



Corning

MAN IN GLASS BOWL—A glass hemisphere 44½ inches in diameter is a production prototype of similar hemispheres to be tested by Corning Glass Works, Corning, N.Y., to prove the feasibility of a manned glass submersible. A manned craft would have a spherical pressure hull of two 56-inch diameter hemispheres joined together.

OCEANOGRAPHY

Ocean Mysteries Revealed

Exploration of the Indian Ocean has produced new understanding of its currents and its inhabitants that will make its resources more available

► **THE HOTTEST**, saltiest water in the seas has been found in the Indian Ocean, as have the fastest midsea current and the coldest surface water in the Tropics.

Within this vast ocean lie acres and acres of productive plants and a layer of water that can be lethal to millions of fish.

Scientists working with the International Indian Ocean Expedition have put together a remarkable body of knowledge about this sea. From September 1959 to December 1965, 25 oceanographers from 15 nations explored the Indian Ocean using every tool at their disposal from modern research vessels to weather satellites to tramp steamers.

An Indian Ocean Meteorological Center has been set up in Bombay with United Nations aid and the only international collection of small marine animals or zooplankton can be found at the Indian Ocean Biological Center at Cochin.

The existence of the Somali Current, a "western boundary current" running north past Africa and Arabia at speeds up to seven knots, was confirmed. (The Gulf Stream in the Atlantic and the Kuroshio in the Pacific travel at a maximum of four knots.)

The world's only boundary current to cross the equator, it is also the only one that reverses itself with the seasons.

Because it is only surface deep, it races north during the summer months when India's southwest monsoons are raging, only to do an about face and head calmly south when the monsoons die out.

At the point where the Current turns, near the Arabian coast, the surface temperature of the water drops to 55 degrees F. because of the tremendous upwelling of cold water far below.

This upwelling carries with it nutrients from the ocean depths, making nutrient concentrations in the western

Arabian Sea twice as high as those in the North Atlantic, according to Dr. R. R. Prasad of India. Zooplankton actually clogged the nets biologists lowered into the water during this period.

However, the upwelling also brings death. At depths of more than 200 meters, the Indian Ocean is oxygen-deficient, and when this layer of life-threatening water is brought closer to the surface, along with layers of terribly cold water, fish are unable to survive.

The significant advances of the expedition scientists in understanding the activity of the Indian Ocean should, with improved techniques and more data, help raise the present annual catch of fish from 2.5 million tons to 20 million within 35 years.

The ways and means of transporting and storing fish must be updated if advanced scientific knowledge is to be applicable. If increased catches are to reach hungry millions, more ports and modern freezing facilities are necessary.

OCEANOGRAPHY

Test Glass Hemispheres For Manned Submersibles

► **MASSIVE GLASS** hemispheres 44½ inches in diameter and an inch thick are being fabricated by Corning Glass Works for use at the Naval Ordnance Test Station, China Lake, Calif., to prove the feasibility of building a manned deep diving submersible. Two hemispheres will be joined to form a spherical pressure hull.

The 44½-inch sphere will be followed later this year by spheres 56 inches in diameter for the manned vehicle, according to present plans of Dr. William B. McLean, technical director at China Lake.

Glass, the only material that has the strength to go to the bottom of the ocean and still be 50% buoyant, is tremendously strong under compression. Normally it fractures only under tension. Therefore, hydrostatic pressure, which seldom translates into tension, tends to make glassy materials stronger as they go deeper. The effect is sometimes called "depth hardening."

Another advantage of glass is its transparency. Dr. McLean envisions a transparent vehicle in which all of the equipment would be attached to the outside of the sphere. The equipment then could be controlled through the glass by optical signals, thus increasing working space within the sphere.

Such a sphere would be strong enough to take the "aquanauts" to the bottom of the sea at normal atmospheric pressure inside. They could go down and return to the surface very quickly, without spending long periods for decompression and with no danger of suffering pressure effects—such as the "bends." A life-support system similar to those used in spacecraft would provide the necessary environmental control.