MILK IN POWDERED FORM.

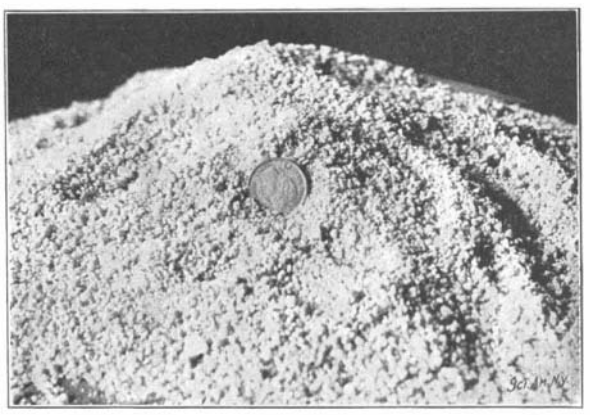
BY GEORGE J. JONES.

For more than fifty years efforts have been made by the scientists of nearly all the civilized countries to separate the water and the fat from milk and secure the non-fatty solids in such condition that by the simple addition of water the milk could be restored, with all its original properties unimpaired, and unchangeable by time or the extreme variations of climate.

These efforts proved unsuccessful for many years. A portion of the water could be readily removed, but when concentrated to about one-sixth of its original bulk the pasty condition of the mass rendered it unmanageable and complete desiccation became impossible without subjecting it to such a high temperature that the character of the product was completely changed, rendering it insoluble, incapable of coagulation by rennet and reducing the digestibility by pepsin tests 50 per cent. The nearest approach to desiccation was condensed milk. A dry product seemed impossible without the sacrifice of all the valuable constituents of milk except the casein, and this was preserved only in an altered form after treatment with acids and alkalies which thoroughly changed its character and impaired its nutritive qualities.

Dr. Joseph H. Campbell, a citizen of the State of Pennsylvania, who had spent a great deal of time in the study of the petroleum products, turned his attention to organic chemistry some time ago, devoting himself especially to the products of the dairy.

The developments of the dairy interests of this country had reached enormous proportions. The butter industry was largely being concentrated at the creameries, and in many cases skim milk was a waste product, often thrown away. If the skim milk could be utilized so as to recover the non-fatty solids in dry, soluble, sterilized and thoroughly peptogenic condition, the product at half the price of butter per pound would be more valuable than the butter interests itself, as the milk would yield but four pounds of butter to the hundred pounds of milk, while the non-fatty solids would furnish nine and a half pounds of the dry powder, and the annual value would run into hundreds of millions of dollars, creating a new industry exceeding in value the wheat crop of the United States.

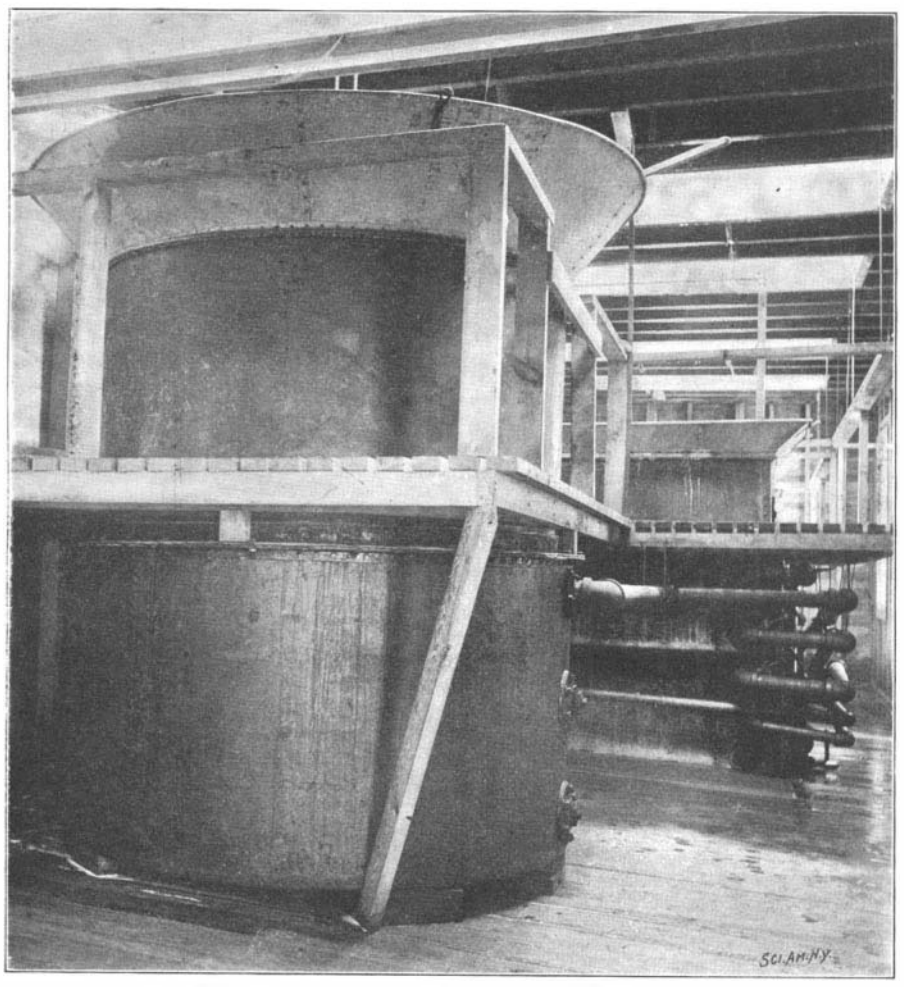


DRIED MILK BEFORE BEING GROUND INTO POWDER.

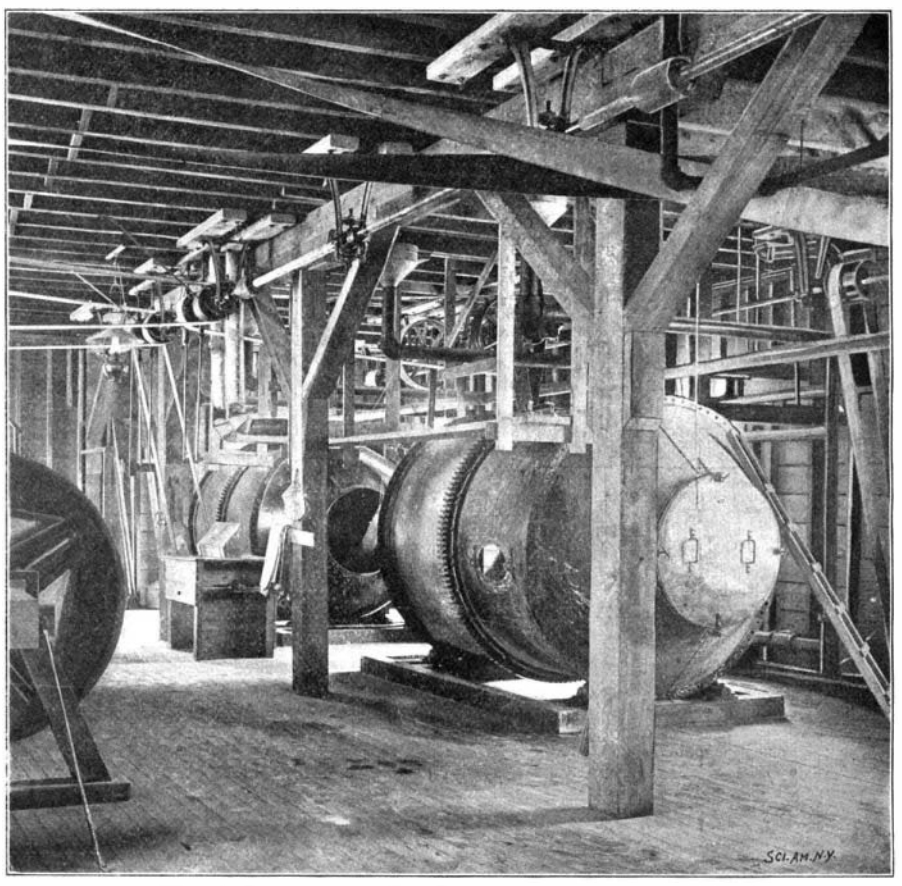
But even more than this it was realized that the recovery of the non-fatty solids of milk in a dry condition would furnish milk to the tropical regions where it was heretofore unobtainable; would permit an addition to the rations of the soldier and the sailor in the most convenient form, with the least possible waste; would be an invaluable addition to the hospital dietetics; would supply an important factor in the treatment of diabetes, Bright's disease and other similar maladies; would furnish properly balanced rations to all classes at the cheapest rate, and would be a general boon to humanity in maintaining vigorous normal health, allaying suffering, promoting longevity and reducing infant mortality.

The process of development was slow; difficulties were presented at every turn, some of which for a time seemed insurmountable. But after nearly three years of labor and the expenditure of nearly $100,000 success crowned the efforts and powdered milk or Nutrium, as it is known, became a reality, and its manufacture is now a flourishing industry.

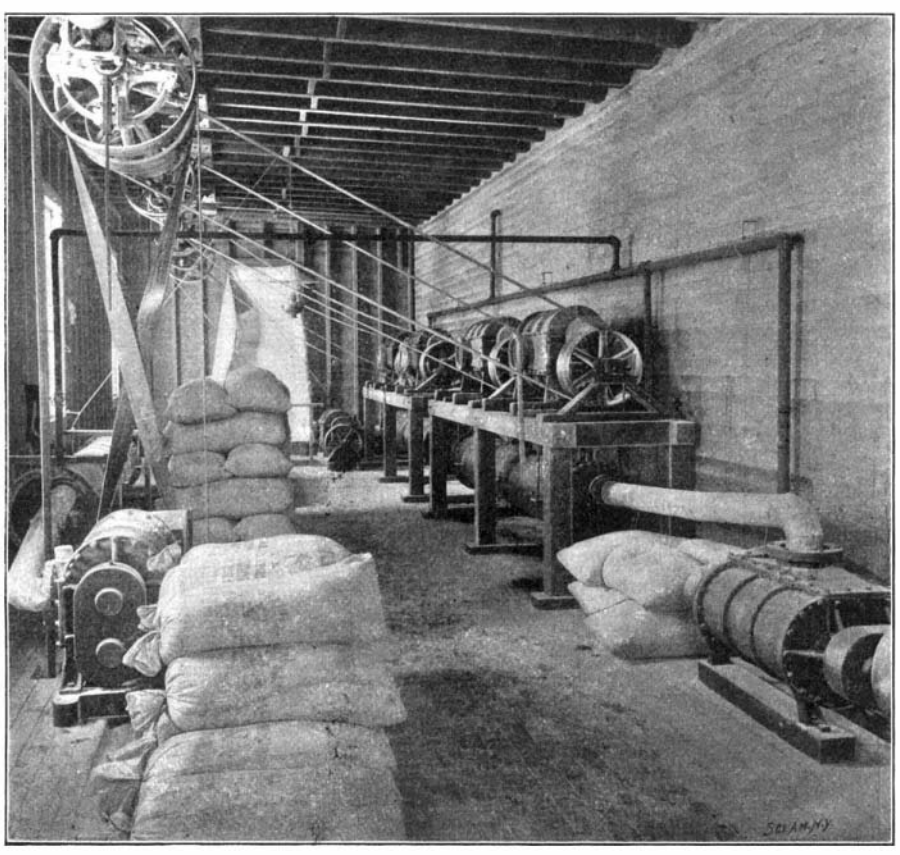
The views herewith presented show the various stages through which the milk passes at one of the three mills of the National Nutrient Company, pre



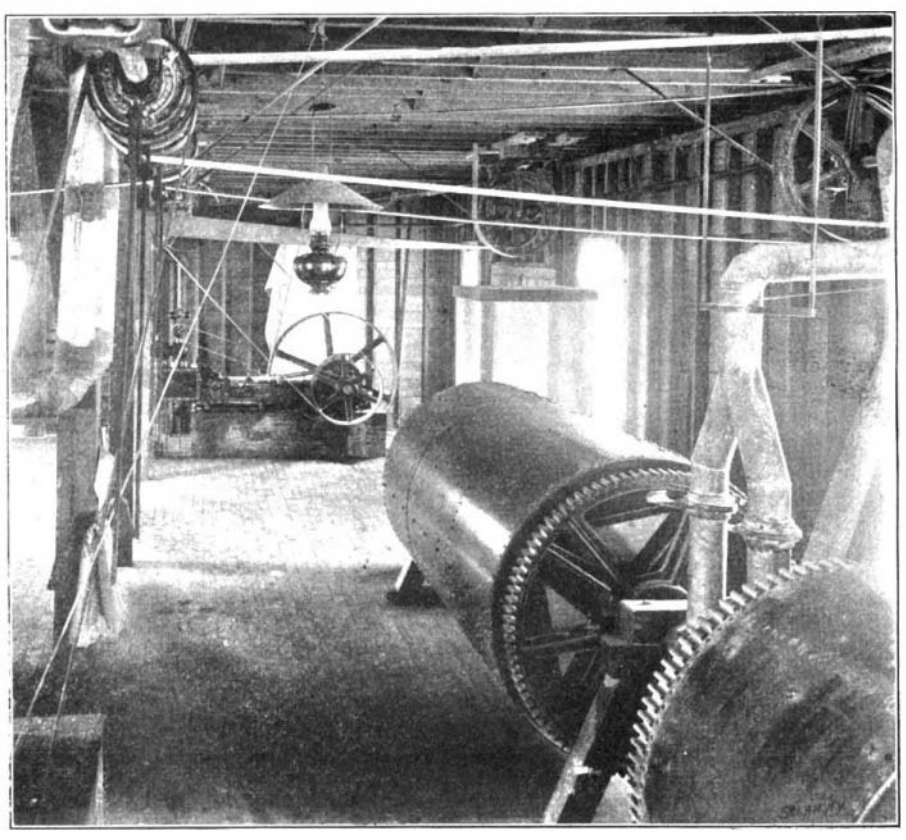
CONCENTRATING ROOM, SHOWING STERILIZING VAT.



GRANULATING ROOM, SHOWING ROLLER DRUMS.



BLOWERS AND AIR STERILIZING APPARATUS.



GRANULATING ROOM, SHOWING DRIER DRUMS.

paratory to its shipment to the Jersey City, N. J., mill of that concern, where it is ground, bolted and packed. In this plant there are two of the largest pebble mills in the world used in grinding the dry lumps. The product in appearance resembles fine wheat flour, and is packed suitably for the safe transportation to all climates.

In one view is shown the copper tin-lined concentrating vessel. The milk is pumped into the large round copper vessel, where it is agitated and heated by sterilized air blasts preparatory to its being pumped into the four rectangular concentrating vessels. These concentrating tanks are provided with a circulating medium of hot water surrounding them and coils in their interior. They are also provided with pipes and fan-shaped nozzles for the introduction of sterilized air below the surface of the milk. This air is under a pressure and is allowed to escape when the tanks are charged with milk and causes the water vapor to be driven off. The milk here has a violent rolling motion, greater than if boiling. The milk is thus reduced to about one-sixteenth of its volume. As the product becomes concentrated the temperature is lowered. The opening of a valve permits the mass to fall into the large roller drums with tapered ends, shown in another cut, and which are located on a lower floor. These roller drums are tin-plated and are perfectly smooth on the inside with cone-shaped ends. An air blast is then introduced into the head of the drum. The latter revolving about two turns per minute, carries the pasty product up on its side, and as it approaches the top it falls back through the dried atmosphere, the air thus carrying away the moisture. This paste soon becomes too heavy to be carried up by the revolving of the drum and rolls into a large mass, the cone-shaped ends causing it to move unequally and twisting and grinding it into small particles. These are then conveyed to the drier drums, where the desiccation is completed.

These drier drums have a novel construction. Sterilized air is forced through a central shaft having lateral arms extending down into the mass, where the constant rolling of the drums exposes all parts to the desiccated air. When the product is bone-dry it is then conveyed to a grinder, which brings it to about the consistency of corn meal, and it is then packed.

The proper office of powdered milk is not so much to act as a food of and by itself, but as a means of cheaply furnishing other foods with the proteids in which they are deficient, and thus restoring the balance which is essential to health.

The successful reduction of milk to the form of a powder is an achievement of much importance to the bakers, particularly those engaged in the business in a large way. They are enabled to secure their milk supply without any possibility of interruption and at a much lower cost. This latter is due to the fact that the dried milk can be shipped so much more economically than the milk in its original form. A five-pound box can be shipped at a small fraction of that of its equivalent of whole milk and can be mixed as desired. The losses in the handling of fresh milk around the bakery are very great. Much is consumed by the men handling it, a great deal is wasted and considerable is spoiled by being improperly cared for.

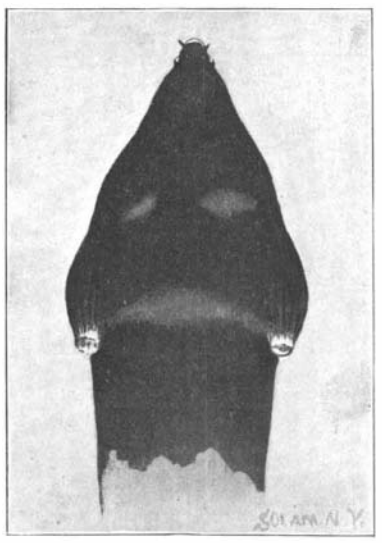
A NEW CURIOSITY AT THE NEW YORK AQUARIUM.

Considerable excitement has been caused in the vicinity of this city over the rumor that a live "sea-serpent" had been captured and placed on exhibition in the Aquarium. The crowds which thronged the Battery with the expectation of seeing a hideous, green-eyed monster of the dime-novel type have invariably returned disappointed and disgusted. Their reports have belittled the importance of the specimen, and given the general impression that the whole story is a fraud. This is unfortunate, for the creature is, indeed, a very rare specimen, never before having been seen in captivity. It has been identified as belonging to the moray family, and is known as the *Channomuraena vitata* (Richardson). That the fish is indeed a rare specimen may be gathered from the fact that there is but slight mention of such a species, and the only authentic record is that of the ichthyologist Richardson, who discovered the fish in 1844 in the neighborhood of Cuba, and gave a fair description of it.

The specimen has a skin of warty appearance, chocolate brown in color and striped with yellowish bands and spots. The tail is slightly flattened and bears no sign of a fin, nor can any fins be found on its body. In this it differs from all other morays, which have a fin extending the full

TREE SHATTERED AT THE BASE BY LIGHTNING.

length of the back. The head also is very different, being broad and flat, while the common species of moray have a deep and narrow head. Its method of breathing, however, is identically the same as that of the other species. It is provided with the gill pockets which are characteristic of the family. In general appearance and manner of swimming the fish is snake-like in the extreme. When extended to its full length



HEAD OF THE EEL RECENTLY BROUGHT FROM BERMUDA TO THE NEW YORK AQUARIUM.

it measures just about 6 feet; however, it often draws itself in to a length of about 4 feet.

The story of its capture is quite amusing. The eel was discovered by three negroes who were fishing about seven miles northeast of Bermuda. The water at this point suddenly deepens from 11 fathoms to over 200. From this it is supposed that the moray is a deep-sea fish which by chance worked its way up from the deep water to the fishing banks. At all events, no such creature had ever before been seen in the vicinity of Bermuda within the memory of the oldest living inhabitants, and the catch so frightened the drunken fishermen that two were rendered helpless by their superstitious fears, while the third, immediately sobered, drew in the line and landed his prize. When the men reached shore the moray was deposited in a tide-pool for safe keeping. There chanced to be a hole in the coral bottom of the pool, and eel-like the creature crawled into this as far as it could, in an endeavor to conceal itself. When the negroes next visited the pool only two feet of eel could be seen, and, frightened beyond reason at the apparent contraction of the fish, they were glad to give it away to Prof. Charles L. Bristol, of New York University, who is in Bermuda gathering specimens for the New York Aquarium.

The moray seems to be doing well in its new quarters, and it is hoped that it will live. As yet the fish has eaten nothing, though constantly tempted with bits of codfish, on which the other morays thrive. This, however, is not an alarming symptom, but rather a characteristic of the moray family, for these fish often abstain from food for weeks at a time.

A PECULIAR LIGHTNING-SHATTERED TREE.

The illustration shows the effects of a stroke of lightning on a tree located near Plymouth, Conn., which occurred in April, 1902. From the peculiarities observed it is believed this tree may have been shattered by an upward discharge.

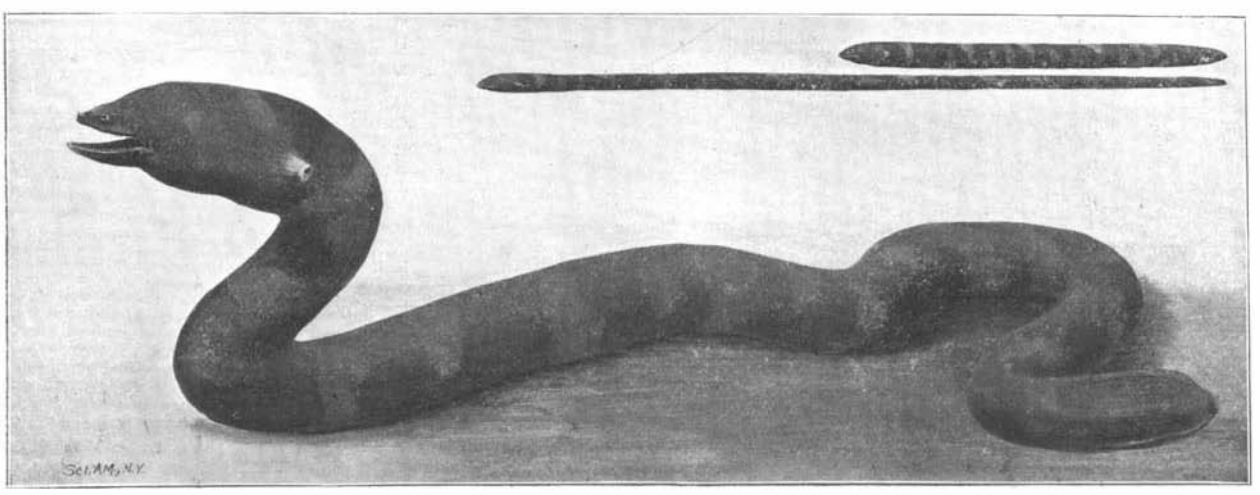
Our correspondent states that the splinters were thrown away from the root of the tree and the body badly splintered, but the top of the tree untouched; but one limb about ten feet above the highest splinter on the tree is broken off about three feet from the tree.

On the opposite side of the tree there was a deep furrow plowed in the ground from the root of the tree toward a low swampy spot, as though the lightning may have come from this damp ground to the tree. The earth and leaf mold from this furrow were thrown as widely as the splinters, and the dark spots on the upper right-hand side of the picture are pieces of the leaf mold lodged on the branches of the surrounding trees.

It is certainly a very peculiar effect of the work of lightning, and would apparently lend color to the theory that it was caused by an upward stroke. Generally, however, a wet soil is regarded as a good conductor, and the track observed going toward the pond would indicate that the stroke descending might have struck the center of the tree first, and followed the easiest course to the pond.

Bonus for Gold-Saving Appliances.

According to Mining and Scientific Press, a bonus of £2000 ($10,000) is offered by the government of New Zealand to any person who, before the first of January, 1904, shall invent appliances to successfully save gold from black sands in New Zealand. It is a condition of the offer that the invention shall, in its main features, differ from all machinery and appliances at present in use for the saving of gold, whether coarse or fine. It shall be readily transportable from place to place, and shall be capable of utilizing local water for all its requirements. The invention must be capable of treating not less than 30 cubic yards an hour of black sand or any coarser material up to a diameter of 4 inches, and it must be capable of treating such material profitably where there is not more than a value in gold of 3d. (6 cents) per cubic yard, not less than 80 per cent of the gold contained in the material to be recovered by the machine. No bonus to be paid until the invention has been continuously worked for not less than six months, and it shall during that period have treated not less than 100,000 cubic yards of material, working three shifts a day. The bonus will be paid on the certificate of an officer that not less than twenty persons other than the applicant for the bonus are successfully working the invention. Any person who receives the bonus shall not be allowed to take out patent rights in New Zealand for his invention.



REMARKABLE EEL AT THE NEW YORK AQUARIUM (CHANNOMURAENA VITATA). WHEN STRIKING ITS PREY THE EEL IS ELONGATED AS SHOWN ABOVE.