

HISTORY of the CALLINS CAPACITOR

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“The devise that changed lives”



The Callins capacitor was manufactured by Callins Industries headquartered in Greenfield, Tennessee. However, its story begins before the founding of the corporation; and its history cannot be separated from its founder Fred Callins.

Fred Callins, electronics engineer, chemist, and industrialist.

Fred Callins is a classic example of a self-made man. Having been born into a rural West Tennessee farming family his early years were characterized by economic hardship and a determination to find a better way. He was the eldest son of Claud and Ivie Jean [Flowers] Callins a circumstance which instilled in him a virtuous character and the custom of productive work.

Much of his early formal education was obtained at a one room school which was common for that time and place. At that time, the obtainment of a high school education was the exception not the rule. Nevertheless, he completed Greenfield High School, class of 1941, where he excelled both academically and in athletics.

Shortly after graduation, he enlisted in the U.S. Army where he served until contracting tuberculosis, and was discharged as a medically disable veteran. During the recovery years from the disease, he developed an interest in radio electronics. This was a most difficult time, but he was not alone as he had married Velma Charles a Henry County native. She was a great source of encouragement and assistance for the remainder of his life. Also he had the strength and comfort of a strong bond with his parents and younger brothers. These relationships would later have an impact on the Callins capacitor.

As his health improved he resumed work and continued his education. In 1945 he established a radio repair service in the small town of Gleason. The equipment to be repaired generally was the battery powered, vacuum tube set which was common as home entertainment. In his quest to find a better way, he entered Bethel College as a part time student, and later transferred to Tri-State College to continue the study of electronics. Funded by the Servicemen's Readjustment Act of 1944 and a service disability pension of \$105 per month, he took his young family to Angola, Indiana. Fred completed the traditionally four year program in 27 months, and received the Bachelor of Science degree in radio engineering with honors August, 1951. Recruited on campus he started his professional career with the research and development team of the Delco Radio Corporation of Kokomo, Indiana. The starting salary was \$300 per month, less than the amount from the radio repair service. However, the years at Kokomo provided further skills and focused his interest toward research and development.

The year of 1954 held critical events for the future invention of the Callins capacitor. First having acquired significant skills in engineering and research at Tri-State and Delco, he decided to return to his naïve Tennessee and establish a consulting practice. Secondly, the Regency TR-1 transistor radio was introduced in 1954. It was the world's first commercially produced portable transistor radio, and was manufactured by Industrial Development Engineering Associates of Indianapolis, Indiana. The size of the TR-1 was a mere 3"x5"x1.25". And "finding parts small enough to fit together inside the case wasn't easy. Almost every component required innovation". [Invention & Technology Magazine, fall 2004, Volume 20, Issue 2] I.D.E.A. contacted the newly formed International Electronics Incorporated of Nashville for the development of miniature electrolytic capacitors. Each of these Regency radio sets utilized four electrolytics. They featured a tubular ceramic case with epoxy end seals, and used a paste electrolyte. While the units met the compact size requirements, they contained design flaws resulting in a service life of between four to six months.

In 1955 electronics and chemistry came together with a research collaboration between Fred Callins and Alvis Holladay. Doctor Holladay was chemistry department chair and a professor at Peabody College, Nashville.

Together these two great innovators developed viable electrolytics for the Regency transistor radio, and I.E.I. became one of the first United States companies to mass manufacture the new components for transistor application. "The company helped initiate an industry that lead to the computer revolution." [Vanderbilt Register, Vanderbilt University]

The development of the Regency transistor radio had a profound impact on the electronics industry, International Electronics Incorporated, and the future development of the Callins capacitor. Its magnitude of importance as an innovation resulted in it being placed on permanent exhibit at the *German Museum of Masterpieces of Science and Technology* in Munich. Also, the Regency became an exhibit at the Smithsonian [see figure 2].

In 1956 Alvis Holladay left Peabody College to pursue further development work at International Electronics. Meanwhile, Fred concluded his I.E.I. assignment, and started 1957 as the general manager of the new M.E.C. firm. The Miniature Electronics Components of Nashville was an Edward W. Carmack, Jr enterprise. [Microfilm AN 1179, Tennessee State Library and Archives]

To view the backdrop for the next major event in the future development of the Callins capacitor, consider Fred's situation in 1957. Sixteen years after the West Tennessee farm boy was a proud member of the Greenfield High School class of 1941, he had developed a rewarding career as an electronics and research professional. His steady progress had only been slowed, but not stopped, by the years of tuberculosis. Both professional and personal relationships were established, and he was an active member of a West Nashville church. The M.E.C. firm was developing well. In short, he and his family enjoyed a comfortable suburban life. Then in late 1957, he makes the decision to pull up roots and return to his small rural hometown of Greenfield, Tennessee. The population of Greenfield in 1957 was approximately 1743. [U.S. Census Bureau] So why was Greenfield selected to start an electronics business?

Callins Industries Incorporated, Greenfield, Tennessee: "Manufacturer of the World's Finest Capacitors".

Callins Capacitor

In this article the term "Callins capacitor" is used in a collective sense, and it means the set of capacitors invented and manufactured from 1957 through 1969. The first Callins capacitor was invented in the research and development laboratory by Fred Callins and his fellow research associates. These capacitors were the bedrock of Callins Industries, and were identified either by name **Callins** or the Electronics Industry Association code **1068**.

Callins was incorporated on December 10, 1957 by Fred and Velma [Charles] Callins. The phrase "*Manufacturer of the World's Finest Capacitors*" was both the firm's slogan and its mission statement. The corporation was financed by their personal savings and shares sold to initial investors from Nashville and Greenfield, Tennessee. The new firm was located in a former VFW Post building on East Broad Street in Greenfield.

As mentioned the initial components were of the miniature type which from an external view looked like those he helped design at International Electronics for the Regency portable transistor radio [refer to Figure 1]; but they were, internally, a totally new invention. The differences were the proprietary electrolytic formulas, the unique methods of establishing the oxide film, the construction materials, and the highly skilled assembly associates. For the aluminum electrolytic, its operating characteristics depend on those factors. The manufacturing of miniaturized components was challenging as this was an era before computer operated robotics. At this point in industrial history, the manufacturing of miniaturized components was both an art and a science.



Figure 1

Figure 1 shows the internal components of the Regency transistor pocket radio. There are four white cylinder shaped components with two of them located at the bottom. One is located on the left side, and one is located on the right. There is one located on the right side about half way up on the picture, and one turned horizontally nearby. These are the miniature capacitors from International Electronics, Nashville.

1958

The first full year for the fledgling firm was marked with both difficulties and achievements. First, the U.S. economy had gone into a significant recession which began in the fall of 1957. Industrial production had dropped by 14 percent, and unemployment increased to 7.5 percent. [Vatter, Harold G. The U.S. Economy in the 1950's, 1963] Secondly, the firm had a most modest budget; additionally, Fred had too “many hats he had to wear”. His two younger brothers, Junior and Thomas, had joined the company to manage the production activities, while Velma was responsible for the samples produced. The strong family bond mentioned earlier resulted in a company culture dedicated to the new firm’s mission statement, and a strong pride in the family name imprinted on each capacitor. Consequently the capacitors manufactured met very strict quality standards. Also new associates were required to face an accelerated learning of capacitor production methods.

The research and development laboratory occupied about one third of the facilities available space, and it had priority on the modest budget. The firm could be described as a specialty operation producing components to fulfill the unique circuit requirements of its customers. There existed a collaborative engineering relationship between Fred Callins and the engineers of the customers to be served. That is, he assisted them in the design of their circuits.

The new firm’s modest budget presented quite a difficulty. The vice-president and chemist could only be compensated with a small salary, and the hope his initial investment would have future value. Fred contributed his first two years of work in exchange for stock only, and Velma was compensated at the rate of \$40 per week. Fred’s two younger brothers “enjoyed” similar beginnings. Needless-to say, personal budgets were also lean. In 1958 the new corporation had a total of 16 associates.

Never-the-less, there existed intangible benefits and achievement. Fred was back in his beloved hometown near parents, brothers, and friends of earlier years. Now there was an opportunity to create jobs in Greenfield; and now you have the answer to the question “Why Greenfield?” posed earlier. By the end of 1958, a viable new operation had been achieved.



Figure 2

Figure 2 is a picture of the Regency transistor radio on exhibit at the Smithsonian, Washington, D.C.

1959

1959 provided a mixture of good news bad news for the Callins capacitor. The good news was an improving U.S. economy and the securing of the Arvin Industries account. There was a 4 percent increase in economic activity from the fall of 1958 through the fall of 1959. [Historical United States GNP, SignalTrend, Inc.] Secondly, the establishment of a significant relationship with Arvin Industries of Columbus, Indiana. Arvin was a highly respected brand which had been producing radios since 1927. And now Arvin is introducing a small transistor model.

The bad news for U.S. electronic manufacturers generally was the emerging presence of Japanese electronic products in the consumer market. Electronic products exported from Japan increased 250 percent in 1958 over 1957. [Made in Japan: Transistor Radios of the 1950s and 1960s] Moreover by 1959, there were more than 6 million Japanese transistor radio sets in the U.S. market. [Transistor Radios: A Collector's Encyclopedia, David Lane and Robert Lane 1994] However, the American consumer

at this time generally equated “Made in Japan” with “junk”. The rise in foreign competition was driven by importers who sought low price coupled with an attractive radio case. Yet there were exceptions to the “Made in Japan” image such as Sony’s TR-63 transistor radio introduced in 1957.

The Arvin account was a *milestone* for the Callins capacitor. Arvin certainly was not the firm’s first customer, but it was one of the first major buyers. The fledgling firm was now the electrolytic capacitor supplier for one of America’s most established radio and television manufacturers.

Arvin Radio division of Arvin Industries was based in Columbus, Indiana; and it had been producing home radio sets since 1927.[Indiana Historical Radio Society] The company produced a diverse line of high quality radios including the **Silvertone** brand sold by Sears. As a producer of high quality radios, Arvin expected high quality components from its suppliers.



Figure 3

Figure 3 shows an example of a 1960’s era Callins miniature capacitor in an amplifier circuit. This component has a 0.25 inch diameter with a length of 0.56 inches. A high degree of skill by the company associates at Greenfield was required to hand assemble the internal materials. This capacitor provided one microfarad of capacitance at 25 volts.

1960-1964

Callins Industries experienced a rapid growth during the years 1960 through 1964. The growth occurred from a larger portfolio of customers served, expanded line of components manufactured, and expansion of its manufacturing facilities.

Its impressive portfolio of customers was diverse in the type of equipment manufactured, and geographic location. This diversity in its customer base provided the necessity for Callins to broadly expand its component line. Having begun as a specialty manufacturer of miniature capacitors, it now produced a broad range of aluminum electrolytics, and it no longer was limited to the consumer electronics market. For example, Bendix used the Callins capacitor in its Century autopilot systems for aircraft. Its portfolio of customers included the following:

Arvin, Altec, Bendix, Emerson Radio, Fisher Electronics, Hammond Organ, Hewlett-Packard, Jensen Electronics, Kimball Electronics, Lowery Organ, Magnavox, Motorola, Peavey, Syracuse Electronics, USAF Arnold Engineering, and Zenith. This is only a partial list.

The increase in its customer base resulted in an extensive increase in its facilities at Greenfield and elsewhere. The former VFW Post building which constituted the entire factory in 1957-1958 was now used for the personnel department. A new building which contained the corporate offices and manufacturing facility [Greenfield] had been built just to the east of its original site. Also in March of 1964 a second location was added at the Shannon Industrial Complex at Shannon, Co. Clare, Ireland. *Callins International Ltd* contained a comprehensive manufacturing facility, and provided quality aluminum electrolytic capacitors for the European market. Its general manager was Patrick "Pat" Kneafsey. Callins Ireland engaged approximately 150 associates. Additionally, Callins rapid growth resulted in another firm being established in Greenfield which provided products and services to Callins Industries: Hilbilt Plastics Incorporated. Hilbilt was a custom injection molder of phenolic plastic products which provided the capacitor cases for Callins as well as other electronic component manufacturers.

In January, 1964 a major turning point in the history of Callins Industries developed. The company had achieved industry wide attention with its rapid growth and line of premium components. Consequently in the fall of 1963, representatives of the Whitehall Corporation [formerly Whitehall Electronics] approached Fred Callins with an offer to purchase *Callins*. At that time Whitehall was a Dallas, Texas based holding company with Lee D. Webster as its president and chairman. In December 1963 the decision was made by the Callins family and the other investors to accept the purchase offer. By the end of January of 1964 the negotiations were finalized and the sale was completed. The Whitehall Corporation, in a measure to protect its acquisition, required Fred under contract to continue as Callins Industries president and C.E.O. for a period of five years. That insured Whitehall of a continuation of management, research and development activity by Fred; and it prevented the possibility of any competitive operations from him.

That turning point resulted in a reduced rate of growth for Callins Industries. As a holding company, Whitehall used a large part of the operational profits from *Callins* to finance future corporate acquisitions for itself. Callins Industries now faced an impaired ability to reinvest in its own operations. Never-the-less, Callins Industries continued to grow its capacitor market share and facilities over the next five years.

1965-1969



Figure 4 International Electronics Incorporated. Tennessee State Library and Archives.

1965 through 1969 was a dynamic period for the U.S. economy and its electronics industries. The real domestic product [GDP] for the 1960s grew at an average rate of 5 percent [[American Enterprise Institute](#), Mark J. Perry August, 2013]. Technology in the electronics industries was developing at an accelerated pace. In 1966 the hand held pocket calculator was invented by Texas Instruments. The first manned moon landing occurred on July 20th of 1969. Foreign competition in the U.S. electronics market was intensifying. For example, the years 1965 through 1967 there was a 55 percent increase in the production of Japanese electronics. And in 1965 many American set makers opened buying offices in

Japan. In 1968 the American electronics industry charged Japan with the “dumping” of its electronics products into the U.S. market [Progress in the Electronic Component Industry in Japan, Yuzo Takahashi].

Japan, Inc., a term first used in the 1980s to describe the relationship between the Japanese government and Japanese private firms to gain international competitive advantage, was in full force. [Industrial Policy of Japan, Wikipedia, November 2014]

So how are these events related to the Callins capacitor? The demand for the Callins capacitor was derived demand. That is the demand for an electronic component is directly related to the demand for the equipment in which it becomes a part. And it is in this environment that Callins Industries continued to prosper. It did so by broadening its product line, strengthening its customer diversification, and expanding its facilities to meet the increasing demand for the Callins capacitor. Some of the notable events for this time period are as follows:

1965 Greenfield Engineering Company, Incorporated was the second firm established in Greenfield for the purpose of supplying Callins with products and services. G.E.C. custom manufactured low voltage direct current power supplies used in the production of the Callins capacitor, and it was the exclusive small quantity distributor of the Callins capacitor.

1966 International Electronics Incorporated of Nashville becomes a division of Callins Industries [refer to Figure 4]. IEI was the firm which produced the miniaturized capacitors for the Regency TR-1 transistor radio in 1954.

1966 Callins purchases a Piper Aztec 6 passenger aircraft for travel to its customers.

1967 Callins establishes another manufacturing facility at Hollandale, Mississippi.

1968 Callins Industries marks the 10th anniversary of its founding.

1968 The number of associates engaged in the manufacturing of the Callins capacitor reaches 850 not including the I.E.I. division.

1969 Original research and development of the “Callins capacitor” ended.

As stated earlier in the History of the Callins Capacitor, the term “Callins capacitor” meant the set of capacitors invented by Fred Callins and his research associates. These components were manufactured by Callins Industries headquartered in Greenfield, Tennessee during the period of 1957 through 1969. They became the bedrock for Callins Industries. However in 1964 Callins Industries was sold to the Whitehall Corporation, and Fred was placed under a five year contract which expired at the end of 1969.

At that time he was offered a continuing relationship with Lee D. Webster, formerly of Whitehall, in the capacity as a board member of the Dallas based conglomerate LTV Ling Altec, Incorporated. A most significant compensation package was offered to Fred, but it would require him to relocate from his hometown of Greenfield to Dallas. As a result, he declined the offer. After 1969 no further significant research was conducted at Callins Industries. The company continued the manufacturing of aluminum electrolytic capacitors, based on its bedrock, until 1984. Records of the Office of the Secretary of State, State of Tennessee show that the corporation was dissolved on November of that year.

Commentary

In a historical perspective, how can an electrochemical device be evaluated? Perhaps by its social and economic impact it may be evaluated. Also its related contribution to scientific knowledge or technical applications could be relevant measures. The Callins capacitor looks, frankly, like a most simple device. When inspected with the eye it appears both externally and internally to be quite simple. The Callins capacitor, in fact, was a most complex set of electrical and chemical relations which had to be measured with the aid of scientific equipment and mathematical formulas. These relationships gave it a collection of distinctive qualities which were highly valued in the electronics industries. In terms of social and economic impact, its manufacturing directly impacted at least three cities: Greenfield, Hollandale, and Shannon. Greenfield, Tennessee and the surrounding area experienced a social and economic revival which lasted over two decades. On November 8, 1967 Mayor J.W. Fore of the City of Hollandale, Mississippi wrote a letter to Callins Industries [Greenfield] describing the City's improvements in medical facilities, infrastructure, banking and retail activities, and level of employed persons as a direct result of the device. As for Shannon, the significance of the Callins International employment was the subject of discussion in the Houses of Oireachtas [Parliament] of Ireland. The scientific knowledge required to produce this capacitor formed a barrier for Callins Industries from the competitive market forces, and it advanced capacitor science. The technical applications it was suited for provided flexibility for engineering and added quality to equipment in which it became a component.

However, the success of the Callins capacitor was in large part the result of the hundreds of highly skilled and dedicated associates who made its production possible. This unique device was an American electronics icon for a quarter-century. The following images are from the Callins Historical Exhibit.



Figure 5 1966 Zenith Royal 51 Transistor Portable Radio



Figure 6 1966 Callins miniature electrolytic capacitor



Figure 7 1960's Zenith solid state Home Entertainment Center

The Zenith Corporation was one several manufactures which extensively employed the Callins capacitor across its entire product line of electronic equipment.



Figure 8 Examples of electrolytic capacitors manufactured by Callins Industries during the 1960's.

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