Bailey Controls Company

Celebrating 75 Years of Excellence

1916 - 1991

Ervin George Bailey

Introduction

"Invention is the conception of a new means to fill a need."

That thought, voiced by Ervin George Bailey in 1949, encapsulates the history of the Bailey Controls Company. Since its founding in 1916 as the Bailey Meter Company, Bailey has flourished by meeting the control needs of utilities and process industries in the United States and around the world. As global industries and the processes driving them have grown more complex, so have the technologies and solutions Bailey provides for monitoring and controlling them.

As the Bailey Controls Company celebrates its 75th anniversary in 1991, the company stands as an acknowledged world leader in innovative controls technology. Culminating with the development of NETWORK 90® and INFI 90® distributed digital systems, Bailey has provided its customers with state-of-the-art control and business support systems unparalleled in the industry.

Technology has changed over the decades; the precepts upon which E.G. Bailey founded his company have not. Bailey today remains a company committed to engineering excellence, committed to quality and, above all, committed to meeting the needs of its customers.

Prologue

Bailey Controls Company headquarters, Wickliffe, Ohio

Irvin George Bailey
1880 - 1971
Founder of
Bailey Controls Company

Bailey Controls Company
The First 75 Years
A Retrospective

Acknowledgements

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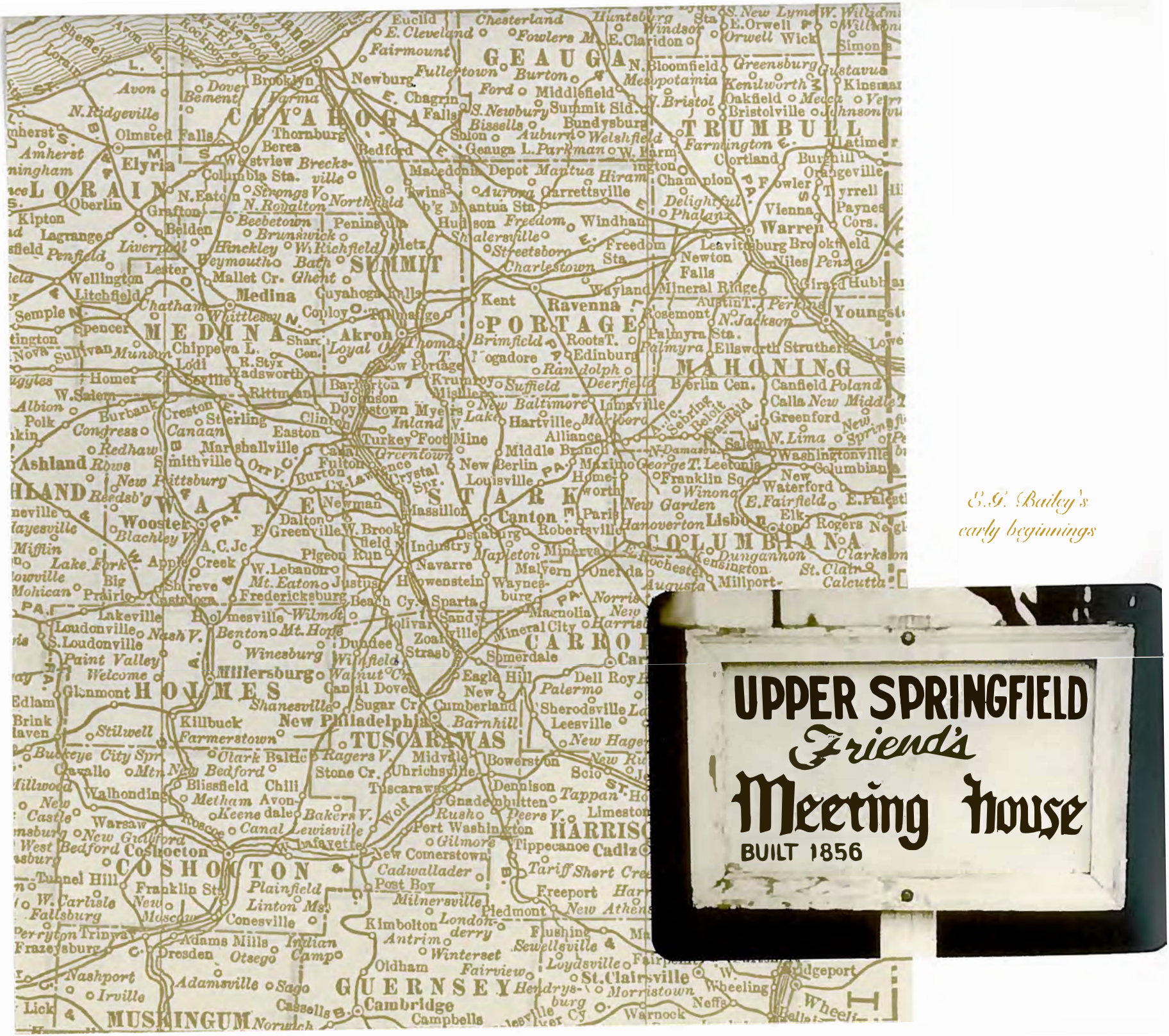
Thanks also to those many Bailey people – active and retired – who willingly consented to interviews and provided valuable documents and photographs used in the preparation of the book. Finally, thanks to Bailey's executive management team for their willing support of this project.

Note: Unless otherwise attributed, quotes from E.G. Bailey are from the archives of Lafayette College in Easton, Pennsylvania where Bailey was a trustee for many years, from the archives of the Franklin Institute in Philadelphia, and from Bailey family memoirs. We are grateful to Spencer Bloor of the Instrument Society of America, Research Triangle Park, North Carolina, who compiled the documents from Lafayette College and the Franklin Institute used here as sources.



E.G. Bailey's early beginnings

Chapter One

Bailey Today

Virtually every type of industry depends on controls to run safely and efficiently. Microprocessor-based systems enable plant operators to track hundreds of simultaneous process variables in the modern industrial plant. Armed with this precise information, the operator uses an equally complex web of controls to influence the processes – adding or taking away a particular ingredient, for example, or raising or lowering the temperature – to produce the desired outcome.

Since its founding in 1916, Bailey Controls has earned a reputation as a leading supplier of advanced controls, instrumentation, and computer systems throughout the United States and the world. As the 1990s began, annual revenues, including those from affiliate companies, were approaching $700 million. The company was ranked first for the number of distributed control systems in place domestically, and had the largest share – over one-third – of the digital process controls market in the United States.

Bailey directs a diverse network of marketing and manufacturing facilities from its headquarters in Wickliffe, Ohio, a tidy, working-class suburb 20 miles east of Cleveland. The company's large systems are assembled in Wickliffe, while smaller systems are assembled at regional process control centers throughout the country. Advanced electronic sub-assemblies are manufactured in Williamsport, Pennsylvania. Another operation in Carson City, Nevada – TBI-Bailey – supplies sophisticated liquid analysis equipment. Bailey operates 28 sales and service offices throughout the United States.

For much of the company's history, the majority of its customers were electric utilities. The development of distributed digital control technology allowed Bailey to broaden its customer base to include a variety of other industries, including the chemicals, metals and ceramics, energy management, food processing, petroleum, and pulp and paper industries. Typical of its worldwide acceptance and proven performance, Bailey is one of only two preferred suppliers of distributed control systems to the international chemical giant, E.I. Du Pont De Nemours & Co., Inc.

Bailey's international connections date to 1921, when it launched its first subsidiary, Bailey Meter Co., Ltd. of Canada. While the company has maintained a steady level of international sales for many years, an intense effort to increase overseas revenues began in the 1980s. Bailey today derives over 50 percent of its sales from abroad. With affiliate companies in Australia, Brazil, Canada, China, France, Italy, Japan, Jordan, Mexico, Norway and the United Kingdom, as well as sales representatives around the world, Bailey is well positioned to profit from the globalization of the economy.

The company has grown steadily since E.G. Bailey opened shop. Bailey was purchased in 1925 by The Babcock & Wilcox Company. It remained a subsidiary of B&W until both were acquired by McDermott, Inc. of New Orleans in 1978. Late in 1989, the Elsag unit of Finmeccanica Societa Finanziaria per Azioni, a high-technology Italian holding company, purchased Bailey. Finmeccanica is part of IRI Group, Italy's largest industrial organization and one of the ten largest corporate structures in the world.

In a move befitting the man and the company which have done so much to advance automation technology, Bailey's parent formally changed its name to Elsag Bailey S.p.A. in early 1991. An independent unit named Bailey Process Automation was formed, enhancing Bailey's financial position and access to global markets.

Bailey's strength also derives from the hard work and commitment of its some 5,500 employees worldwide. True to the spirit of E.G. Bailey, the company continues to stress the importance of training and education for employees at all levels. In addition to offering its own courses in control technology and application, Bailey offers employees reimbursement for courses taken toward advanced degrees.

The engine driving much of Bailey's growth through the last decade has been the distributed digital technology of Bailey NETWORK 90, and its successor, the INFI 90 system. Introduced in 1980, NETWORK 90 won immediate acceptance in the marketplace. Today, thousands of Bailey distributed digital systems are installed worldwide.

NETWORK 90 is a microprocessor-based, distributed digital process control system. At its heart is a series of multi-function controller modules, each capable of performing the complex mathematical operations needed to control processes in a utility or industrial plant. These modules are distributed physically to sites around the plant where varied processes are taking place, speeding communications and eliminating the potential single point of failure found in centralized computer systems.

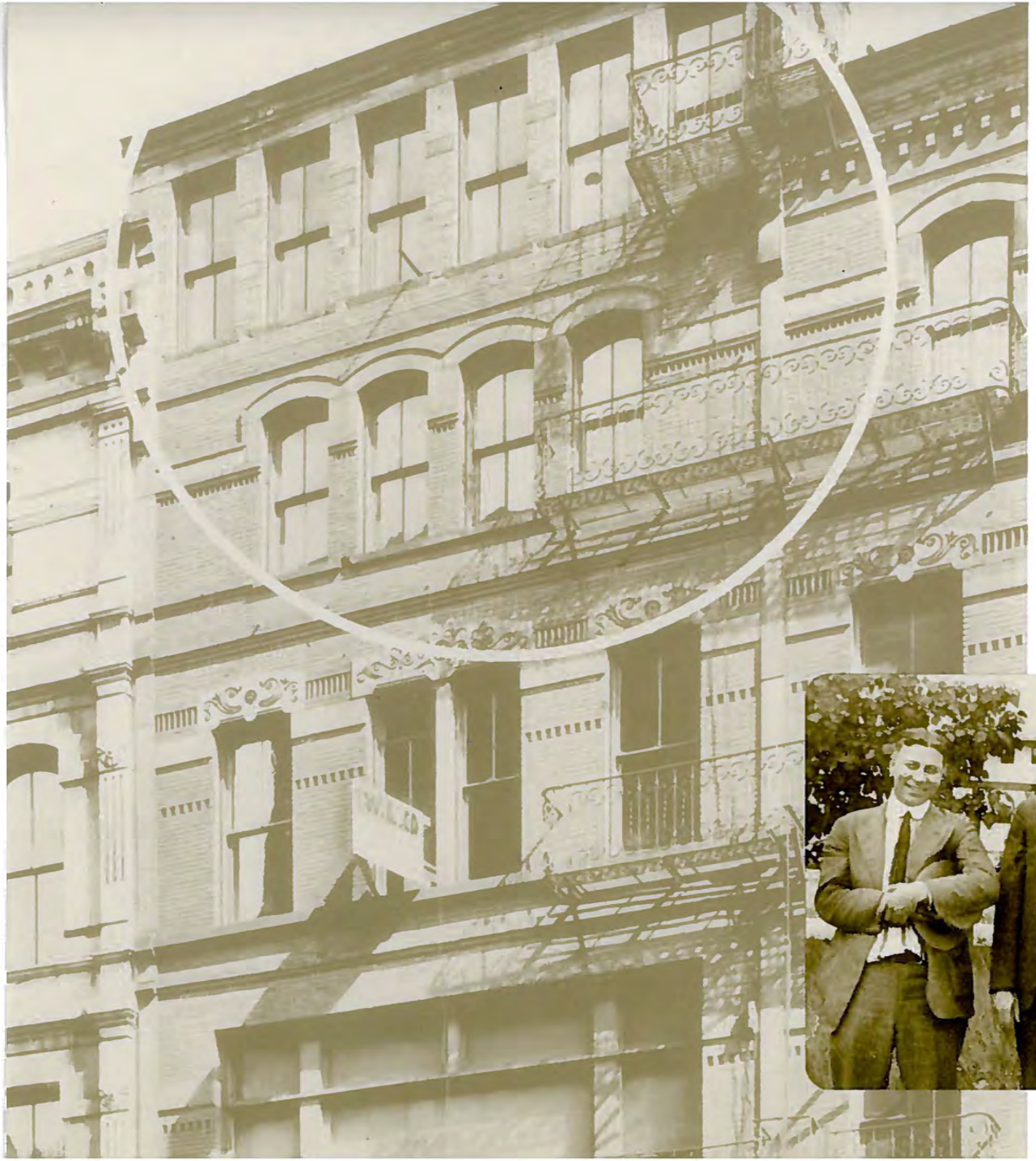
When the operator wants to make a change in a process – perhaps to adjust the pressure level or the flow rate – he enters the command at his control console. The system instantly performs the mathematical calculations necessary to carry out the command, and instructs the controlling device, such as a valve, how to accomplish the change.

NETWORK 90 has been successful largely because of its application flexibility and expandability. Previous control systems relied on large, complex central computers to perform calculations and operate controls. Upgrading or expanding these was time consuming and expensive, when it could be accomplished at all. With NETWORK 90, expanding the system means only adding new modules. All of Bailey's subsequent technology is compatible with the original NETWORK 90 architecture.

INFI 90, Bailey's Strategic Process Management system, can accomplish the same tasks as NETWORK 90, but it can also link up with a company's other business computer and automation systems, such as accounting, manufacturing automation, and management information systems. This capability enables the plant operator to make control decisions based not only on what is occurring in the plant itself, but on other critical elements that are happening to – and within – the company. The "process control" of yesterday has become the "strategic enterprise management" of tomorrow, launching for Bailey not only a new control system but an entirely new concept in control philosophy.

NETWORK 90 and INFI 90 are testimony to how the company has maintained the tradition established by E.G. Bailey – that of designing and building products and systems which place the needs of the customer foremost. To better understand that tradition, and how it still influences Bailey today, it is necessary to take a closer look at the history of an extraordinary company, and the extraordinary man who founded it.

Bailey Around the World



E.G. sets up shop with the aid of R.S. Coffin, left, and support of E.A. Hitchcock

Chapter Two

The Age of Invention: E.G. Bailey and the Marvelous Bailey Boiler Meter 1880 - 1915

Ervin G. Bailey was born Christmas Day, 1880, in the town of Damascus in Columbiana County, Ohio – coal country, some 20 miles from where Ohio, Pennsylvania and West Virginia come together along the Ohio River.

He was the fifth of eight children born to George W. and Ruthetta Butler Bailey. The Bailey family traces its American roots to 1682, when Thomas Bailey, a member of the Society of Friends (Quakers), left his native Bristol, England, to settle in Bucks County, Pennsylvania.

E. G. Bailey – he preferred his initials to his given name – was more than simply the father of the Bailey Controls Company. He was a brilliant inventor and engineer whose contributions to early combustion technology – and ultimately to modern power generation – are second to none. At the same time, he was a visionary businessman, albeit sometimes eccentric and intimidating, who has left his indelible mark on modern industry through the company he founded.

Historical marker erected in Damascus, Ohio, 1991

The great influences in E.G.'s life were incubated in his childhood. Among the most important of his early experiences was firing the boiler of his father's sawmill – his first encounter with combustion. Young E.G. had to use whatever fuels were at hand: coal from nearby mines, slabs of wood, sawdust, even corn cobs. It was a challenge to keep a steady fire going with such unpredictable and varied fuels.

The town of Damascus in 1991 commemorated E.G.'s contributions with an Ohio historical marker next to the old town school house. It was a fitting place for the memorial to be raised. E.G. had a deep love for learning, apparently inherited from his grandfather, George. According to *History of Bucks County* by W.W.H. Davis, George was known for his "zealous and useful efforts in behalf of education." E.G.'s own quest for knowledge manifested itself through his true calling – invention.

Before he reached his teens, he invented a typewriter that used a flywheel, similar in concept to those found in offices today. He also invented a device that enabled him to milk cows with his feet so he could read while performing the tedious chore.

Even these early creations fit into E.G.'s mature ideas as to the *why* of invention. In his 1949 James Clayton Lecture at the prestigious Institution of Mechanical Engineers in London, E.G. stated that one of the motives for invention is "the need to produce a product, perform an operation or process, or render a service either 1) with less labor, or 2) through the use of less, or more readily available, material or equipment, or 3) in less time, or 4) at less cost."

Bailey attended school at Damascus Academy, a Quaker institution whose aim, according to its brochure, was "the inculcation of Christian virtues and the development of a Christian spirit." Bailey was graduated in the class of 1898. That September, he set out for Columbus and the Ohio State University to obtain a degree in mechanical engineering.

The Bailey family was by no means wealthy. E.G. knew he would have to work his way through the university. He noted in a memoir that it had always been his intention to take five years to get his degree instead of the normal four. During his first year and a half at Ohio State, he took "outside work at odd jobs, including a grocery store, delivering to students living in South Dorm."

Then something happened that changed the course of his life. A brother (probably Edward, four years his senior), who had been working as a test fireman at the university's boiler plant, and as janitor in the mechanical engineering building, was forced to quit because of failing health. E.G. immediately applied for both positions.

One of the faculty members assigned to filling the spots was Embury A. Hitchcock, a professor of experimental engineering, who was later to become dean of the engineering school. In his autobiography, ***My 50 Years in Engineering***, Hitchcock wrote, "Perhaps the sheer audacity of this boy, applying for two jobs on top of his difficult school course and not deterred by what had happened to his brother, bowled us over.

Damascus Academy 1887

At any rate, he was hired, and he did his work very well, in addition to making a remarkable record at school."

E.G. later recalled that he fired more than 100 tests on the school's boiler – "partly for lab and thesis work, and also for special testing of different kinds of coal for coal companies who wanted to know more about the uses and values of their coal."

Bailey was also a student of Hitchcock's. During the coursework, Hitchcock made a point about combustion efficiency that he later explained in his autobiography: "The wise power-plant engineer tries to regulate his firing and drafts so that he is operating as nearly as possible with the right amount of excess air, and, consequently, the peak of efficiency."

According to Hitchcock, E.G. was particularly attentive to this point and asked, "Why, excess air would be an index of efficiency, wouldn't it?"

With that question, the idea was born that would later lead directly to the development of the Bailey Boiler Meter – and with it, the Bailey Meter Company, which 75 years later, as the Bailey Controls Company, would become an international enterprise.

Bailey quickly became a favorite of Hitchcock's. E.G. did much of his thesis work under Hitchcock, which consisted largely of road tests on the Hocking Valley Railroad.

Ohio State University Mechanical Engineering Lab, early 1900s

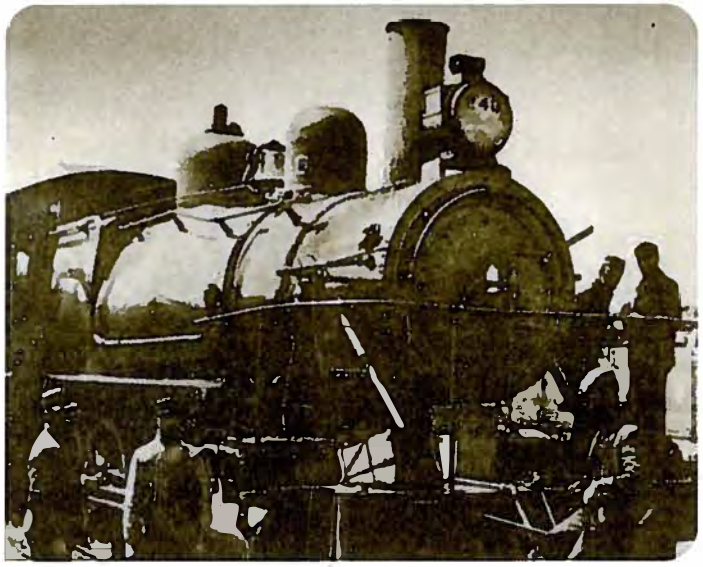
In the summer of 1902, another engineering professor, N.W. Lord, suggested that Bailey take his course in oil and gas analysis. However, the course was already full. So Lord asked his assistant in his private lab if he had space available. Finding no space there either, Lord had an idea. "I know the answer," Lord told Bailey. "You leave this course on your card, and one of these regulars will flunk, and I will give you the full year's work in two terms."

Lord was as good as his word. Bailey wrote later: "I received better than a regular one year's training, as Prof. Lord gave personal attention to me during the two terms. Also he had given me very much education and advice about sampling coal and other chemical and metallurgical work while firing the boiler tests for him and Prof. Hitchcock over the four years. It was very fortunate to have this outside work under two such good men."

And so the rural Ohio Quaker with the penchant for invention was graduated from Ohio State in June, 1903 as a determined young man with a bachelor's degree in mechanical engineering.

It seems inevitable that a man of Bailey's drive and intelligence should devote his career to coal and combustion. Not only did he come from coal country, but the economy of the industrialized world at the time ran on coal, and would continue to do so for many years.

E.A. Hitchcock, professor and mentor



Second from the left, E.G. on the Hocking Valley Railroad road test , 1902

Dr. Charles Jeffrey of Harvard, in his 1925 book C*oal and Civilization*, explained the importance of coal. "Of all the resources which are basal to our civilization, the possession and utilization of coal must be placed first. The elaborate housing and heating, the complicated systems of transportation, the huge and manifold manufacturing activities of modern communities – are based on the use of coal." Dr. Jeffrey even drew a correlation between the prosperity and birth rates of certain countries with their natural supplies of coal.

In 1880, the year Bailey was born, 75 million tons of coal were mined in the United States. By 1900 that amount had almost quadrupled to about 300 million tons. By the time World War I ended in 1918, American miners were producing 700 million tons.

At the same time, the number of electric utility generating plants – the bulk of the Bailey Meter Company's early customers – was also growing rapidly. In 1902 there were 2,250 plants in operation. Ten years later the number had grown to 3,520, and by 1922, to 3,722. It was into this new industrial world that E.G. Bailey embarked on his career.

E.G. went to work immediately upon graduation as a laboratory assistant with the Fairmont Coal Company, which soon after became the Pittsburgh Consolidation Coal Company. The firm was located in Fairmont, West Virginia, not far from where E.G. grew up. He also applied for junior membership in the American Society of Mechanical Engineers. Hitchcock was one of his sponsors.

E.G. quickly advanced through the ranks at Pittsburgh Consolidation. At age 26, he became head of the firm's testing department. He traveled extensively, helping firemen in boiler plants maximize the energy obtained from Consolidation's coal. One trip took him to Buenos Aires, Argentina, where his knowledge of steam locomotives helped him secure an order for Consolidation against competition from English and Welsh coal companies.

Bailey remained with Consolidation for four years. During this period, in the summer of 1904, E.G.'s heart caught fire and he married Carrie Huntington of Charleston, West Virginia.

Coal burning power plant, 1896

Like E.G., Carrie came from a Quaker family. They had met in Columbus, where she worked as a milliner. Carrie, who bore two children, Katherine and George, was the prototypical "woman behind the man." As E.G. became more and more successful through the years, much of his business was conducted at dinners and parties at home, first in Boston, then Cleveland, then Easton, Pennsylvania. Carrie was a superb hostess, seeing to every detail. The Baileys were devout Christians and eventually converted to Presbyterianism, the denomination of Cleveland's business elite during the early 20th century.

E.G. left Consolidation in 1907. Destiny beckoned in Boston. The noted Arthur D. Little had recruited E.G. from Consolidation to start a coal department in Little's Boston-based management consulting firm. The department tested various grades of coal and helped Little's clients improve the efficiency of their coal-fired plants.

Although Little's initial agreement with Bailey had been for two years, he asked Bailey to remain for another two years. Bailey declined. He had other plans. From now on, he would work for himself.

In the spring of 1909, he formed a partnership in Boston with H.D. Fisher and Hugh Calkins, a friend from his Ohio State days.

They called their enterprise the Fuel Testing Company, with offices at 220 Devonshire Street. The company's letterhead lists Bailey as "Mechanical Engineer" and Calkins as "Chemist." Its motto was, "Devoted to the Fuel Problem in All its Phases." It was a commercial fuel testing laboratory.

Between Pittsburgh Consolidation and the Fuel Testing Company, the experience Bailey gained was invaluable. The combined experience, he later wrote, gave him "the opportunity to take part in and observe the operation and testing of stationary, marine, and locomotive boilers, as well as a variety of furnaces."

More important, E.G. learned first hand the difficulty of producing an even fire generating a steady quantity of steam with the crude measuring instruments then in service. He was determined to do something about it.

Shortly after forming the Fuel Testing Company, Bailey began work on a device which came to be known as the Bailey Furnace Indicator.

This instrument could tell the fireman the thickness of his fuel bed by measuring the bed's resistance to air flowing through it. Fuel Testing began renting these to its customers in the spring of 1911.

The Furnace Indicator was a good start, but it did not address a boilerman's greatest need – knowing how much steam was actually being produced.

Bailey came to recognize this point vividly during an encounter he had with two firemen, Mike and Tim, while servicing one of his furnace indicators. He saw that Mike was conscientious in his firing work, and took pride in firing little and often so as to make good records on the indicator charts. Tim, on the other hand, was a big talker, and liked to throw in a great deal of coal in a hurry so that he could have time for a smoke and a chat. When Bailey tried to get Tim to match Mike's records, Tim replied, "I admit Mike makes the best records on the chart, but I'm making the most steam."

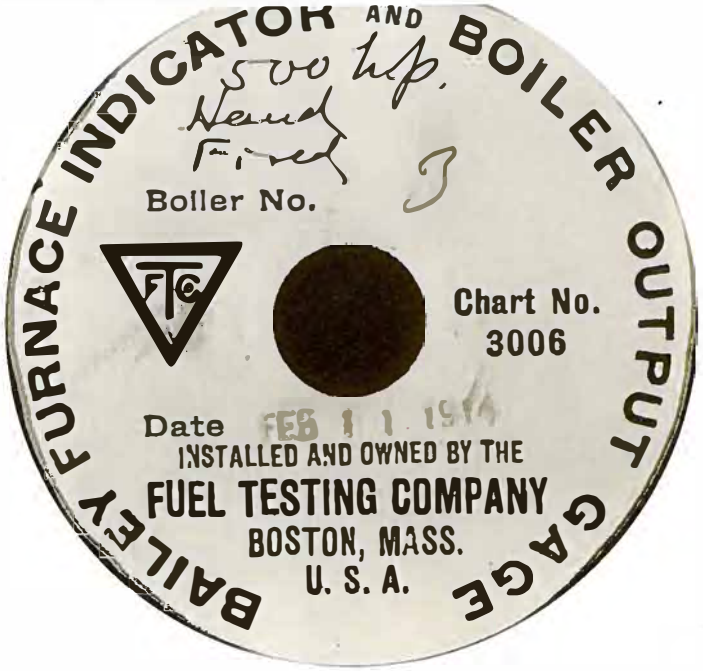
Bailey could not prove him wrong without a device to measure steam flow, so he set out to create one. After months of experimentation, he was successful. The Bailey Fluid Meter was born. But E.G. still was not satisfied.

Neither the Furnace Indicator nor the Fluid Meter were built to show the boiler operator – and show him simply – that combustion was taking place with maximum efficiency. This is what E.G. was after. It could be accomplished, he realized, by combining measurements of air flow and steam flow on the same chart. By adjusting the air flow indicator so that it would read the same as the steam flow, maintaining maximum efficiency would become easily achievable for boiler operators, who generally had no knowledge of the theory behind the process.

So E.G. set out to create yet another instrument – his magnum opus, the Bailey Boiler Meter. In an August 1915 informational brochure, he described his revolutionary invention:

"The main purpose of the Bailey Boiler Meter is to help the fireman get the best results from each boiler with respect to both efficiency and capacity. The Meter shows and records continuously three very important things, namely: (1) how much steam the boiler is making; (2) the rate of Air Flow through the furnace, or how much air is being used; and (3) the thickness or conditions of the fuel bed."

Erwin G. Bailey
Mechanical Engineer,
Fellow in Experimental
Engineering, Ohio State
University - 1903



Bailey Furnace Indicator, 1914

"The Steam flow part of this meter ... is recorded by (a) red pen drawing near the center of the chart, and reads in percent of boiler rating. The Air Flow part of the Meter is ...recorded by (a) blue pen drawing the record near the center of the chart. This Air Flow reading is not given in terms of cubic feet or weight of air, but on a basis of what it should be under the best regular operating conditions to get a corresponding steam output. That is, if the Air Flow reading is 120%, it shows that there is enough air flowing through the furnace to produce a steam output of 120% of boiler rating, provided the air is properly used so as to secure complete combustion without an unreasonable excess of air. In other words, the Air Flow and Steam Flow pens should always be together and show the same reading, no matter whether the load on the boiler is heavy or light. *So long as these pens are together they indicate that the proper amount of air is being used to generate the amount of steam as shown, and a separation of the pens means that the conditions are wrong and should be remedied.*"

Bailey's brilliant observation in Professor Hitchcock's class that "excess air would be an index of efficiency" had finally taken concrete shape. The Bailey Boiler Meter was an extraordinary breakthrough which put the finishing touch on the Industrial Revolution. There was now a means of actually measuring the energy that drove the economy.

Coincidental with the development of the Boiler Meter, scientists began to recognize E.G.'s achievements with his earlier meters. But not even his peers knew what advancements Bailey had in mind with the Boiler Meter. In March, 1915, the chief engineer of the United Gas Improvement Co. in Philadelphia wrote to the secretary of that city's prestigious Franklin Institute suggesting the institute investigate the Bailey Fluid Meter – the

steam flow device that preceded the Boiler Meter – for an award.

The institute must have followed up on the idea, because five days later Bailey wrote to William Bullock of the Institute's Committee of Science and Arts, advising him that Fuel Testing did not have any printed material describing its products, but did have some typewritten materials and other items – "which will give you an idea of not only our Fluid Meter but our Boiler Instrument which is in reality a steam flow, air flow meter and indicator giving the condition of the fuel bed."

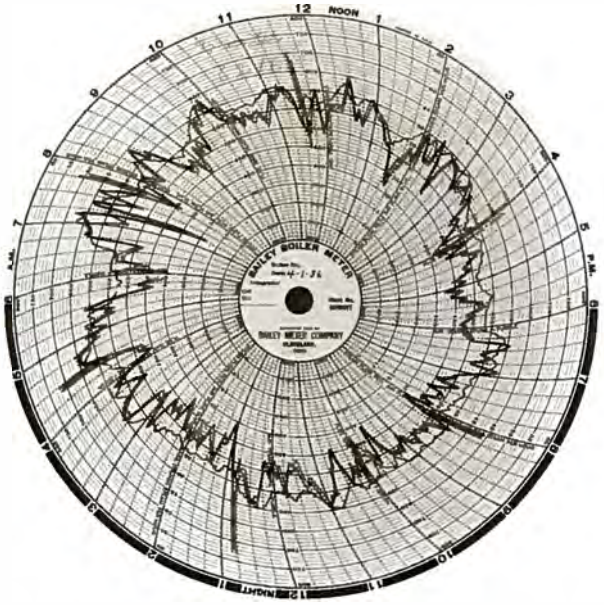
He went on to say the Fuel Testing Company had five such devices in operation at Harvard, and that the company was working on other, related instruments.

Bullock wrote again on April 9, probably to tell Bailey he had been nominated for an award for the Fluid Meter. Eleven days later, Bailey finally replied, somewhat impatiently, to Bullock's letter. "I have had no opportunity to give this matter further consideration," he curtly wrote, apparently annoyed that Bullock and the institute had failed to recognize the true significance of his current work.

E.G. chose not to pursue the award, stating "The Fluid Meter ... is of a minor importance in comparison with other similar instruments which are now being developed." He no doubt meant the Bailey Boiler Meter.

By the end of 1915 more than 100 Boiler Meters were in service, and Fuel Testing was being swamped with orders for more.

Each meter was custom made and required extensive adjustment and field testing. This limited E.G.'s ability to expand the company. So E.G. took stock and decided the time had come to standardize the manufacture of his meter and related boiler instruments, as well as develop a large-scale field testing operation, both of which ultimately took shape as his innovative Cadet Program. A man about to take his place among the giants of American industry, E.G. Bailey stood at the crossroads of his life. His decision – to start the Bailey Meter Company – would affect international industry for generations to come.



The Bailey Boiler Meter was an extraordinary breakthrough which put the finishing touch on the Industrial Revolution.

Bailey Meter Company: The First Thirty Years 1916 - 1945

The Bailey Meter Company officially opened for business January 1, 1916. It began modestly enough, with paid-in capital of $50,000. E.G. Bailey was president and majority stockholder of the closely-held company; Robert S. Coffin, formerly assistant secretary and assistant treasurer of the Boston Chamber of Commerce, was secretary-treasurer. Its offices were at 141 Milk Street, Boston, and it rented factory space on Pearl Street. Eighteen people were on the payroll. By the end of the year the company had sold 46 meters and related items, and showed a profit of $3,000.

In April, 1917, the United States entered World War I. The nation's industries geared up for war production. Energy efficiency and fuel conservation became top priorities and demand for Bailey products increased sharply. By the end of 1918, the company's payroll had grown to 65 and revenues soared to $300,000. More than 700 meters were sold that year.

Peace arrived late in 1918. Bailey soon after came to a major decision: He would move his fledgling company to Cleveland, Ohio.

The Downtown Arcade: built in 1890, is testament to Cleveland's prosperity

The decision was, like all of E.G.'s business decisions, flatly pragmatic. Cleveland was a growing industrial city accessible to the country's major markets. It also had a skilled and growing labor force.

Bailey's former professor, E.A. Hitchcock, whom Bailey had persuaded to join the company, says in his autobiography, "He (Bailey) wanted to be nearer the center of industry of the United States...Another consideration...was that in Cleveland he would have a better opportunity to obtain recent graduates of the Midwest engineering schools."

Bailey himself credits a customer of the company with planting the idea in his mind. He explained the practicality of the decision in a 1973 letter to Sam Dukelow, a retired Bailey executive. "The incentives for moving were largely due to the comments of Alex D. Bailey (no family relation) of Commonwealth Edison of Chicago, who was very well satisfied with our Boiler Meter, and asked, why we did not move to the Middle West, as Boston was too far for good service."

Though the move does not seem to have been motivated by sentimental reasons, it was a homecoming of sorts; E.G. Bailey was, after all, an Ohioan.

In the summer of 1919 the company opened its new headquarters in Cleveland at 2015 E. 46th Street at the corner of Euclid Avenue, above a car dealership, on the edge of downtown. It was not far from what had once been Cleveland's premier residential district, Millionaire's Row, during the halcyon years of John D. Rockefeller and his fellow industrialists. E.G., his wife Carrie, and their children, Katherine and George, temporarily settled into a boarding house. They eventually moved into a home on Coventry Road, later moving to Overlook Road, in Cleveland Heights, a residential suburb not far from the new offices.

Expansion was rapid. In the next few years the company opened district and branch offices in Boston, Chicago, New York, Philadelphia, Pittsburgh, Cincinnati, Buffalo, Kansas City, St. Louis, St. Paul, and Atlanta. A Canadian subsidiary, Bailey Meter Limited, opened in Montreal. This was the first step in what was to become an expansive international operation.

That same year, 1919, Bailey also made one of the most significant and farsighted moves of his career. He instituted a formal training program for the young engineers he recruited to his company. The Cadet Program was directed and taught at first by Hitchcock, who left after a year to become dean of the Ohio State School of Engineering.

The Cadet Program, as E.G. conceived it, dissolved in the late 1960s basically because the company's new engineers thought the term "cadet" was inappropriate. (The term was revived in the late 1970s and applied to sales trainees, then dropped again in 1981.) But during Bailey Meter's formative years, the cadets were the company's competitive advantage. Not even well-established corporations of the day were so pioneering.

Bailey Meter cadet class of 1952

Bailey explained the reasoning behind the program in a speech, "Building A Company With Young Engineers," delivered to The American Society of Mechanical Engineers in November, 1951, in Atlantic City. He said that the success of the Boiler Meter depended on testing each boiler for the most economical ratio of fuel and air supply. That meant training a great many engineers "so that each and every installation could be promptly and effectively serviced when initially placed in operation."

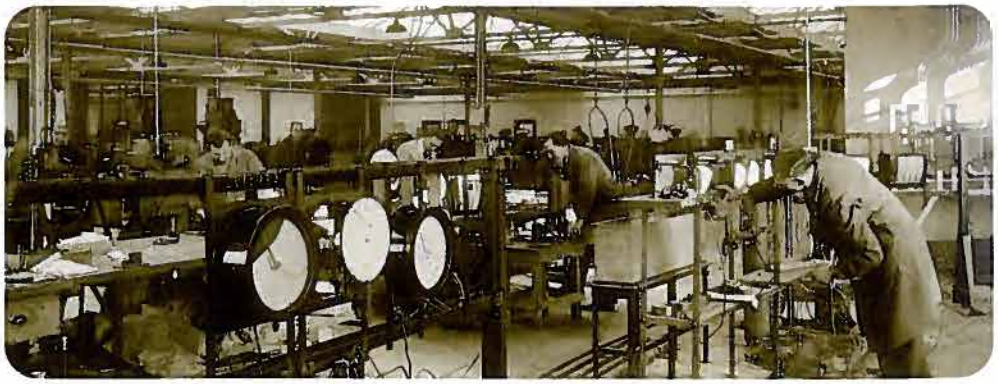
Bailey in his speech also stated a view that undergirded the structure of the cadet course and the entire company: "It is the duty of the employer to recognize the capabilities and ambitions of the employees and make available to them as much advancement in responsibility, remuneration, and position as can be justified by the prevailing circumstances and economics of the situation."

E.G.'s mission was to make engineers the backbone of his company. Clayton Barnard, a member of the cadet class of 1935 who later became vice president of international operations, succinctly explains E.G.'s reasoning. "Being a cadet gave us an intimate knowledge of what we were building and how it was built," Barnard says. "You got to know the company inside out."

Bailey and Hitchcock personally recruited the first class, which began work in June, 1919. The group consisted of 12 engineering graduates representing eight universities. Starting pay for the new hires was $90 a month. Seven college juniors were also hired to work during the summer.

The following year's class more than doubled in size to 25. The average class size was 17 during the program's first decade.

Cadets were rotated among 11 factory and three office departments before district office placement

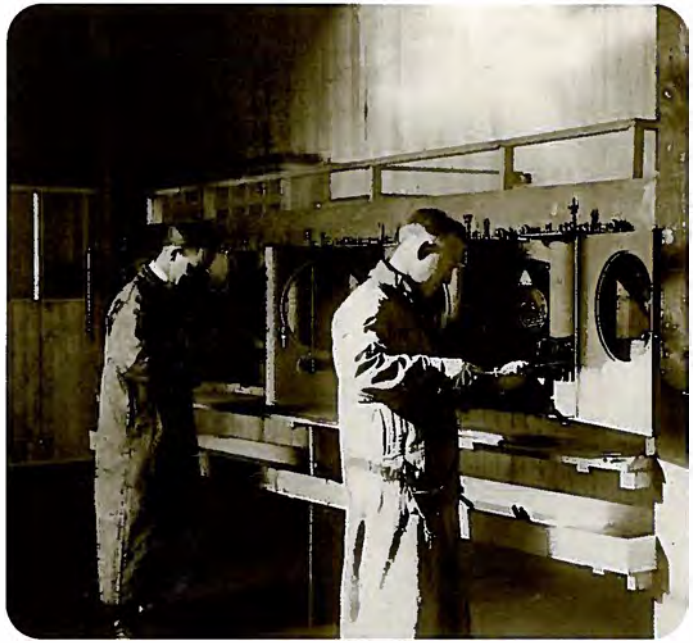


Course work was intense and wide-ranging. It consisted of lectures as well as on-the-job training. Cadets spent time working in each area of the company. For example, in the 1951-52 program, which Bailey outlined at his Atlantic City speech, cadets spent nine weeks in the Meter Calibration Department; in all, cadets were rotated among 11 factory and three office departments, and spent long weeks doing field service work. After that, they were sent to begin work in district offices.

The majority of cadets in those early years were recruited from the engineering schools and departments of midwestern universities such as Purdue, the University of Iowa, the University of Illinois, Case Institute of Technology, and the Ohio State University. Hitchcock in his autobiography states that the qualities he sought in a potential cadet were scholastic standing, mechanical ability, work in power plant subjects, proficiency in power plant subjects, proficiency in experimental laboratory work, and "personal qualities, such as initiative, energy, reliability, tenacity, cooperation, integrity, personality, appearance."

Hitchcock recounts how a subsequent head of the cadet program eliminated two schools he had initially visited in his recruiting efforts. "The engineering students at those two schools have a superior air and seem to be especially interested in coonskin coats and flapping galoshes," the new recruiter told Hitchcock.

"It is the duty of the employer to recognize the capabilities and ambitions of the employees and make available to them as much advancement in responsibility, remuneration, and position as can be justified by the prevailing circumstances and economies of the situation."



Boiler meter assembly at the Montreal factory in 1922

By 1925, 73 of the company's 280 employees – a fourth of the staff – were engineers. By the early 1930s that number had risen to 34 percent. By the time of E.G. Bailey's Atlantic City speech in the early '50s, engineers comprised about 15 percent of the payroll, while the average of most large companies of the day was a mere two percent. Moreover, virtually every top post in the company – and most mid-level ones – was filled by ex-cadets.

Former Bailey executives recall it as a no-nonsense program. "You were a full employee of the company. But if you screwed up, you were gone," says Sam Dukelow, a 1941 cadet who went on to become manager of power generation marketing. "You worked right alongside longtime employees. There wasn't really any sort of hazing, but there was more of a `Let's see what this guy is made of' attitude.

"The company was a tightly run organization. You'd punch a time card every morning. There were two 10-minute breaks, one in the morning and one in the afternoon. Other than that it was heads-down work."

Dukelow recalls hearing about strict, though unwritten, rules forbidding female employees – almost all of whom worked in the manufacturing area – from dating cadets. It was enforced over the young women by an older, unmarried woman, whom Dukelow describes as "a mother superior type." The reasoning she gave to her charges was that they, being only high school educated, were of a different class than the college educated cadets. "Of course, you couldn't really stop it," Dukelow adds. "In fact, a lot of the fellas found wives among the girls."

In testament to the success of the Cadet Program, two years after its advent Bailey Meter introduced a multi-pointer gauge – the first instrument to indicate more than three related drafts and pressures on adjoining scales for easy comparison. The following year, Bailey installed a Feed-Water Flow-Air Flow Meter on the S.S. *President Harding*. This was the first recording instrument installed on a marine boiler.

A year later, in 1922, the company reached a turning point in its product history. While it is true that E.G. had proven to be an extraordinary businessman, he was still first and foremost an engineering genius who invented, literally, in his sleep. E.G.'s daughter, Katherine Hoyt, recalls her mother saying E.G. would wake up in the middle of the night exclaiming "I've got it!", evidently having worked out some knotty mechanical problem in his subconscious. And so it was that in 1922, E.G. perfected a system whereby fuel and air supplies to a boiler would automatically adjust to the steam pressure of the boiler while the boiler still ran at maximum combustion efficiency.

Ivanhoe Road office during the early 1910s

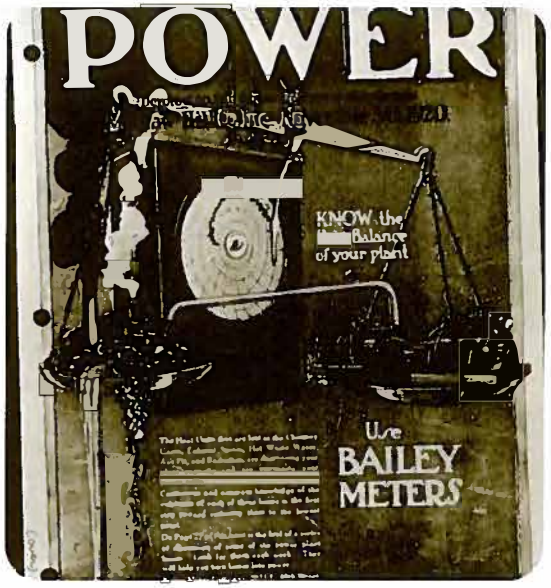
To use a simplistic analogy, the system was similar to cruise control in an automobile. When a car reaches a hill, the control mechanism senses the increased load on the engine and automatically increases the gasoline flow, enabling the car to continue traveling at the pre-set speed.

The Bailey Automated Control System, as it was called, was complicated and expensive, and not a resounding commercial success; that success would come later with Bailey's pneumatically operated control system. Nevertheless, the early control system was a primitive precursor of the complex control systems that make the company a leader in its field today.

While World War I and the nation's growing prosperity in the 1920s contributed to Bailey Meter's growth, most of the credit – as the invention of the control system shows – belongs to the engineering and business genius of E.G. Bailey himself.

Bailey was relentlessly devoted to his work and virtually tireless in performing it. His daughter Katherine Hoyt, who lives with her husband Harry in Milton, Massachusetts, near Boston, recalls seeing little of her father while she was growing up in the suburbs of Boston and Cleveland.

E.G. did, however, take time for his family on Sundays. Katherine recalls that while growing up in Boston, her father would take the young family out for long walks on that one day of rest – walks that sometimes became so arduous that the children, Katherine and her brother George, would become exhausted. E.G. and his wife would walk home with the children cradled asleep in their arms.



This cover began a series of ads run by E.G. Bailey in Power Magazine in 1920

E.G. had other diversions. He loved to read. He was also enamored with photography and motion picture technology. Many of his inventions stemmed from this avocation. He would take photographs of the insides of boilers that were actually fired up so he could capture the processes on film and study them closely. "He would get so close to the fire that his fingernails would actually get burned," says Harry Hoyt.

"He was always working, day and night, except on Sundays, when he would take long walks, or long drives after we moved to Cleveland and finally had a car," Katherine wrote in a memoir. "After he moved the Bailey Meter Company to Cleveland he worked even harder, often being reminded to eat by Mr. Coffin."

"He was the `big boss,'" Hitchcock wrote in his autobiography, "but he had clung to the habit of hard work that distinguished him in school. Office hours for him were from seven thirty in the morning to eleven at night, day after day."

The long, demanding hours and his failure to eat regularly eventually took a toll on E.G.'s health, keeping him out of the armed forces during World War I. He developed ulcers, which Carrie treated by making him ingest pure cream. "She kept him from being, you might say, dedicated to ruining his health permanently," says Harry Hoyt. Indeed, Bailey lived to be 94 years old.

E.G.'s drive for absolute precision in his products spilled over into his personal life. His family tells the story of how he would time his morning departures from the family's home in Boston and walk to the streetcar so precisely that the car would arrive at the stop exactly when he did, enabling him to board the car without breaking his stride.

Cleveland: Gateway to Midwest industry, 1921

1930s research conducted at Ivanhoe Road plant

He was equally fastidious in his personal appearance – well-groomed, trim, hair combed straight back. His countenance was stern, and while he was notoriously impatient with people not in tune with his vision, he was generous and warm to his friends. Although his company made him a wealthy man, his frugality is legendary among his surviving family members."He was frugal because he started out with nothing – but he was very generous with other people," says his granddaughter, Virginia Kurtz.

There may have been another reason for his driven nature. In December, 1921, E.G.'s and Carrie's only son, George, a mere teenager, died suddenly from an attack of appendicitis.

The family was devastated. It may well be that Bailey threw himself into his work even more as a way of overcoming the grief stemming from George's death. "He worked so hard that it took him a good six months to finally realize that George was gone," says Harry Hoyt. "He didn't talk much about it, none of us did, because we were so dreadfully upset by it," says Katherine. "He really liked children."

Katherine wrote in a memoir that her father said he worked so hard for humanitarian reasons. "He wanted to make the world a better place for his fellow man." But she knew the nature of her father's obsessive genius better than E.G. might have suspected: "Actually he loved to work and couldn't help from inventing and thinking of ways to save coal and other fuels," she wrote.

The Bailey Meter Company reflected E.G. Bailey's mission. In 1925 the company inaugurated an employee newsletter, *The Bailey Record*. From it emerges a portrait of a resourceful and hardworking enterprise. The first issue, dated May 15, announces the arrival of L.W. Heller as general engineer, the appointment of G.C. Barnaby to manager of the Kansas City office, and the dates for the company's annual sales-service conference (August 19-22).

The *Record* also contains brief accounts of the company's newly-formed basketball team (it went 13-10 in its first season in the Industrial Basketball League), results from the company-wide bowling league (the third floor team won), and the first victory of the company baseball team in the Industrial League.

The July 15 issue describes the outing for the cadet class of 1925 at Mentor Beach along Lake Erie east of Cleveland. There were 15 junior cadets and 13 seniors in that class. Among the latter group was Paul.S. Dickey, who would go on to become president of the company.

That same year, 1925, marked yet another turning point in Bailey Meter's history, perhaps the most significant up to the end of World War II. E.G. had been approached by The Babcock & Wilcox Co., a boiler manufacturer in Barberton, Ohio, near Akron, about the possibility of B&W buying the Bailey Meter Company. Bailey, who still held the majority of the stock in Bailey Meter, accepted.

Bailey Meter at the Euclid Avenue location, circa 1920s

Babcock & Wilcox, a venerable company founded in 1867, was progressive and dynamic. It sold boiler equipment to electric utilities and wanted to offer its customers Bailey Meter's products and engineering know-how. In essence, B&W wanted E.G. Bailey. The Cadet Program, which was the actualization of E.G.'s engineer-driven philosophy, was about to pay off in spades.

According to his daughter Katherine, E.G. felt Bailey Meter could do great things with the considerable resources of B&W behind it; Babcock & Wilcox was a public company in the throes of dramatic growth. Bailey's decision to sell his privately-held company was yet another pragmatic and shrewd business move. Steam-generation technology was rapidly changing – E.G. himself was a major agent of that change – and competition was becoming fierce.

General Electric, for instance, had also entered the flow meter business, but with a formidable difference. G.E.'s meters operated electrically rather than mechanically, like Bailey's. As a stand-alone company, Bailey Meter essentially had reached its growth and innovation limits.

Not so E.G. He struck a deal by which he would remain president of Bailey Meter, and also become president of the Fuller-Lehigh Company, which Babcock and Wilcox was in the process of acquiring. Fuller-Lehigh was a maker of coal pulverizing equipment in Lehigh, Pennsylvania. Bailey also acquired a large block of B&W stock as part of the deal. (By the time of his death in 1974 he was B&W's largest individual shareholder.)

Bailey's board of directors met for the last time as an independent company on December 17, 1925. The board passed a resolution acknowledging the company's past success and future prospects. "These are due not only preeminently, but almost entirely, to the ability and personal efforts of President E.G. Bailey," declared the resolution. The board praised E.G. for his foresight, technical expertise, his energy, persistency, ingenuity and inventive instinct. It was a fitting send-off.

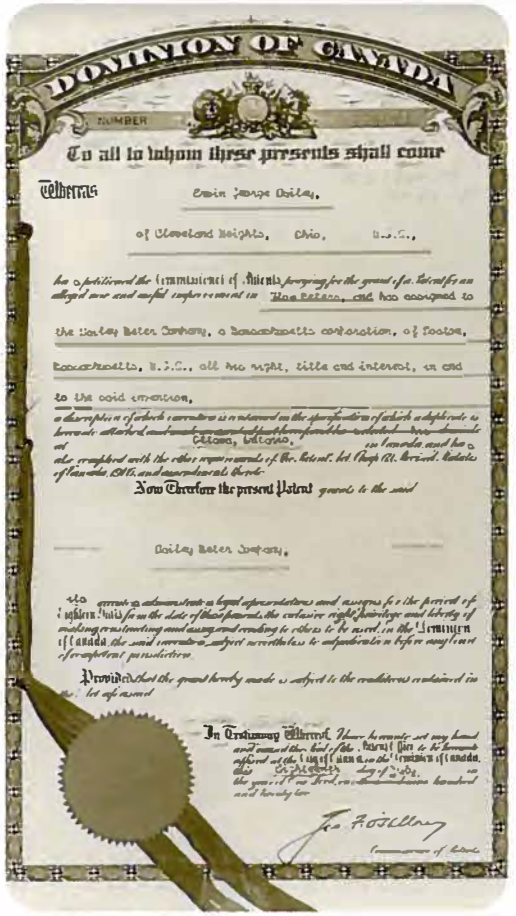
With the deal struck on January 1, 1926 – ten years to the day from the founding of the Bailey Meter Company – E.G. and his family moved to Easton, Pennsylvania, in the eastern part of the state. He moved at the behest of B&W, which needed him to turn around the Fuller-Lehigh

Company. E.G. no longer resided in Cleveland, but as president of Bailey Meter he continued to have a major say in the company, frequently visiting from his new home. He chose Easton because it was roughly mid-way between Lehigh and B&W's New York City offices. True to his life-long interest in education, he became a member of the board of trustees at Lafayette College in Easton.

In April, 1927, E.G.'s foresight in aligning himself with Babcock & Wilcox paid big dividends. Bailey Meter acquired the flow meter business of General Electric, thus further solidifying Bailey's leadership in the metering field.

As part of the transaction, Bailey Meter was reorganized, with General Electric acquiring one-third of Bailey's stock from B&W. A formal announcement sent to customers, vendors and the media stated that E.G. was to be president of the reorganized company and R.S. Coffin would be vice president of administration and finance. R.E. Woolley, formerly with General Electric, would be vice president of engineering and sales. H.M. Hammond would remain sales manager.

The significance of acquiring G.E.'s technology was explained in the April 15, 1927 issue of *The Bailey Record*. "The most important addition to the line of equipment sold by the former Bailey Meter Company is of course the electrically operated flow meter. This type of equipment permits the installation of the indicating and recording elements at a considerable distance from the point where the flow is being measured. The mechanically operated types of meters have always been handicapped in this regard."


DOMINION OF CANADA

NUMBER

To all to whom these presents shall come

Whereas Edwin George Bailey,

of Cleveland Heights, Ohio, U.S.A.,

has petitioned the Commissioner of Patents praying for the grant of a patent for an alleged new and useful improvement in Flow Meters, and has assigned to the Bailey Meter Company, a Massachusetts corporation, of Boston, Massachusetts, U.S.A., all his right, title and interest, in and to the said invention,

a description of which invention is contained in the specification of which a duplicate is hereunto attached and made a part hereof, and has complied with the other requirements of the Patent Act Chap. 61, Revised Statutes of Canada, 1906, and amendments thereto;

Now Therefore the present Patent grants to the said

Bailey Meter Company,

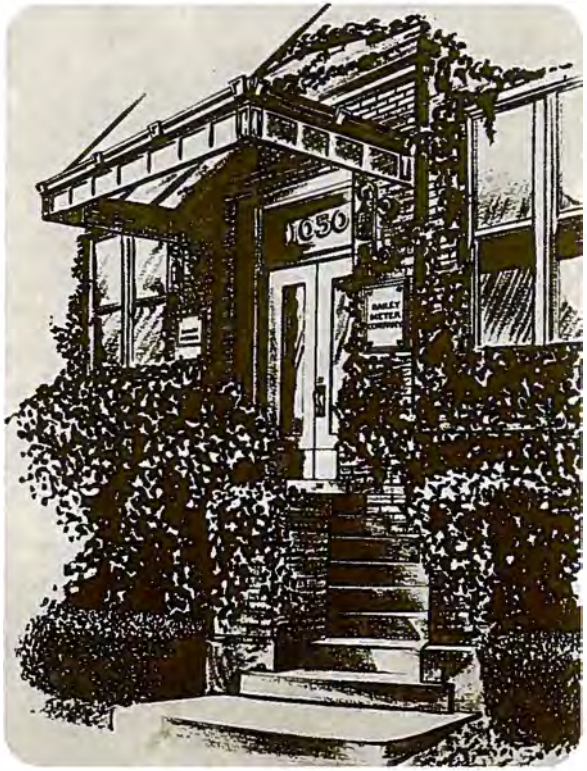
its successors, administrators, legal representatives and assigns for the period of eighteen years from the date of these presents, the exclusive right, privilege and liberty of making, constructing and using and vending to others to be used, in the Dominion of Canada, the said invention, subject nevertheless to disputability before any court of competent jurisdiction.

Provided that the grant hereby made is subject to the conditions contained in the said Act as amended.

In Testimony Whereof I have hereunto set my hand and caused the Seal of the Patent Office to be hereunto affixed at the City of Ottawa, in the Dominion of Canada, this 25th day of July, in the year of our Lord one thousand nine hundred and twenty two.

Commissioner of Patents

Early Flow Meter patent, 1922



Ivanhoe Road facility, 1930

Bailey Meter, as a subsidiary of Babcock & Wilcox, was now an industry giant. Befitting its status, the company in 1927 moved to new, larger quarters at 1050 Ivanhoe Road in Cleveland's industrial Collinwood neighborhood, formerly the site of the Coburn Machine Tool Company. A newspaper account of the move put the cost of acquiring, renovating and expanding the two-story office building and one-story factory at $1 million – an enormous sum in 1927.

John F. Luhrs, a cadet in the 1926 class who later became Bailey Meter's attorney, clearly remembers the facility. There were two buildings. The first floor of the front building housed the executive offices, with an office reserved for E.G. when he came to town. The second floor of the front building housed the design department. The rear building – the larger of the two – was the factory.

The January 15, 1928 issue of the *Record* describes Bailey's new home. "It is one of the finest plants in Northern Ohio. That is not only our opinion, but that of all who have seen it. Good light, plenty of room, easy flow of materials and splendid communication facilities characterize it... In a short time this plant is going to require a larger volume of work to keep it busy."

Vice President Bob Coffin used the occasion of the move to issue an eight-page manual reminding employees of company rules and procedures. Company hours were 8 a.m. to noon and 1 p.m. to 5 p.m. weekdays, and 8 a.m. to noon Saturdays. Employees were to have punched in earlier and be at their desks, ready for work promptly at 8 a.m. and 1 p.m.

Monthly bonuses were paid for consistent and prompt attendance, but the bonus was docked each time the employee was late.

The company promised to keep night work to a minimum. "But we expect that if and when it may be necessary to do so, everyone will exhibit a hearty spirit of cooperation," said Coffin's manual. Employees working after 5 p.m. were responsible for turning off lights. Because of the large number of phone calls going through the switchboard, employees were asked to limit personal calls to the lunch period, to make them only when necessary and, of course, to be brief.

Employees were told to limit at all times unnecessary noise and moving around the office. "It distracts the attention of others who are working." Desks and files should be kept neat. "Indiscriminate hanging of calendars or other wall decorations is not permitted."

Bailey Canada, 1921

Safely ensconced in its new offices and factory, Bailey Meter continued to grow. By 1929 it was selling 3,600 meters and control units per year and employing 500 people in America, the majority of these in Cleveland. The company opened a wholly-owned subsidiary office in Australia, Bailey Meters (Aust.) Limited. The Canadian subsidiary opened a branch office in Winnipeg, Manitoba to service western Canada.

John Luhrs says Bailey's competition were the Republic Flow Meter Company, Leeds & Northrup, and the Smoot Control Company. "But Bailey was considered to be the clear leader, at least in technology," Luhrs says.

A Three-element Feed Water Control was also introduced that year. This device kept the water in a boiler drum at a constant level, by linking the amount of water coming in to the quantity of steam being produced. Because it responded quickly to changes in steam output, it allowed utilities to use smaller boiler drums. This reduced the costs incurred with larger, high pressure boilers.

Then in October, 1929, in the midst of Bailey Meter's new era of explosive growth, the stock market crashed, precipitating the Great Depression.

The Depression's effects were some time in coming to Ivanhoe Road, however. In March, 1930, the *Record* published a letter to employees from Vice President R.E. Woolley, in which he states that orders for the first three months of 1930 were 28.5% ahead of budget, and up 46.5% over the same period a year earlier. "The Board of Directors have very wisely decided that we should augment the anticipated expansion of our regular business by taking on new lines of apparatus," Woolley said.

1931 Bailey calendar card

Things started to change by the summer. In July, the *Record* reprinted a letter to *The New York Times* sent by a Bailey salesman in Schenectady bemoaning the spreading "depressionist" mentality in the country. By October, a salesman on business in the United Kingdom wrote the *Record*: "This depression surely will end one of these days and when that happy time comes, the fruit of hard work done now will be reaped." In a pep talk to employees a year later, Coffin acknowledged, "The year 1931 has been a most difficult one both for the Company itself and for each of us as individuals."

E.G. Bailey himself discussed the Depression's effects on the company in his 1951 address to the American Society of Mechanical Engineers. The company laid off 40 engineers (he doesn't say what the total employment reduction was), and the salaries of those remaining were cut. From 1931 to 1935, sales were less than half of the 1927-1930 rate. Monthly starting salaries for engineers dropped from $135 in 1930 to $118 the next year and $90 in 1933. By 1940 they had climbed back to only $120.

Needless to say, the financial hardship took its toll. Dick Richardson, a 1930 cadet, recalls his monthly starting $135 salary being cut three times. By the end of 1931 his monthly earnings were $106. "It wasn't easy getting by on that, I can tell you," he says.

Richardson was posted to the Los Angeles office in 1933, from which he also covered Arizona and New Mexico. "When we went to Arizona we would sometimes sleep in the car to save money," he recalls. On one occasion, while driving from Phoenix to call on a copper smelting plant near Prescott, Richardson found himself in a one-horse town called Cottonwood. Since the town's only motel had no dining room, and Richardson had hardly any money, he bought cheese and crackers at the market and ate that over the weekend.

As business slowed to a crawl, the company used the time productively – again testament to E.G. Bailey's acute business savvy. Much of the company's product line was overhauled. New products, systems and services were brought to market.

Of particular significance was the introduction, in 1932, of the pneumatic control system, successor to the old Bailey Automated Control System. It was more easily manufactured than the older control system, thus making it more affordable to power plants and, unlike the earlier system, a great commercial success.

Four years later, completely automated combustion control systems were installed for the first time on ocean-going and Great Lakes steamers.

The S.S. Panama begins its maiden voyage with Bailey instrumentation, 1939

Bailey's employment of women increased dramatically during the Second World War

The pneumatic control system was so successful, in fact, that it remained Bailey Meter's standard system until solid state electric analog controls and digital logic and computer systems were introduced in the late 1950s and early 1960s.

In 1939, the company brought out an Oxygen Recorder, used to measure the oxygen content of gases emitted from boilers. By knowing how much oxygen was being given off, the boiler operator could judge more precisely how much oxygen was needed to obtain the most efficient combustion in the furnace. The Oxygen Recorder was electronic, one of the first instruments of its type.

Buoyed by the new technology and its many applications – and the early rumblings of another world war – 1940 found Bailey Meter recovering from the worst of the Depression. Five thousand square feet of floor space were added to the Collinwood factory in the latter part of 1940, and 9,000 more in early 1941.

That unforgettable year of 1941 was significant for two key reasons. First, it marked the 25th anniversary of Bailey Meter, which company officers acknowledged by sending 25 roses to E.G. He called them "a very suitable token of the personal friendship and loyalty which have existed between a few of us for the entire period, and all of us for whatever period of time we have been working toward a common end," according to the *Record*.

In December, 1941, America entered World War II. Even before the official declaration, Bailey Meter was gearing up for the effort. The March 15 *Record* listed the 16 members of the technical staff who were

Army reserve officers and said, "It is expected that these men may be called up for active duty in the near future." Six men from the Cleveland office had already been drafted, but deferments had been obtained for several others with special engineering expertise needed for military applications.

In short, demand for Bailey products and services was at a premium as the nation prepared once again for war. By September, 1941, employment at the company had reached 764, an all-time high. Bailey meters and controls quickly became an integral part of the war effort. They were used in plants that manufactured weapons and munitions. Because the meters and controls increased boiler efficiency, they increased the cruising range of warships. Bailey instruments even helped eliminate boiler smoke on the ships, making them less visible to enemy planes and submarines.

In fact, virtually all of the company's efforts during 1941-45 were directed to a nation at war. Most of Bailey Meter's work had the highest military priority. This meant Bailey had no trouble getting the necessary material and getting it quickly.

As the war progressed, more and more Bailey men enlisted or were drafted in the armed forces. The September 15, 1944 *Record* reports that 317 employees had gone to war, four of whom made "the supreme sacrifice."

In many cases, those men who left the factory and office floor were replaced by women. This was common in plants and factories all over the United States during World War II. By March 1, 1943, more than 100 women were working in 13 company departments.

At the height of the war effort, 1944, the company's Board of Directors elevated E.G. to chairman, and Bob Coffin to president. It was in many ways merely a formality, for E.G. continued to exercise a good deal of influence over events at the company. "He used to come by unexpectedly and tell us we were doing everything wrong," jokes a former executive.

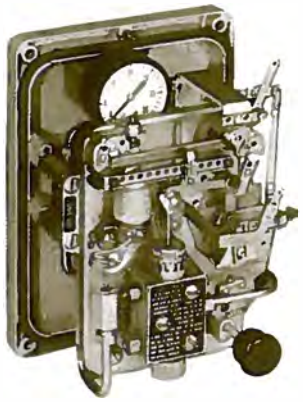
The following year brought the end of the war, and with it, America was set to embark on a long period of peace and prosperity. So, too, was Bailey Meter.

America was set
to embark
on a long period
of peace and prosperity.
So, too,
was Bailey Meter.

Bailey prospers from the post-war technology boom

Chapter Three

Postwar Prosperity: Bailey Meter and the High-Tech Revolution 1945 - 1970



The quarter century following World War II was a golden age for the Bailey Meter Company. The population grew rapidly with the start of the baby boom, which was to last well into the 1960s. Suburbs sprang up overnight around the nation's big cities. These new communities meant millions of new homes, as well as schools, factories, shopping centers and office buildings.

All this development translated into a seemingly insatiable appetite for electric power. Production of electric energy, measured in millions of kilowatt-hours, skyrocketed from about 271,000 in 1945 to 629,000 a decade later, and 1,200,000 by 1965. Of special interest to Bailey Meter, the proportion of that power generated by steam plants grew from about 66 percent to more than 83 percent during the period.

Through the far-sightedness of E.G. Bailey and his associates, the company was poised to take full advantage of the demand for its products and services. The training of young engineers in the cadet program and promoting them to positions of responsibility meant the company had a high proportion of engineers among employees at all levels. Thus, the company could meet and profit from the challenges of the technological innovations in the industry – nuclear power, solid-state electronic circuitry, and computerization.

The U.S.S. Nautilus in New York Harbor

The immediate post-war years also brought growing recognition to E.G. himself. In September, 1947, he was elected president of the American Society of Mechanical Engineers. Two years later, he gave the prestigious James Clayton Lecture to The Institution of Mechanical Engineers in London. (He previously had been awarded honorary membership in the Institution, one of only five Americans to be so honored.) His address, "Invention and Sifting Out Engineering Facts," is a primer for his views on the invention process and the benefits of inventions to mankind.

In 1951, E.G. won the John Fritz Medal, a joint award of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Institute of Electrical Engineers, and the American Society of Mechanical Engineers. *The New York Times* said the medal went to E.G. "for outstanding engineering achievements in the field of combustion and distinguished service to his fellows in advancing the engineering profession."

At Bailey Meter, the early 1950s brought the beginning of the company's involvement with nuclear power. The company supplied controls and instrumentation to the United States' first nuclear powered submarine, the *Nautilus*, launched in 1954.

Building on this expertise, as well as its parent's Babcock & Wilcox growing nuclear business, Bailey expanded into supplying nuclear power plants, including the world's first full-scale commercial atomic power plant at Shippingport, Pennsylvania, and the Enrico Fermi Reactor in Monroe, Michigan.

Bailey Meter not only produced individual instrumentation products but complete safety and non-safety related control systems. "We were always in the steam business, so when nuclear came along it was a natural for us," says Richard McMahon, who oversaw much of the company's nuclear-related work in the 1970s from its Lynchburg, Virginia office. McMahon is currently a project manager at Bailey. "The other guys in Lynchburg used to get steamed when I first went down there, because I'd say these reactors were just a boiler with funny burners."

McMahon estimates that in the 1970s the company derived 15 to 20 percent of its revenue from the nuclear energy industry. Bailey's reputation for excellence was borne out during the Three Mile Island meltdown in 1979. The reactor contained Bailey instrumentation, which provided technicians with their only clues as to what was happening inside the unit.

Beyond nuclear power, the early 1950s were significant to Bailey for other reasons. General Electric sold its one-third share of the company back to Babcock & Wilcox, so that Bailey was once again a wholly-owned subsidiary of B&W.

Early 1950s sales conferences included engineers and customers

Of greater significance, the company's steady expansion meant it was outgrowing its Ivanhoe Road plant. The factory expanded after the war, but it was not sufficient. Bailey president Bob Coffin and plant manager Carl Sutherland headed a committee that began looking for a site for a new plant to supplement the Ivanhoe Road facility.

The committee explored numerous possible locations. In 1951 it settled on a 42.6-acre site on Worden Road and Euclid Avenue in the Lake County community of Wickliffe, 10 miles east of Ivanhoe Road and 19 miles east of downtown Cleveland. What finally swayed the decision, says John Luhrs, who headed Bailey's legal department, was that Cleveland's water and sewer lines were already available in Wickliffe. Ground was broken in September, 1954, and the new plant opened 13 months later with 160,000 square feet and 200 employees.

Shortly afterward, the company announced plans to add two more floors to the facility of 36,000 square feet each. The plant in Wickliffe gave Bailey a more efficient division of labor to assemble its systems, while the Ivanhoe Road plant focused solely on parts production.

With so much of Bailey's resources and attention shifting to Wickliffe, it seemed but a matter of time before all the company's operations moved there. In July, 1962, the company announced plans to build a four-story, $5-million building to house its administrative, research, development and engineering offices. The new building – Bailey's current headquarters – was to be located on Euclid Avenue, Wickliffe's main commercial thoroughfare, next to the new manufacturing plant.

Bailey Meter breaks ground for new office in Wickliffe, 1962

The new headquarters opened in December, 1963. Although the Ivanhoe Road factory remained open for the time being, its role in the company's operations gradually diminished. In 1976, the company closed the plant. Fifty-seven years after E.G. Bailey moved his fledgling company to Cleveland, Bailey Meter no longer had a presence in the city proper.

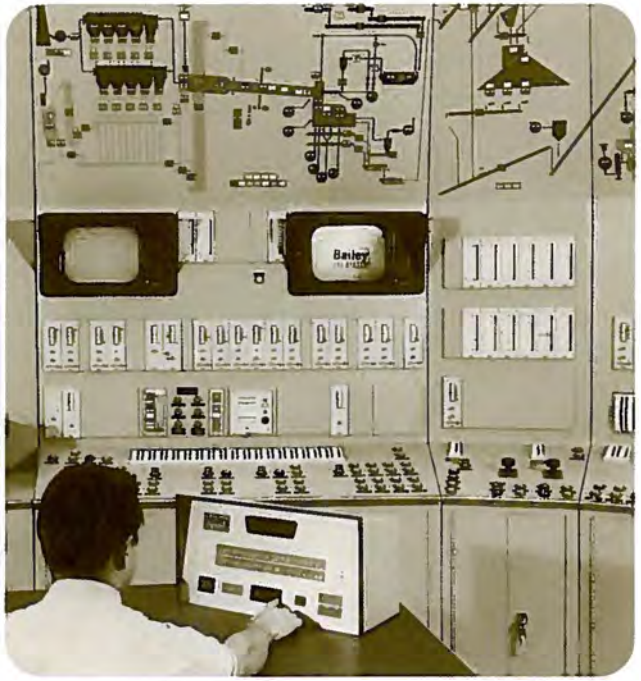
E.G. himself was by then no longer officially connected with the company he founded. Opinionated and forceful as ever at age 75, he retired – reluctantly, and without public fanfare – as chairman in 1955. Bob Coffin, after 11 years as president, succeeded E.G. as chairman. Paul Dickey became president.

A brilliant and able leader, Dickey was eclipsed only by E.G. in terms of importance to the company. A graduate of Purdue University, Dickey was a member of the Bailey cadet class of 1925. He rose quickly through management to become vice president of engineering, reporting directly to E.G. and Bob Coffin.

"Paul was a brilliant guy," says Sam Dukelow. "Pretty soon the old man found out how bright he was. He was one of the few people who could keep up with E.G mentally. Bailey would be talking on about something and leave everyone else in the dust, but Paul would just follow right along. E.G. liked that, because he didn't like having to explain anything twice. It's no exaggeration to say that he and Bailey were the guys who really built the company."

Like E.G., Dickey was farsighted in his view of the industry and Bailey's place in it. "Paul had a great deal of imagination, and he could see what direction the company had to go in," says Dick Richardson, who retired from Bailey in 1971 as vice president of sales and a director. "It was his vision that got us started in pneumatics in a big way in the 1930s, then solid state and digital."

The Bailey Record celebrates half a century of progress



Bailey 700 Series control system, 1968

Dickey, like E.G., surrounded himself with capable engineers who were also sharp administrators. Harve Gorrie was vice president of engineering and later senior executive vice president under Dickey. It was Gorrie who guided the company from outdated pneumatic controls into the era of solid state electronic controls and the 700 series of control systems.

Jim McEvoy succeeded Gorrie as vice president of engineering under Dickey. McEvoy was responsible for much of the research, development and design work that resulted in the 700 family.

In contrast to E.G., says Richardson, Dickey was generally liked rather than feared. "Paul had a very engaging personality," recalls Richardson. "Nearly everyone had a great liking for him. His way wasn't to motivate by pushing, but by persuasion." Even Dickey's physical appearance – he was a tall man with a deep voice – worked to his benefit, says Richardson. "I saw him get up at executive board and directors meetings and everyone quieted down right away and listened to him. I guess you could say he was a real leader."

At Dickey's urging, in November 1956, Bailey purchased the assets of the Metrotype Corporation. The technology developed by Metrotype allowed for continuous scanning of such processing variables as temperature, pressure, and flow rates. The results were printed continuously on teletypes. This provided operators – for the first time – with electronically recorded logs of all the processes taking place in the plant. Bailey Meter enhanced the Metrotype technology by replacing vacuum tubes with faster, more reliable solid state electronic circuitry.

Bailey acquired Metrotype partly in pursuit of what had been an elusive goal: diversifying beyond electric utilities into other process industries. The company in its first four decades was largely geared to serving the needs of power generating plants. And as long as this line of business continued to look profitable indefinitely, there was little incentive to change.

But Dickey was determined to diversify. "The move into process industries was really Dickey's push," Richardson says. "He saw even then that the growth in utilities wasn't going to go on forever."

As executive vice president in the early 1950s, Dickey had pushed for the creation of separate divisions to market products and services to process industries, including iron and steel, paper, ceramics and non-ferrous metals, water and waste, marine, and atomic energy. The Metrotype acquisition represented another step in this strategy, since its technology could easily be applied to many of these industries, as well as to power plants.

The strategy looked at first as though it would pay off. By the close of the 1950s, sales to process industries accounted for upwards of 20 percent of the company's revenues. But soon afterward the new thrust stalled.

"The problem was that we didn't have the products to do the job right," says Richardson. "The big guns in those fields had been there a lot longer. They sold individual products, which the customers would buy and use to design their own systems. We were more accustomed to going in and fitting out an entire power plant with a turnkey system."

For most of the postwar era, then, the power industry remained Bailey's bread and butter. No competitor could match Bailey in the range and quality of systems and products for utilities, or in the technical expertise to back them up.

"We grew because each sales person became an expert in power plants," says Richardson. "It got to the point where most of our guys knew more about the plants than the people who ran them. We sold as well as we did because we built our customers' confidence in us."

Under such a rigorous and forthright philosophy the company began the 1960s optimistically. At the end of 1960, Dickey announced to a Cleveland newspaper that total employment at the Ivanhoe Road and Wickliffe plants had reached 2,000 – a record – and that more expansion was planned. New business for 1960 was up 27 percent over the previous year, and orders shipped had risen by six percent.

Dickey's optimism rested on his belief that the company's technical and engineering prowess would keep it in the forefront of changes sweeping the controls industry. These changes were due in part to a transformation taking place within the utility industry itself. For example, new, efficient supercritical once-through boilers required more sophisticated monitoring and control devices than their simpler predecessors.

Other developments were occurring as well. Electronic controls, once expensive and unreliable, were becoming less costly and more reliable through solid-state circuitry. Control commands traveled far more quickly when sent by electrical rather than pneumatic impulse – an important consideration as utilities and processing plants grew larger, and boilers or process sites were greater distances from central control rooms.

Finally, the 1960s saw computers become far more integral to the controls industry. The development of microchips allowed computing devices to become smaller and increasingly powerful. This led to the introduction of direct digital control technology.

Direct digital control enabled computers, for the first time, to continuously monitor the various elements comprising a particular process – such as the flow of water going into a boiler, the boiler's temperature and pressure, and the flow of steam coming from the boiler – and to make the necessary adjustments to any of them to maintain the process at the most efficient level.

Bailey Meter was in the forefront of these new technologies. In 1961, Bailey became the first company to install a control system which incorporated a digital computer at one of its utility customer plants. At the same time, the company also brought out its 700 family of control systems, which were used to monitor processes and provide data logging, performance computing, and burner and pulverizer start-up and supervision.

Electronic circuit manufacturing, Bailey Williamsport facility

Chapter Four

Among these were early versions of today's sophisticated parallel multiprocessor systems, where several computers work together to provide more precise monitoring and control of all the processes in a plant.

In the face of it, modern computer and electronic technology seems light years from the simple recording instruments devised by E.G. Bailey half a century earlier. Yet the underlying aim has not changed: To provide plant operators with precise information to ensure that industrial processes – the combustion of fossil fuels, the refining of petroleum products, or the splitting of atoms – are carried out with maximum efficiency and safety.

"The old saying, `knowledge is power' applies very truthfully to power plant operation," E.G. wrote in 1915 as he prepared to found his company. "It is impossible for a fireman to know how much air is going through his furnace, how much steam each boiler is generating or how much water is flowing through a pipe without some means of measuring them."

In testament to the enduring genius of E.G.'s original concept, a Bailey Boiler Meter was included in the permanent display of the Smithsonian Institution's American History Museum, which opened to the public in April, 1963. Interestingly, the formal presentation of the Bailey Boiler Meter to the Smithsonian was not held until January 1967. E.G., 86 years old and still active, attended with Bob Coffin, Paul Dickey, members of their families, and various corporate representatives.

E.G. Bailey, R.S. Coffin and P.S. Dickey share congratulations on presentation of the Bailey Boiler Meter to the Smithsonian Institution

No one today can account for the four-year delay, but it seems typical of E.G.'s indifference to awards that he took so long to acknowledge the most prestigious form of recognition this country bestows on its inventors. The company's association with museums does not end there. In 1964, Bailey Meter installed the first automated boiler control system on a Great Lakes steamship, the S.S. *William* G. *Mather*. The *Mather* is now one of the most prestigious marine museums in America. It officially opened for visitors in the spring of 1991 at Cleveland's Ninth Street Pier, and is operated by The Great Lakes Historical Society. The Bailey control system is still intact.

That same year, 1964, Bailey Meter outfitted a Canadian ship, the S.S. *Cape Breton Miner*, as the first fully automated sea-going vessel.

As the 1960s closed at Bailey Meter, so did the era of Paul Dickey's presidency. He became chairman in May, 1969, and was succeeded as president by Joseph H. Dennis. While the company's glory years as part of an international conglomerate still lay ahead, it first had to go through a period of transition in the 1970s.

Domestic Turmoil And Global Rebirth: The Bailey Controls Company 1970 - 1991

The 1970s and 1980s arguably constitute the company's most dramatic period. The '70s were a time of almost continual restructuring. Presidents came and went. Sales suffered. The company was unionized and weathered a tense strike.

As the '80s opened Bailey was reborn, thanks to innovative microprocessor-based controls technology and management in tune with the changing times. The company had a new name reflecting the new era: the Bailey Controls Company.

The passing of E.G. Bailey in 1974 ranks among the notable early events of the period. The founder died quietly at home in Easton – the official cause of death was complications from pneumonia – on December 18, a week short of his 94th birthday.

E.G. reflects on a lifetime of achievements, 1968

E.G. Bailey – inventor, engineering genius, business innovator, family man – is in retrospect almost larger than life, an American archetype whose presence spans two centuries. His values and ethics were shaped by the 19th century, yet his work played a significant role in the unprecedented technological advances that mark this century.

Typically, E.G. remained active and alert to the end of his life. His wife, Carrie, had died in 1966, so E.G. lived alone, performing daily chores for himself in keeping with his frugal and independent Quaker upbringing. As late as a month before his death he was exercising his prodigious memory in typing letters to Harold A. Bolz, the dean of the Ohio State University's engineering school, discussing the results of boiler tests E.G. had run as an OSU student at the turn of the century. In 1978, the university received a gift from Bailey's estate to establish the Bailey Chair in Energy Conversion in the college of engineering.

E.G.'s death occasioned national attention. It was reported in a seven-paragraph obituary in *The New York Times*, as well as in numerous trade journals. The Rev. Robert G. Sandercock, pastor of the College Hill Presbyterian Church in Easton, eulogized Bailey."He was a man of principles and convictions," Sandercock said. "He attempted to be a good steward of the time and talent which God gave to him. His was a rare talent, and God gave him a long lifetime."

With Paul Dickey leaving the company's presidency in 1969, Bailey Meter found itself adrift. The founder had always been an advocate of a strong two-man team running the company. Up until Joe Dennis took over from Dickey, these teams grew out of a kingdom-like line of succession. First it was Bailey and Coffin, then Coffin and Dickey, then Dickey and Harve Gorrie, who retired shortly after Dennis became president.

Management turnover was partly responsible for the company's drifting. Because of the line of succession, the company had only three presidents between its founding in 1916 and 1969. It had the same number in the '70s alone.

Apart from turnovers at the top, opinions on the struggles during these years vary with the perspective of the teller. Dick Richardson says some of the problems resulted from the decision to split the company into systems and products divisions. "The problem with that was we didn't really have any products to peddle," Richardson says. "We were a systems company. The products we did have weren't priced competitively."

Former President and Chief Executive Officer Marion A. (Bud) Keyes IV says the company did not translate its technical leadership into marketing gains. Bailey was one of the first companies to utilize distributed control technology for electric utility power plants – a market that had always been Bailey's domain – but competitors had introduced similar technology several years before Bailey was able to gain a large market share in the industrial process control business.

"We installed systems for the utility industry that were extremely reliable but more costly than our competitors," Keyes says. "That was okay when we were the only player. But when others came out with distributed digital control systems that could be used for process industries and utilities, our protected niche was no longer tenable."

Electric utilities provided early product dominance

Clayton Barnard, who retired as vice president of international operations in the early '70s, remembers the difficulties during the period. "It seemed like things just sort of broke down. We were shipping orders anywhere from six to 14 months late. There wasn't much sense of direction."

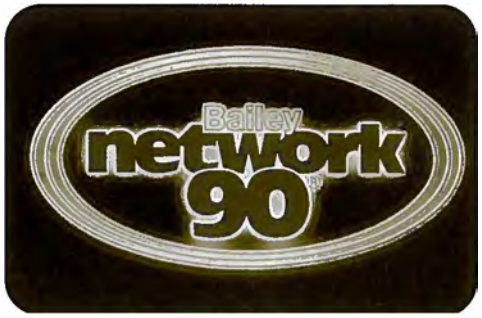
Paul Dickey's successor as president, Joe Dennis, had been with the company since 1937. He resigned at the end of 1971, just two years into his tenure, and shortly thereafter retired. His replacement was Dr. Charles E. Jones, who had been the director of research at Babcock & Wilcox.

Jones represented a break from the tradition of internally trained leadership that E.G. Bailey had installed through the Cadet Program. Though a determined man, Jones was seen as an outsider not quite attuned to the company's unique culture. His term, which lasted until November, 1974, ended without a significant shift of sales and earnings.

Management instability was partly responsible for one of the most dramatic changes in Bailey's culture – the unionization of its hourly workers. The company had always prided itself on its family-like atmosphere and good relations between hourly and salaried workers – a closeness that developed as Bailey cadets spent a good portion of their training on the factory floor. Because of these warm relations, hourly workers had found little need for union representation.

But labor-management relations were less than optimal under the stress of the internal changes. In February 1973, by a vote of 472 to 322, the United Auto Workers was selected as the bargaining agent for the 1,100 hourly workers at the Ivanhoe Road and Wickliffe plants.

Not all the company's problems were internal. New market forces were at work. The Arab-Israeli war of 1973 caused a disruption in America's oil supplies. The price of oil quadrupled. The country was forced to conserve and the utility industry began to slump. At the same time, public ambivalence about nuclear power caused orders for new nuclear plants to dry up.



By 1975, Robert Campbell was president of Bailey Meter. Like Jones, Campbell was a stranger to Bailey's ranks. Although Campbell was an engineer, he also had a background as a management consultant. "Babcock & Wilcox brought in Campbell as a turnaround specialist," explains Sam Dukelow. "He took the job with the understanding that he would get a lot of autonomy."

Campbell helped set the stage for Bailey's recovery by committing the company to vital research that would later produce the NETWORK 90 system, the company's most important process controls breakthrough to that time. Bud Keyes, who was then Bailey's vice president of engineering, oversaw the team of engineers who developed NETWORK 90 under Campbell.

Several other events of note occurred during Campbell's term. One was McDermott International's acquisition of Babcock & Wilcox, which had owned Bailey since 1925. This began when United Technologies attempted an unfriendly takeover of Babcock & Wilcox. McDermott International, a New Orleans-based conglomerate specializing in building offshore drilling rigs, averted the takeover by waging a successful stock bidding war against UT. Bailey was not directly affected; it simply was made a division of its former parent, Babcock & Wilcox.

Also that year, Bailey Meter changed its name to the Bailey Controls Company. This was long overdue. Decades had passed since the company had progressed from simple meters to sophisticated process controls.

Bailey INFI 90 distributed systems deliver integrated platform automation and control

Bailey acquires General Electric controls technology. 1971

But the most convulsive event of the era began in June 1979, during the last year of Campbell's term as president. Bailey Controls and the UAW were unable to come to terms over a new contract. The company claimed it could not grant the pay increases the union was seeking because of the federal wage guidelines then in effect. The result was a 21-week strike, which turned bitter on several occasions.

The strike was a fitting culmination to a bleak decade. But at this dark moment the company rebounded, propelled by its new technology and new management. The research and development seeds that had been planted for several years finally blossomed in 1980 when Bailey introduced the NETWORK 90 process control system. The system had been developed under the leadership of Bob Campbell. That same year, the company's helm was passed to Bud Keyes.

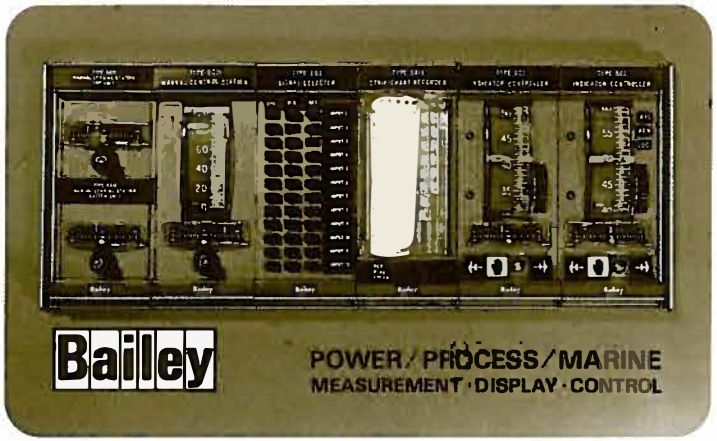
Keyes had joined the company in 1975 as vice president of engineering after many years with the Taylor Instrument Company. He went on to serve two terms as president of Bailey Controls. A physically imposing man at six feet, seven inches tall, Keyes was a basketball player at Stanford University as well as an intellectual. He was recognized for his technical expertise – he held or shared credit for 46 patents – and was regarded as a demanding leader.

At the close of the 1970s, with the first signs of improvement in Bailey's operations now evident, the introduction of NETWORK 90 brought the turnaround the company had been waiting for.

NETWORK 90 was Bailey's first microprocessor-based distributed control system, and was much faster and more powerful than the digital-based technology the company had been using. It was a standardized system, built around processor modules that take commands from plant operators and translate them into instructions for controlling the operations around the plant. The "distributed" nature of the modular system permitted easy expansion and removed the potential single point of failure found in central computer-based systems.

The processor modules that drive NETWORK 90 and its successor, INFI 90, are manufactured in Bailey's Williamsport, Pennsylvania plant. The company has had a presence in Williamsport since 1974, when it bought the plant for the manufacture and assembly of General Electric's line of 7000 Controls. Bailey purchased the rights to the 7000 line in 1972.

NETWORK 90 enabled Bailey to attain a long-held goal: diversifying within the process control market. While Bailey's utility customers used NETWORK 90 for monitoring and controlling



1972 Bailey calendar card

boiler operations, the system's technology was equally applicable to processing industries such as chemicals, refining, and pulp and paper.

NETWORK 90 and the entree it provided to the process control market could not have come at a better time. Oil prices had escalated dramatically in 1978-79 for the second time in five years. The U.S. economy experienced virtual back-to-back recessions from 1980, when NETWORK 90 was introduced, to 1983. The result was hard times for utilities.

Describing NETWORK 90 in McDermott's 1984 annual report, Keyes wrote, "We can sell the same product line to a corn-processing plant in China, a utility in Cleveland, or a pulp and paper mill in Canada. That means our customers need only one set of instruction manuals, they need to train only one group of operators, and their maintenance is on one type of equipment."

A vital feature of NETWORK 90 was its flexibility. It was built to be compatible with all the products and systems Bailey has introduced since then.

"What we saw during the 1960s and `70s was that every new electronic line to come out obsoleted all the previous ones," says former Bailey President Doug Cannon, who succeeded Keyes's first term in 1985. "We were committed to never doing that again, to not leaving our customers hanging out there with an outdated system every time something new came down the pike."

NETWORK 90 was an instant success. Says Keyes, "Our customers by and large were pretty conservative in their outlook, and we thought it would take them a good five years to get used to the idea of microprocessor-based controls. What we found instead was that in a year we weren't selling any of our previous systems. Everyone wanted NETWORK 90."

"If we had not penetrated the process control markets, we would not have been able to survive," Doug Cannon declares. "That's really what got us through. Our top five customers in 1980 were all power companies. By 1989, at least two of the top five were in process controls."

The shift in Bailey's customer base was indeed dramatic. In the company's 1979 fiscal year, the last one before it introduced NETWORK 90, 82 percent of its sales were to the utility industry, with the balance going to process industries. A decade later, 56 percent of the company's revenues came from process industries, while 44 percent were from its traditional utility customers.

Other shifts were also in the works. In 1985, Bud Keyes was promoted to group vice president at Babcock & Wilcox. His replacement at Bailey, Doug Cannon, had been vice president of manufacturing under Keyes.

A member of the Bailey cadet class of 1962, Cannon began his career at Bailey in the San Francisco and Los Angeles sales offices. In 1969 he became a project manager and worked his way up to director of planning and market development in 1978. Among the projects he oversaw that year was the planning for NETWORK 90. In 1982 he was named vice president of manufacturing.

Cannon was in some ways a Keyesian, but he says he differed from his predecessor by trying to balance market share with profitability. "In the early part of the 1980s, we had taken a lot of market share without worrying too much about the effect on the bottom line. I tried to change that."

Cannon also steered Bailey toward a growing emphasis on quality control through a program known as the Total Quality Initiative. It utilized many of the quality control concepts coming into vogue among American manufacturers of the time.

"I was trying to institutionalize what I think a lot of Bailey employees already felt intuitively, which was to always be on the lookout for ways to serve our customers better," says Cannon. "If what drives the employee is to do what's best for the customer, and if the employee feels he has management support, that's the most valuable thing management can do."

This focus on quality paid off in 1990 when Bailey became the first controls supplier to achieve dual quality management certification from both the International Standards Organization (ISO) and the Canadian Standards Association (CSA).

Cannon's term was also noteworthy for Bailey's 1986 acquisition of TBI, Inc., its first in 20 years. Located in Carson City, Nevada, TBI manufactured devices used for analyzing water, especially the acidity and concentration of dissolved solids in waste water. Although relatively small – $4 million in annual sales – TBI played an important role in Bailey's continuing penetration of the process control markets.

1990 brings ISO and CSA quality management certifications

"Smart" field instrumentation marks further control advancements

"Almost every process industry uses water and needs to clean it up. TBI gave us an important product line we could offer to complement our systems," Cannon says.

Concurrent with the rapid growth of NETWORK 90 technology, Bailey devoted great emphasis in the 1980s to the introduction of "smart" field instrumentation. The comparatively crude meters that marked early 20th century controls evolved into highly sophisticated devices to measure, indicate and adjust such variables as pressure, temperature, level and flow.

The "smart" devices feature on-board processing capabilities that permit remote communication, calibration, and diagnostics between the field instruments and the host control system. This greatly reduces the need for in-field maintenance of the devices and yields more accurate and more useable signals from the devices.

Bailey brought out many such new products in the 1980s, but NETWORK 90 remained its bread-and-butter system. As such, the company continued to modify it, making it more powerful and adding new features. By 1988, enough changes had been made to warrant reintroducing NETWORK 90 under a new name – INFI 90.

Explains Cannon: "INFI 90 was a way of communicating to the marketplace that this clearly was not the same system we introduced back in 1980. It was a way of collecting all those changes we had made in the intervening years and packaging them in a way that would be most valuable to our customers."

With INFI 90, Bailey introduced the new and extraordinary controls philosophy of Strategic Process Management. Among INFI 90's many enhancements was its ability to communicate with a company's other computerized systems, permitting for the first time simultaneous, real-time access to not only process data but business data as well, such as economic and market forecasts, production analysis and product mix. Hence the name Strategic Process Management.

By 1990 thousands of NETWORK 90 and INFI 90 systems had been installed around the world in a wide variety of process industries. A study released that summer by an independent marketing firm showed Bailey with the largest share, 33 percent, of the U.S. process control market.

TBT-Bailey facility in Carson City, Nevada

As important as NETWORK 90 and INFI 90 were to the company in the 1980s, there was another vital evolution at Bailey Controls during that period: an aggressive, well-organized effort to export Bailey's "smart" products and systems and establish a major international presence – an effort that was to have as profound an impact on the company as its new technology. Bailey not only established its future as a major vendor in the global controls market, but it attracted a corporate parent of enormous international stature.

While the company's foreign activities dated to 1921 with the opening of a Canadian subsidiary, Bailey Meter had made little effort to expand its overseas presence beyond a handful of other countries.

The first stirrings of change were initiated in 1977 by M.N. (Mike) Zaharna. Born in 1941 in what was then the West bank of Jordan and educated in the U.S., Zaharna joined Bailey in 1966 as a contract engineer. From there he advanced to assume numerous engineering positions, including manager of Bailey's industrial programs office. In 1977 he was appointed manager of international marketing and sales.

"Our international operation then was meager at best," Zaharna says. "It consisted of me and a secretary, who I shared with someone else, and a budget of $200,000."

Zaharna began looking for ways to market Bailey products abroad, including joint ventures and licensees. Among the latter was an Italian company named Esacontrol, a subsidiary of Elsag. Elsag is part of a large Italian conglomerate, Finmeccanica Societa' Finanziaria per Azioni, which in turn, is part of a still larger entity, Istituto per la Ricostruzione Industriale (IRI Group). A $60 billion holding company headquartered in Rome, IRI is among the largest corporate structures in the world.

In 1983, Bailey licensed Elsag to manufacture and market its products in Europe. This began the highly successful relationship that led to Bailey's acquisition in 1989.

In the meantime, Zaharna became vice president of international operations and later executive vice president of global operations. By the end of the '80s, Bailey owned subsidiaries in Australia, Brazil and Canada, had licensees in India, Italy and the U.K. and joint ventures in the People's Republic of China, Mexico, Norway, Venezuela, Jordan, Japan and Saudi Arabia, with immediate prospects in Korea and the Soviet Union.

As the 1990s dawned, Bailey was truly a global company. Some 65 percent of its revenues came from foreign sources, almost an exact reversal of the situation a decade earlier. As if to carve in stone Bailey's new stature, in September 1989 McDermott International announced the company's sale to Finmeccanica for $295 million – a dramatic difference from the $50,000 that seeded the company in 1916.

According to Doug Cannon, Finmeccanica first considered purchasing only a partial stake in Bailey as a way of gaining a foothold in North America and obtaining access to Bailey's advanced technology. But McDermott had heavy cash needs and welcomed the chance to sell Bailey – all of it.

Bailey became part of Finmeccanica's Elsag unit on November 1, 1989. The company asked Bud Keyes to come back from Babcock & Wilcox to serve as president and chief executive officer. Cannon left to become president of ITT Fluid Technology, Inc. in New Jersey.

But Keyes's second term as president was short-lived and he left Bailey late in 1990. He was succeeded as Bailey chief by the man who originally established Bailey's relationship with Elsag. Mike Zaharna became Bailey's chief operating officer.

"I thought it was a good deal then and I still do now," says Cannon of the acquisition. "Because of its cash problems, McDermott was unwilling to invest heavily in Europe. But we had to have a presence there because economic union was coming in 1992. And at the time, Europe was the one place we were not getting the rate of growth we would have liked."

Zaharna notes that being part of Elsag has created a synergy between Bailey and Finmeccanica's other units in such high-tech fields as semiconductors and factory automation. Finmeccanica's willingness to invest in high-tech research and development began immediately to pay dividends for Bailey Controls.

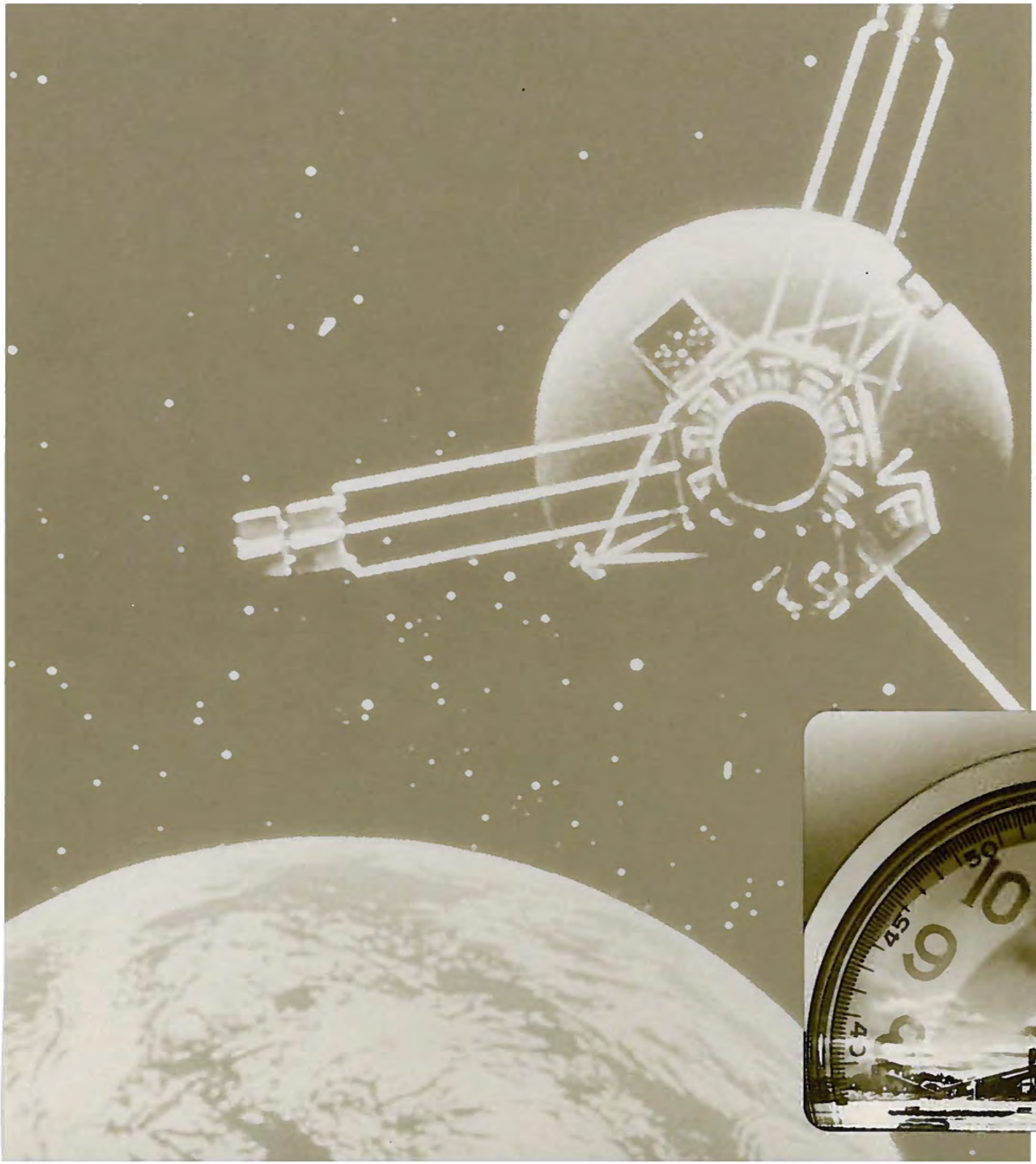
Bailey Sercg, S. A. - France

"Since the acquisition, Bailey's business has grown at a healthier rate than ever before," Zaharna says. "Normally our target is to grow at a rate of three to four times faster than the Gross National Product. In the second half of 1990 our growth rate was 25 times that of the GNP."

As part of its drive to increase its presence in the world-wide industrial controls field, early in 1990 Elsag purchased the industrial controls division of the French company Schlumberger Industries, renaming it Bailey Sereg. Further acquisitions strengthened Bailey's global capabilities, prompting Elsag to change its name to Elsag Bailey S.p.A. in early 1991. Bailey Process Automation then was formed as an independent unit to market the Bailey name and technologies worldwide.

"Just about anywhere we look in the world there are significant opportunities for growth, and we are in a strong position to take advantage of them," says Zaharna. "With our financial strength and rich history of being in the forefront of technological innovation, Bailey Controls has a lot to look forward to."

Bailey



Bailey's established market presence perpetuates B.G.'s commitment to engineering excellence

Epilogue

Epilogue: Into The 21st Century

E.G. Bailey no doubt would be pleased that his name and company have been carried into the global market. Innovators seek out needs, start trends and look forward to the inevitable. As the 21st century approaches, Bailey Controls is positioned to take further advantage of business and technology opportunities around the world, all geared to its overriding mission – delivering to its customers the best control systems, products, and services.

The collapse of Communism in Eastern Europe has presaged the first steps in the modernization of those nations' industrial bases. Similarly, as underdeveloped countries around the world seek to join the global marketplace, they will need new industrial process controls. With Bailey's established presence on every continent, the company has a solid advantage over its competitors in reaching and helping new customers.

In the U.S., Bailey will continue to expand its share of the process control market. Construction of many new power plants is unlikely, but Bailey will continue to retrofit existing plants with the most sophisticated control products and systems in the world. Strong growth resulting from the introduction of new products and processes by the process manufacturing sector also will bolster Bailey's domestic prospects in the foreseeable future.

Bailey Controls technology has advanced light years since E.G. Bailey developed the first basic instrument for measuring steam in a boiler. The company has grown with its technology. From a handful of employees operating out of a few rented offices in Boston, Bailey's global operation today employs some 5,500 people. The future holds equally momentous changes.

The trend for the immediate future can be summed up in three words: More, better, faster. When NETWORK 90 was first introduced, it could process 500,000 bits of information per second. A decade later that was up to ten million bits per second, and that's likely to increase by a factor of 20 in the next five years or so.

"In the next 10 years we are going to see facilities become almost totally integrated, with information instantly available on quality, composition, and all the other variables that affect a product," predicts D.J. Dziubakowski, Bailey's director of product line application engineering. "We're going to see more automation in the way our customers run their plants, which will mean we will provide them with controls that are increasingly automated."

Bailey Controls Company