecting cables from controls and power supplies to wire feed motors etc. He said he was asking as a general question because when they buy Lincoln equipment, it comes hard wired with a fixed length of cables, no options, no plugs where our products used expensive multi-pin plugs that were offered in various lengths. Not the Lincoln Way. It's made this way, it's cheap and works! I always related their equipment to Holiday Inn mediocrity. Yep it works, was often half our price BUT had no extra features or flexibility!

CUSTOMERS:

The "Internal Confidential Lincoln Trouble Shooting Sheet" I was given by my first boss when I started in R&D provided an excellent insight to who they wanted as customers. It was what to do for when working with a SAW customer trying to solve a problem. Lincoln was known for hiring top notch field people. Most were engineers. Their high bonuses were well known. Where we had great sales folks all with degrees, we also had engineers in all 7 sales regions and an engineering manager to support the salesman. In Lincoln's case they mostly did both.

This simple 10-point list was obviously made not to just provide a procedure to follow but to have these "engineers" understand that they should not get involved in a difficult complex but perhaps fun project. They had to use judgment! Point 1 was check the Voltage, Point 2 check the Amperage. Point 10 was very clear. It said you have spent sufficient time let Linde have that account!

It remined me of my boss for 7 years prior to my full-time job in welding R&D. That was part time working in a large, 14 register supermarket during High School and College! Learned a great deal about customer service from my boss. In fact, as a ":part timer" managed the store on a Sunday when I was a senior in college. That way they only had to pay me time and a half versus double time for full time employees!

His name was Clayton Shepard and we called him Shep. Looked like Mr. Clean, tall and bald! Since many of us were part time students he had a simple statement about customer service. He said when a customer complains and expects a concession you have two choices, you can say *"Yes Mam or Yes Sir"* or call me. I will make all decisions who we want as a customer- NOT YOU. He had another, *"Be penny foolish and pound wise!"* If a customer came in with a dented obviously old can they wanted to return that was less than a dollar take it back with a smile and give them credit. We'll toss it out! If it's much more than a dollar, call me!

Yep, J.F. Lincoln was teaching his Engineer/Salesman the Pareto Principle. They should focus on satisfying 80% of the fabricator customers who would appreciate their low cost, Holiday Inn mediocrity but quality products and leave the fringe 20% with varying, more difficult to satisfy demanding needs to others! It the case of submerged arc products, we were the only other!

DISTRIBUTORS AS CUSTOMERS

J.F. Lincoln felt distributors in general do not serve a function for a user. He thought the only discount they earned was to buy in large qualities where Lincolns costs were lower and could offer a small discount and sell to fabricators in smaller quantiles at higher prices to have a modest margin. On 40,000 lb. truck load qualities of filler metals, the most economical for Lincoln to ship they often gave only a 10% margin, for some only 5%. Was surprised when Don Hastings said they were often called "Stinkin' Lincoln" he did not mention the low distributor discounts.

Another anecdote was told to me my by Charley Sanborn who had automotive supply stores in Ohio in the 1940s, 50's etc. when rebuilding engines etc. was common and included machine shop services. He said he approached J.F. Lincoln directly as he wanted to be a distributor and sell stick welding products. He said after the discussion he realized Lincoln had no use for distributors!

Don Hastings (*former Lincoln CEO*) in his Book, "Behind the Mask" stated as a salesman when he went to Cleveland to be trained there was no mention of dealing with distributors!

Lincoln salesman would often take larger fabricator business directly so distributors often would not bring them into an account. They had over 25 warehouses in their sales districts so could serve smaller accounts. We did not and typically gave a minimum of 20% distributor margins so were "liked more!" Our salesman would often say, *"Wish they hated us as much as Lincoln and bought a lot of our product as they do theirs!"*

INTELLIGENCE:

As mentioned, unlike Sun Tzu we did not use spies but gathered intelligence mostly from discussions with prior Lincoln employees and gathering existing info picked up in conversations. We had several managers who had been Lincoln salesman and were a source of the Confidential for "Lincoln Salesman Only" documents. There was a large binder. With the Industrial gas business, knowledge of all large accounts, their gas supplier and when their contract was up, was critical. We even hired an outside firm who would use women to call and help define contract dates when a salesman could not get the information. If a regional sales manager was out with a salesman and saw a large liquid gas tank he wanted to know the supplier and the contract date. If the salesman didn't know he best find out. We had similar input coming in trip reports or sent my mail. I traveled a great deal and would pick up good intelligence from our salesman, sales/engineering managers as well as customers.


Ferro Alloys used in stick electrode coatings and Sub Arc flux was purchased as cheap Lump by Lincoln where we purchased ground fine. Could have been an issue with some weld quality issues we found!

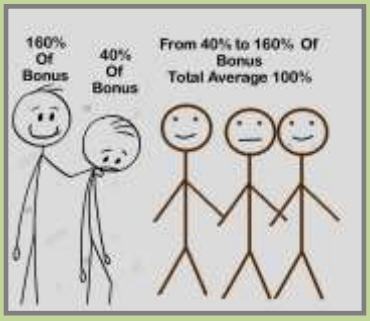
Lincoln had very secretive manufacturing systems. None of their raw materials used were labeled. The vendor had to send product in container's marked with only a number, no product or supplier name. However, our Corporation had a Division that was a leader in Ferro-Alloy manufacturer. We'd get a list of what they purchased periodically. Vendors were also a good source of information.

There is a story told about a fellow, whose job was to package stick electrodes that came through a hole from a room next door. One day when nothing was coming through he went into the next room to see why and was fired! That's one I validated was my neighbor who was the manager of Lincoln's motor business. I asked if he

could walk in the plant and must only go in his related work area. He said, "Oh, I could walk wherever BUT if Mr. Irrgang *(the CEO and his "boss")* saw me in a location that was not relevant to my motor business, it would surly come up in my bonus performance review and it could cost me a lot of money

When managing an R&D Lab located with our wire production plant in OH, although my boss was in NY I had an agreement with the plant manager that I would interview any hourly job applicants who had worked in the Lincoln wire plant 45 miles away in Mentor OH. Although reportedly for a possible job in our Lab I was digging for production info. Recall defining wire drawing speeds from now many 60 lb coils of 0.045 wire a person could package on a good day!

Wire drawing supply salesman were also a great source of info. Although Lincoln was very secretive found out a lot about their inline coppering system from a copper sulfate plating material supplier. He knew the temperature and time the wire had to be immersed. It was a much higher temperature than is normally used. He found out the tank length, at my request. We used batch coppering and their replacement copper product worked fine for our application. We evaluated the information in out Lab and duplicated the finished surface of the Lincoln wire product!



The Lincoln bonus system worked fine for hourly employees but there were some irritating issues for new engineers /salesman and exempt folks in general. If a manager had more than ~5 exempt employees reporting to them, they had to be forced ranked with one being at 40% and another 160% for bonus payout. That was multiplied by how well the company did financially that year. So, where the hourly folks got say a 90% of earned salary bonus, one of the manger's reports got 90% X 40% = 36% of their salary as bonus and another 90% X 160% =144%. The actual performance difference might be much less.

My neighbor, the senior manager in charge of the motor division worked directly for Mr. Irrgang. At his first year's performance review he got a lower percentage because his piers ate their lunch in their office while working and he went to their cafeteria! Heard similar stories from some salesman who left Lincoln because of their performance rating! Several worked for us and had left Lincoln for that reason. One said his boss told him, *"I have to force this ranking and new salesman always get a low rating because you're new."* J.F. Lincoln would no doubt disagree with that approach but it's not easy to tell someone they are getting only 40% for this or that minor reason when they did a good overall job.

I spent a lot of time supporting our Canadian company engineers and customers. Recall details from a person who had been with Lincoln as a salesman for many years. As typical of salesman, paperwork was not his strength. However, with Lincoln it was essential to getting reimbursed for his expenses.

As in the US, salesman did not "get a company car." They used their own and were reimbursed at a relatively low $/mile when documented as used for company business. The required documentation was interesting. For every sales call they had to write a visit report. Thought some requirements were very smart. They had to define what the objective was of the visit, what the result was AND what the next step would be.

The expenses, car etc. for that trip were placed on a form on the back of the sheet. No report (*not acceptable)* no reimbursement. ***IF*** they took a customer to lunch there had to be an objective and again the result reported. No customer for lunch no reimbursement. Receipts were required.

When managing a welding materials R&D Lab 60 miles from Cleveland I paid anyone of our group of engineer's metallurgists and skilled technicians the cost of dinner at the monthly AWS Section meetings, with a Lincoln employee often the Section Chair. A number of Lincoln employees attended. We would carpool for the trip to the meetings and I would also pay the cost of transportation for those few cars that were driven. The incentive to go was if you attended 60% of the meetings the company would pay your AWS Membership!

However, my instructions were not to sit together! If possible I recommend they sit with a Lincoln person and listen and ask questions. We would debrief at coffee break the next day! Recall someone mentioned they sat next to a maintenance worker. He said Lincoln was very strict about no smoking. In the mid 1970's that was very difficult to enforce. He said it was grounds for being fired! He said he was lucky as when welding in the plant he had arc curtains set up around him and could sneak a smoke. He also said he got a bonus for repairing a crack in an extruder in record time so it could be put back in service and not lose production. He finished the weld while the machine was operating!

Questions? Email: Jerry_Uttrachi@NetWelding.com

WA Technology

MIG Gas Saver System (*GSS*)

CUT MIG SHIELDING USE IN HALF
By Eliminating the "GAS BLAST"
and Resulting Gas Waste at Weld Starts
IMPROVES WELD START QUALITY

The Blast of Gas When You Pull the Trigger Pulls in Air Causing Excess Spatter and Inferior Welds
We Have a Solution:
www.NetWelding.com

How Much Gas Can Be Saved??

The best way to show the gas savings of our patented Gas Saver System (*GSS*) is with an example

from one of our industrial customers who tested the system then bought them for all 35 of his MIG welders.

A Texas Truck Box manufacturer evaluated the *GSS* system on a repetitive job, welding doors. With their standard gas delivery hose, they welded ***236 doors*** with a full cylinder of shielding gas. Just substituting their gas hose with our patented ***GSS*** maintaining the same flow settings they welded ***632 doors***! That's a 63% reduction in shielding gas use.

Weld Performance Improvement

A small shop owner, Al Hackethal

provided this feedback after he purchased a 3-foot *GSS* for his small MIG welder. Al Hackethal reported these findings:

"Well, I can't believe it. I never thought a hose could make that much of a difference. I had a small job that's been waiting for a while. The weld quality, and even penetration is considerable better. Almost no spatter! The weld seemed to be hotter and I turned my MIG down a notch.

Initially thought that my imagination had kicked in, but then realized that the gas I'm buying is actually working the way it's supposed to. Glad I found your website. This is one of the few things that really works better than any info could suggest. I understood the theory, though in practice I understood much better after the first couple of welds. Now I have better looking welds and almost no spatter, which means less grinding and finish work! In addition, the tip was cleaner after the job I just did.

This will provide savings in time, labor and maybe even consumables too. As a one-man shop there's never enough time for anything.

Al also has a TIG welder and bought one of our Leather Cable Covers. His email said this about it!

Oh, the leather wrap for my TIG hoses worked very well and fits perfectly. I'd just replaced the hoses and was looking for something to protect them that was better than the nylon wrap that's available around here. Now I'm "TIGing" again too, and much safer. It's good to know the coolant hoses are well protected. Much better than using a 300-amp TIG and then realizing that I was standing in a puddle of coolant, which is what recently happened. Can't pay the bills if I electrocute myself!

Thanks for making products affordable".

A Professional Street Rod Builder Had This to Say About the GSS*:*

They use a 250-amp MIG welder with built in feeder and a 6-foot gas delivery hose. With their standard gas delivery hose, the peak shielding flow at weld start was measured at 150 CFH, far more than needed and enough to pull air into the shielding stream. Air is then sucked into the gas stream causing inferior weld starts and possibly weld porosity.

With the *GSS* replacing their existing hose, the peak flow surge at the weld start was about 50 CFH and it quickly reduced to the 25 CFH setting. With the many short welds made and frequent inching of the wire, they now use less than half the gas and have better starts.

Kyle Bond, President, indicated a big benefit is the reduced time and effort changing cylinders less than half the time. He quickly saw the improvement achieved in weld start quality as a significant advantage! Kyle, an excellent automotive painter, was well aware of the effects of gas surge caused by pressure buildup in the delivery hose when stopped. He has to deal with the visible effects in the air hose lines on the spray gun in his paint booth! It's too bad we can't see the shielding gas waste as Kyle can the effects of excess pressure when he triggers his spray gun!

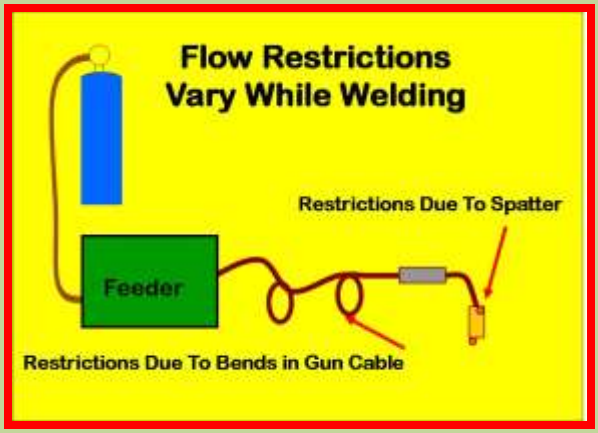
The paint surge is visible and creates defects unless the gun is triggered off the part being painted!

Kyle can manage the surge by triggering the paint gun off the part.

Unfortunately, we can't start our weld with the MIG gun off the part ! The *GSS* has a built-in surge flow limiting orifice that keeps the peak flow from becoming excessive. So, you not only save gas you improve your weld starts!

How Does The GSS Work?

Gas waste occurs every time you pull the MIG torch trigger even if it's only to inch the wire to cut off the end.



To keep flow at the preset level the gas pressure in the cylinder regulator will be between 25 and 80 psi. Flowgauge regulators (those with a flow calibrated pressure gauge) operate in this pressure range as well.) However, to flow shielding gas though the welder and torch typically requires 3 to 5 psi depending on restrictions.

Therefore, every time welding stops the pressure in the gas hose raises to the regulator pressure of 25 to 80 psi. That stores up to 7 times the hose volume of gas in the hose. This is similar to your shielding gas cylinder which holds about 150 times the volume of gas as the physical volume of the cylinder due to the high pressure!

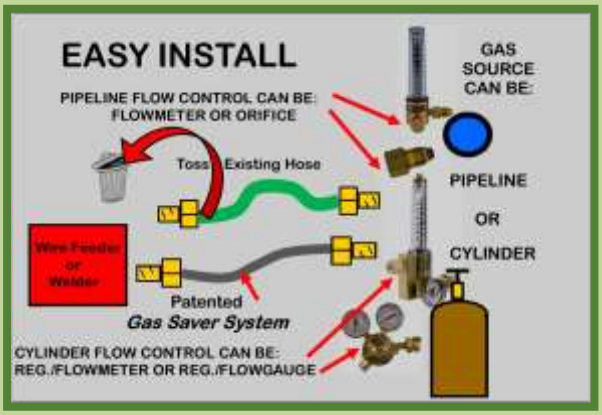
The patented *GSS* stores over 80% less gas then typical shielding gas hoses. In addition to the wasted gas (which you can hear when you pull the torch trigger) the high flow also causes air to be pulled into the turbulent shielding gas stream! This is like starting with the gas cylinder shut off! You have probably experienced that before when you forgot to open the valve!

It takes a short time for the shielding gas flow to return to a smooth less turbulent (laminar) flow even when the start gas surge flow reduces. That can take several seconds so when making short welds or tack welds you're not getting all the benefits of the shielding gas you're purchasing!

SUMMARY:

GSS can cut shielding gas use in half or more by having 80% less stored gas. It uses a surge restriction orifice built in welder/wire feeder end that limits peak flow avoiding excess turbulence for better starts. Note, the orifice does not limit any practical flow set on the existing flow control device. A controlled amount of extra shielding gas is still quickly provided to purge the weld start area of air. Welders appreciate the starts.

IT'S EASY TO INSTALL: Replace the gas hose from cylinder or pipeline supply to welder/wire feeder with our patented *GSS*. It is available in various lengths at *www.NetWelding.com* The inexpensive *GSS* will pay for itself in a few months of use. With Helium mixtures, the payback is measured in weeks.



Note: The Gas Surge restriction orifice built into the fitting at the welder- wire feeder end limits peak flow to a level that avoids excess turbulence for better starts. It reduces starting spatter. It allows a controlled amount of shielding gas to quickly purge the weld start area.

In DOES NOT SET the steady state flow. That is controlled by any quality gas flow control on cylinder or pipeline gas supply.

Questions? Email us at:
TechSupport@NetWelding.com

