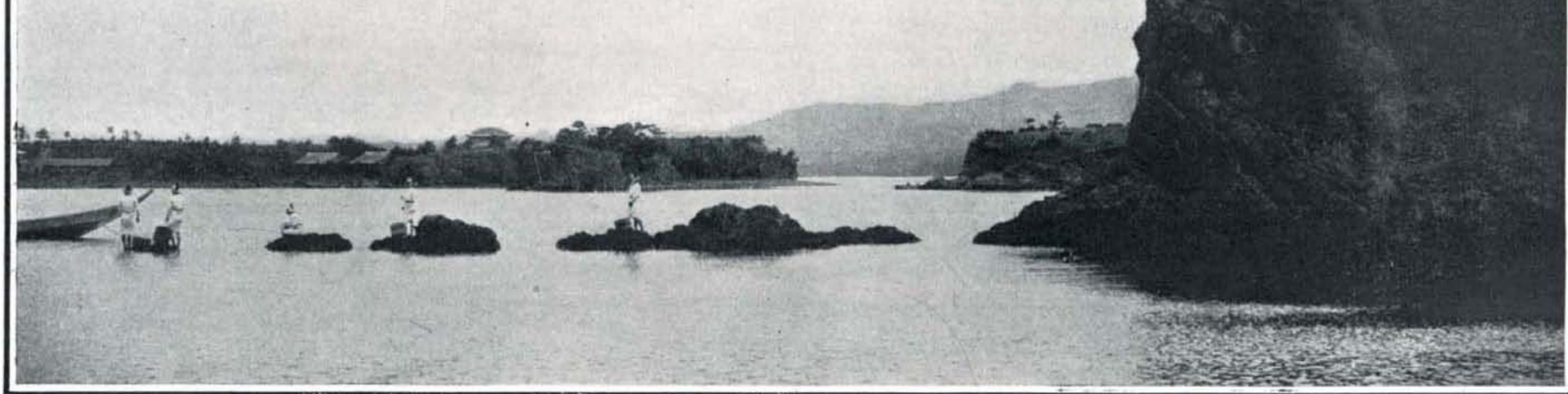


JAPANESE PEARL CULTURE

WOMEN WHO DIVE FOR PEARLS

BY T. KUME



THE SHELTERED BAY OF AGO WHERE WOMEN DIVE FOR PEARLS.

WHETHER or not there were any pearls in prehistoric Japan, and, if so, whether these pearls were used for ornament as in our day, is unknown. Even in Japanese tradition and history the ancient references to precious stones, and particularly to pearls, are by no means clear. In the "Kojiki," or the Book of Tradition, the oldest written history of Japan, dating from the seventh century, a word is to be found standing for the present pearl, or "Shinju" in Japanese. In the epic of the goddess "Tamayori-hime" a description will be found of a "white jewel," by which a pearl is meant. Still another reference is to be found in the story of the goddess of the sea in her meeting with the god "Hiorino-mikoto," where "giving a pair of jewels from the sea" is mentioned. Indistinct as these mythological references are, there seems to be no doubt that pearls were known even in ancient Japan.

That this should be so would follow from the very nature of the country. Japan is composed of a group of six large and numerous small islands, incessantly washed by the warm waters of the Pacific. In mythological times the people were more or less barbaric. There were no houses, no roads, no commercial or political intercourse. The inhabitants dwelt in caves near the seashore. They settled in one place, and stayed there until their food supply was exhausted. Then they removed to another place, where again they took up a temporary habitation. No doubt sea food was their chief nourishment, and above all shell food. After the flesh had been eaten, the useless shells were thrown aside at the entrance of the caves. Thus the Japanese account for the innumerable mounds of shells which are to be found near the seashore. In these shell mounds no pearls have been found, yet it stands to reason that, if pearls were ever abundant in these prehistoric times, they must have been discovered and prized.

In the reign of the twentieth Emperor Inkyo, which began in the fourth century, the pearl was undoubtedly known. In the "Nippon-Shoki," published 720 A. D., the oldest history after "Kojiki," we read: "In September of the fourteenth year the Emperor Inkyo went to the island of Waji to hunt. Wild animals were

abundant at that time, but not one could be killed. All escaped. Then the god of the island said to the Emperor: 'It is I who have hindered the chase. There is a pearl at the bottom of the Sea of Akashi. Obtain that and worship me with it, and I will let you hunt to your fill.'

"And the Emperor gathered about him all the skillful divers that he could find, but not one of them was successful. Finally there came a diver from the Province of Awa, whose name was Osashi. He wound a long rope around him and leaped into the water. After a few minutes he came up and said, 'There is a big "Awabi-shell" twinkling at the bottom of the sea.' Then all exclaimed, 'That is the very thing for which we are seeking. That must be the very pearl prized by the god of the island.'

"Then the diver Osashi plunged in again, and, after a while, he came to the surface with a giant Awabi-shell. At the very moment that he touched the shore he lost breath and died. When they sounded the water by means of a rope, they found it to be sixty fathoms deep. In the giant shell was found a pearl the size of a peach."

Exaggerated as this story is, it contains a suggestion of pearls, and moreover the suggestion that pearls were highly prized. But in the "Nippon-Shoki" there are many references to the existence of pearls and their use as personal ornaments.

Japan has long yielded the most beautiful specimens of Oriental pearls. In Marco Polo's "Island of Chipangue," published in 1298, we read: "They have also pearls in abundance, which are of a rose color, but fine, big and round, and quite as valuable as the white ones. In this island some of the dead are buried and others are burned. When a body is burned, they put one of these pearls in its mouth." Since Marco Polo's time, Kaempfer, Tavernier, Thunberg, and others have written of the beauties of the Japanese pearl.

In ancient times Japanese pearls were used more for general decoration than for personal adornment. They were to be found in old lacquer work, desks, furniture or cloisonné work, "inro," "netsuke," tobacco bags, and sometimes in sword handles. One of the

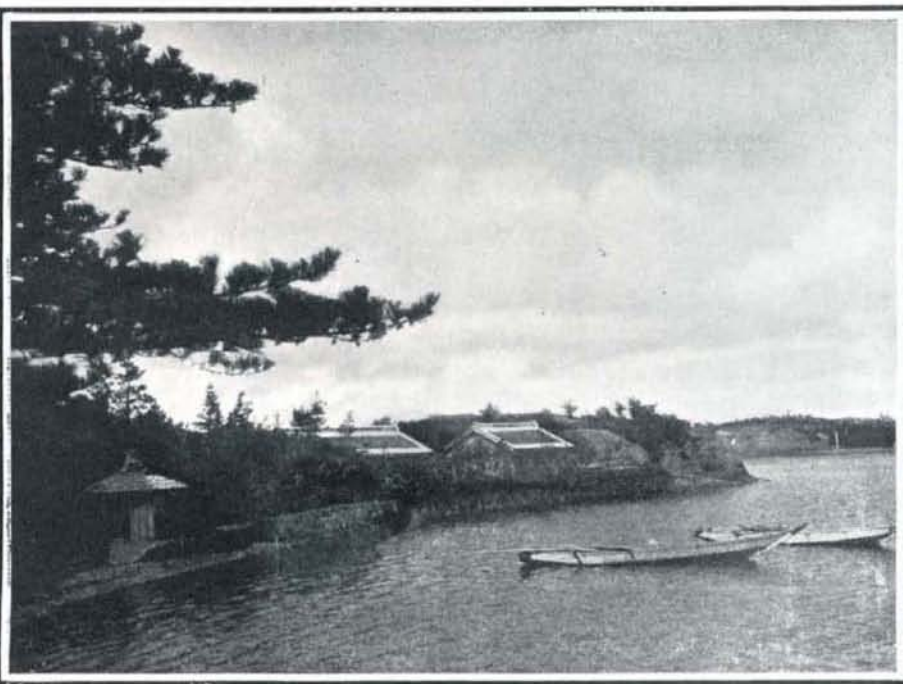
oldest pearls used for ornamental purposes is mounted in the statue of the goddess Kannon kept in the Sangetsu-do Temple at Nara. Still another is to be found among the imperial treasures kept in the Shosoin Temple of Nara. These two gems are said to have been deposited in these temples during the "Tempyo" age (A. D. 729-748) and are probably the oldest pearls now in Japan.

The history of Japan contains not many references to the use of pearls in connection with feminine jewelry. Evidently in ancient times there were no brooches, bracelets, rings, or pendants. Only the hair was ornamented. Hence it is that large pearls in old Japan were used only for hairpins and for tobacco bags and for string fasteners, and that many valuable pearls were lapped in cloth. This lapping was attended with not a little superstition. When two pearls were thus lapped together, it was thought that they would multiply in time. Still another superstition was that a pearl wrapped in a cloth was regarded as a family treasure, the possession of which insured prosperity to the family. More curious than these customs is the use of pearls as a medicine. The ancient Greeks were in the habit of drinking pearls to improve the skin. The ancient Japanese took them into the system to improve the eyesight.

In the last ten years the Japanese have altered their opinion of pearls. Never in the history of the country has the pearl been more highly prized as an article of feminine adornment than at present. Pearls are used largely in the "Obidome" or obio fastener, embroidery and the like.

There are many species of pearls in Japan. Among the shells which produce pearls, here given by Dr. T. Nishikawa, are the true pearl oyster (*Margaritifera martensi*), black-lipped shell (*Margaritifera margaritifera*), *electroma* sp., *Margaritifera panassæ*, *Mytilus crassitesta*, *Pecten yessoensis*, *Haliotis gigantea*, *Unionidæ* or *Naiades*, *Corbicula*, *Pinna*, *Solen*, *Arca*, *Tridacna*, *Ostrea*, *Tapes*, *Cytherea*, *Trigonella*, *Mactra*, *Melina*, *Pecten*, *Rapana*, *Turbo*, *Haliotis*, *Cassia rufa*.

This list comprises some of the best-known species. Among these species, *Margaritifera martensi*, *Margari-*



The women along the Bay of Ago and the Bay of Gokusho when they reach the age of thirteen or fourteen years, learn to dive for pearls. Their native towns and villages lie along the seashore. They are in the water almost all the year.

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tifera panassæ, *Mytilus crassitesta*, and *Haliotis gigantea*, *Unionidæ*, yield some of the finest pearls. The best of the so-called oriental pearls are obtained from *M. martensi*; black, blue, and sometimes greenish pearls from *M. margaritifera*; yellow pearls chiefly from *M. panassæ*, and black or dark pearls from *Mytilus crassitesta*; and beautiful pinkish and greenish pearls from *Haliotis gigantea*; most of the pink pearls, however, are obtained from *Unionidæ*.

M. margaritifera and *M. panassæ* are limited to the region of Byukyu Islands in the southern part of Japan, and *Unionidæ* to the Lake Biwa and also the Lake Kasumigaura. The others are to be found almost everywhere on the coast. Afo Bay in the province of Shima, Omura Bay in the province of Hizen, Takaoka Bay in the province of Tosa, Nanao Bay in the province of Noto, the islands of Awaji, the island of Tsushima are most famous for their yields of *M. margaritifera* and *martensi*.

JAPANESE ARTIFICIAL CULTURE OF PEARLS.

Recently the Japanese, thanks to the energy of Mr. K. Mikimoto, have inaugurated a new industry which is nothing more nor less than the artificial culture of pearls. Everyone has no doubt often seen shells of mollusks lined with a smooth and iridescent coating which is called *nacre* or mother-of-pearl. This coating, like the rest of the shell, is produced by the animal and is made up mostly of carbonate of lime and an organic matrix which usually presents a laminated texture. The color and brilliancy of this layer differs in various species of shell. For instance, in the ordinary oyster it is of a lusterless white, and in a kind of shell called *abalone* or ear shell (*Haliotis*), the *nacre* is of a greenish blue tinge, changing to purple

of all, however, are the products of the true pearl-cysters. These are the pearls which have always been called oriental pearls—"solidified drops of dew," the poets have named them.

Pearls are of many different shapes: some round, some pear-shaped, some egg-shaped, and some of very fantastic shapes indeed. The round, pear-shaped, and egg-shaped ones are known as oriental or virgin pearls, while those of irregular shapes are called baroque pearls. These are sometimes found in the shapes of fish, birds' wings, or creeping worms. The seed pearls, generally used as medicine by the Chinese, are always very small and usually found together in numbers.

Sometimes two pearls will be found joined together by the nacreous substance, thus forming what is known as "twin pearls."

All these are called free pearls because they are found in the tissues of the animal's body and are not joined to the shell.

In the same way that twin pearls are joined it sometimes happens that pearls are found attached to the inner surface of the shell. This position interferes with the symmetry of the pearl so that when it is taken out of the shell it is flat on one side, making what is known as a "perle bouton." The attached pearls are not always of inferior quality, but are often highly valued. The world-renowned "Southern Cross," which was valued at \$50,000 by the company to which it belonged, was found off Cossack, western Australia, attached to the central part of the inside of a shell.

CULTURE PEARLS.

When once the nature of pearls was understood, it was but natural that many experiments should be

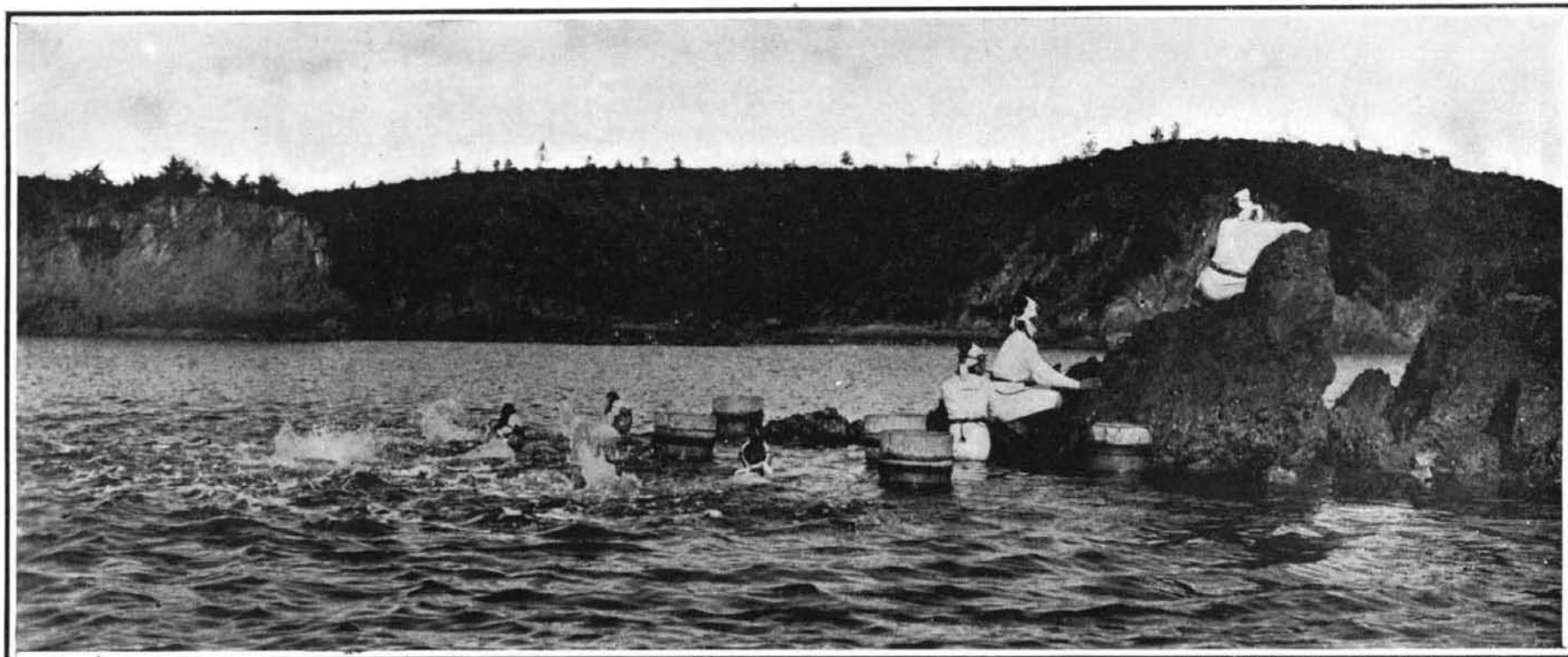
abalone shell. The public was naturally greatly interested, and the newspapers in Europe and America applauded his success and called it a great discovery.

It may perhaps come as a surprise to many that before Dr. Boutan's attempts, a very extensive and successful system of pearl oyster cultivation had been carried on in Japan by a Mr. Mikimoto, and "culture pearls" had not only been produced but placed regularly on the market. Even at the present day, it may be claimed that this is the only pearl-oyster farm in the world which undertakes the extensive cultivation of the precious mollusk and produces "culture pearls" on a commercial scale. An account of this successful enterprise may therefore be not wholly devoid of interest.

THE HISTORY OF THE JAPANESE CULTURE PEARL.

At the Third National Industrial Exhibition held in Tokyo in 1890, Mr. Mikimoto exhibited in the aquarium of the fisheries section some living specimens of the pearl oyster. This made him acquainted with Dr. Mitsukuri, professor of zoology in the Imperial University, who first suggested to him the possibility of cultivating pearl oysters and of making them produce pearls by the use of proper stimuli. Being deeply interested in the subject, Mikimoto went afterward to the Marine Biological Station of the Imperial University at Misaki, where the professor was staying, and learned from him many facts concerning pearl formation and the natural history of the pearl oyster.

Mikimoto's home was Toba in the province of Shima, one of the localities in Japan famous for large yields of pearls. Directly after his return there he began experimenting on his idea. At first it seemed almost like pursuing a fleeting shadow, and his friends



The women pearl divers of Japan wear a special dress. The hair is twisted into a hard knot and the eyes are protected by glasses. The oysters are dropped into tubs suspended from the waist.

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as it is turned. In the black-lipped shell (*Margaritifera*) the mother-of-pearl is of a greenish black color. In the shells of the true pearl-oysters the *nacre* is of a clear, delicate white, which has the sheen of floss silk faintly tinted with azure, exhibiting a beautiful play of color—a quality which makes these shells of great value in commerce.

Now it often happens that foreign substances such as sand grains, microscopic organisms of various kinds, parasitic worms, crabs, or sometimes even small fish are introduced by accident or otherwise inside the shell or in the tissues of the mollusk's soft body. In such cases, the animal sometimes begins to deposit a part of the material which goes to form the nacreous layer of the shell around or over these foreign objects, and as new material is added year after year in the form of layers, these concretions, which may at first be very tiny, grow to be of a considerable size. When this takes place in a shell with specially beautiful *nacre*, such as that of the pearl-oyster, the result may be an object of great beauty. In this strange way, pearls are produced.

Such being their origin, pearls may be formed in any kind of mollusk, bivalved or spiral. And just as the *nacre* of different kinds of shells differs, so the pearls themselves vary according to the shell which produces them. Thus the pearls of the common oyster, the scallop, and the giant clam are milky white and not very bright, while those of the sea mussel are usually black. The chank and the conch shells produce the pink pearls which are brought from the Bahamas and the West Indies. These pink pearls are also found in several kinds of fresh-water mussels, which are plentiful in some of the streams and lakes of America, Europe, China, and Japan. Most superb

made to produce the precious objects at will. We do not here refer to the manufacture of "artificial pearls" such as the so-called "Roman pearls," "Venetian pearls," etc., which are not pearls at all, but are made of glass and painted with fish-silver; rather what is referred to are the attempts to make the pearl oyster work for man and produce natural and true pearls in a reliable and methodical manner—in short a kind of "harnessing" the mollusk for the service of man.

It is well known that Linnaeus, the "father of natural history," claimed that pearls could be obtained by piercing holes in the shell of an oyster with a fine auger, making a small wound, and afterward "parking" the animal for many years. But his suggestions do not seem to have been clearly understood, and no one has been able to pursue his method successfully. The Chinese, as is well known, have been specially successful in raising pearls by inserting grains of clay between the shell and the thin outer membrane which covers the soft body of the fresh-water mussel; but the best of these are of very inferior quality, and are valuable merely as curios.

At the International Fisheries Exhibition held in Berlin in 1880, some pearls were shown which had been cultivated in Germany. From looking at these, one could see that the plain relief might be covered with nacreous substance, but the result was of little value. Mr. Saville Kent, late naturalist to the government of Queensland and to that of western Australia, undertook the same experiment with the large pearl oyster, and a gentleman on Thursday Island tried inserting a shot through a hole in the shell.

The most important of such experiments are probably those of Dr. Louis Boutan of Paris, who succeeded some six years ago in producing pearls in the

laughed at him for "throwing his money into the sea." However, he persisted, making all sorts of experiments and changing his methods from time to time, relying on suggestions and advice from Prof. Mitsukuri and Dr. Kishinoue. At the end of four years of hard work, disappointment and renewed efforts, some results were obtained which seemed to promise success. In 1896, things had so far progressed that the experimental stage was a thing of the past, and the enterprise was put on a commercial basis. A patent for the new method was obtained from the government, and the cultivation of the pearl oyster on an extensive scale was begun at the island, Tatokujima, in the Bay of Ago, leased some time before for the purpose. At the end of 1898 the first, though small, crop of pearls was harvested and placed on the market. These have been given the name of "culture pearls" by Prof. Mitsukuri. Since then the enterprise has been steadily growing in every way, and the skill and experience obtained by handling millions of pearl oysters have enabled the establishment to maintain a constant improvement in the quality of the pearls produced.

THE PEARL-CULTURE FARM.

About a dozen miles south of the famous Shrine of Ise is the sheltered Bay of Ago, long famous for producing the best quality of pearls. It is a remarkably quiet body of water some six miles in length and three miles in breadth, with an average depth of ten fathoms, although it is over twenty fathoms deep near the entrance. The coast line is cut into with many deep and irregular indentations which, besides affording excellent shelter and ground for the pearl oyster, have the additional merit of making the scenery exceedingly picturesque. The fact that the "Kuroshio," the great "gulf stream" of the Pacific, sweeps near by,

is also undoubtedly an important factor in making this a favorite haunt of the precious mollusk.

Somewhat to one side of the middle of the bay toward the north is the small island of "Tatokujima," the center of Mikimoto's enterprise. When first taken possession of it was uninhabited, but now it supports a flourishing colony of several dozen families and many hundred individuals all connected in some capacity with the pearl-oyster culture. The sea bottom around the island was at first leased, the area being increased from time to time until finally in 1903 and also 1905 the government, recognizing the importance of the enterprise, granted the use of a very large portion of the bay, so that at the present day, the whole of the sea area leased by Mikimoto extends for 29 nautical miles.

The pearl oyster cultured on these grounds belong to the species (*M. martensi*) abundant in the Bay of Ago and found more or less in all parts of Japan. They closely resemble the Indian species found near Ceylon, famous for producing the finest pearls in the world. These mollusks live at depths not exceeding seven fathoms, and are anchored to rocks, stems of algæ, etc., by threads which the animals secrete.

The methods practised at Mikimoto's farm are as follows:

Every year during the months of July and August small pieces of rock and stone are placed in spots where the larvæ of the pearl oysters have been found to be most abundant. Soon small oyster spat are found attached to them. As this takes place in the shallow waters of not more than a few fathoms, they would die from cold, if left there during the winter; so together with the rocks to which they are anchored they are removed to deeper waters and carefully laid out in beds prepared for them. Here they lie until they reach their third year, when they are taken out of the sea and undergo an operation which leads to pearl formation. This consists chiefly in introducing into them the small pearls or round pieces of nacre which are to serve as the nuclei of pearls. The shells are then put back into the sea and left undisturbed for at least four years more. At the end of that time, they are taken out, and it is found that the animal has invested the inserted nucleus with many layers of nacre and has in fact produced a pearl.

Pearl culture as we have described it may seem to be

very simple, but in reality it is by no means an easy work. Large mortality among the pearl oysters from various causes, the ejection of the inserted nuclei, the depredations of the oysters' enemies, uncertainties attendant upon long years of waiting, are some of the drawbacks which beset the industry. The most dreaded of all the evils is perhaps the invasion of the so-called "red current." This has been ascertained to be due to an immense accumulation of microscopic organisms causing a discoloration of the sea water. Wherever this appears it is followed, for some reason not yet well understood, by a wholesale destruction of marine organisms, and when it invades the pearl-culture grounds, it may undo in one day the work of years. Another unwelcome intruder of the culture ground is a sea weed called "Mirumo" (*Codium*), which if allowed to grow luxuriantly will cover up the pearl oysters and stop their growth or even kill them by smothering them, so to speak. Again the octopus plays sad havoc among the pearl oysters which it seems to consider a great delicacy. The starfish is another animal which especially enjoys a meal of pearl oysters.

THE WOMEN PEARL DIVERS OF JAPAN.

Every country has its own particular method of catching fish and shell fish, and so has Japan. Among the many different methods employed in Japan for pearl fishing none is more interesting than that employed by the women divers, who obtain the pearl oysters. Pearl fishing is conducted mainly by men divers in Australia and India and other countries, but in the region about Ago Bay in the province of Shima, the Bay of Gokasho in the province of Ise, as well as in other parts of the country, women are employed in diving. Still the general tendency nowadays is to engage men wherever possible. The women along the coast of the Bay of Ago and the Bay of Gokasho, when they reach thirteen or fourteen years, by which time they have completed a primary school education, go to sea and learn to dive. Thus they are trained more or less from childhood in their vocation. Their native towns and villages lie along the seashore. Hence it is but natural that they should all dive and swim almost from babyhood. They are in the water almost all the year round, except in the coldest season, from the end of December to the beginning of February. Yet even during this inclement

season they sometimes dive for pearls. It goes without saying that the climate in these regions is almost always mild, and that snow is almost unknown in winter. These women divers wear a special dress. White underwear is worn, and the hair is twisted up into a hard knot. The eyes are protected by glasses to prevent the entrance of water. Tubs are suspended from the waist. A boat in command of a man is assigned to every five to ten women divers to carry them to and from the fishing grounds. When the divers arrive on the grounds they leap into the water at once, and begin to gather oysters at the bottom. The oysters are dropped into the tubs suspended from their waists. When these vessels are filled, the divers are raised to the surface and jump into the boats.

The Mikimoto pearl farms lie at a depth of from five to thirty fathoms, with an average of ten fathoms. The women dive to the bottom without any special apparatus, and retain their breath while they remain under the water. They stay under the surface from one to three minutes. When they are chilled they return to the shore, and warm themselves at fires built in huts especially for the purpose, and then return and resume their work. The women engaged in this work vary in age from thirteen to forty years. Women from twenty-five to thirty-five make the best divers because of their physical strength and experience. The hours of labor vary with the seasons. In warm summer weather about six to eight hours constitute a day's work. In cold weather the divers cannot work more than from one to two hours. The wages paid range from ten cents to fifty cents a day. The highest ever paid is one dollar. Astonishing as it may seem, some of the women manage to save considerable money, largely because the cost of living is very low. Most of the young divers try to earn their marriage dowry by diving. Even after marriage many of them support their families by diving. Skill in diving is a woman's greatest possession. Most of the pearl fisheries are situated in small inlets flanked with evergreens. The water is wonderfully clear. There is something indescribably picturesque in the aspect of divers plunging into the glassy water, and sending out ripples in all directions. Their curious whistle as they inhale and exhale on entering and leaving the water has something uncanny about it.

THE EXPANSION OF AIR BY HEAT.

SOME SIMPLE EXPERIMENTS.

If a bladder, partly filled with air and with its neck tied tightly, is laid on a hot stove, it will soon become filled completely, and it will burst with a loud report if it is heated very hot or has been nearly filled with air in the first place. As the same confined mass of air which only partly filled the bladder when

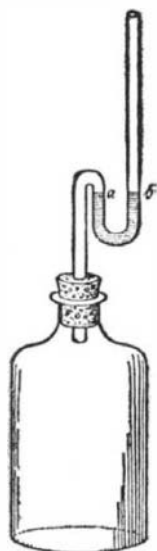


FIG. 1

cold fills it completely and "to the bursting point" when hot, this simple experiment gives a striking proof of the fact that air expands when its temperature is raised.

The following experiment shows that even a slight increase of temperature produces an appreciable expansion. A glass tube, softened by heating in the flame of a spirit lamp or a Bunsen burner, is bent into the form shown in Fig. 1, and, when cold, is accurately fitted to a hole bored through the tightly fitting cork of a small bottle. A little colored water is poured into the tube, of which it fills the U-shaped portion which is shaded in the illustration, forming a water seal and preventing communication between the air in the bottle and the external atmosphere. If the bottle is clasped with the hand the level of the

water rises in the branch *b* and sinks in the branch *a*, because the water is driven along the tube by the expansion of the confined air by the heat which it receives from the hand.

The appearance of vibration or "shimmering" which is observed over a hot stove, and over paving-stones exposed to the sun in summer, is caused by the ascent of air which is expanded, and consequently made lighter, by contact with the heated stove or stones. Spiral strips of stiff paper and more elaborate constructions containing inclined surfaces are often mounted on pivots over stones, where they are caused to rotate rapidly by these upward air currents.

The ascensional force of heated air is shown still more strikingly by the following experiment: Strips of tissue paper are pasted together to form a bell, which is hung over a tripod, as shown in Fig. 2. A single upright rod may be used instead of the tripod, but the rod should carry at its top a rather large disk in order to keep the mouth of the bell open. If a large spirit lamp or, preferably, a little cotton wool placed in a cup and saturated with alcohol, is set beneath the mouth of the bell and lighted, the paper bell will soon become inflated with hot air and will rise to the ceiling. The bell is, in fact, a hot air or fire balloon, the oldest of all balloons, which was invented by the brothers Montgolfier more than a century ago. The Montgolfier balloon was made of paper, yet these pioneer aeronauts dared to intrust their lives to it, and thus made the first balloon ascension, from Lyons, France, in 1783. The balloon was filled with smoke produced by burning wet straw and wool. The Montgolfiers thought, until they were convinced of their error by men better versed in science, that this smoke possessed electrical properties which increased its lifting power.—Kosmos.

A SIMPLE METHOD OF ELECTRO-PLATING.

At a meeting of the Royal Society of Arts on February 2nd, a paper by Mr. A. Rosenberg was read upon an improved method of electroplating. Mr. Rosenberg dispenses altogether with the plating bath and all external sources of electricity. The plating is carried out simply by rubbing on a powder moistened with

water. The process is really a refinement of the old contact method. It will be remembered that in this process a piece of metal which it is desired to plate upon is immersed in an electrolyte, for example, one containing a silver solution. In contact with this metal a more electropositive one is placed, also dipping into the electrolyte. This metal, usually zinc, passes into

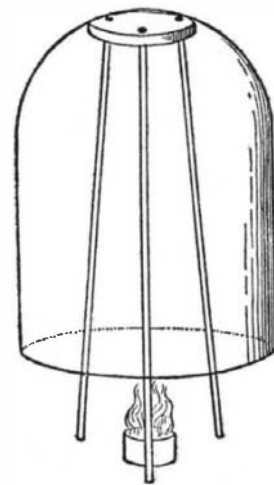


FIG. 2

solution, and an electric current thereby is generated. The silver is then plated-out upon the less electropositive metal.

Mr. Rosenberg employs his electro-positive metal in the form of a fine powder, and generally uses magnesium. This is mixed with a metallic salt or with the powdered metal it is desired to plate-out, and ammonium sulphate or other ammonium salt. In order to plate a piece of metal the powder is moistened with water and rubbed over its surface by means of a piece of rag or a brush. By this means adherent and bright deposits are obtained in about one minute, the thickness of the deposit depending upon the time employed and the quantity of powder used.

The magnesium, being strongly electro-positive, reacts with the moist electrolyte, and goes into solution, causing the metal to be plated-out upon the metallic