GINACA

Pineapple Processing Machine

INTERNATIONAL HISTORIC MECHANICAL ENGINEERING LANDMARK • HAWAII SECTION

DOLE PACKAGED FOODS COMPANY • HONOLULU, HAWAII • FEBRUARY 19, 1993

INTERNATIONAL HISTORIC
MECHANICAL ENGINEERING LANDMARK

GINACA PINEAPPLE PROCESSING MACHINE
1911

COMMERCIAL PINEAPPLE PRODUCTION BEGAN IN HAWAII ABOUT 1890. FRUIT WAS HAND-PEELED AND SLICED TO MATCH CAN SIZES FOR EXPORT. IN 1911, JAMES D. DOLE HIRED HENRY G. GINACA TO DESIGN A MACHINE TO AUTOMATE THE PROCESS. AS FRUIT DROPPED THROUGH THE GINACA MACHINE A CYLINDER WAS CUT TO PROPER DIAMETER, TRIMMED TOP AND BOTTOM, AND CORED. THIS MACHINE MORE THAN TRIPLED PRODUCTION, MAKING PINEAPPLE HAWAII'S SECOND LARGEST CROP. IN THE FASTER GINACA MACHINES NOW USED AROUND THE WORLD, THE PRINCIPLE REMAINS UNCHANGED.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS—1993

Historical Significance

Commercial pineapple production which started about 1890 with hand peeling and cutting operations soon developed a procedure based on classifying the fruit into a number of grades by diameter centering the pineapple on the core axis and cutting fruit cylinders to provide slices to fit the No. 1, 2 and 2-1/2 can sizes.

Up to about 1913, various types of hand operated sizing and coring machines were used to perform this operation. The ends of the pineapple were first cut off by hand. The pineapple was then centered on the core and sized. Production rates were about 10 to 15 pineapples per minute. A large amount of labor was required, and it was not practical to recover the available juice material from the skins.

Under these conditions the number of machines required for production rates above about twenty tons of pineapple per hour became so great that it was not feasible to build canneries equipped for large scale production of pineapple products.

About 1911 Henry G. Ginaca of the Honiron Company, Honolulu, was engaged by Mr. J. Dole, founder of Hawaiian Pineapple Company, to develop the machine which made the Hawaiian pineapple industry possible and which bears his name today.

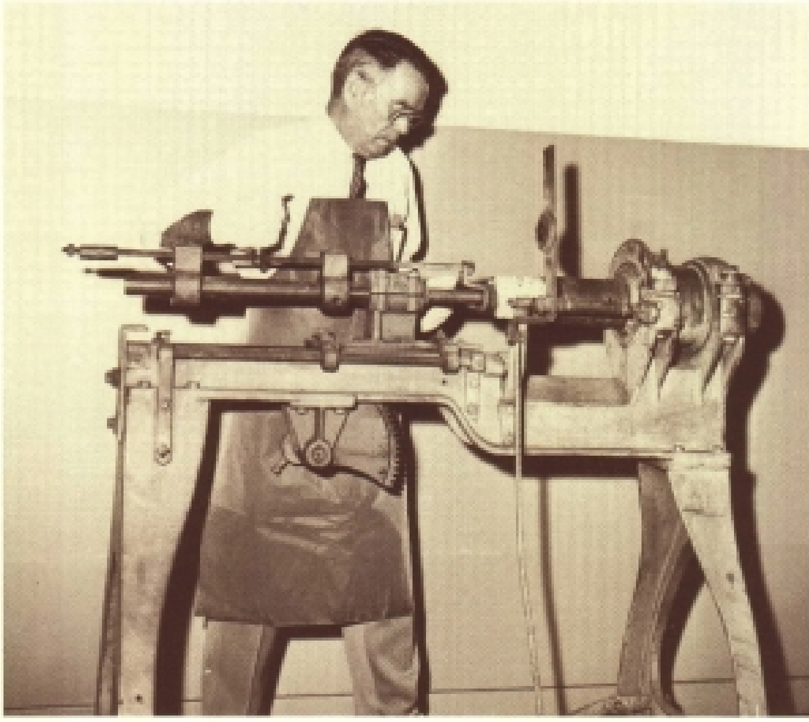
The term "Ginaca" is now generally applied to a variety of machines which are designed to automatically center the pineapple on the core, cut out a fruit cylinder, eradicate the crushed and juice material from the outer skin, cut off the ends and remove the central fibrous core.

The cored cylinder leaving the Ginaca machine is then passed to a preparation line where each fruit is treated individually to remove cylinder defects or adhering bits of skin.

The early Ginaca had a production capacity of about 50 pineapples per minute and required from three to five operators depending on how much inspection of the machine product was performed at the machine.

The increase in production from 15 to 50 pineapples per minute was enough to reduce the cannery size to economical proportions and made possible the design of efficient preparation lines. Once the new preparation and handling systems were proven the industry grew rapidly.

The first production Ginaca machine was actually a combination of devices developed and patented separately.



"Hand sizing and coring machine"

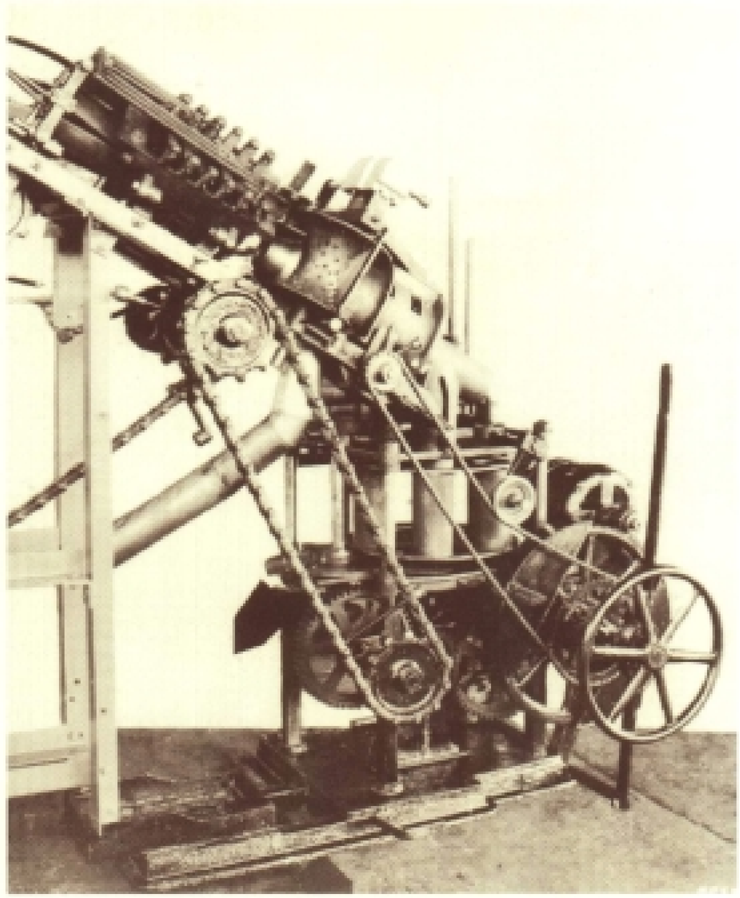
The first device was designed to feed, center and size the fruit cylinder. It consisted of a chain provided with pushers, a centering head, which was the subject of a separate patent, and a stationary sizing knife.

The second was a six-pocket turret mechanism designed to receive the sized pineapple cylinders and remove the ends and core between the feed and discharge stations.

The third device was a skin eradicator to remove the juice material adhering to the skin. A variety of systems were used for this operation depending on the cannery and product requirements and the stage of machine development.

To cut a clean fruit cylinder it was soon found necessary to rotate the sizing knife, and when the devices developed for the individual operations were combined the first Ginaca consisted of:

1. Feed chain provided with flat faced pushers at regular intervals.
2. A centering head consisting of approximately 14 pairs of fingers having mechanical cross linkages which accurately located the pineapple for sizing.
3. A rotating, circular sizing knife inclined 30 degrees to the horizontal. (The pineapple was pushed about halfway through the sizing knife by the feed chain pusher and left hanging for the next pineapple to push it completely through.)
4. An eradicator consisting of a cleated belt, grids and a knife which cut the juice material from the out skin removed by the sizing knife. In the early days of the industry there was little demand for juice and the eradicator was often omitted.
5. A stationary curved tube which guided the fruit cylinder from the inclined sizing knife to the feed station of the vertical turret.
6. A vertical turret mechanism provided with a six-pocket turret to receive the fruit cylinders, timed, rotating end cut knives, a spring-loaded plunger to move the fruit in the turret pocket against a stop so that the upper end could be cut off by a timed rotating knife. A hollow core tube with a crank and slider mechanism removed the core after the ends were cut off.



The Ginaca was redesigned as a production machine in 1919.

1919 Model Ginaca

After a period of initial success which firmly established the preparation methods used, the Ginaca was redesigned as a production machine in 1919 and this model is still used in one form or another by many canners today.

The inclined rotating sizing knife, the stationary curved transfer tube between the sizing knife and turret and a vertical turret mechanism were retained — features which have also been used on machines manufactured in the mainland U.S. and Australia.

However, there were a number of disadvantages to this original arrangement from the standpoint of modern requirements for design, performance and maintenance.

In general, the basic arrangement of the original Ginaca and 1919 model with the inclined sizing knife and vertical turret required more complex mechanisms, more drives, shafting and bearings and more brackets and supports than later straight through designs.

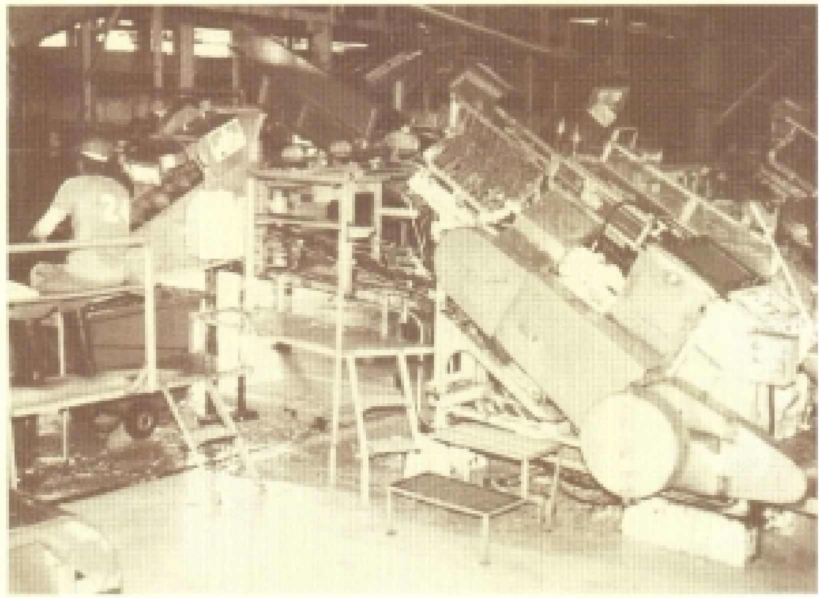
Most of these machines which incorporate a vertical turret are characterized by maximum speeds of 65 pineapples per minute, light drives, open gearing and high annual maintenance costs in terms of the amount of pineapple produced.

1925 Model Ginaca

After a number of years of constantly increasing production, a new high-speed machine was designed at the Hawaiian Pineapple Company capable of preparing from 90 to 100 pineapples per minute depending on fruit size.

The increase in speed from 65 per minute with the 1919 model was accomplished by aligning the turret with the sizing knife axis so that there is a straight path for the fruit cylinder between the sizing knife and the turret feed pocket and a hooked pusher design which delivers each pineapple completely through the sizing knife without the need to wait for the following pineapple to complete the sizing operation.

About sixty 1925 model Ginacas have been built and most are still in operation. There have been numerous changes in details of eradicators, feeds, auxiliary drives and construction and in one form or another most of the machines have been completely rebuilt several times to improve details to satisfy changing cannery requirements or simply to replace worn out parts.



1925 MODERN MACHINE
Capacity–105 pineapples per minute • Size–6 feet 6 inches high • 6 feet 6 inches wide • 8 feet 0 inches long • Power–3 horsepower

Post-World War Designs

The 1925 Ginaca machines were used through the Word War II years up to about 1947. Although the potential market was not large, improving the Ginaca design remained a challenging engineering problem.

Since 1947 at least five major attempts have been made to improve the basic Ginaca design to better fulfill modern cannery requirements.

In three of the resulting designs the combination of gravity force and pineapple velocity relied on to transfer the cylinder from the sizing knife to the turret pocket is replaced by either vacuum, applied through a seal at the low end of the turret, or by air pressure introduced between the ends of two pineapple cylinders at the sizing knife position. The resulting pressure between the free cylinder and the one being cut, forces the first cylinder into the turret — a method of operation called "jet transfer".

By using air to move the cylinder into the turret the path of the pineapple through the machine can remain horizontal. The expense of the necessary vacuum or air and the extra complications of the seals, pipe and nozzles, more than make up for the doubtful advantages of horizontal operation.

Production speeds are also limited to a maximum of about 100 pineapples per minute and most of the units in production operate at about 75.

Only one horizontal machine design has had any degree of success but even this model is limited in speed to about 75 pineapples per minute. This is an expensive and complex machine requiring three primary drive housings plus the jet transfer construction.

Three of the designs were complete failures—not only because of their complexity and expense, but also because they failed to perform as expected and were less efficient than existing machines.

One post-war design based on the use of air cylinders to perform feeding and coring operations failed when it proved impossible to obtain cylinder operation in sequence fast enough to produce more than 40 pineapples per minute.

In general, the post-war designs which departed from the original Ginaca gravity transfer have been more complex and more expensive than the earlier machines. They have proven to be less reliable and more difficult to maintain and there have been no advantages in production capability.

The Ginaca machine made canning pineapple economically possible. As a result, until the "jet age" Hawaii had an agricultural economy and pineapple was the second largest crop. Until 1990 pineapple was the sole crop and industry of Lanai, an island of the chain of islands constituting the State of Hawaii. The pineapple industry contributed to the migration of people from many parts of the world such as Puerto Rico, Mexico, the Philippines, etc. adding to the ethnic diversity of the islands.

JAMES D. DOLE

James Dole (Jim) was born in Jamaica Plain, Mass., a suburb of Boston, on September 27, 1877 to Rev. Charles Fletcher and Frances Drummond Dole. Jim was the oldest of four children.

A few days after he was born, an old man who had lost a son, brought a gift of $50 for him. This was the beginning of the savings account which Jim used when he first set out for Hawaii in 1899 to seek his fortune.

Once Jim started growing pineapple on his Wahiawa plantation, he realized that the market possibilities were huge in the U.S. and the rest of the world. Canning would do it and canning, he decided was the only logical way to market Hawaiian pineapple. On December 4, 1901, Hawaiian Pineapple Company, Limited (Hapco) was incorporated.

In 1911, when a lot of pineapples were growing in the fields about ready to pick and the need for a machine that would process fruit more quickly was apparent, Dole hired Henry Gabriel Ginaca to try to develop a machine that would peel, core, size, and trim pineapples.

Jim built his cannery on a solid base of the moral principles he had absorbed from his mother and father. “We have built this Company on Quality—and Quality—and Quality” was based on Jim’s principles of quality and morality. Jim died in May 1958.

HENRY A.G. GINACA

Henry Ginaca was born May 19, 1876. The records are not clear whether he was born in California or in Winnemucca, Nevada, where his father had worked as a civil engineer. His father was Italian, his mother French.

Ginaca inherited his father's aptitude for engineering. While a teenager, he became an apprentice at the old Union Iron Works in San Francisco. He also took a course in mathematics to enable him to become a mechanical draftsman.

He was hired by the Honolulu Iron-Works and came to Honolulu, apparently to work on engine designs. It was here that the young designer came to the attention of James D. Dole, founder of the young and still struggling Hawaiian Pineapple Company.

Dole hired Ginaca to work specifically on a mechanical fruit peeling and coring machine. He joined Hapco in March, 1911, at a salary of $300 per month, a substancial wage in those days. Ginaca was 35 years old.

In the first year of Ginaca's employment he came up with the initial design for his machine. From then until 1914 he added improvements and refinements to it. Though many “bugs” had to be worked out, Ginaca's machine was a success from the beginning. The machine was awarded a gold medal at the Panama-Pacific Exposition in San Francisco in 1915.

In 1914 Ginaca and his two brothers decided to return to the mainland and try their hand at mining. The mining ventures of the three brothers were failures. For Henry Ginaca, a productive career came to an untimely end on October 19, 1918, when he died of influenza and pneumonia at the old Mother Lode mining camp of Hornitos. He was only 42.

The History and Heritage Program of ASME

The ASME History and Heritage Program began in September 1971. To implement and achieve its goals, ASME formed a History and Heritage Committee, composed of mechanical engineers, historians of technology, and the Curator of Mechanical and Civil Engineering at the Smithsonian Institution. The Committee provides a public service by examining, noting, recording, and acknowledging mechanical engineering achievements of particular significance.

The Ginaca machine is the 37th International Historic Mechanical Engineering Landmark to be designated. Since the ASME History and Heritage Program began, 155 Historic Mechanical Engineering Landmarks, 6 Mechanical Engineering Heritage Sites, and 4 Mechanical Engineering Heritage Collections have been recognized. Each reflects its influence on society, either in its immediate locale, nationwide, or throughout the world. A landmark represents a progressive step in the evolution of mechanical engineering. Site designations note an even or development of clear historical importance to mechanical engineers. Collections mark the contributions of a number of objects with special significance to the historical development of mechanical engineering.

The ASME History and Heritage Program illuminates our technological heritage and serves to encourage the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians, and travelers, and helps establish persistent reminders of where we have been and where we are going along the divergent paths of discovery. For further information, please contact the Public Information Department, The American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017, 212-705-7740.

Acknowledgements

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