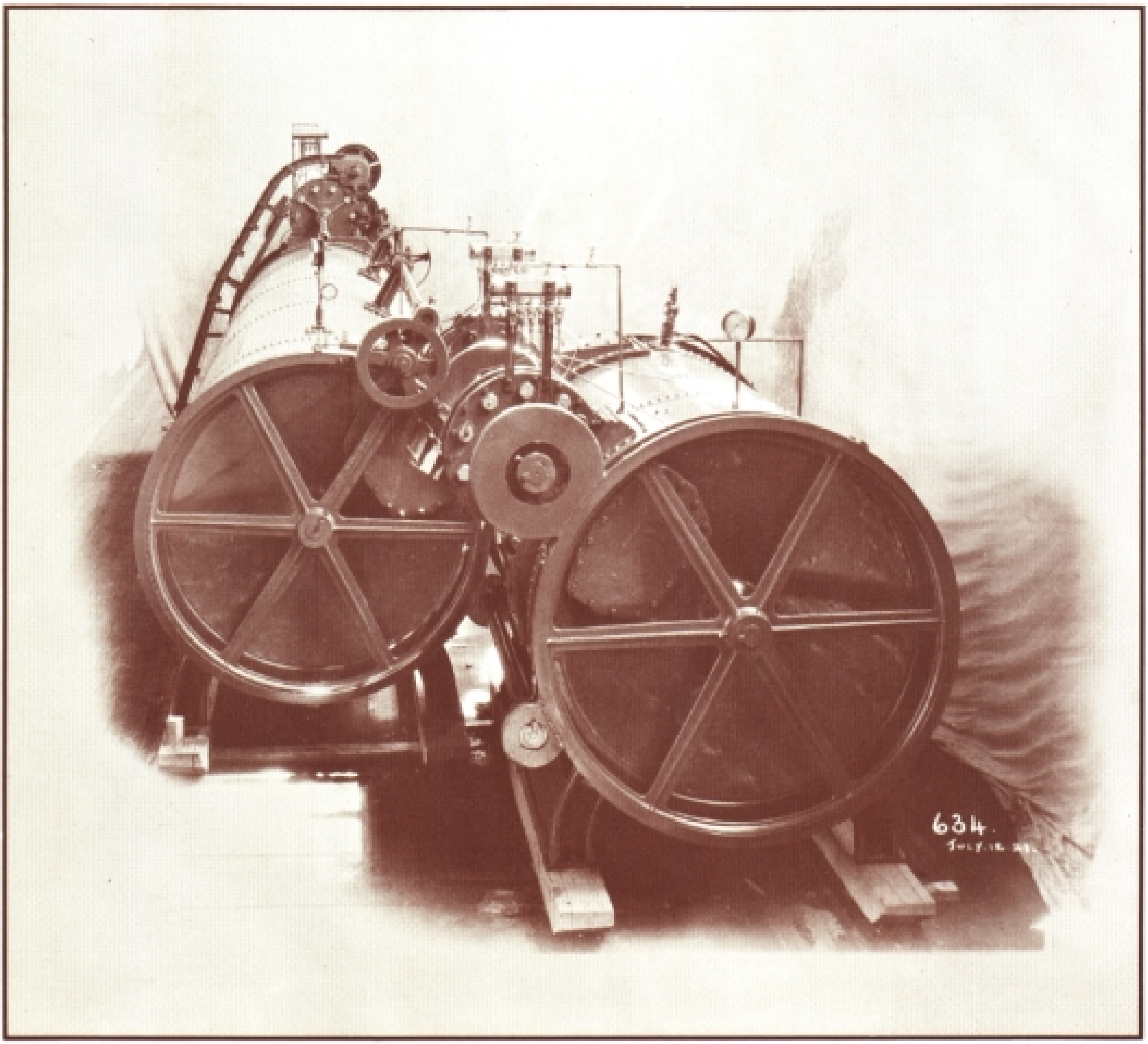
The FMC Rotary Pressure Sterilizer

Introduced in 1920

An International Historic Mechanical Engineering Landmark



Designated by

American Society of Mechanical Engineers — May 17, 1982

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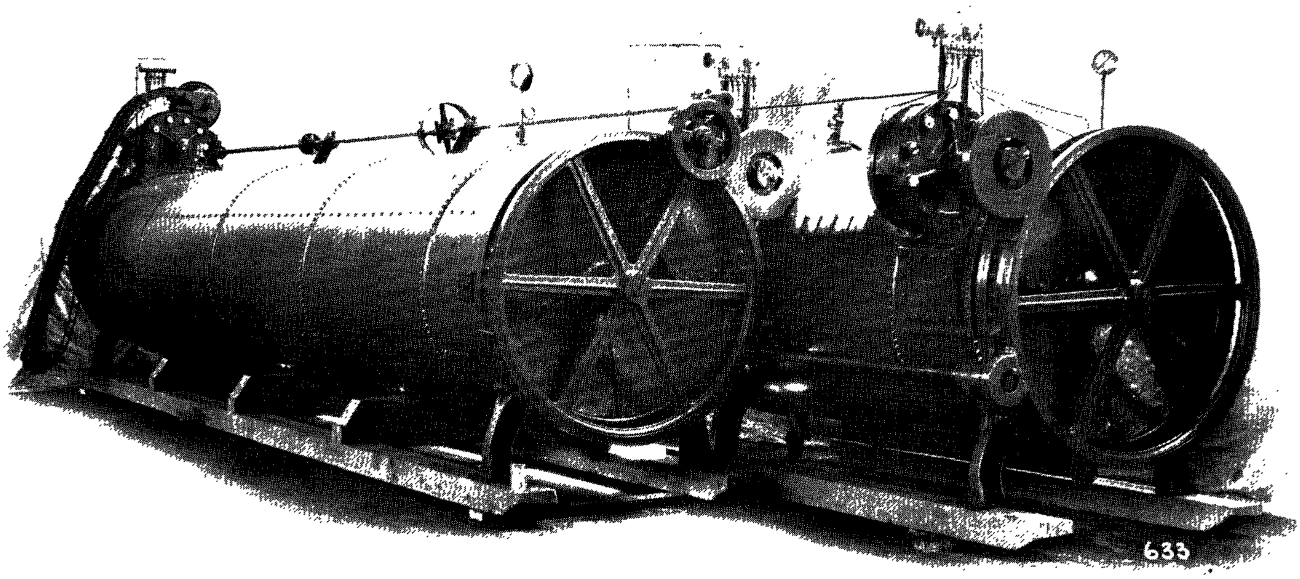


Designated by American Society of Mechanical Engineers
At FMC Central Engineering Laboratories, Santa Clara, California — May 17, 1982

PROGRAM

Welcome
Peter Weber, General Manager
Central Engineering Laboratories
FMC Corporation

Introduction of Guests
William J. Adams, Jr., Chairman
Region IX History and Heritage Committee
ASME

ASME Landmark Program
Professor R. S. Hartenberg
National History and Heritage Committee
ASME

Historical Perspective
R. Michael Hunt, P.E., Chairman
Santa Clara Valley Section
History and Heritage Committee, ASME

The FMC Rotary Pressure Sterilizer
Richard L. Houtzer
Product Manager, Sterilization Equipment
FMC Food Processing Machinery Division

Presentation of Plaque
Dr. Robert B. Gaither, President
American Society of Mechanical Engineers

Acceptance for FMC Corporation
W. A. Wolff, Vice-President, Western Region,
FMC Corporation

Closing
Peter Weber

The American Society of Mechanical Engineers wishes to thank everyone who cooperated in the designation of the FMC Rotary Pressure Sterilizer as an International Historic Engineering Landmark. Special thanks are extended to FMC Corporation for their kind assistance in production of this brochure.

The Rotary Pressure Sterilizer

Invention of the Continuous Rotary Pressure Sterilizer, in 1920, which brought automation and uniformity of product to the cooking of canned goods, and vast savings in labor and fuel to the canning industry, solved a problem that had baffled engineers for years.

The problem was this: How to introduce a continuous stream of filled, sealed cans into a pressurized chamber full of steam; heat the contents uniformly and cook the cans for a prescribed length of time; then retrieve and cool them under pressure in the same continuous stream.

There was yet another aspect to the problem. The standard method of cooking, or sterilizing, canned products was in a closed retort. Cans were placed by hand into mesh baskets and stacked in a retort which was then locked down and filled with steam. The product was cooked and cooled, and the baskets were fished out of the retort. In addition to high labor requirements — up to 15 men — and start-stop batch operation, the retort system required long times for the heat to penetrate to the center of the immobile cans. Hence, some agitation of the cans to shorten the penetration time was desirable.

The solution was supplied by the Anderson-Barngrover Company of San Jose and Albert R. Thompson, its chief engineer, who devised and patented not only the basic machines but a whole string of improvements and refinements in succeeding years.

In 1928 Anderson-Barngrover Manufacturing Company, which had grown from a modest plant on West Julian Street to a sprawling complex occupying both sides of the street, merged with a neighbor a few doors away, the John Bean Spray Pump Company. Shortly thereafter the new firm acquired Sprague Sells Corporation in Hoopeston, Illinois to form Food Machinery Corporation with the John Bean organization as the sponsoring company. By 1972, the company had become a diversified enterprise, and the name was changed to FMC Corporation.

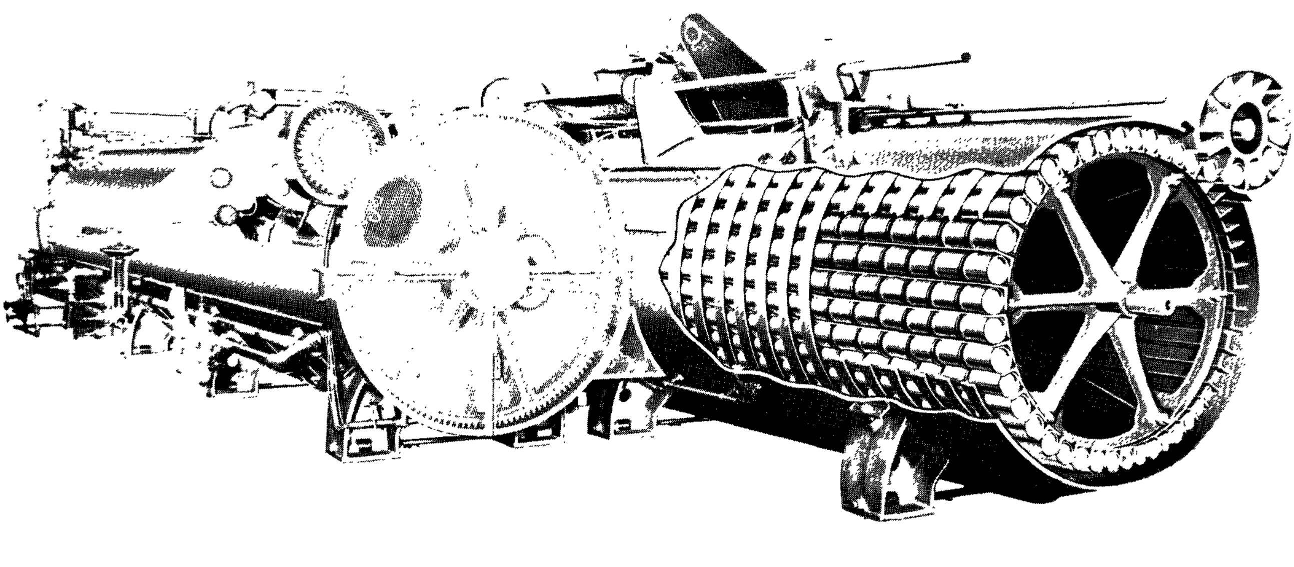
The answer to the problem of continuous sterilization of canned goods was a series of three devices, each building on the last. The first was introduced in 1913.

A continuous cooking process

This was the Anderson-Barngrover Continuous Variable Discharge Cooker and Cooler. Despite the long and ponderous name, it solved at least part of the problem, that of a continuous cooking process, and was an immediate success in the canning industry.

The machine consisted of a long rectangular steam heated cooking tank with a series of slide gates spaced at regular intervals along one side, and a discharge conveyor running beneath the gates and leading to a second, smaller, cooling tank. Incoming cans were admitted at the end and propelled through the tank by a reel and spiral arrangement. The reel was made up of channels around its circumference wide enough to hold a line of cans on their sides and running the length of the tank. It turned inside a close-fitting fixed T-section spiral whose flights were spaced a can length apart to form a track which held the cans in their channels and slowly pushed them forward as the reel turned.

A great feature of the cooker was the slide gates, its "variable discharge". Cans could be released from the cooker at any of these openings and conveyed to the cooler section. Purpose of the vari-



CUTAWAY VIEW of a modern Rotary Pressure Sterilizer system, showing rotating pocket valve, upper right, which feeds cans into the reel inside the pressure shell; the reel filled with cans, and the continuous spiral track attached to the inside of the shell. As the reel turns, the cans ride against the spiral track and are moved forward in their channels. A transfer pocket valve at the end of the cooking tank moves the cans into the pressurized cooling shell at left.

THE FIRST continuous automatic cooker, introduced in 1913, operated at atmospheric pressure and relatively low temperature. Square tanks held a reel and spiral.

able discharge was to provide a mechanical means of regulating the cooking time to accomodate various types of canned products. The cooker reel was designed to run at a fixed speed (powered by a belt and pulley from an overhead jack shaft) and, since it operated at atmospheric pressure, cooking temperature was more or less fixed at the boiling point of water, which left time-in-the-cooker as the only practical variable.

The sterilizer had achieved at least part of the ultimate goal. It was a continuous, automatic cooker which could receive filled, sealed cans from mechanized lines and process them without manual handling. Al Thompson applied for a patent in 1913, and received it in 1917.

The machines, with a number of variations, including cylindrical tanks with variable inlets, remained in the company's line of cannery equipment for nearly 30 years, and many are still in use.

A critic reports

The atmospheric cooker, however, didn't do the whole job, as Daniel G. Trench of the Sprague Canning Machinery Company, Hoopeston, Illinois, pointed out in a treatise on corn machinery written for a Souvenir History of the Canning Industry, published by the Canning Trade Magazine for the 1914 National Canners Convention in Baltimore:

"In the very early days of the industry the final sterilization (of canned food) was accomplished by means of a long cook in water bath. Later the process was shortened by the use of high termperature calcium (chloride) bath. Next came the closed retort or pressure process which is now mainly used. During recent years, persistent efforts have been made to perfect an apparatus that will operate automatically and furnish a continuous sterilizing system (notably the agitating machine) which have encountered many mechanical difficulties and have further tended to show that there is a distinct limit to the agitation that can be given corn during processing and yet avoid granulation of the starches, etc., in the can.

"A continuous, automatic, high-pressure sterilization for corn still remains one of the unsatisfied demands of the (canning) trade."

But it was on the way.

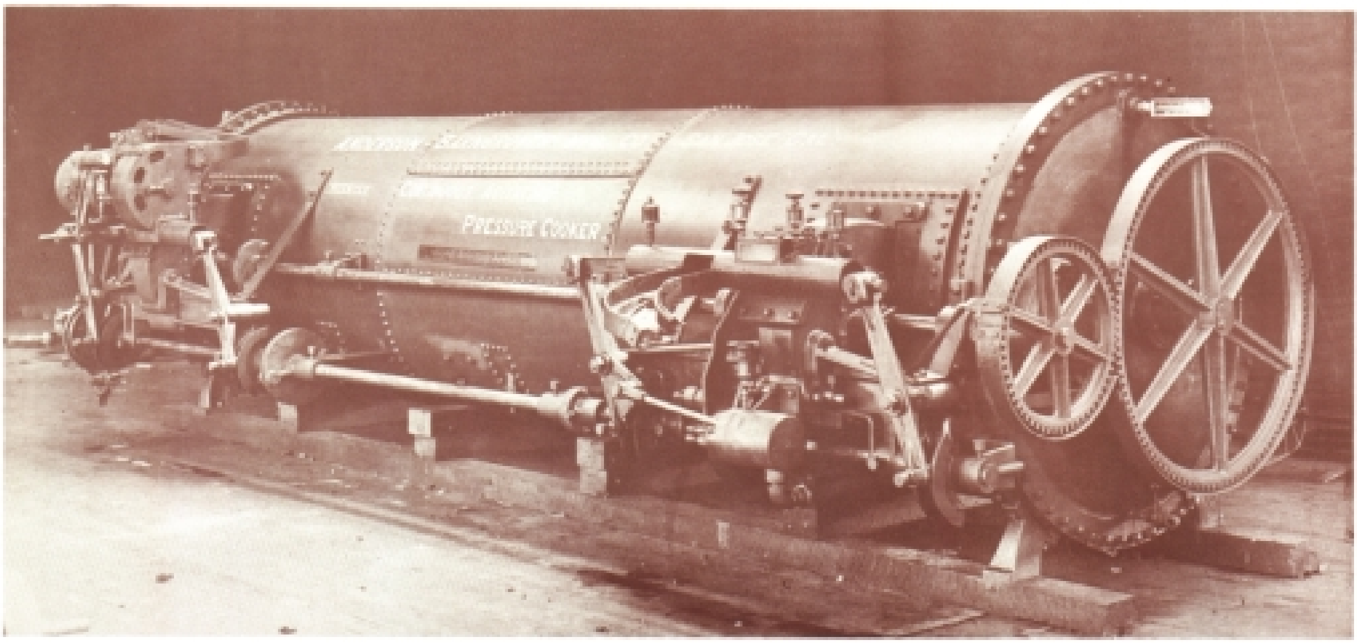
ALBERT R. THOMPSON

The first pressure machine

In 1915 Anderson-Barngrover and Al Thompson unveiled their first rotary pressure machine. It was a massive cylinder about 20 feet long and 5 feet in diameter, made of riveted boiler plate. On the front of the tank, at each end, were two heavy sliding valve assemblies resembling the breech of a giant bolt action rifle which acted as steam locks to admit cans at one end and discharge them at the other. A reel-and-spiral (the spiral attached to the inside of the tank) propelled the cans through the pressurized steam chamber.

The machine worked and a number were sold, but it was slow (about 50 cans per minute) and cumbersome. Anderson-Barngrover engineers went back to their drawing boards.

In place of the sliding valves, Thompson designed an ingenious rotary pocket valve, something like a revolving door on its side, to receive incoming cans and transfer them to the channels of the reel.



IN 1915, this pressure vessel was introduced. It's sliding valves were too slow, and it was re-designed.

The same valve was used on the discharge end, here assisted by a rotating star mounted beneath the end of the reel and synchronized so that a star point pushed up through an opening in each channel to lift the can out of the reel and into a pocket of the discharge valve.

Final version introduced

The third A-B cooker was introduced in 1920, and this one was the real thing. The precisely synchronized steam-tight pocket valve plopped cans accurately into the reel channels in perfect timing and the corresponding discharge valve at the other end, with its helper star, retrieved them with equal dexterity.

The cooker shell was joined directly to a pressure cooler shell at the discharge end. It was the same diameter as the cooker and slightly shorter, also made of boiler plate, and employed the same mechanical handling system. Cans went directly from the cooker to the cooler. The cooler was partially filled with water and air under pressure to prevent swelling or bursting of cans as they cooled.

The long awaited automatic pressure cooking process was substantially complete. The Anderson-Barngrover system was continuous ... it was completely automatic ... it cooked cans of food under pressure at high temperatures for short times

CANNERY equipment heads for the 1915 Panama-Pacific Fair in San Francisco.

COOKER LINE at the Anderson-Barngrover plant about 1915. Photo was made on a glass plate negative.

...and immediately cooled them, under pressure... it provided near perfect uniformity, each can was handled exactly like all the others. And it was fast — up to 400 cans per minute.

Moreover, the rotary action provided gentle agitation. During the bottom third of the reel's rotation the cans fell away from their channels and rolled on their rims along the bottom of the tank, held in position by the spiral and the edges of the channel. This caused the little bubble of headspace in each can to move through the product, stirring it up and promoting more even heating within, which further shortened the cooking time.

When it was finally introduced, the long-awaited continuous pressure sterilizer more than lived up to expectations.

- It reduced cook room labor from as much as 15 to 1.
- It reduced steam consumption by 50 %.
- It produced a uniform product throughout the can run. Variations were virtually eliminated.
- Finally, it produced a better quality product, turning out canned goods with better color, flavor, and texture.

Adapted for evaporated milk

The first major market of the new sterilizer was the evaporated milk industry. Milk is one of the most difficult products to can. It must be carefully heated and cooked under agitation to avoid discoloration, changes in taste, and other injuries to the product. The new A-B continuous sterilizers were tested for preparing canned milk, and while they were successful, they produced a product different from the more viscous milk the public had grown to accept.

WILL C. ANDERSON

To match the traditional milk product Thompson developed a preheater shell with successive chambers which heated the cans in stages prior to pressure sterilization; and a cooler shell which did the same thing in reverse. In addition, the company devised a means of eliminating leakers - a simple arrangement of two convex discs with space for the cans to pass between them. Normal cans, coming from the pre-heater with ends slightly distended would engage the rotating discs and be lifted to the runway, while leakers, with flat ends, would pass through and drop out of the system. Detectors were placed between the pre-heater and the cooker and at the end of the cooler in reverse, where normal cans with flat ends would pass through, while leakers whose ends remained distended were kicked out.

The special milk lines were leased to the evaporated milk canners and, by 1928, Anderson-Barngrover noted in their catalog that these machines were placed in virtually every major milk state.

Use of the rotary sterilizer for general canning grew steadily but at a slower pace, and although the 1928 catalog was studded with testimonials on its performance in cooking various types of products, it did not achieve dominance in the industry until the 1950's by which time the company was known as FMC.

A Company founded on inventions

Forty years earlier, the FMC "parent" company was founded in San Jose on another food processing invention. In 1888 Will Anderson patented a "Prune Dipper", a hand-operated arrangement of hinged baskets and levers to dip freshly harvested prunes in a hot caustic solution to prevent fermentation when the prunes were spread

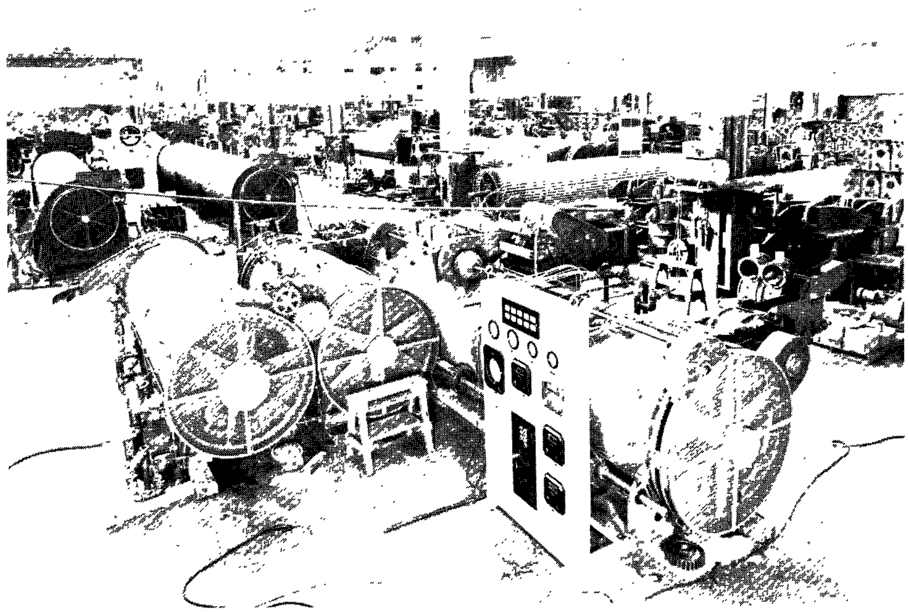
ANDERSON-BARNGROVER plant in San Jose about 1920. Cars are parked by hitching posts.

out to dry in the sun.

He built the first ones by hand in a rented wood lot, and the business was known as W. C. Anderson, Horticulture Supplies. In 1897, the Anderson Prune Dipper Company was formed, and moved into its own quarters. In 1901 Anderson hired a brilliant, self-taught, young engineer, Albert R. (for Riley) Thompson, 21, to help with the design of equipment which ranged from orchard cultivators to warehouse wheelbarrows.

The company became embroiled in a patent dispute with a rival prune dipper manufacturer, the Barngrover-Hull Company, and in 1902 they settled the argument by merging to form Anderson-Barngrover. Two years later they built their first cannery equipment, a syruper which filled 12 cans simultaneously. It was operated by a foot treadle, and fill height was eyeballed by the operator.

In 1910, the company built a new factory at 333 West Julian Street in San Jose, which was to be its headquarters for the next 70 years. A year later the John Bean Spray Pump Company moved in a few doors down the street. They were the two largest manufacturing companies in San Jose. They were merged to form the basis of Food Machinery Corporation in 1928, and, ultimately FMC Corporation. Will Anderson became chairman of the board, and Al Thompson chief engineer.



MODERN Rotary Pressure Sterilizer assembly line at remodeled San Jose location. Cookers were made here for 60 years.

Production expands overseas

After World War II, there was a rush to install the "new" automatic cooking systems and in the decades to follow they spread around the world. Manufacture of the cookers was begun at an FMC plant in Europe in 1954, and in Australia and South Africa shortly thereafter.

The company established a Food Research Laboratory in San Jose in 1946 to help canners develop time and temperature formulas to process a great variety of canned products. Researchers calculate that during its 35 years, processes tested by the laboratory have been used to produce 5 trillion cans of food without danger to the public.

FMC and its predecessors have built about 1,550 Rotary Pressure Sterilizer systems, the vast majority of them still in operation. They are known to be in use in 25 countries: USA, Canada, Mexico, Panama, Venezuela, Brazil, Peru, Australia, New Zealand, Philippines, Malaysia, Thailand, Singapore, Japan, United Kingdom, France, Germany, Italy, USSR, Iran, Israel, Kenya, South Africa, China and Holland. They are estimated to produce about 43 billion cans a year.

Which is a far cry from the early days when canners often stacked their cans outside the building to cool in case some of them exploded.

"Canning" dates from 1810 when Nicholas Appert, a Parisian confectioner was awarded a 12,000-franc prize, offered 15 years earlier by the French revolutionary government to anyone who could develop a means of preserving food in containers. Appert had worked patiently during those years cooking various foods in glass jars with cork stoppers. He called the process Appertizing.

Development of the rotary pressure sterilizer which brought automation to the industry was, in many ways, the culmination of the Art of Appertizing begun more than 170 years ago by Nicholas Appert. Recognition of this invention as an international engineering landmark by the American Society of Mechanical Engineers is a welcome tribute to the pioneers who developed it.

Refinements came as technology progressed. Welding replaced rivets; the drive pulley gave way to electric motor and gear reducer. In the 1940's ASME pressure tank standards were adopted for the shells and working pressures rose from 20 to 33 psig and beyond. But the basic machine remains unchanged over 62 years, an eloquent testimony to the soundness of its design and the efficiency of its function.

The invention of canning has been ranked by at least one scholar, Dr. E. E. Free, in 1937, as one of the seven most important inventions of mankind, joining such pre-historic discoveries as the function of seeds and the control of fire (together with the invention of pottery, writing, standards of weights and measures, and the Pasteur germ theory). In a world of exploding population, half of whom are hungry, this assessment appears more and more to be correct.

And the title of "Benefactor of Mankind" conferred on Nicholas Appert may well apply to the men who carry on the industry he founded.

The American Society of Mechanical Engineers
Historic Mechanical Engineering Landmark Program

A National History and Heritage Committee was formed in 1971 by the ASME Council to promote a general awareness of our technological heritage. The committee gathers data on all works and artifacts with a mechanical engineering connection which are historically significant to the profession.

The committee's national, and international, landmark program is a demarcation of sites which are of national or international significance — people or events which have contributed to the general development of mankind.

The Society also cooperates with the Smithsonian Institution to provide contributions of historical material to the U.S. National Museum of American History in Washington, D.C.

The FMC Rotary Pressure Sterilizer is the 75th Landmark, and the ninth International Landmark to be designated since the program began in 1973, and the first honoring the food processing industry. The ASME citation:

INTERNATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK
FMC CONTINUOUS ROTARY PRESSURE STERILIZER
1920

These machines represent an important contribution to the ageless problem of food preservation and human nutrition. About one-half of all the food sterilized in cans in the world is processed in them.

Their development (1913-1920) was led by A. R. Thompson of the Anderson-Barngrover Company of San Jose, California. In 1928 this company became part of the Food Processing Machinery Division of the FMC Corporation.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS - 1982

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