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THE FRESH-WATER MUSSEL SHELL AND BUTTON INDUSTRY

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The use of mussel shells as industrial raw material is of recent origin. The shell, or mother-of-pearl of the mollusk, was formerly considered as waste material, for the principal interest was in valuable pearls which might be found within the shell. In 1856, when Tiffany and Company paid $2,500 for a single pearl discovered in New Jersey, considerable excitement arose and, as a result, a search for pearls was made in all streams in the eastern part of the United States and in the Mississippi River basin. Mussel shells were opened and discarded after a thorough examination for pearls.

Although fresh-water shells had been utilized in button manufacturing in Europe since about 1840, it was not until around 1891 that industrial use of this shell for buttons was made in the United States. According to the United States Census of Manufacturers for 1900, J. F. Boepple, a German immigrant, is credited with having established the first fresh-water shell button plant in the United States, located at Muscatine, Iowa, where niggerhead mussels, of the genus Unio, were found abundantly along the Mississippi River. The success of this first company, although based upon the crude manufacturing tools and processes utilized in Austria and Germany, soon led to widespread use of shells for button manufacturing, and plants were established along the Mississippi River from Red Wing, Minnesota, to Louisiana, Missouri. Muscatine remained the center of the industry by virtue of ample raw material and because it was the home of Mr. Boepple, who was a directing influence in the development of the industry. Today it is estimated that the button industry at Muscatine manufactures approximately 95 per cent of all buttons made from river shells. Although the raw material around Muscatine has been almost exhausted, this center of industry has extended its procurement of raw material to cover all the important mussel-bearing rivers in the Mississippi River basin.

* See NOTE on page 16.

PRODUCTION

The 1955 figures of the Fish and Wildlife Service indicate that mussel shells were taken in six states in the Mississippi River and Great Lakes regions. The producing states in the order of their importance were: Alabama which contributed 42 per cent of the total quantity; Tennessee 24 per cent; Arkansas 17 per cent; Kentucky 13 per cent; Indiana 3 per cent; and Illinois 1 per cent. The production of buttons would closely follow these percentages with the exception that Alabama might be higher in percentage.

The relative importance of shell-producing states to the total production is shown in table 1. Arkansas, Illinois, Indiana and Tennessee have been historically, the most important sources of this raw material. Over a long period of time, however, there has been a continuous shift in the relative importance of different states as shell producers. As streams become exhausted, as the size of shells limited the economic feasibility of working certain beds, and as states restricted the working of certain rivers or sections of rivers by law, some producing areas became relatively unimportant while production increased in other areas. In the course of time, a reverse condition may exist when streams that have produced few shells may become extremely important producers.

Table 1 represents records secured from button manufacturers, cutting plants, exporters and brokers. Tables 2 and 3 show the production of the lower Tennessee Valley Authority reservoirs.

TABLE 1

PRODUCTION OF FRESH-WATER MUSSEL SHELLS, BY STATES, 1929 - 1955

Year	Alabama	Arkansas	Illinois	Indiana	Iowa	Kentucky	Michigan	Tennessee	Wisconsin	Other States	Total
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1929	(1)	5,435	2,174	2,174	2,174	-	2,718	5,707	1,902	4,892	27,176
1930	(1)	9,221	4,164	2,677	1,785	-	2,380	3,867	-	5,651	29,745
1932	(1)	2,047	3,139	3,003	819	546	955	1,501	137	1,501	13,648
1933	(1)	6,934	3,316	4,824	1,507	1,809	2,713	4,220	1,507	3,316	30,146
1934	(1)	5,440	4,946	3,462	989	1,484	1,484	2,967	989	2,967	24,728
1935	(1)	1,866	1,442	933	424	509	594	1,442	169	1,102	8,481
1936	(1)	10,235	4,094	3,509	1,170	2,047	877	3,509	877	2,924	29,242
1937	(1)	7,558	3,509	2,699	540	3,239	540	5,669	540	2,699	26,993
1938	(1)	1,671	1,488	1,321	503	972	156	2,235	172	743	9,261
1939	(1)	2,447	1,336	1,309	306	2,050	142	3,299	372	1,953	13,214
1940	(1)	1,656	745	1,407	414	1,821	-	1,076	-	1,159	8,278
1941	(1)	3,302	1,391	1,391	695	4,345	-	5,388	174	695	17,381
1942	(1)	4,598	1,379	1,150	460	7,127	-	7,357	230	690	22,991
1943	(1)	1,855	428	714	285	4,424	-	6,136	143	285	14,270
1944	(1)	3,654	812	2,030	406	5,075	-	7,105	-	1,218	20,300
1945	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1946	1,282	3,514	2,442	1,249	335	3,194	361	7,798	99	447	20,721
1947	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1948	1,800	519	349	793	26	2,254	(2)	3,845	-	71	9,657
1949	976	151	325	656	38	1,686	-	1,775	(2)	21	5,628
1950	1,567	1,149	109	785	(2)	2,911	-	4,099	-	56	10,676
1951	1,734	930	212	267	236	1,325	-	2,449	-	210	7,363
1952	2,389	1,864	111	222	244	(2)	-	2,732	(2)	854	8,416
1953	1,318	1,014	203	305	406	2,029	-	4,564	101	203	10,143
1954	6,438	1,950	17	689	56	967	-	4,977	-	-	15,094
1955	6,782	2,766	9	502	-	2,174	-	3,950	-	-	16,183

(1) Data not available
(2) Included with other states

TABLE 2

MUSSEL SHELL HARVEST - LOWER T.V.A. MAINSTREAM RESERVOIRS 1944 - 1955							
	North Alabama Reservoirs			Kentucky Reservoir		TOTAL	
Year	Weight (Tons)	Value		Weight (Tons)	Value	Weight (Tons)	Value
1944	-	-		9,000	$375,000.	9,000	$375,000.
1945	220	$ 8,660.		3,500	140,000.	3,720	148,660.
1946	1,275	48,781.		8,600	325,000.	9,875	373,781.
1947	1,610	55,540.		9,000	325,000.	10,610	410,540.
1948	2,663	115,229.		9,000	387,000.	11,663	502,229.
1949	1,570	54,950.		6,000	210,050.	7,570	265,000.
1950	3,135	94,050.		7,365	220,950.	10,500	315,000.
1951	2,491	99,640.		7,750	310,000.	10,241	409,640.
1952	4,124	185,580.	(Est)	4,000	180,000.	8,124	365,580.
1953	6,390	326,828.		4,500	230,130.	10,890	556,958.
1954	6,815	286,270.		3,405	144,325.	10,220	430,595.
1955	6,282	276,452.		3,900	171,600.	10,182	448,052.

TABLE 3

THE 1955 MUSSEL SHELL HARVEST FROM THE T.V.A. RESERVOIRS OF NORTH ALABAMA		
	Weight (Tons)	Value
Guntersville Reservoir	2,181	$ 96,008.
Wheeler Reservoir	4,049	178,156.
Pickwick Reservoir	52	2,286.
Total	6,282	$276,452.

The more important fresh-water shells, which have been fished over the past fifty years for use in button manufacturing include the nigger-head, pimpleback, monkey-face, three-ridge, pig-toe, washboard, mucket, pocket-book, and black and yellow sand shells.

There is a great deal of variation in quality of shell between the different species. Some shells are adaptable for one use while others may be used for entirely different purposes. Even within the same species there is considerable variation regarding such factors of quality as color, luster, texture, shape, and thickness. For commercial purposes it is desirable to have shells of considerable luster and pearliness and of a firm texture yet not too hard, but which are not colored by spotting or stains, or which do not contain a pink, salmon, or purple nacre.

At the present time the shells from the northern rivers, outside of the Mississippi, are not in demand. The chief reason seems to be quality. The northern shells consist mainly of muckets and pocket-book shells. If a heavy demand for shells should arise, these northern river shells would be used. The trade is now calling for fancy or high-lustered buttons, which these northern shells will not make.

It was generally thought that when the dams were built on the Tennessee River, the mussel industry would be destroyed. This belief was so strong that no attempt was made to harvest mussels from Wheeler Reservoir until 1945, nine years after impoundment. That year three former mussel diggers, then unemployed, decided to investigate the old mussel beds. They were amazed to find that the mussels had not disappeared but were actually thriving.

Almost overnight the industry revived and now it furnishes part-time employment for approximately 100 persons. In 1951, diggers in the north Alabama area had an income of around $100,000. The shell that is most plentiful in the catch is commonly called the pig-toe. This is a thick shell, very much in demand for the manufacture of self-shank buttons for uniforms. Most of the shells are shipped to Muscatine, Iowa, to be processed, but several cutting plants are now operating in the Tennessee Valley.

METHODS OF FISHING

There are three principal methods of obtaining shells from the rivers.

The Crowfoot Method

(1) The most common, is fairly inexpensive and is well adapted to all sorts of conditions. The necessary equipment for this method includes a boat of the type shown (figure 1) operated by one man, an iron bar, 12 to 20 feet long, to which are attached lines about 3 feet long and spaced from 4 to 6 inches apart. Pronged wire hooks are attached at intervals to these lines. By means of a tow line, the bar is lowered almost to the bottom of the stream. Then the run is made over the shell bed by dragging the wire hooks in a direction parallel to the current. The mussels lie half imbedded at the bottom of the stream with the hinder end of the shell partially open and extending against the current. As the crowfoot hook passes over and is inserted

into the shell opening, the mussel closes tightly upon it and is thus drawn from the water. Using this method of shelling, the operator obtains from about 200 to 800 pounds of shells per day. However, there are certain disadvantages in the use of this method, the most important of which is the possible injury to mussels, especially the young ones, which may close onto the hooks and then drop off before being raised out of the water, or else are taken from the hook by the operator because of size limitation and thrown back into the water. Investigation showed that approximately 38 per cent of all mussels that are returned to the water after being caught by the crowfoot gear subsequently die.

Hogging Shells

(2) The second method, known as hogging shells, is the simplest and least expensive. A flashlight and a sack are all the equipment necessary. The process involves merely wading into shallow water at night and picking shells out of the water as the mussels come up for feeding. This method permits the operator to obtain from about 25 to 100 pounds of shells per night. When this method is used to collect yellow sand shells, only spawning females are taken as the females make a spawning migration to shoal water.

Diving Method

(3) The third method, the diving method, is the most efficient yet the most expensive because the necessary equipment includes a barge, motor, and an air compressor. The operator, equipped with a diving helmet, is lowered into the water to an average depth of about 25 feet. An air line, about 50 feet long, permits the operator to move about in order to collect shells and place them in a sack which, in turn, is raised to the barge.

Other methods include the use of such equipment as the dip-net drag, shoulder rake, and shell tongs. The dip-net drag is useful in deep water where there is no current and is suitable in rivers and lakes with soft-mud bottoms. It is a simple and inexpensive method, for all the equipment that is necessary is a wire hoop covered with a net and attached to a pole 16 to 20 feet long. The net is used to scoop the mussel shells from the beds. The shoulder rake is essentially a metal rake having 10 to 12 curved tines. The rake with a wire hoop is fastened to a handle and is operated the same way as the dip-net drag. This equipment is very useful in swift water where the bottom is not too hard and where there are no obstructions. The shell tongs consist of two rakes with long handles worked like a pair of scissors. They are lowered into the water and closed over the shells.

PREPARATION OF SHELLS FOR MARKET

Once the shells have been removed from the beds and transported by boat or barge to some concentration point along the river, they are placed in a metal vat containing a small amount of water, covered by a sack, and are then cooked for about twenty minutes. After the mussels are killed by steam, the shells can be opened easily. For the most part, the meats are considered as waste material, although they are sometimes dried and made into a meal which may be fed to fish or mixed with grain for poultry feed. Any pearls that are discovered are sold on the commercial market. The mussel shells, freed from meat, are ready for the market.

Shell prices, which influence the volume of production, may vary considerably between communities and in different seasons of the year. The prices are determined by competitive bidding among several buyers in each market, with premiums being paid for superior quality. Indirectly, the price for shells reflects the market for buttons.

During the Second World War, some types of shell sold for $200 per ton, but the introduction of plastic buttons has had a depressing effect on the shell price and in 1955 the average price per ton of shells was $42.00.

PRELIMINARY PROCESSING

Sorting and Classifying

After the mussel shells have been delivered and concentrated at the cutting plant, they are sorted by hand according to type; such as sand shell, washboard, and niggerhead; to quality; and to size. The shells are then stockpiled in covered or exposed bins, although if they are not protected from the weather they will soon lose luster and become chalky. Since it is the practice of most button-blank cutting plants to buy enough shells from May to November (the harvesting season) to permit a full year's operation, the proper care of these shells in stockpiles is very important.

Before the shells are prepared for use in the cutting plant, they are classified according to size and character by a mechanical grader, which is essentially a long revolving drum made up of sections with openings of different sizes. The classified shells, stockpiled according to size, may be better adapted to particular grades of buttons, to uniform speeds of machinery, and to the size of buttons that may be cut with a minimum of waste.

Soaking

The shells are soaked in large metal tanks or barrels filled with water for 2 or 3 weeks. This soaking softens the material, making it possible to saw the blanks without chipping them.

Blank Cutting

Cutting button blanks is a mechanical process, but the volume obtained, quality, and economy depend largely upon the skill and judgment of the individual operating the machine.

The following method was in general use years ago, but today it is becoming obsolete. The majority of button plants now use carbide-tipped saws on new type machines. The old method is as follows:

The button-cutting machine is essentially a lathe. It is fitted with a tubular saw of a diameter to obtain the desired size of button blank, and with a wooden plug and ratchet handle with which the shell is forced against the rotating saw. The shell is held with special tongs or mitten against the wooden plug, and is advanced toward the revolving saw by means of a feed plunger or screw operated by the ratchet handle. Throughout the process a small stream of water is applied to the cutting saw and shell, in order to prevent the heating of the saw and to clean the shell dust from the saw teeth. After the blanks are cut, they pass into a hopper and then fall into a bucket.

Size of button blanks is determined by the diameter of the cutting end of the saw; hence, various sizes are used. The unit of button measure is 1/40 inch and is called a line. Buttons from fresh-water shells may vary in size from 14 to 40 lines or from one-third to one inch in diameter. The most common sizes of blanks cut in plants are 17, 20, 22, 24, 30 and 36 lines. Blanks of different sizes are obtained from the same shell.

On the average, mixed shells are cut into button blanks at the rate of 15 per cent of the original weight, niggerheads at the rate of 20 per cent, and sand shells at the rate of 40 per cent. For the most part, however, the number of pounds of shell necessary to produce a gross of button blanks will vary according to the line, character of shell, skill of the button cutter, and the judgment of the plant manager. Although it is important to utilize as much of the raw material as possible in cutting the shells, the market for buttons of a particular size is a more important factor, than is efficient use, in determining the pattern of utilizing shells. In either respect, it is the skill of the cutting-machine operator and the plant manager which reconciles efficiency with market prospects in order to achieve the profitable use of raw material in button-blank manufacturing

Techniques drastically different from those employed in older methods are embodied in the machines designed for cutting button blanks from mussel shells. Two new types of cutting machines have been perfected. One is semi-automatic. The other works somewhat like the traditional button-cutting lathe except that the operator is seated and the saw functions on a vertical rather than on a horizontal axis.

Important features of both types of new cutting machines are saws that have for their cutting edges an extremely hard metal known as cemented tungsten carbide. The carbide-tipped tools are superior to steel tools because they retain their cutting edge longer, reduce shell flaking, are more accurate, and give a higher yield of blanks of particularly high quality.

The number of these machines in a cutting plant varies. A typical plant has 30 of the vertical-type cutting machines on which production per operator is said to be several times greater than on the older-type cutting machine. Such a plant has a production capacity of two million blanks per week, and would require between 1,500 and 2,000 tons of shells yearly.

PRODUCTION OF NOVELTY MATERIALS

Considerable use is made of shells as raw material for novelty products. For the most part, novelty blanks are made in the same plants engaged in cutting button blanks. The sand shell is particularly adaptable for novelties. In former years this shell was shipped largely to France for processing into products requiring mother-of-pearl inlay. Some colored novelties are used for decorative purposes in fish bowls and other similar items.

WASTE MATERIAL

A considerable amount of waste occurs in the manufacture of button blanks. After the blanks have been cut and material for novelties obtained, the remainder of the shell is discarded as waste. Assuming that mixed shells cut into blanks at a rate of 15 per cent of the original weight, niggerheads at 20 per cent, and sand shells at 40 per cent it is estimated that if the total production of about 16,000 tons of shells purchased by button-cutting plants during 1955 had been cut into button blanks, the volume of waste material would have been about 13,000 tons or approximately 26 million pounds. Records show that about 4,800 tons of lime, poultry, grit and polished shell with a value of about $44,000 was produced.

For the most part the waste shells are given away or sold to individuals and townships for use on driveways and for street improvements. The economic feasibility of utilizing waste shell from button-blank cutting plants depends largely upon the ability to concentrate sufficient volume.

THE MANUFACTURE OF FINISHED BUTTONS

The manufacture of button blanks into finished buttons is almost wholly mechanized, requiring considerable investment in plant and equipment. The scope of mechanization may be understood by a description of the actual processing steps.

Semi-finishing

After the button blanks are received at the finishing plant they undergo four semi-finishing processes. These include: (1) Classifying, which is a machine operation designed to separate the button blanks according to thickness. (2) Tumbling, a machine operation which involves placing button blanks in watertight tumbling barrels where they are churned in a mixture of water and an abrasive in order to remove the "bark" or outside of the shell as well as any marks made by the saw teeth of the blank cutting machine. (3) Grinding, a machine operation to obtain uniform thickness. The grinding machine is equipped with two conveyor belts on which button blanks move under two revolving grinding wheels, 4 inches wide by 18 inches in diameter. The only hand labor required in this operation is for pouring the blanks into the machine hopper and seeing that the back side of the blank is turned upward as it moves along the belt. This machine is equipped with discharge pipes for removing dust and grit. (4) Soaking the semi-finished buttons in water to soften them for the final finishing process.

Complete Finishing

The complete finishing of buttons is obtained by use of the automatic facing and drilling machine. This is the most intricate machine operation in button manufacturing and the machine itself when introduced about 1903 revolutionized the button industry. The same type machines are in use today, although improved. The operation of this machine has been described by Dr. Robert E. Coker of the former United States Bureau of Fisheries, as follows:

The blanks are fed by hand into depressions in the tops of vertical chucks, which are arranged in series constituting an endless chain. As the chucks in endless chain pass around the circumference of the machine each blank is automatically operated upon by various tools, and each tool is automatically sharpened and prepared for the succeeding blank. The processes accomplished in the machine consist in rounding the edges and carving out the center in the desired pattern to make the face of the button and in drilling two or four holes according to pattern. After the first hole the drill rises, the button makes a turn through a fourth or a half of one revolution (according to whether it is to be a four-hole or two-hole button), when the drill again descends to make a new hole. After the last hole is drilled the chuck opens automatically to release the button, which is sucked into a tube connected with the blower system, to be dropped into a bucket through a counting tube.

Some twenty-odd distinct operations are combined in the double automatic machine, and it is interesting to record them. Let it be noted that the button travels in an oblong orbit, while the carving tools and the drills, respectively, travel in smaller circular orbits at opposite ends of the button orbit.

The traveling chuck, which is open after releasing a finished button, closes on the new blank placed in the top depression.

The chuck with the blank begins to revolve rapidly on its axis while continuing to travel to the right.

The face of the revolving and traveling button is applied to a carving tool of proper form to make the desired face. The tool itself is stationary on its axis, but travels in orbit with the buttons.

The facing completed, the tool rises.

The rotation of the blank is stopped.

The tool, continuing on its orbit, is sharpened on an emery wheel.

Before meeting another blank the tool is lowered by a small fraction of an inch to compensate for the shortening due to the grinding on the emery wheel.

The chuck, with its blank, leaves the orbit of the carving tool at a tangent to pass over to the orbit of the drilling tools.

When the blank is in just the right position, one of the drills descends to make the first hole in the blank. In this operation the drill revolves, while the blank is stationary on its axis, but both travel together.

The drill rises.

The chuck, with blank, turns through one-fourth of a revolution.

The drill descends for the second hole.

The drill rises.

The blank turns another fourth of a revolution.

Third hole is drilled.

Drill rises.

Blank turns.

Fourth hole is drilled.

Drill rises.

Drill continues in its shorter circular orbit, to return into proper position for a later blank.

Button chuck rises a little and releases the button.

As the chuck passes beneath a suction tube, the button is drawn up against a small, fine screen in the tube.

The button drops of its own weight upon a small trap.

When a number of buttons corresponding to a given weight have

accumulated on the trap, it releases and drips the buttons into a bucket.
The tripping of the door or trap registers the number of buttons finished. (Not used for this purpose by all firms).

Tumbling and Polishing

In order to smooth off the rough edge and to make the buttons ready for receiving the final polish they are placed in tumbling barrels. Following this process they are placed in the polishing machine where they are given a polished luster by means of sulphuric and muriatic acids and water and tumbling.

Drying

The buttons are next dried in a centrifugal dryer and further polished by tumbling in sawdust. The buttons are then ready for dyeing, if colors are to be added.

Sorting

The final step in preparing buttons for market is sorting according to quality and grade. Buttons are handled individually by skilled workers who separate the buttons into a variable number of grades according to freedom from defects, and with respect to such quality factors as color, luster, and irridescence.

Carding

The sorted buttons are then ready for carding and packing. Buttons sold in bulk are packaged.

COST OF MANUFACTURE

It is difficult to determine the cost of processing shells into buttons because of the great variation in grade and quality of shells, difference in size of buttons, quality of labor, size and output of plant, and type of management. However, by courtesy of three button manufacturers, the relative cost of processing buttons of three different sizes, and an average cost of all sizes, is presented in table 4.

TABLE 4

COSTS FOR MANUFACTURING BUTTONS, PER GROSS, ACCORDING TO THE SEVERAL STEPS IN PROCESSING

Items of Cost	17-line button		20-line button		24-line button 1/		All lines 2/
	Company		Company		Company		Company
	A	B	A	B	A	B	C
	(Cents)		(Cents)		(Cents)		(Cents)
Shell.	11	18	20	21	27	28	21.62
Cutting.	13	26	15	31	16	38	21.77
Overhead expense in cutting . .	16	13	19	16	21	19	22.
Grinding	2.5	1.5	2.5	1.5	2.5	2	1.5
Overhead expense in grinding. .	5	2	5	2	5	2	1.5
Blank sorting. .	1.5	1.5	1.5	1.5	1.5	1.5	-
Overhead expense in blank sorting.	-	1.5	-	1.5	-	1.5	-
Machining. . . .	4.5	3	5	3	6	3.5	7.09
Overhead expense in machining .	11	4	12.5	4	15	5	9.83
Sorting.	2.5	2.5	2.75	2.5	3	2.5	4.23
Overhead expense in sorting . .	2.5	3.5	2.75	3.5	3	3.5	1.98
Total (allowance for losses in process of manufacturing not included)	69.5	76.5	86	87.5	100	106.5	91.52
Shell cost as percentage of total cost . .	15.8	23.5	23.2	24	27	26.3	23.6

1/ Better grade of raw material used as compared to that used for 17- and 20-line buttons in these cost estimates.

2/ Cost of all lines secured from different manufacturers than company A or B.

Table 4 represents processing costs only, and does not include sales expense and a margin for profit. According to figures, the cost of the shell raw material plus the cost of cutting shells into blanks, overhead expenses in cutting, and freight charges on blanks to Muscatine account for 74 per cent of the total cost in processing a gross of 17-line buttons, 77 per cent for 20-line buttons and 79 per cent for 24-line buttons. Another dealer giving only average figures for all lines showed 71 per cent.

An estimate of capital investment required to establish a button-finishing plant is presented below, through courtesy of the Barry Company, manufacturers of button equipment, Muscatine, Iowa. The number and type of machines required are based on the use of one automatic facing and drilling machine. Leaders in the button industry believe that a plant of minimum size for manufacturing buttons should contain at least ten automatic facing and drilling machines; therefore, the number of pieces of equipment listed below and the net price should be multiplied by ten in order to determine the total equipment investment. On this basis the necessary equipment would cost about $80,000.

TABLE 5

ESTIMATE OF CAPITAL INVESTMENT

Number	Type of Machine	Net Price *
7	Cutting machine symbol "S1"	$ 770.
1	Centrifugal dryer	310.
1	Double blank grinder	1,250.
1	Classifying machine	632.
1	Automatic facing and drilling machine	3,372.
1	Tumbling barrel	208.
1	Polishing machine	345.
1	Button conveying and sorting table	688.
4	Fluorescent lights for same	36.
1	Cutting machine bench for eight machines complete	224.
	Total equipment cost	$ 7,835.

* As of January 1953.

The volume of buttons produced from fresh-water mussel shells started to decline in 1929; however, the years 1943 to 1947 showed a fairly high production in comparison to the present. (1946; 9,669,580 gross of buttons, 1955; 3,763,460 gross of buttons).

ECONOMIC POSITION

Fresh-water pearl-button manufacturers are faced with competition from makers of buttons made of ocean pearl and from plastics. The ocean pearl is an expensive button, the fresh-water pearl is a medium-priced button, and the plastic button is of the cheapest type. Therefore, the fresh-water pearl-button manufacturers must meet competition from both the ocean pearl and plastic industries. It is only in the medium-priced field that fresh-water pearl buttons are able to maintain an established market. During the last war the fresh-water pearl-button industry competed easily with the ocean pearl industry because of the limited supply of pearl buttons. Also, the fresh-water pearl buttons made from thin shells of low quality were able to compete fairly successfully with plastic buttons. In the interest of maintaining a well-rounded production there seems to be a definite trend for manufacturers of fresh-water shell buttons to expand their operations to include the use of ocean pearl and plastic materials, thereby producing for all three types of markets in the same plant or under the same management. To a limited extent the same equipment is adaptable to all three types of raw material.

The present output of fresh-water pearl buttons by the industry in Iowa comprises about 85 per cent plain pearl buttons and 15 per cent fancy pearl buttons. About 65 per cent of this total output is of the two-hole type of button and 35 per cent the four-hole type.

Buttons are sold in bulk form or as carded buttons. It is estimated that 85 per cent of the present output is sold in bulk and 15 per cent is carded. About 60 per cent of the carded buttons produced by this industry are sold to chain stores, while 40 per cent go to wholesale dry goods companies.

The sale of buttons in bulk, according to type of market, is distributed as follows:

Type of market	Button purchases in bulk Per Cent
Clothing manufacturers (including manufacturers of shirts, underwear, house dresses and aprons)	85
Laundries	1
Button jobbers	14
Total	100

Late in the 19th century, when the button industry was in its infancy, there were fifty factories spread over many towns on the Mississippi, manufacturing mussel shell buttons. In 1956 this has changed to twelve plants, some of which are considering combining to cut overhead expenses.

The fresh-water pearl button business is considered by the trade to be in close to good condition, to some extent, due to the shortage in supply of ocean mother-of-pearl shell. While volume of sales has declined, prices have increased to make up some of the difference in dollar sales. The future looks favorable, depending on tariffs on Japanese and other buttons and the domestic success of plastic buttons.

* NOTE.

In June 1947 the United States Department of the Interior, Fish and Wildlife Service, published leaflet #246, entitled "Fresh Water Mussel Shells". It consisted of (Excerpts from Research Series No. 9, entitled "Fresh-Water Mussel Shells, the Basis for an Arkansas Industry", by W. Paul Brann, Bureau of Research, University of Arkansas, Fayetteville, Arkansas.)

This revised leaflet uses much of Mr. Brann's material as originally prepared, with some changes in methods, conditions and tables interposed to bring the leaflet closer to the situation as it exists today. Much help has been received from the firms of the button industry, (especially Ronda Button Company) from Richard O. Jones of the United States Fish Cultural Station, Marion, Alabama, and from the Fisheries Section of the Division of Forestry of the Tennessee Valley Authority at Decatur, Alabama.