MANUFACTURING HIGH EXPLOSIVES

The Importance of Compressed Air as a Motor in Firing.

It is a long jump from a pop-gun to a dynamite gun; and yet such a jump a certain schoolmaster made. This is how it came about:

One day a mischievous urchin fired a paper ball from a pop-gun and struck his schoolteacher in the eye. So forceful was the impact of the wad of paper that Meford, the teacher, who was of an inventive turn of mind, determined to see if compressed air could not be used as a motive power for firing something more important than paper balls out of a boy's pop-gun. Why might not dynamite, or other powerful explosives, be fired safely from a huge air-gun? was the question the wad of paper propounded to his mind. In this way, he thought, the shock liable to cause premature explosion might be avoided. The experiment was worth trying, and he at once set about devising such a gun. His success was sufficient to attract the attention of Lieutenant Zalinsky, who had the crude gun of the schoolmaster brought to his station; and, working from it as a starting point, finally produced the Zalinsky Pneumatic Gun, the first successful gun capable of firing a shell heavily loaded with dynamite. This is the part the small boy and his smaller pop-gun played in the invention of the deadly dynamite gun.

The knowledge that several hundred pounds of dynamite, gun-cotton or nitro-gelatine can be hurled from a great gun, miles away, and exploded at the spot aimed at by the gunner, makes all anxious to know something about the nature and military uses of these dread substances.

Five things are required of military explosives. "1—The substance must possess the greatest breaking efficiency for the smallest unit of weight and unit of volume. 2—It must possess great insensitiveness to sympathetic explosions and to mechanical shocks, especially those due to small projectiles, while it yet retains the property of exploding completely through the influence of an initial detonation. 3—It should be quite insensitive to fire, or at least so much so that there would be no chance of an immediate explosion when a considerable mass of it becomes ignited. 4—It should possess great stability, and not only should its efficiency remain unimpaired, but it should remain so under very extreme conditions. 5—It should remain unaffected by water."

Thus far the chemist have produced only three substances which may be considered as approaching the fulfillment of these requirements. They are dynamite, compressed wet gun-cotton and military explosive gelatine. Of these three gelatine comes the nearest to meeting the five required conditions. Weight for weight it has 25 per cent. more breaking efficiency than the best dynamite or gun-cotton, and for equal volumes it possesses 40 per cent. greater efficiency than dynamite and 75 per cent. greater than gun-cotton. It is superior to gun-cotton or dynamite in its insensitiveness to great pressure or mechanical shocks; but stands below wet gun-cotton as regards fire and about on par with dynamite. Wet gun-cotton cannot be set on fire by either flame or spark. It must be dry before it can be ignited. This property of wet gun-cotton makes it the safest of all explosives where the danger feared is fire. The keeping qualities of gelatine are equal to those of gun-cotton or dynamite; and it remains unaffected by water.

These properties of gelatine make it the most valuable of the explosives for military uses. This will quickly be seen if the question of transportation and storage is considered; for 25 per cent. more energy can be carried if explosive gelatine be used instead of dynamite and 40 per cent. more force can be put into one magazine if it is filled with gelatine in place of dynamite. Then again smaller torpedoes, having the same destructive power, can be employed if loaded with gelatine rather than the other high explosives. Gelatine is the most effective filling for shells, now that it can be fired with comparative safety and accuracy from pneumatic guns. A small chloride of silver battery is enclosed in each shell, and so arranged that the electric current fires the charge at the moment the shell strikes. This battery nearly does away with the danger of premature explosion; and also renders it possible to explode the charge from the rear, which has been found to be the most effective way.

In the navy compressed gun-cotton is still largely used for torpedo charges and other submarine ground mines; but the army favors the more powerful nitro-gelatine owing to its enormous shattering power. When bridges, stockades, walls, forts or any similar obstructions have to be removed gelatine is the substance that will do it the most effectively.

Gelatine, as used for military purposes, consists of 92 per cent. of nitro-gelatine and 8 per cent, of nitro-cotton. A certain percentage of camphor is sometimes added to this compound, as a safeguard, camphor having the property of rendering the gelatine less explosive. Gelatine, at an ordinary temperature, is quite elastic to the touch and looks very much like a beautiful straw-colored jelly. When lighted with a match it burns with an intense white flame. It is insensible to shock, to friction, and to the pressure or action of water. A powerful detonator must be used to explode it.

Dynamite is made by forcing a certain quanity of nitro-glycerine into some porous substance, usually silicious infusorial earth. Nitro-glycerine is formed through the action of concentrated nitric and sulphuric acids on glycerine. It is an oily liquid, clear, colorless or of a yellowish tint, of a sweetish and burning taste and without odor. A sudden blow will explode it.

Gun-cotton is produced by treating ordinary cotton with concentrated nitric and sulphuric acids. Notwithstanding the extraordinary chemical change which has taken place in the nature of the cotton, it still looks like cotton. It is a trifle less white, feels somewhat harsher to the touch grates slightly when squeezed and is heavier than cotton. When rubbed gun-cotton will become strongly electrified and stick in lumps between the fingers of a dry hand. Cotton will not do this. Gun-cotton explodes from a blow, or heat, particularly by ignition; but when wet cannot be lighted.

A Sign of the Times.

A few days ago a solicitor, while instructing a man with regard to the cremation of the remains of a deceased client, remarked:

"You know well enough that the headings 'Births, marriages, and deaths' also bear the description Hatched, matched, and despatched?'"

"Oh, yes," said the man; "but if cremation becomes more general than now, those words will have to be modernized into 'Created, mated, and cremated!'"

The First and the Last.

A short time ago a young fellow, having heard wonderful tales of the skating-rink, made up his mind to visit one. The sight of such a large number of young ladies and gentlemen gliding round and round in all directions led him to believe that skating was the easiest thing in the world.

He hastily made up his mind, and, after ordering a pair of skates, and having them fixed to his boots, he took a brave,bold step forward, and—bang he dropped full length on the ice! An assistant at once ran up to help him up.

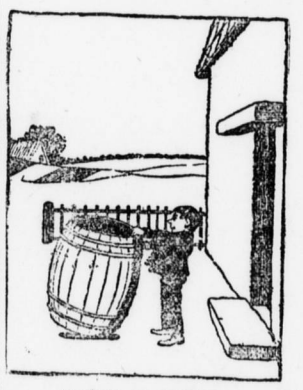
"Is this your first attempt at skating, sir?" he asked.

"No," growled the young fellow; 'the last!"

When two quarrel, both are in the wrong.

BRINGING UP A YOUNG RASCAL.

A chastised boy—



resolves on revenge—

gives his mother a terrible fright—

and didn't she give him a walloping?

THE SUBMARINE TORPEDO.

A Connecticut Yankee Conceived the Idea a Century Ago.

The basic idea of submarine warfare was born, nearly a century and a quarter ago, in the fertile brain of that eccentric Connecticut genius, David Bushnell, when he conceived the project of disabling or destroying a ship by exploding a magazine of powder under its submerged parts, and invented a submarine boat with which to convey the explosive to the bottom of the ship. This was the first submarine boat, capable of locomotion while under the water, of which there is any accurate record; and, certainly, the idea of using such a vessel as a means of destroying an enemy's ships was entirely original with Bushnell.

The shape of this first of submarine vessels was something like that of two upper tortoise shells of the same size joined together. The room inside was large enough to hold the operator and a sufficient quantity of air to support him thirty minutes, without the admission of fresh air. An oar for rowing forward and backward furnished the means of locomotion. The boat could be made to descend or ascend at the will of the operator. In the top of the boat were two air pipes. A ventilator drew fresh air through one of these pipes, and the impure air was expelled through the other. Both air pipes were made to shut themselves whenever the water rose near their tops, and to open again immediately when freed from the water. When under the water the operator was in darkness. He directed his course by a compass marked with phosphorous; and ascertained his depth by a water-gauge, lit by phosphorous placed on a piece of cork.

A large magazine, holding a hundred and fifty pounds of powder, was placed behind the vessel just above the rudder. A rope extended from the magazine to a wood-screw in the front part of the boat, which was so arranged that the man inside of the craft could drive this screw into the planks of the ship he wished to destory. When the wood-screw was firmly fixed the magazine was cast off, the boat backed away from the imbeded screw and the powder was left to do the rest of the work.

When afloat so small a portion of this unique vessel showed above the water that a skilled operator might approach very close to a ship in the night without fear of discovery, then dive beneath the hull, fasten the magazine and row out of harms way. At least its inventor thought all this might be done.

During the Revolutionary war several attempts were made with Bushnell's submarine boat and torpedoes to blow up the ships of the enemy. A 64-gun ship, lying near Governor's Island in New York harbor, was attacked one night. The operator dove under the ship and attempted to fasten the wood-screw into her bottom. The screw failed to penetrate, probably striking a piece of iron, and the unskilled operator in trying to find another place lost the ship and was obliged to give up the attempt. Two other efforts were made to destroy ships in the Hudson river; but both failed.

The cause of these failures is plainly set forth in a letter from General Washington to Mr. Jefferson. Referring to Bushnell's strange craft Washington wrote: "Where it was to operate against an enemy, it was no easy matter to get a person hardy enough to undertake the variety of dangers to which he would be exposed—first, from the novelty; secondly from the difficulty of conducting the machine and governing it under water, on account of the current; and thirdly, from the consequent uncertainty of hitting the object devoted to destruction, without rising frequently above the water for fresh observations, which, when near the vessel, would expose the adventurer to discovery and to almost certain death. To these causes I always ascribed the failure of his plans, as he wanted nothing I could furnish to ensure their success."

Twenty years passed. Then Robert Fulton turned his restless genius to the subject of submarine warfare; and invented the submarine boat. Nautilus," and the submarine bombs, to which he now gave the name of torpedoes.

The "Nautilus" had windows of thick glass, a wheel and a crank to give the boat locomotion above as well as below the surface and masts and sails, which could be quickly struck when it was desired to plunge beneath the water. He also compressed two hundred atmospheres of air into a copper air chamber, to be held as a reserve air fund. With this boat Fulton repeatedly descended to various depths in the water, and while submerged moved about at pleasure at the rate of a little over one mile an hour. On one occasion he remained under the water four hours and twenty minutes, without suffering any inconvenience.

In August, 1801, Fulton by means of his "Nautilus" placed a torpedo under a small vessel furnished him for the experiment and blew her into fragments. This is the first destruction of a ship on record brought about through a submarine boat and a torpedo; and at the time occasioned much excitement in naval circles.

Notwithstanding their many failures, modern submarine warfare owes the debt of fatherhood to David Bushnell and Robert Fulton.

On a horse dying lately, its stomach was found to be partly filled with broken glass, some pieces of which had pierced the tissue. The glass was of several kinds, going to prove that the horse had a rondness for the diet.

OUR COAST LIGHTS.

BEACONS WHICH GUIDE MARINERS SAFELY TO FRIENDLY HARBORS.

May be First to Detect the Approach of an Enemy—The Loneliness of the Lighthouse—How They Aid in Time of Peace or War.

All along our Atlantic and Pacific coasts, and usually situated on some lonely, storm-beaten point of land, where the great waves never cease their sullen roarings, the lighthouses of the United States, like giant sentinels, keep watch and ward. And then, far out from the shore, where the danger from rock and storm is greatest, with only the unquiet ocean and the changing skies for company, swing and tug at the moorings the lightships of the coast. Hundreds of brave men and thousands of dollars worth in ships and merchandise are saved annually from the waves and the rocks by these watchful guardians, who have eyes that never slumber and warning voices that even the noises of the storm cannot drown. The wildness of their situations, the lonesomeness of their surroundings, the character of their duties—the saving of human life and property—cast a glamour over the lonely lighthouses and storm-tossed lightships and make all that pertains to them of fascinating interest.

Stark and white upon the bare white beach of North Island, South Carolina, stands the historic Georgetown lighthouse. The tower is 85 feet high, and its light can be seen for fifteen miles. It throws a plain white light, which shines with unbroken radiance far out over the dark waters, a beacon of hope to the storm-driven mariners. This light has watched while history was made. It was built in 1801, and rebuilt after the war.

Another light, famous in history, is the one at Cape Henry off the coast of Virginia, at the entrance of Chesapeake bay. It is 108 years old; and its light has often guided "the father of his country" on the way home from his travels. Recently a new house, 157 feet high, was built at this place and equipped with all the latest light appliances, electric light signals, a steam siren, etc. A "steam siren" is a trumpet blown by steam, which sings a song to lure mariners away from destruction, and has a voice so loud that it can be heard for many miles at sea. The song of this siren is a blast five seconds long, then a silence of ninety seconds, a blast five seconds, followed by a silence of ninety seconds, and so on through all the hours of the day and night. The light is white in color, with red rays between southwest and west and south-southwest, and shines steadily.

The Cape Cod lighthouse is connected with Boston by telegraph. A signal display station reads the messages signalled from passing ships, and within a minute these messages are in Boston. The light is situated on the highlands of Cape Cod, facing the ocean two hundret feet above the level of the sea. The building is all white and can be seen by vessels twenty miles away. Its Daboll trumpet sends forth continually blasts eight seconds long, with intervals of half a minute of silence.

The entrance to Delaware bay is guarded by the Cape May lighthouse, 167 feet high. This light can be seen for a distance of nineteen miles. One of the highest lighthouses in the United States is the one at Block Island, Rhode Island. It is 204 feet high, and shows a fixed white light than can be seen for a distance of twenty-two miles.

The lonesomeness and the dangers of the position of lighthouse keeper are so apparent that one would hardly expect to find women serving in that capacity; and yet, in the United States, some twenty women hold this responsible and ofttimes dangerous post. There are heroines, too, among them, whose deeds have been so heroic as to command the admiration of the brave everywhere. Ida Wilson-Lewis, the story of whose bravery is too well known to need retelling here, keeper of Lime Rock lighthouse, Newport, Rhode Island, has rescued eleven persons. Five people owe their lives to the courage of Mrs. Blake, keeper of the lighthouse at Robbins Reef, off Tompkinsville, New York harbor. Heroic Janet Malby, keeper of the Elk Neck lighthouse in Chesapeake bay, during a terrible storm of wind and rain and hail in 1894, pushed her own boat out from the safety of Elk Neck Rock into the angry waters, and rescued six men, whom she saw struggling in a frail boat, which the great waves threatened to swamp each moment.

Few people, except seamen, know anything about the number of lightships, which the United States keeps moored in dangerous places, far out in the ocean and exposed to all the perils of the stormy sea. From Boston to Galveston there is an almost unbroken line of these floating lighthouses, placed where they can best warn the mariner of danger. Fastened to the ocean's bottom with great anchors and strong chains or hawsers these lightships keep lonely vigils over the surrounding waters; and when the heavy storms and seas sweep down the coast the bright flashes of their electric lights, the loud blasts of their steam whistles or the deep boom-boom of their great bells warn the storm-tossed sailor lads from hidden dangers and guide them on their way to havens of safety.

Embarrassing.

Mabel—"It is very annoying. I happened to say that it was the most interesting novel I had ever read."

Laura—"Well?"

Mabel—"Well, he insisted on talking about just those incidents I must have skipped."

War Fads Of The Fair.

Fashion Reflects The Beloved Red, White and Blue.

Patriotism is rife just now, and honors to Dewey are rightly the order of the day. One popular fancy is a chin bow—the latest touch found in the scheme of decoration upon many of the newest and most elegant gowns made of Manila net. Net bows are much softer and are really more becoming than are the stiffer ribbon bows, and as these nets come in all the shades, both light and dark they are really very desirable for the bows.

The red, white and blue craze is in evidence everywhere. When conservative business men wear as many as three or four quite good sized flags on their coats and are proud of them, small wonder that our women have fallen in love with the "Dewey" shirt waist. These Dewey waists are of blue and white stripes running bias in front with straight plait, as is fashionable now. They are in Madras, lawn or Japanese silk, with collar and cuffs of red. Besides being novel and appropriate, their effect is very pretty and becoming.

Probably one of the most popular ways women have of expressing their love for their country is in having patriotic cushion tops. The up-to-date housewife can't have too many cushions, and is always eager for something unique.

The *Tobacco Trade Review* says there is no doubt that cigarette smoking is on the increase among women and that various branches of the trade have started to cater to women smokers. The advanced female of the beginning of the next century may be expected to take to chewing.

Spain was only able to buy two Atlantic liners to be converted into cruisers, the Normannia and the Columbia of the Hamburg-American line. After the sale had been completed the German government expressed in strong terms its displeasure at the transaction. Germany had the like claim on these two vessels that the United States government had on the four steamers of the American line, the St. Paul, St. Louis, New York and Paris, and there was an implied understanding that they should be taken and converted into armed cruisers for the service of the empire, if they were ever to be needed for such purpose.