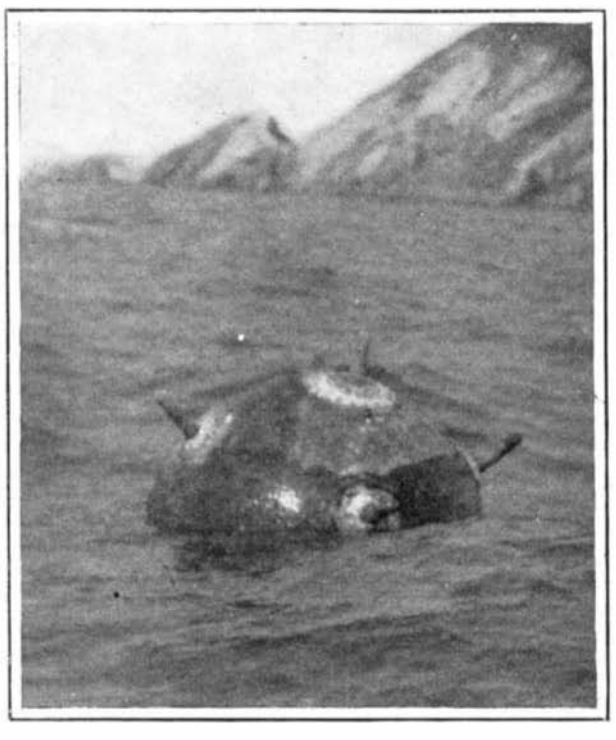
governing the motion of air, which are at variance from those generally accepted by scientists. The construction of an airship in accordance with and adapted to these conditions has occupied his attention since 1884. His deductions, after being reduced to a mathematical formula, have resulted in the construction of the aeroplane "Santa Clara." Guided by the practical suggestions given by theories and experiments, the aeroplane used in the present work has been constructed. It consists of two wing surfaces, parabolic from the front to the rear edge, a flat tail, and a vertical keel. The two surfaces are so formed and placed that they lead to a uniform action in the building up of a general rotation, very much as if they were the front and rear portions of a large wing. To this extent they are the elements of a divided wing; yet, inasmuch as they are separate, they have independent modified forms and adjustments, the purpose of this arrangement being to obtain by the use of two points of support, fore-and-aft equilibrium, and yet retain the elements necessary for the production of the complete rotary tendencies in the air. The rear portions of the wing surfaces are hinged at the center, and free to drop from above, but are restrained in their upward movements by wires so adjusted that they may swing like the arms of a balance, yielding automatically to excessive air pressure on one side or to the effort of the aeronaut in contending with unfavorable gusts or directing its course. The relative adjustment of these edges is such that the control of the wings on either side may be similarly changed, or one side move in one direction while the other undergoes an opposite but reciprocal change. The tail or rudder is so placed relative to the rear surface that any change in its position immediately produces a change of pressure along the entire wing, thus meeting the requirements of fore-and-aft equilibrium, these requirements changing with variations of speed as the pressure on the surface moves toward the front edges with increased speed, and *vice versa*. The ventral fin serves partly to preserve the side equilibrium and is so formed and placed as to meet antagonistic requirements of pressure above and beyond the surfaces.

By a change of form and position of the rear surface, the varied pressures necessary to the fore-and-aft equilibrium are developed, and the aeroplane may be caused to dart downward, move horizontally or rise, or to check its position suddenly. With proper manipulation, the machine travels in a wave line through the air, with a gradual descent, turning in circles to the right or left, as the form of the surface on either side is modified.

Owing to generally prevailing ideas on the subject of flight, many exaggerated opinions have been expressed since the first announcement of the experiments with the present aeroplane, which Prof. Montgomery does not sanction, as these may give rise to radical conclusions, and lead to disappointments. It is no doubt true that the experiments were of an extreme nature, for when the aeronaut, at an elevation of several thousand feet, cut loose from the balloon and trusted to the aeroplane, there were only two alternatives before him—a dash to the earth and a crushed and lifeless corpse, or a convincing success of the aeroplane.

In reference to the experiment which the writer witnessed under most satisfactory circumstances, the conclusion is that an advance has been established in the science of navigating the air, though that problem is not yet solved. A great step, in the opinion of the writer, a great leap forward, has been accomplished and maintained. It is but just to Prof. Montgomery and his distinguished coadjutor, the Rev. R. H. Bell, S.J., Professor of Physics in Santa Clara College, that no countenance has been afforded the extravagant declarations relative to the aeroplane which they have jointly conceived. An aeroplane has been constructed that in all circumstances will retain its equilibrium and is subject in its gliding flight to the control and guidance of an operator, but beyond this there remain two other obstacles which are to be overcome before navigating the air is either practically or commercially possible. There remains continuance in flight, as an essential, and lastly, the power of a machine to raise itself from the surface. The first principle has been solved beyond a doubt. The two remaining, perhaps the most difficult of all, await solution.

The Mine After Being Dragged Ashore.



Drifting in Chefoo Harbor.

American Officers Examining Shothole in the Mine.

DESTROYING A RUSSIAN MINE.

The accompanying photographs give a fair idea of the appearance of the mines whieh the Russians are using to protect their harbors. These mines are usually held several feet below the surface of the water by heavy anchors, but on account of their buoyancy and the action of the tides and storms they frequently break their cables and become a floating menace to all shipping in the vicinity. It is known that scores of these deadly machines have broken adrift; and although several have been located and destroyed, there are many others yet afloat upon the high seas.

This one had undoubtedly broken loose from its moorings at or near Port Arthur, and been carried by wind and tide to the harbor of Chefoo, China, where it was found. The discovery was reported to the commanding officer of the U. S. S. "New Orleans," who promptly ordered an officer to go out with a party and destroy the floating danger.

Wishing to investigate the construction of the mine more closely than could be done while it was floating, a long line was attached to it, and from the safe side of a high bank on one of the small islands in the harbor, it was hauled to the beach and up out of the water. The party then went out several hundred yards from shore and after several attempts succeeded in striking the mine with a shell fired from a one-pounder mounted on the bow of the steam launch. The mine, however, could be exploded by electricity only, and although the shell tore a hole through the casing, the guncotton charge remained intact. Through the opening thus made the electrical connections were cut, and the mine rendered practically harmless.

Each of the lead spines on the outside of the mine incloses a thin glass bottle containing acids, and when the spine is bent by collision with a ship or other floating body, the bottle is broken and the acids emptied into a receptacle containing zinc-carbon elements. The combination instantly produces an electrical current and the spark ignites a fulminate detonator, which in turn explodes the main charge of about 250 pounds of wet guncotton.

After the mechanism had been carefully examined electrical connections were laid from the mine to the lee side of the bluffs which are seen in the accompanying photographs and the charge exploded from a safe distance.

This Russian mine may be compared with the Japanese mine which was illustrated in the issue of the Scientific American of March 11 of this year. In the Japanese mine, the firing arrangement consisted of a ball carried on a flexible vertical rod, provided with a contact disk which, when the mine was struck, came in contact with a ring of metal and closed the electrical circuit, thereby detonating the mine. The chief interest in this Russian mine lies in the contact mechanism, which would not appear to have been very effective, at least in this particular mine, inasmuch as when the mine was dragged ashore, the lead spines must have been bent and the glass bottles broken without causing the firing mechanism to operate. During the Spanish war, immunity from disaster from submarine mines, in the case of at least two of our warships, was due to the fact that the contact fingers or triggers, which should have detonated the mines, were so incrusted with marine growth and otherwise out of order, that although the mines were struck and roughly handled, one of them being torn adrift by the propellers of the "Texas," no damage was done.

DESTROYING A RUSSIAN MINE.

Driverless Engine.

Germany possesses a miniature but most useful railway, to which no parallel is found in this country. Its peculiarity is that its trains have no drivers. It is used for carrying salt from the salt mines at Stassfurt. The trains consist of thirty trucks, each carrying half a ton of salt. The engines are electric, of twenty-four horse power each. As it aproaches a station, of which there are five along the line, the train automatically rings a bell and the station attendant turns a switch to receive it. He is able to stop it at any moment. To start it again he stands on the locomotive, switches the current and then descends again before the engine has gained speed.—Railroad Men.

In Golden Gate Park, San Francisco, there has been installed a large windmill of the familiar old Dutch type for pumping water. With the wind at ten miles an hour it develops 4.65 horse-power, and at thirty miles an hour the horse-power is 126. Its daily pumping record in June, 1904, ranged from 5,460 gallons to 371,397 gallons against a gage pressure sometimes of 32 pounds and sometimes of 53 pounds.

Incandescent gases under slight pressure give light composed of lines, but under pressure a continuous spectrum.