

not be developed while a battery is being discharged or in use.

Experts asserted tonight that no battery that develops or throws off hydrogen gas while being discharged could be used in a submarine. Hydrogen gas is always thrown off or developed while the battery is being charged, and submarine batteries are never charged when the boat is submerged, because the boat is airtight, the gas could not escape, and its accumulation in a moving submarine would result in an explosion. For that reason these batteries—whether the old lead type or the new Edison nickel type—must be charged when the submarine is on the surface or in dry dock, so that the hydrogen or other gas developed in charging can be pumped out of the submarine by means of electric fans or blowers.

The Edison nickel batteries have been found in official experiments in the navy to throw off considerably more hydrogen than the lead batteries, during the charging of the batteries. For this reason very great care had to be exercised in charging the Edison batteries. Reports show that this battery developed from two to three times as much hydrogen gas during the charging process as did the lead batteries. But experts of the navy wanted to be certain that the Edison battery did not develop any appreciable quantity of hydrogen gas while charged. To clear this point the Navy Department employed an expert analyst of the air and directed him to ascertain whether the Edison battery developed hydrogen gas while being discharged, that is, while being used in a submarine run. This expert went aboard the E-2 with very delicate testing instruments and made his tests while the submarine was operated under water in a six-hour run. His report to the department was that only an infinitesimal quantity of hydrogen gas was developed while the battery was being discharged. Other tests and experience demonstrated the same thing. The facts indicated that the Edison nickel battery would be safe for use in submerged runs by submarines.

## MANY SUBMARINE DEATHS.

### More Than 200 Killed in Accidents Before Europe's War Began.

Submarine accidents in the navies of the world caused the loss of more than 200 lives in the ten years preceding the present war. Little is known of the accidents which have taken place among the many submarines in actual service during the war. Most of the 200 lives lost in accidents before the war were due to collisions, explosions, and chlorine gas. The navies of France, Great Britain, and Russia have been the principal sufferers in lives lost. In five accidents France lost eighty-two lives. England before the war has lost seventy-seven men in submarine disasters.

The American Navy had been notably free from losses to its submersibles before the sinking of the F-4 in Honolulu Harbor last March, when the entire crew of twenty men was lost. A corroded battery lining and poor diving qualities were held responsible by a board of investigation. All the submarines of the F type were soon after brought into navy yards for improvements, which are now under way. The total deaths caused by accidents on American submarines, including those of yesterday, are twenty-five.

The first important accident to an American submarine occurred on Sept. 18, 1908, when one man was killed and several injured at the Brooklyn Navy Yard by an explosion on a barge to which the submarines Pike and Grampus were moored. On Oct. 10 of that year the crews of the Cuttlefish, Octopus, and Viper were much affected by poisonous gases generated on a run from New York to Norfolk.

On May 12, 1913, the C-5 of the United States Navy sunk the steamer Annie in Norfolk harbor, and eighteen persons were saved by quick work.

## BLOW TO EDISON BATTERY.

Was Thought Not to Generate Any Dangerous Gas While in Use.

*Special to The New York Times.*

WASHINGTON, Jan. 15.—News of the explosion on the submarine E-2 produced a painful impression in naval circles in Washington. The fact that the explosion took place on the particular submarine in which the new Edison nickel-potash electric storage battery had been installed aroused even greater interest in the cause of the accident, for this battery had been installed experimentally in the hope that it might render American submarines safer.

These batteries have not been ordered installed in all other American submarines, and upon the results of the investigation into the cause of the E-2 explosion will depend whether the Edison battery is used or discarded by the United States Navy.

The information which Rear Admiral Usher communicated to the Navy Department tonight indicated that the explosion may have been caused by an explosion of hydrogen gas. It showed that the accident occurred apparently under the battery deck, where the Edison battery was installed, and that it happened while the Edison battery was being discharged—that is, while the electrical energy that had been stored in the battery was being removed by means of a rheostat. Experts here tonight indicated that, if the investigation confirms the belief that the cause was an explosion of hydrogen gas while the battery was being "discharged," it means the end of the Edison battery in the navy. If it was due to a hydrogen gas explosion while the battery was being "charged," the situation would be altogether different, for the important point is that hydrogen gas should