sion, so that the fry might obtain it. Simple as this solution of the problem was, no one had ever thought of it before.

To prove the correctness of this theory, it was decided to experiment with the lobsters, which were at that time in small bags. The water in the bags was stirred with an oar continuously for six days and nights. The result was a brilliant success. The evident efficiency of this crude method of stirring in maintaining the life of the young fry naturally suggested a mechanical contrivance for protecting the fry during the extremely critical period of their early life.

Consequently, a series of bags 12 feet square and 5 feet deep was sunk into the water and tied securely in place. In each bag near the bottom was placed a two-bladed rotating fan, resembling that commonly in use over restaurant tables. These fans or propellers were connected with vertical shafts, which in turn were geared to a gasoline engine. When the machinery was set in motion, the rotation of the fans created a continuous current of water directed upward from the bottom of the bags, the force of the current being readily controlled by altering the angle of the blades. This also prevented the accumulation of parasites on the young lobster's body.

Scientists will tell you that from 30,000 new-born larvæ, which represent the average total mass of the brood produced by one pair of lobsters during their lifetime, only one pair of mature lobsters are alive after a lapse of seven to nine years. The lobster fishermen have been at their wits' end to supply the ever-increasing demand of hotel and restaurant for this popular sea food. Now it bids fair to become so plentiful as to be within the reach of the humblest purse.

Before the installation of the stirring device at Wickford, it was the custom to turn out the young fry soon after hatching. But the young lobster at birth is as helpless as a human baby, with only feeble means of locomotion and no defensive weapons. There are many stages in the life of a lobster, at each of which he sheds his skin or shell and grows another. It is not until the fourth stage that he assumes the familiar form of the lobster, and is able to defend himself to a certain extent.

A successful effort was made to hatch the lobster eggs with the same stirring apparatus. Female lobsters were obtained from Newport, and the eggs were combed off in the ordinary manner, and placed in the stirring bags. When the propellers were set in motion these eggs were gently swirled about, and hatched into very beautiful young lobsters.

During the first three stages the lobsters swim near the surface in an aimless jerky way that reminds one of a wiggle-tail. The first stage lasts about three days, the second about four or five days, and the third usually about five or six days. From nine to sixteen days are required for the larvæ to pass from the first to the fourth stage.

A most marvelous change of form, and an even more astonishing change of habits, occurs at the third molt. The emerging fourth-stage lobster has the general form of the adult. The abdomen is no longer bent down at right angles to the body, but, as in the adult, extends straight behind. The downward stroke of abdomen, which was the chief means of motion during larval life, is now used, as in the adult, only for rapid retreat. All five pairs of walking legs have lost their upper branches, and the first pair, which are now the large characteristic "nippers," are extended straight in front of the head while the lobster is swimming. These structural changes are accompanied by more radical changes, in habits and instincts. The lobster, no longer helpless upon the bottom, burrows under shells or stones and picks out a home, from which it sallies forth in search of prey. In shedding its third skin it has cast off all its previous timidity, and with its strong crushing claw is ready to defend itself against all comers.

A new style of swimming, which lasts only a week or two, is now adopted. The tail being extended straight behind the body, and the large claws extended in front of the head, the lobster swims forward in a perfectly straight and definite course by the strokes of the "swimmerets." No trace of its former aimless activity remains, for the lobster now actively seeks food, avoids enemies, and retreats from danger. The active but careless and helpless infancy has been succeeded by enterprising independent youth. The fourth-stage lobster has passed the most critical period of its entire life, and is vastly better fitted for the struggle for existence than at any earlier stage.

In the first molts, as in the succeeding ones, the process is the same, the old skin being split across the back, between the thorax and the abdomen, and the body working out through this opening, leaving the cast-off skin otherwise intact. The actual process of molting occupies only a few minutes, but occasionally something goes wrong, and the struggle is quite prolonged. Often the lobster dies in the process, and the period of molting is at best a very precarious one.

Last year 294,896 lobsters of the fourth stage, counted singly after being taken out of the hatching bags with a tea strainer, were liberated in various places along the shores of Narragansett Bay. These thousands of lobsters have more value for the improvement of the local lobster stations than as many millions of larvæ of the first stage, with the setting free of which the experiment stations had previously to be satisfied. But even after the lobsters have been reared to the fourth stage their future chances of life depend, in some degree, on the time and place and manner of their liberation. Thus far it has seemed best to liberate them in the morning, so that they may find hiding places and settle themselves before night falls, and to scatter them over a considerable extent of territory, so that they may not gather in a conspicuous swarm.

For years the United States Fish Commission has hatched at Woods Hole, Gloucester, and at other stations, many millions of eggs annually, and have set free the young as soon as possible after they were hatched. But in this case the fry are distributed in deep water, and are thus in less danger from their natural enemies, which, like the mummychog and the shrimp, abound in shallow water. The apparatus used in hatching at Woods Hole is the McDonald jar, into which the eggs are placed immediately after they are "combed" from the females. In this they are kept swirling sometimes for weeks by a constant stream of salt water.

The lobster ranges from Labrador to Delaware, and inhabits the waters from the very shore to a depth of more than one hundred fathoms. It is thus confined to a strip of the Atlantic Ocean about 1,300 miles long, and at some points, as the coast of Maine, from 30 to upward of 50 miles wide. The number of eggs or "seed" carried by the female on the under surface of her tail varies from 10,000 to 20,000.

At Wickford the young lobsters are raised from the egg to maturity, in order to determine not only their habits and requirements at various stages and in various seasons, but to ascertain as nearly as possible the normal rate of growth. When the fourth stage is reached, a number of lobsters are put into cars provided with sand, gravel, and seaweed, to stimulate as closely as possible the natural environment. The sides of the cars are made of galvanized iron screening, which allows a free circulation of water.

During the summer the cars are suspended from the house-boat, or from floats, so that the water in them is about eighteen inches deep. In the fall they are provided with tight-fitting covers, and sunk in the channel in from eight to ten feet of water, and left undisturbed until spring. The lobsters are frequently fed during the summer on chopped clams, fish, and several other varieties of food, but in the winter no food is given them, although they may obtain some food from the water or from the animal organisms which grow in the car. The cars seem to furnish a natural environment, for not only are the lobsters in a healthy condition, but seaweed, oysters, clams, mussels, shrimp, tunicates, barnacles, various specimens of marine worms and other animals grow inside of the cars as rapidly and normally as in other places.

An interesting part of the work at Wickford is the liberating of a number of lobsters with copper tags attached to them. Last summer 210 were set free with tags bearing a number and the words "Return to the Rhode Island Fish Commission." Thirty-six of the tags were returned by lobstermen with the date and place of capture, and valuable information on the movements of the lobsters was thus obtained. Although the greater number returned had not wandered far, some had made their way southward for several miles. The lobster bearing the tag "75," shown in the photograph, which was caught one mile southwest of Beaver Tail, holds the record up to date for fast traveling, having covered a distance of ten statute miles in less than eight days.

Official Meteorological Summary, New York, N. Y., September, 1909.

Atmospheric pressure: Highest, 30.48; lowest, 29.81; mean, 30.10. Temperature: Highest, 79; date, 3rd; lowest, 48; date, 29th; mean of warmest day, 74; date, 23rd; coldest day, 58; date, 28th and 29th; mean of maximum for the month, 72.2; mean of minimum, 59; absolute mean, 65.6; normal, 66.4; deficiency compared with mean of 39 years, 0.8. Warmest mean temperature of September, 72, in 1881; coldest mean, 61, in 1871. Absolute maximum and minimum of September for 39 years, 100 and 40. Average daily excess since January 1st, 1.1. Precipitation: 2.66; greatest in 24 hours, 0.83; date, 27th and 28th; average for September for 39 years, 3.61. Accumulated deficiency since January 1st, 0.95. Greatest precipitation, 14.51, in 1882; least, 0.15, in 1884. Wind: Prevailing direction, northwest; total movement, 7,335 miles; average hourly velocity, 10.2; maximum velocity, 45 miles per hour. Weather: Clear days, 10; partly cloudy, 9; cloudy, 11; on which 0.01 inch or more of precipitation occurred, 7. Frost: light, 29th.

Correspondence.

THE FLOORS OF PANAMA LOCKS.

To the Editor of the Scientific American:

I notice in your last week's issue an interesting description of a plan for anchoring down floors of locks in the Panama Canal, to prevent lifting and injury by upward pressure of seepage water.

As an unbiased bystander, "watching the game," I venture to suggest that any possible pressure of the kind feared could be easily relieved by providing small openings at intervals in the floors of locks, with steel tubes extending vertically from upper to lower surfaces, with valves which could be opened to allow seepage water to flow into locks freely during inspection.

Such safety valves could be inserted with very much less expense than anchorages proposed. Would some of your readers interested in hydrostatics kindly point out any practical objections there might be to such a procedure? R. Armstrong.

Rock Park, Ramona, Cal.

THE NUMBER OF OUR ANCESTORS.

To the Editor of the Scientific American:

Will Mr. Solon De Leon kindly give us his authority for his "consanguine groups"? The more the habits and customs of primitive peoples are studied, the more it becomes apparent, I believe, that they have, and had, strict rules preventive of all close interbreeding. I am not in a position to name authorities, but have just been reading John Rhys's "Studies in the Arthurian Legend," in which, referring to such matters, he says: "Celtic mythology fails to carry us back to a state of society where it could have been possible." (See page 227.) Mr. Eckles's isolated communities were bad enough, but now we have Mr. De Leon's family groups, all the daughters of which were wives of all the sons; yet science is emphatic in teaching that all inbreeding, whether of plants, animals, or man, is fatal, and leads to the degeneration and extinction of the race. And Nature confirms the same. These gentlemen greatly exaggerate the conditions, I think, or surely we should all have vanished off the scene centuries ago! If "consanguine groups" ever existed, it must have been in the very infancy of the race, and certainly could not be placed within the last 25,000 or 30,000 years.

Should it be true that it is next to impossible to find any two Englishmen who have not an innumerable number of ancestors in common, then it can only be a question of time when the same truth would apply to all human beings. We are told that everything is possible in this wonderful world except logical contradictions; are not these theories a fair example of such? Isolated and consanguine groups would tend to keep the general population separate, and so cut both ways. In any case, the problem as given in my last letter in your issue of September 11th remains unaffected. Such a case of intermarrying as F. W. A. specifies must surely be very rare indeed!

Doubtless the intermarrying of relatives explains much of the puzzle, but it will not bear all the weight some of your correspondents are willing to risk upon it.

Los Angeles, Cal. A. K. Venning.

The Current Supplement.

Just now the popular conception of Fulton is that of a man who invented steam navigation. A critical consideration of what he really did is presented in the current Supplement, No. 1763. The very high power which is now demanded of naval ordnance, especially the main armament of battleships, has led generally to a consideration of the utmost importance—the life of the guns. This question will be found admirably discussed in a thorough article. Well-equipped experimental laboratories are indispensably necessary for the progress of aviation. One of these is the Aerodynamic Institute of Kutchino, which is well illustrated and well described. Steam turbines may be governed in several ways, which are considered in a carefully prepared article. The admirable *résumé* of importance in the internal-combustion engine begun in a recent number by Mr. H. E. Wimperis is continued. The old dusty road that winds from the landing of the village of Capri to the mountain top behind the village will no longer be used by the tourist. A cable railway now takes its place. This railway is described and illustrated. E. Sherwald writes on some decorative designs derived from the polarization figures of quickly-cooled glass. Prof. L. Jaloustre contributes a simply worded article on catalysis. G. Espitallier discusses building methods in the earthquake regions. The makers of arc lamps have several times devised more or less ingenious lamps, in which the clockwork or motor by which the carbons are moved as they are consumed is suppressed. Most recent attempts of this kind are to be found in the Beck arc lamp, which is described in the Supplement. Oliver Light contributes a suggestive article on the making of automobile repairs