F. & H. BENNING COMPANY OYSTER MILL
14430 Solomons Island Road (moved from 1014 Benning Road,
Galesville, Anne Arundel County, Maryland)
Solomons
Calvert County
Maryland

HAER MD-135
MD-135

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

F. & H. BENNING COMPANY OYSTER MILL

HAER No. MD-135

LOCATION:	14430 Solomons Island Road, Solomons, Calvert County, Maryland; moved from 1014 Benning Road, Galesville, Anne Arundel County, Maryland
DATE OF CONSTRUCTION:	patented 1884
DESIGNER:	Frank Wilson, Wilson Brothers, Easton, Pennsylvania
PRESENT OWNER:	Calvert Marine Museum
SIGNIFICANCE:	The F. & H. Benning Company Oyster Mill is a remnant of the once vital and significant Chesapeake Bay oyster industry. The F. & H. Benning Company, along with many other Maryland oyster companies, found lucrative methods of dealing with their industry's largest byproduct, the oyster shells. By using grinding mills already available for grinding hard materials like bone, oyster companies could crush oyster shells for such uses as chick grit and agricultural fertilizer.
HISTORIAN:	Justine Christianson, HAER Historian, 2004-2007
PROJECT INFORMATION:	This project was undertaken by the Historic American Engineering Record (HAER), a division of the National Park Service, U.S. Department of the Interior, in cooperation with the Calvert Marine Museum (C. Douglass Alves, Jr., Director). Richard Dodds, Maritime History Curator, and Robert Hurry, Registrar, provided access and research assistance. Todd Croteau (HAER Architect) served as project leader. Measured drawings were produced by Todd Croteau (HAER) and Victoria Valletta (ICOMOS). Justine Christianson (HAER Historian) served as project historian. Todd Croteau produced the large format photography. For additional information on the F. & H. Benning Company, see HAER No. MD-138.

INTRODUCTION

Oyster processing results in a large byproduct, the shells. Shrewd businessmen in the oyster industry soon found ways to market and profit from their industry's byproduct. Crushed shells could be used as chick grit and as fertilizer while whole shells placed on oyster beds served as cultch. In order to crush the shells, oystermen took advantage of grinding mills already available for grinding a wide variety of hard materials. The F. & H. Benning Company of Galesville, Maryland, a small oyster house in the Chesapeake Bay area, was one business that sold and marketed its oyster shells. They purchased a grinding mill patented by Frank Wilson of Easton, Pennsylvania around 1929-30 for the express purpose of crushing shells. The mill still survives and is currently held by the Calvert Marine Museum.[1]

DESCRIPTION

The grinding mill is currently housed in a frame building located to the rear of the J.C. Lore Oyster House (see HAER No. MD-139). Although not fully assembled, the components of the mill are intact. Frank Wilson of Easton, Pennsylvania, in conjunction with John L. Wilson and James E. Wilson, received approval on February 3, 1885 for a mill patent application (see Appendix D for patent drawing). The patent states that their mill "relates to that class of mills which are employed for grinding bones, charcoal, or other animal or vegetable substances." The Wilson's improvements to the mill allowed for "the certain and rapid disintegration or pulverization of the bones or other material which is being treated." The patent specifies the main body "preferably cast in one continuous piece" have a serrated interior. A hopper or feed-chute attached by a screwbolt to the main body of the mill. A central-operating shaft ran through the mill, with a cone "sleeved upon the shaft." The cone, made of cast or wrought iron, had grinding teeth. The shaft ran through two serrated grinding burrs, which Wilson designed to have flat teeth since he found it "very effective in its utilization of the entire power applied in the operation of the mill, the bones, shells and other material already coarsely ground in the conical shell being brought directly in contact with the flat ends of the teeth upon both of the burrs." The two grinding burrs did not interlock but worked at the same time. As the mill ran, "those portions of the material which have been pulverized to a degree which will permit them to pass through the space between the two burrs near their peripheries will fall through the discharge-passage." Larger pieces are "carried upward and brought into contact with the large crushing tooth" attached to a fixed grinding burr "near its upper extremity, and will be by it so broken that the process of comminution will be effectively completed by the smaller teeth." This system, according to Wilson, kept the small pieces of ground material from obstructing the grinding of larger pieces. The Wilsons had two mills of this design, the larger one operated by steam power while the smaller one had a hand crank. The burrs in the larger mill could be taken out and replaced when they became too worn, but those in the smaller one could not because one was

[1] Many of the pieces of equipment used in the Benning operation were donated to the Calvert Marine Museum by Steuart Chaney, W. Calvert Chaney, Elmer Benning, and Eric J. Steinlein, Jr., including the grinding mill. Paula Johnson, ed., *Working the Water: The Commercial Fisheries of Maryland's Patuxent River* (Charlottesville, VA: The University Press of Virginia, 1988), p. xviii. For more information on the F. & H. Benning Company, see HAER No. MD-138.

actually attached to the casing.[2]

It is not definitively known where the F. & H. Benning Company obtained its Wilson Brothers grinding mill. A handwritten letter from the Bennings to the Holland Crushers Company on May 4, 1929 provides the only information. In it, the Bennings asked if the company had a crusher that could handle 5 tons a day of shells. They requested that the company send the price of such a machine, if they had one, and describe if it was gas, steam or electric-powered.[3]

The Bennings set up the large Wilson Brothers mill in one of their buildings. Oyster shells were sent over from the shucking house and put on an inclined canvas conveyor that carried them to the feed hopper. The toothed cone roughly crushed the shells and then forced them into a chamber with rotary burrs, consisting of two disks with a small space between each. One disk was fixed to the housing while the other rotated around the axis of the drive shaft. A weighted arm pressed the rotating disk against the fixed one. The cone and disks could be removed when worn and replaced. After grinding, the material dropped into a concrete pit where a second inclined conveyor affixed with metal pockets carried the crushed shell up to a rotary screen that sorted the material into three grades: ¼", 1/8", and 1/16" diameter. The crushed shells then dropped through the screen into hoppers that led to canvas chutes used for filling bags below. A 1926 Fairbanks-Morse gasoline engine (listed as type Y Horizontal Oil Engine, Style HB) powered the grinding mill, conveyors and rotary screen. This single-cylinder, 25 horsepower engine transmitted power via a system of belt drives and chain drives. A single belt from the engine powered the grinder.

Some components of the mill remain disassembled and their original purpose is not specifically known. One such component is an upright corrugated metal cylinder with stacked pans above that may have served as a radiator for the engine. There is also a galvanized metal container that may originally have been a fuel tank. A shaft with a cog and belt wheel appears to have powered a centrifugal water pump that may have circulated water through the radiator system. Finally, there are several sets of small and large cones and burr wheels.

The Bennings had the smaller hand-powered Wilson Brothers mill, and the Calvert Marine Museum now owns this as well. They may have used his as a backup or for regrinding material to an even finer size. Another explanation is that the Bennings used this mill at first until they began dealing with a larger volume of oyster shells, which would have necessitated purchasing the large mill.

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[2] Frank Wilson of Easton, Pennsylvania, assignor of two-thirds to John L. Wilson and James E. Wilson, both of Easton, Pennsylvania, Patent for Grinding Mill, Patent No. 311,626, dated February 3, 1885. Frank Wilson also applied for and received a patent for a smaller hand cranked grinding mill on January 29, 1884, see Patent No. 292,523.

[3] Letter from Bennings to Holland Crusher Co., May 4, 1929, in F. & H. Benning Collection, Box 1, Acq. A-1, Calvert Marine Museum Library (hereafter cited as CMM Library).

OYSTER BIOLOGY

Oysters are invertebrates belonging to the phylum *Mollusca* and genus *Crassostrea*, characterized by soft bodies surrounded by a hard shell. They are related to snails, squids, octopi, clams, cockles, and mussels. There are about 400 species of oysters, including about seventy edible species. In the United States, there are several native oysters that thrive in different climates: *Crassostrea virginica*, also known as the Eastern or Atlantic oyster, which is found from Nova Scotia and Prince Edward Island, Canada, to the Gulf of Mexico and the West Indies; *Ostrea frons* of the southeastern United States that attaches itself to mangrove trees; *Ostrea equestris*, also known as the horse oyster and native of the Southeast; and *Ostrea lurida*, called the California or Olympia oyster and the only one native to the West Coast. There have also been various types of oysters introduced to this country, including *Crassostrea gigas*, a Japanese oyster brought to the panhandle of Alaska, British Columbia, Washington, Oregon and California; *Crassostrea rivularis* of Asia introduced to Puget Sound; and *Ostrea edulis*, a European oyster found in Maine.[4] In Maryland, the oyster industry harvests and processes *Crassostrea virginica*. Oysters can thrive in waters with various temperatures and salinities, ranging from the Gulf of St. Lawrence to the Gulf of Mexico, with the "most productive" waters "the estuarine bodies from Rhode Island to Texas."[5]

All oysters develop in the same manner, regardless of species. Within twenty-four hours of fertilization, tiny oyster larvae are produced. Fifteen days later, the oyster larva uses its foot to scoot itself along, searching for a good spatting location on which to take hold. When a suitable home has been found, the larva attaches itself in about fifteen minutes with secretions that harden like cement thereby becoming a "spat." From that point on, the spat remains in its chosen location and matures into an oyster.[6] As oysters grow and reproduce, spat attach themselves to the mature oyster, thereby extending the oyster bar.

Oysters have two valves hinged together that form the shell, thus they are "bivalves." The shells are formed by "a heavy glandular membrane" producing a liquid secretion that hardens. Lime deposits on interiors of the shells help thicken them. Oysters have gills that pump in water while cilia gather food particles from the water, filtering and discarding that which is inedible. This process enhances the health of the ecosystem by facilitating oxygen flow through the water and preventing silt deposits.[7]

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[4] Ralph Eshelman, "Oyster Fisheries of the United States: A Part of the Maritime Heritage of the United States, National Landmark Theme Study," National Park Service, U.S. Department of the Interior, 1993, 2001, p. 6; Robert A. Hedeen, *The Oyster: The Life and Lore of the Celebrated Bivalve* (Centreville, MD: Tidewater Publishers, 1986), pp. 28-29.

[5] Hector Bolitho, ed., *The Glorious Oyster* (New York: Horizon Press, Inc., 1961), pp. 99-100; Eshelman, "Oyster Fisheries," p. 5; R.V. Truitt, "The Oyster," State of Maryland, Board of Natural Resources, No. 7 (Solomons Island, Department of Research and Education, February 1945), p. 4.

[6] Truitt, "The Oyster," p. 11.

[7] Bolitho, p. 100; Truitt, "The Oyster," p. 4-6; Fred W. Sieling, *The Maryland Oyster*, a publication of the State of Maryland, Department of Natural Resources, Public Information Services, 1974, unpaginated.

OYSTER SHELLS AND THEIR USES

By the late nineteenth century, demand for the "toothsome mollusk" in the United States had propelled the country to first in the world in terms of oyster production. The 1891 oyster harvest totaled $15 million, and in 1929, despite a marked decline in production, "152,000,000 pounds of oyster meat were harvested in the United States; equivalent to 1 ¼ pounds of oyster meat per person in the country at that time." The United States still produced 80 percent of the world's oysters in 1929.[8] The increased consumption of oysters in the second half of the nineteenth century was the result of larger historical developments.

While preserving oysters by pickling has been recorded as early as 1764, consumption of oysters necessarily occurred most frequently in those areas where fresh oysters could easily be obtained. Several developments, however, allowed the oyster in both fresh and canned states to reach consumers across the country by the mid-nineteenth century.[9] The Gold Rush and the Civil War sparked consumer demand for canned goods. Road and railroad construction opened the country to shipping, while canning made the transport of oysters safely and cheaply across the country possible.

Oysters became an affordable source of protein due to advances in canning technology. In 1819, Englishmen Thomas Kensett and Ezra Daggett began canning oysters in New York using the Appert method, a technique developed by Frenchman Nicolas Appert that involved sterilizing food-filled glass jars in boiling water. In the 1840s, Kensett moved to Baltimore where the oyster supply was much more plentiful and began packing oysters in cans.[10] Soon other canneries opened, and by the 1860s, business was booming in Baltimore. By 1880, there were over 100 canneries in Baltimore packing not only oysters but also such local vegetables and fruit as peaches, tomatoes and corn in the oyster off-season.[11] Oysters were no longer a delicacy available only to the wealthy or those living along the Atlantic seaboard; by the late nineteenth century, canning had made it possible for them to be safely consumed across the country. Oysters would not have reached a larger market, though, if railroad expansion had not occurred. Changing consumer tastes coupled with technological advancements in food preservation and transportation combined to propel canned and raw oysters into the nation's marketplace.[12]

Large scale oyster consumption in the late nineteenth century would result in ever increasing shell piles for which those in the oyster industry would find new uses and markets. In time, the

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[8] Eshelman, "Oyster Fisheries," p. 11.
[9] Eshelman, "Oyster Fisheries," p. 35.
[10] Eshelman states Kensett began shipping canned oysters in 1841 in "Oyster Fisheries," p. 36; Jarvis states in "Curing and Canning of Fishery Products: A History," that Kensett began packing in Baltimore in 1844 (see N.D. Jarvis, "Curing and Canning of Fishery Products: A History," *Marine Fisheries Review* (Fall 1988), unpaginated, available at http://www.findarticles.com/p/articles/mi_m3089/is_n4_v50/ai_9102707 , accessed December 2004). For more information on Appert, see Sue Shepherd, *Pickled, Potted and Canned: How the Art & Science of Food Preserving Changed the World* (New York: Simon & Schuster, 2000).
[11] "Brief History of Canning," from Baltimore Museum of Industry Education Package, Canning General vertical file, Baltimore Museum of Industry Library, in Baltimore, Maryland (hereafter cited as BMI).
[12] Nicholas F. Bellantoni and Collin Harty, "The Eastern Oyster: Changing Uses from an Archaeological Perspective," *CRM*, no. 4 (2001): p. 30.

shells became just as valuable as the oyster meat so that "the shell pile…is guarded, since in many cases it represents the greater part of the profits from the business."[13] Lewis Radcliffe, Assistant in Charge of Fishery Industries, reported that "on the basis of canvasses made by the Bureau of Fisheries of the South Atlantic and Gulf States for 1918 and the New England States for 1919, these sections produced 10,559 tons of ground oyster shells for poultry grit and lime, valued at $98,201." In addition, he noted that Maryland and Virginia produced large amounts of shell as well.[14] In the nineteenth century, for example, it was estimated that the state of Maryland produced one-third of the raw oysters of the world, a total of 400 million bushels valued at $250 million.[15] From 1930 to 1955, oyster production averaged from 2.3 to 3.2 million bushels a year.[16]

Oyster shells have many uses due to the calcium and lime they contain, and their use predates European settlement of the United States. American Indians used oyster shells in pottery by mixing crushed shells with clay. Archaeologists excavating eighteenth century farm sites in New England have discovered that European colonists used shells to fertilize their crops. Shells were so important as a fertilizer that in colonial Connecticut, "oysters were more highly prized as a fertilizing agent than as a table food."[17] Along the southern Atlantic coast, builders mixed shells with sand and lime to create tabby, a building material.[18] In a deviation of tabby, someone in Galveston, Texas in 1913 constructed a house using over five million oyster shells bonded with cement and sand.[19]

Historically, a common use of oyster shells was in road construction and repair, a practice that can be traced to the Romans. Archaeologists discovered in St. Albans, England, that Romans paved their roads in oyster shells.[20] Even more recently, crushed oyster shells were used as road paving material in the United States in areas where large quantities were available, like New Orleans and communities on the Atlantic Coast. In Maryland in 1899, 250 miles of road had been paved with oyster shell, with each mile using 58,000 bushels. The cost of this type of

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[13] Truitt, "The Oyster and Oyster Industry of Maryland," p. 39.
[14] Lewis Radcliffe, Assistant in Charge of Fishery Industries, "Uses of Oyster Shells," Department of Commerce, Bureau of Fisheries, Washington, DC, Memo S-192, April 23, 1921, p. 1, from Oyster vertical file, BMI.
[15] "The Mother of Oysters: Maryland Produces One-Third of the Total Supply of the World," from the *Philadelphia Times*, reprinted in *The Washington Post*, September 21, 1896, p. 7.
[16] MacKenzie, unpaginated.
[17] Bellantoni and Harty, p. 30.
[18] For more information on tabby, see documentation produced by the Historic American Buildings Survey on sites in Beaufort County, South Carolina. The following sites have both photographs taken by HABS photographer Jack Boucher and written documentation by Colin Brooker: HABS No. SC-138-A, Talbird House (ruin), Outbuildings; HABS No. SC-461, Saltus-Habersham House; HABS No. SC-542, Elizabeth Barnwell Gough House; HABS No. SC-856, Seawall; HABS No. SC-857, Callawassie Sugar Works; HABS No. SC-858, Fort Frederick; HABS No. SC-859, Elliott House (Anchorage); HABS No. SC-860, Retreat Plantation; HABS No. SC-863, Tabby Ruins; and HABS No. SC-868, Edwards House & Dependencies. Additional records are photography-only components of the survey: HABS No. SC-865, Cemetery; HABS No. SC-862, Heyward Hamilton House; HABS No. SC-861, Isaac Fripp House; HABS No. SC-541 & 541-A, Berners Barnwell Sams House; and HABS No. SC-287, Thomas Fuller House (Tabby Manse).
[19] "House Built of Oyster Shells," from the *Philadelphia Record*, reprinted in *The Washington Post*, March 21, 1913, p. 6.
[20] "The Bivalve Highway," *The Washington Post*, July 24, 1910, p. ES4.

paving was $1,000 to $2,000 a mile (depending on road width) with each bushel costing 2 cents and the labor to haul and spread it costing 1 cent.[21]

Oyster shells also served as good fill. For example, in Boston, they were used as fill behind the wharves.[22] Vast amounts of discarded shells extended shorelines as well. The shell piles from the J.C. Lore Oyster House in Solomons, Maryland, for example, created new land behind their facility. In 1922, the State of Maryland granted the Lores a land patent for 2,308 square feet of new land.[23]

A particularly lucrative and large-scale use for crushed oyster shells was as chick grit. The origins of the use of oyster shells in the chick grit industry are in Baltimore, which after 1850 became the center of the oyster canning industry in the United States and thus the largest producer of discarded shells. Chick grit was an important component of a chicken's diet because it aided digestion. Furthermore, the calcium in oyster shells helped strengthen the chicken's eggshells. To produce grit, oyster shells first had to be dried in a "direct-heat rotary drier" before being "carried by conveyor to the crusher and from there to the screen, which is usually of the revolving type and made of various size mesh to separate crushed shells into several grades or sizes."[24] The Oyster Shell Crushers Industry noted that the "procedure is essentially to crush the shells, after which they are screened into several more or less well-recognized sizes." The shell was then shipped to distribution centers and sold at feed and supply stores and by mail order.[25] Oyster packing houses could crush shells themselves or sell whole shells to a crushing operation. Companies across the country existed solely to grind shell, a list of which is included in Appendix A.

The use of shell in the chick grit industry was somewhat contentious. One source noted that "there is a strong prejudice against the presence of any oyster-shell in the manufacture of fertilizer, strange to say, and the broken shell finds a market only as food for poultry in place of fine gravel."[26] Such opinions seem to have been inconsequential. In 1921, the United States manufactured $2,261,754 worth of "poultry" grit and lime, with Maryland producing by far the most chick grit as a single state at 51,408 tons valued at $492,958. Virginia produced the next greatest amount as a single state: 26,150 tons for a $325,125 value (see Appendix C for more information).[27] In 1935, the United States produced 264,282 tons of crushed oyster shell for

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[21] Eshelman, "Oyster Fisheries," p. 39.
[22] George Brown Goode, ed., "A Geographical Review of the Fisheries Industries and Fishing Communities for the Year 1880," Section II in *The Fisheries and Fishery Industries of the United States* (Washington, DC: Government Printing Office, 1887), p. 203.
[23] Eshelman, "Oyster Fisheries," p. 38; Clyde L. MacKenzie, Jr., "History of Oystering in the United States and Canada," *Marine Fisheries Review* (Fall 1996), available at http://www.findarticles.com/p/articles/mi_m3089/is_n4_v58/ai19847493, accessed December 2004.
[24] Dr. E.P. Churchill, Jr. in "The Oyster and the Oyster Industry of the Atlantic and Gulf Coasts, Appendix VIII to the Report of the U.S. Commissioner of Fisheries for 1919," pp. 48-49, plate XXVIII, fig. 2 and plate XXIX, figs. 1 and 2, quoted in Radcliffe, pp. 1-2.
[25] National Recovery Administration, Code of Fair Competition for the Oyster Shell Crushers Industry, as approved on June 2, 1934 (Washington, DC: U.S. Government Printing Office, 1934), 126.
[26] Goode, 203.
[27] Table, "Oyster Shell Industries, 1921," *Fishing Gazette Annual Review*, 1923, p. 122.

chick grit.[28] Chick grit made with crushed limestone gradually supplanted that made with crushed oyster shell. Since limestone predominately came from the mid-section of the country where chick grit was most needed, the need for oyster shells decreased.[29] According to one source, the irregular supply of shells, the effects of shells on feeders, and the dustiness of the crushed shells caused the shift to limestone. Despite those problems, "in the 1990s, about 100,000 tons of crushed oyster shell a year was being used by the poultry industry."[30]

In addition, oyster shells contain pure lime, free of impurities, making it more desirable than lime obtained from limestone. Lime could be used in plaster, mortar, whitewash, as a disinfectant, and as fertilizer, since it breaks down "vegetable and animal mater by taking water and carbonic acid from them."[31] The lime deposited in "successive films on the inside" of the shell could be extracted by burning the shells in a kiln or simply out of doors. Grinding shells for lime simply produced "carbonate of lime, which is of little or no use as a fertilizer, as it is not soluble in water, and has no active qualities, and cannot, consequently, exert any effect upon the soil or vegetation," according to one source.[32] Very fine shell matter produced as a byproduct of crushing shell into chick grit could be used in fertilizers.[33] In Maryland, an important connection was established between oystermen and farmers as the farming community helped the oyster industry turn a profit on its byproduct.[34] The Benning Company was located in the agricultural community of Galesville, Maryland, illustrating this relationship well. Their name, F. & H. Benning Oyster & Lime Co., reflects the equal importance of the oyster meat and the lime contained in the shells, as does an extant sign proclaiming "F. & H. Benning, Oyster and Lime Co., Dealers in Crushed Shells for Chickens, Seafood in Season, Crushed Lime."

Oyster shells were also particularly valued by the state of Maryland for their use as cultch or beds on which new oysters can attach. The state of Maryland, realizing the need to conserve its oyster resources, passed legislation in 1922 to reshell the oyster bars. An act passed in 1927 required that oyster packers give 10 percent of their shells to the state for cultch.[35] This was necessary to maintain the decreasing oyster population. R.V. Truitt described the depletion of Maryland's oyster bars.

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[28] MacKenzie, unpaginated.
[29] National Recovery Administration, 126.
[30] MacKenzie, unpaginated.
[31] Truitt, "The Oyster," p. 6; "Lime from Oyster Shells," *The Manufacture and Builder* 22, no. 11 (November 1890): p. 262, available at http://memory.loc.gov/ammem/, accessed March 2005.
[32] An article in an 1890 edition of *The Manufacture and Builder* advised readers to dig a pit 10' in diameter and 1' to 2' deep. The bottom foot of the pit would contain wood and brush with kindling in the center. Shells would then be put into the pit, followed by more wood with kindling. Leaves and dirt then covered the whole mound, except for a hole at the top and a few holes at the base. The kindling would be lit and the mound left to burn down, with the end result being a pile of lime. "Lime from Oyster Shells," p. 262.
[33] National Recovery Administration, p. 126.
[34] In 2004/2005, the owner of the Benning Company site and buildings remembered locals purchasing shells from the Bennings. They would then deposit the purchased shells on piles of brush in their field and set the piles alight. The burned shells released lime into the fields for many years. Such activity was probably illegal, however, since in 1836, Maryland prohibited oyster shells from being burned for lime and instead used for maintaining oyster beds. Conversation with owner, December 2004; Eshelman, "Oyster Fisheries," p. 38.
[35] G.F. Beaven, "Maryland's Oyster Problem," State of Maryland, Board of Natural Resources, no. 8 (Solomons Island, MD: Department of Research and Education, May 1945), p. 8.

> Under natural conditions oysters established bars, extended these bar boundaries according to the environmental fitness, and maintained the bars by virtue of the fact that upon the death of the older oysters their shells became fine bar-building cultch materials. However, with the development of the oyster industry, and the removal of adult oysters in greater and still greater numbers, the brood stock constantly was being diminished. With this taking place, fewer oysters were left to die of senility and other causes, thus no longer were shells being added to maintain the cultch supply.[36]

In order for oysters to reproduce successfully and therefore for Maryland's oyster population to be maintained, the free swimming oyster larva had to find a clean surface to call home. Once attached, the spat (as it was then known) could mature into an adult oyster. With the expansion of the oyster industry, new methods of harvesting oysters were developed that were more destructive to the oyster bars. Whereas oystermen had previously used the less invasive method of tonging to pluck oysters from beds, dredging (although tightly regulated by the state of Maryland) scooped up all the material in the dredge's path. High consumer demand for oysters spurred the use of dredging, particularly since New England's oyster beds had been depleted and the Gulf Coast had not yet been established as an oyster producing region. In order to remedy the steady depletion of the oyster bars, Maryland's Department of Natural Resources set aside "State seed areas" on public oyster bars. In order to facilitate successful attachments of spat, scientists conducted experiments on different cultch materials. Their experiments proved oyster shells were the best, followed by glass. Materials like brick-bats, wood, coal, slag and pebbles were not as effective.[37]

By 1931, the Maryland Department of Conservation could legally take 10 percent of a dealer's shells without compensation. By 1950, the State of Maryland took 20 percent of an operation's shells for replanting. In 1960, a regulated program developed that "involved mining and spreading 5-6 million bushels of shells each year on beds that had a history of good setting and then transplanting some resulting seed to growing beds."[38] The state also obtained shells from dredging bars, washed them, and then reset them on an establishing bar. In 1976, over 60 percent of exported oysters were sent in the shell. As a way to keep the shells from leaving the state, Maryland imposed a 10 cent tax on each bushel of oysters in the shell.[39]

While the popularity of oysters (particularly canned oysters) has declined due to changing consumer tastes and decreasing availability, oyster shells continue to be an important component of such goods as paint, plastic, rubber, calcium supplements, and chick grit.[40]

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[36] Truitt, "The Oyster and Oyster Industry," p. 26.
[37] Truitt, "The Oyster," p. 11. See this also for more detailed information on oyster biology, as well as Fred W. Sieling, "The Maryland Oyster," a publication of the State of Maryland, Department of Natural Resources, Public Information Services, 1976, unpaginated.
[38] MacKenzie, unpaginated; Truitt, "The Oyster and Oyster Industry," p. 39; Fred W. Sieling, "Maryland's Commercial Fishing Gears II, The Oyster Gears," No. 25 (Solomons Island, Maryland, Department of Research and Education, May 1950), p. 19.
[39] Sieling, "The Maryland Oyster," unpaginated.
[40] MacKenzie, unpaginated.

GRINDING MILLS

The oyster industry used grinding mills already available for crushing hard substances, as exemplified by the F. & H. Benning Company, who used a mill manufactured by the Wilson Brothers Company, located at 43, 45, and 47 Delaware Street in Easton, Pennsylvania. The Wilson Brothers developed and sold various grinding mills, which they touted as being "for the poultryman, farmer, gardener, housekeeper, miller and fertilizer manufacturer." According to an 1874 catalog, the hand mills "are a *complete success* for crushing oyster shells, grinding bone meal, and all kinds of grain. A *peck of shells* can be crushed in *fifteen minutes*…Whole oyster shells can be put into the mill, as well as bones of the same size."[41] They sold smaller mills that could be clamped to a table or bench, such as the No. 1 Poulterer's Mill, recommended for dry material like dry bones, shells, grit, grass and walnuts, and the No. 0 Family Grist Mill, for grinding graham flour and cornmeal. The Poulterer's Mill was expressly recommended for oyster shells: "A customer writes that he ground $105 worth of oyster shells which he sold, and the mill is as good as new."[42] Other available mills included the Oriole Farm Grist Mill No. 21-2 for grinding corn meal, graham flour, and corn; the No. 3 Farm Mill, a hand cranked mill owned by the Bennings; the No. 4 Mill with Automatic Feed for grinding hard and brittle materials; and the No. 4 Mill with a hopper situated directly over the crusher and used for grinding coal and gravel. The Number 7 Bone Mill could be used to grind shell for fertilizer, according to the catalog. The Wilson Brothers also dealt with mills specifically designed for grinding different types of bones, such as the Number 10 and 11 mills and bone cutters.[43]

A 1921 Bureau of Fisheries memo entitled "Uses of Oyster Shells" included a list of companies aside from the Wilson Company that manufactured grinding mills used in the oyster industry (see Appendix B). Researching the catalogs of these companies revealed that some did not specifically advertise their machinery's shell crushing capability, despite their use for that purpose as evidenced in the 1921 memo. In St. Louis, the Gruendler Patent Crusher and Pulverizer Company touted themselves as "engineers and manufacturers of crushing, pulverizing, screening & conveying machinery," but made no mention of oyster shells.[44] A.J. Sackett of Baltimore, manufacturer of Improved Fertilizer Machinery, was another company whose trade literature did not mention its capability to crush oyster shells but was nonetheless used for that purpose.[45] On the other hand, some companies catered to the oyster industry by pointing out in their trade literature suitable machines for crushing oyster shells. Raymond Brothers Impact Pulverizer Company of Chicago made "special pulverizing & air separating machinery." In addition to exhaust fans, vacuum separators and automatic pulverizers, they also manufactured roller mills for crushing oyster shells and other hard materials. Their "dustless"

[41] Wilson Brothers Grinding Mills catalog, (1874), unpaginated, emphasis in original, available at Smithsonian National Museum of American History, Trade Catalog Collection, Washington, DC (hereafter cited as NMAH).
[42] Wilson Brothers Grinding Mills catalog, (1874).
[43] Wilson Brothers Grinding Mills catalog, (1874).
[44] Gruendler Patent Crusher & Pulverizing Co. catalog, NMAH.
[45] Trade Catalogs, NMAH.

roller mills, according to company literature, were "labor savers" and "perfectly balanced." [46]

The Williams Patent Crusher and Pulverizer Co. of St. Louis, Missouri, manufactured coal crushers, hammer crushers for stone, shredders for making paper, scrap shredders and vibrating screens, in addition to general-use grinding mills. They specifically advertised a crushing plant for oyster shells, noting "with the United States Department of Agriculture and state colleges everywhere advocating the use of crushed shells for poultry the demand is steadily growing. The small back yard chicken raiser and large commercial poultry farm alike realize that lime in the form of crushed shells is a big help in securing greater egg yields." Furthermore, by purchasing their crushing plant, the consumer could "cash in on your shell pile by converting it into profitable crushed shells." They advertised that their shell crushing equipment included "patented hinged hammer crushers, revolving screens, patented steam dryers and cleaners, elevators." A blueprint drawing depicted all the necessary equipment for a complete crushing operation that is much like that used by the Bennings. The shells went into a hopper and then were transported up a conveyor to the Williams Patented Steam Dryer and Shell Cleaner. The cleaned shells went to the crusher and then via another conveyor to a rotating screen to be separated into chicken size, chick size, and fertilizer. Their literature described the process.

> Shells dumped into the raw material hopper are first carried to the steam dryer and cleaner where sand, small oysters, and other foreign matter is removed and the shells thoroughly dried by steam. Steam dried shells are much whiter and of better quality than those dried by direct heat. Another advantage of Williams Equipment and a very profitable one is the fact that less under size goods are made than by any other method. This is due to the Williams Hinged Hammer principal and patented yoke hammers which crush the shells with quick shearing blows eliminating any pulverizing action.[47]

The Williams Company also had other grinding mills that could handle oyster shells, including the Double Pony Crusher. This machine was specifically advertised as an "oyster and clam shell granulator." According to a December 1917 trade catalog, this grinding mill "is a very efficient machine for reducing charcoal, oyster and clam shells, lime and other grit for chick food." The Double Pony Crusher had star type upper rollers. It addition, it had carbon steel lower rollers with "sharp diamond points" to produce a fine granulated product. Finally, the Williams Company also produced "the 'Semi-Vulcanite' Crusher," suitable for crushing limestone, shale, coal, slate, glass and oyster shells.[48]

The Sturtevant Mill Company of Boston, Massachusetts, manufactured grinding mills for oyster shells. Their products included the Sturtevant Rotary Fine Crusher, useful for crushing to a fine size oyster shells, pumice stone, slag and marl. They also manufactured separators, elevators, hammer mills, and rock and ore crushers. In 1911, they had auxiliary works in Buffalo, New York; Americus, Georgia; and Newayago, Michigan, in addition to sales offices in New York, Pittsburgh, Atlanta, Chicago, Paris, Brussels, Berlin, Vienna, and Turin. The Vertical and

[46] Raymond Brothers Impact Pulverizer Co., Chicago, Catalog #8, (1906), unpaginated, NMAH.
[47] The Williams Patent Crusher Company Form 295, undated, NMAH.
[48] The Williams Patent Crusher & Pulverizer Co., Catalog No. 190, (December 1917), p. 14, NMAH.

Horizontal Emery Mills could also crush oyster shells, using emery stones as the grinding apparatus.[49]

CONCLUSION

By using already available multi-purpose mills such as those manufactured by the Wilson Brothers, Gruendler, Williams, A.J. Sackett, Sturtevant, and Raymond Brothers, the oyster industry was able to turn shells into a profitable product without resorting to specialized equipment. The F. & H. Benning Company was one such enterprise that marketed both the oyster meat and the oyster shell, which they were able to successfully grind in their Wilson Brother's mill and sell as fertilizer. A remnant of Maryland's once vital oyster industry, the mill represents how oyster men found lucrative methods of dealing with their industry's largest byproduct, oyster shells.

[49] Sturtevant Mill Company Trade Catalog, NMAH.

APPENDIX A: List of Oyster Shell Crushers, ca. 1919
from: Lewis Radcliffe, Assistant in Charge of Fishery Industries, "Uses of Oyster Shells," Department of Commerce, Bureau of Fisheries, Washington, DC, Memo S-192, April 23, 1921, pp. 2-3, available at Baltimore Museum of Industry, vertical file "Oysters."

NAME	CITY
National Oyster Grit Company	Providence, RI
C.T. Russel	Warren, RI
Oyster Shell Products Company	Jersey City, NJ
(George C. Collins) 308 S. Front St.	Philadelphia, PA
Potomac Crushed Shell Co., Keyser Building	Baltimore, MD
(Mr. Torsch) Clement & Lawrence streets	Baltimore, MD
Baltimore Pulverizing Co., Marine Bank Building	Baltimore, MD
Grabb & Co.	Baltimore, MD
Central Chemical Co., Pennington Avenue	Baltimore, MD
One concern, sun dryer	Rockhall, MD
Wm. H. Valliant & Bro.	Bellevue, MD
Dorchester Fertilizer & Lime Co.	Cambridge, MD
Sun dry plant owned by Mr. Riggin (not now in operation)	Crisfield, MD
Potomac Poultry Food Co.	Crisfield, MD
Chesapeake Shell & Lime Co.	Crisfield, MD
Arthur Bryant & Sons	Crisfield, MD; Alexandria, VA
Keeling-Easter Co.	Norfolk, VA
Mr. Marshall	West Point, VA
J.M. Swindell	Washington, NC
Southgate Packing Co.	Beaufort, NC
Carolina Crushed Shell Co. (H.C. Leiding)	Charleston, SC
Maggioni & Co., 405 W. Bay St.	Savannah, GA
Gulf City Mfg Co.	Appalachicola, FL
Southern Crushing Co.	Appalachicola, FL
Fernandina Crushing Co.	Fernandina, FL
Gulf City Mfg Co.	Mobile, AL
Universal Crushed Shell Co.	Bayou la Batre, LA
Dunbar, Dukate & Co. (not operating)	Bayou la Batre, LA, Neptune, LA
R.B. Jannke	New Orleans, LA
C.B. Masquere	Baras, LA
Louisiana Crushing Co. (Mr. Elms)	Houma, LA
Oyster Shell Products Co.	Berwick, LA
Trachina & Co.	New Orleans, LA
Biloxi Grit Co.	Biloxi, MS
Southern Oystergrit Co.	Biloxi, MS
C.B. Foster	Biloxi, MS
E.C. Julien	Lakeshore, MS
Wilkinson and Biehl	Galveston, TX
Port Lavaca Fish Co. (R.B. Gentry)	Port Lavaca, TX

APPENDIX B: List of Oyster Shell Machinery Manufacturers:

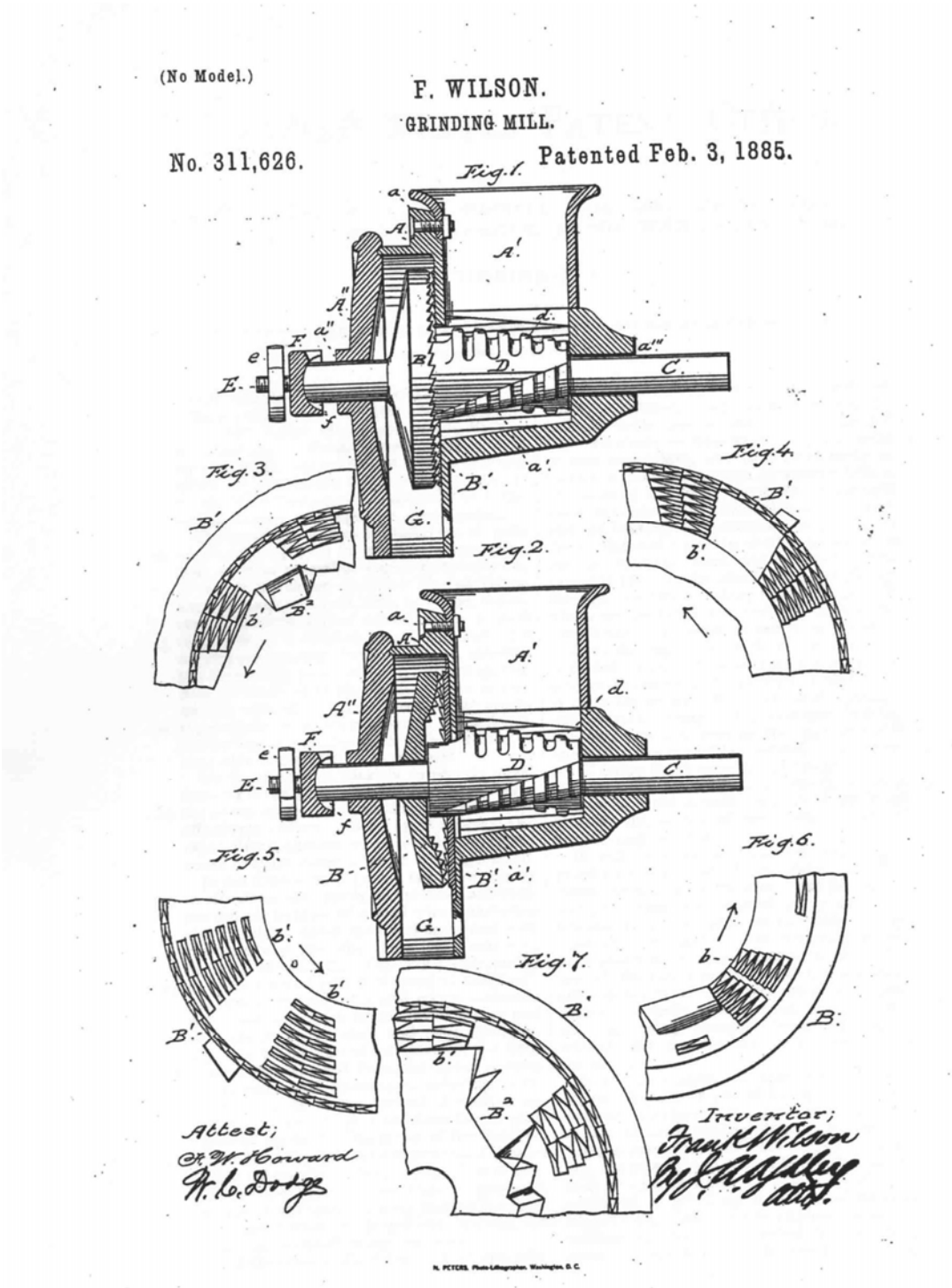
from: Lewis Radcliffe, Assistant in Charge of Fishery Industries, "Uses of Oyster Shells," Department of Commerce, Bureau of Fisheries, Washington, DC, Memo S-192, April 23, 1921, p. 3, available at Baltimore Museum of Industry, vertical file "Oysters"

NAME	CITY
Gruendler Patent Crusher & Pulverizer Co.	St. Louis, MO
Williams Patent Crusher & Pulverizer Co.	St. Louis, MO
A.J. Sackett	Baltimore, MD
Sturtevant Mill Co.	Boston, MA
Raymond Bros. Import Pulverizer Co.	Chicago, IL

APPENDIX C: Table of Oyster Shell Industries, 1921

From: *Fishing Gazette Annual Review*, 1923, p. 122

AREA	POULTRY GRIT (TONS)	VALUE	LIME (TONS)	VALUE	TOTAL GRIT & LIME (TONS)	TOTAL VALUE
RI, PA, NJ	15,239	$157,372	5,241	$29,084	20,480	$186,456
MD	51,408	$492,958	26,859	$148,624	78,267	$641,582
VA	26,150	$325,125	33,478	$306,645	59,628	$631,770
NC, SC, GA	2,957	$26,630	1,555	$9,535	4,512	$36,165
MI, LA, TX	40,865	$364,695	3,586	$3,936	44,451	$368,631
TOTALS	136,619	$1,366,780	70,719	$497,824	207,338	$1,864,604



Appendix D, Grinding-Mill Patent No. 311,626, February 3, 1885, Frank Wilson

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Wilson, Frank. Patent for Grinding Mill, Patent No. 311,626. February 3, 1885.

ADDENDUM TO:
F. & H. BENNING COMPANY OYSTER MILL
14430 Solomons Island Road (moved from 1014 Benning Road,
Galesville, Anne Arundel County, Maryland)
Solomons
Calvert County
Maryland

HAER MD-135
MD-135

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