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DESTRUCTIVE FIRE SHELLS.

While on a visit to the Washington Navy Yard, a few days since, we were shown some shells that were charged with a peculiarly destructive liquid. The person that showed them to us could give no account of their peculiarity, but we have since learned that some experiments were recently made at the navy yard with an apparatus for the ejection of liquid fire which to all intents and purposes is the famed Greek Fire revived, the secret of which has been lost. The chemical composition of this fire may not be the same, but its effects are as terrible as those attributed to the inextinguishable fire of the Greeks. The composition and the apparatus for ejecting it are the inventions of Prof. B. F. Greenough, of Boston, who, though for many years nearly blind, has pursued his chemical investigations with unabated zeal, until he has produced what promises to be a terrible auxiliary in warfare.

The experiments were made under the direction of a Board, consisting of Capt. G. V. Fox, Assistant Secretary of the Navy, Capt. Dahlgren, Capt. Wainwright and Lieut. Badger. A target was erected upon a platform fifty feet long by thirty feet wide, the target being made of solid oak timber three feet in thickness. The fluid was ejected in an inert state from a pipe of 3-16ths inch diameter, and was thrown some thirty to fifty yards before it reached the target. At a distance of several feet from the nozzle the fluid ignited, expanding to a diameter of two feet, with an intense combustion, which covered the target and the platform with liquid fire. The fire was apparently inextinguishable, burning readily on the water, and consuming the target. It emitted dense fumes and smoke which darkened the atmosphere and would have suffocated any human being who had come within its influence. The experiment was quite successful.

Extravagant accounts have come down to us respecting the Greek Fire. It was said to be unextinguishable in water, and was terrific as the flames of pandemonium. Such descriptions have been principally derived from panic-stricken foes—frantic Turks and others, who were more frightened than hurt by the Greek Fire—ships which were saturated with turpentine and sulphur.

Several incendiary and asphyxiating shells have been invented for the purpose of scattering " liquid fire " and noxious fumes around the space where they explode. One of this character was exhibited to us several weeks since by Lieut. Matthieson, of the 79th Regiment, N. Y. S. M. It is a double shell made in one casting, the inner being united to the outer shell by braces, leaving spaces between the two. One was charged with a combustible fluid, and the other with a bursting charge and shrapnell. It was designed for a bombshell to fire dry underbrush when the leaves lay thick on the ground, for the purpose of dislodging an enemy hid under the cover of thick woods.

Those who suppose that either coal oil, petroleum, naphtha or benzole, is suitable for producing incendiary bombshells are mistaken. The fluid capable of performing such an office requires to be inflammable in the atmosphere at common temperatures, which is not the case with petroleum.

The first explosive shells employed in war were grenades and were thrown by hand, a chosen body of strong soldiers called *grenadiers* being selected to use them. The name "grenadiers" is still retained for companies of big soldiers, but their old " occupation is gone."

The first patent taken out for firing bombshells horizontally from guns was by Isaac D. La Chaumette, in England, in 1721. He used a breech-loading cannon (not a mortar), and the shell was ignited by a time fuse. Percussion shells, which explode when they strike, were patented in 1829, by John Tucker. His shells contained a principle which has lately been claimed as new. It contained a hollow tube in which was a loose sliding bar or striker, and at one end of the tube the fulminating powder was placed communicating with the bursting charge. When the shell was fired, the striking bar was situated at the end of the tube opposite the percussion powder, but when it struck an object the sliding bar darted forward to the fulminating priming and ignited the charge. Elongated percussion shells have been patented to strike on their points and explode percussion caps that communicated with the charge inside, but the sliding striker shell is allowed to be the most reliable. Shrapnell shells are formed by charging the inside of common bombshells with balls, then filling the interstices with a brittle substance and the powder. The inventor was Henry Shrapnell, who obtained a patent in 1834. Quite a number of patents have been taken out for making shells with wings to give them a spinning motion when fired from smooth-bored guns.

During the Crimean war the number of patents taken out in England for destructive missiles was astonishing. A few of these deserve consideration. In 1855, J. W. F. Packman patented a shell charged with explosive gases and ferrocyanide of potassum in powder—a powerful poison. In the same year J. Macintosh secured a patent for charging shells with coal tar and naphtha to produce suffocating vapors when it exploded. About the same time Henry Disney applied for a patent for an incendiary shell stated to be of a peculiarly destructive character, but the patent was refused and the invention suppressed for the benefit of the government. Since then it has been stated that this shell was filled with a substance capable of spontaneous combustion when it exploded, and it was, therefore, the first practical incendiary shell. In 1851, J. Macintosh obtained a second patent for an incendiary shell filled with fire balls. These were made by mixing gunpowder with india rubber in solution, spreading this compound on cloth, and coating it with a powder composed of sulphur, steel filings and chlorate of potash. The cloth so made was cut into strips and formed into balls for charging shells. These inflammable balls ignite when the shell explodes, and they set fire to all combustible objects with which they come in contact. We have been informed that Disney's shell was charged with naphtha and phosphorus, which produces a liquid that will take fire spontaneously, and is, therefore, suitable for incendiary shells.

In the published accounts which we have read of the attack on Fort Pickens, it is stated that very few of the shells thrown into the fort exploded, while most of those sent into Pensacola from the fort were effective and very destructive. In explanation of this, it is said that Gen. Bragg's shells were made in Europe, but those used in Fort Pickens were Hubbell's American shells, manufactured at the Washington Navy Yard.

WATER GLASS.

The last number of *Silliman's Journal* contains a long article on water glass (silicate of soda), by J. M. Ordway, in which he relates his experience respecting its adaptability to many useful purposes, and that it is of permanent value in many of the arts. He states that a strong solution of this silicate of soda forms a good colorless cement for glass, porcelain and stone, but it is not suitable for cementing wood, nor is it equal to gum, or flour paste for paper. When a solution of silicate of soda is mixed with clay and sand, it is excellent as a substitute for mortar in setting fire bricks, because it undergoes partial fusion by heat in a furnace and thus it makes very tight and firm joints. Fibrous asbestos moistened with the silicate of soda makes superior packing for the joints of apparatuses exposed to hot acid vapors. Silicate of soda is also well adapted for fixing various pigments used in painting and this is the use to which it has been most recently applied in Europe. When mixed with light colors and applied to wood, it softens the surface of the latter, and is therefore not well adapted for primary coats in painting wood. As it is also devoid of elasticity, it is not suitable for painting in situations where the surfaces are liable to shrink. For painting out-door work, a mixture of zinc white, chalk and silicate of soda is far superior to common lime washes.

One great defect of water glass for coating the surfaces of wood, stone, &c., is its liability to become dull on the surface by the action of the atmosphere. When it is laid on at first and becomes dry, it presents a beautiful smooth and glossy surface, but after exposure for some days, it loses its luster by absorbing carbonic acid from the atmosphere. But although it loses its lustre it acquires another property, and its most valuable one, for applying it to surfaces to render them water and fire-proof. When first applied, it is liable to be washed off with rain, but the absorption of carbonic acid after several days' exposure converts it into an insoluble substance when it is safe from moisture and rain. It is therefore very suitable as a paint for stone, brick, or mortar surfaces which are unyielding. The best way of applying the silicate of soda as a paint is to put it on in several thin coats, and allow several days to elapse between each application. There are several paints with which it is unfit for mixing, such as white lead and Prussian blue, but zinc white, chalk, yellow ocher, sulphate of baryta, cadmium yellow, venetian red, green oxide of chrome, umber, lampblack and ultramarine will mix with it and make good paint. These colors should be ground up with the water glass, and before applying them the surface to be painted should receive a primary coat of pure silicate twenty-four hours before the paint is put on. A good silicate of soda, should be bright and transparent. A great deal of that which has been sold has been mixed with foreign substances and was unfit for painting purposes.

Walls plastered with lime mortar may be rendered very hard, close and smooth, as well as capable of being washed, by applying one or two coats of silicate either alone, or mixed with chalk. Kuhlman, the German artist, recommends a mixture of water glass with ivory black for writing ink, and asserts that it is capable of resisting destructive agents used for erasing common inks. A mixture of water glass and peroxide of manganese is recommended to be applied to cooking stoves when they are red hot, as it is said to make a good blacking not as liable to burn off as common black lead. The silicate of soda is now used as an economical detergent agent in the dunging operations which calico fabrics undergo in preparation for madder colors.

TYPE-SETTING BY MACHINERY.

We have alluded to this subject in previous volumes of the Scientific American, noting from time to time the gradual progress made in introducing machinery into the most important department of the printing office—the composing room. It is here that many busy fingers are employed in picking up the little type, and making what we may call a most beautiful copy, in metal, of the irregular and almost illegible manuscript, from which we may print off thousands of copies in a single hour. The labor of composition is irksome, much of it being done when the world is fast asleep, and is far greater in amount than any other labor of the printer, consequently any considerable advance in this department will be an advance indeed, and must increase the usefulness of the art many fold.

"But can type be set by machinery?" asks some doubting friend. A similar question was asked respecting the steam press; and it was long supposed that human ingenuity could not devise a substitute for the peculiar jerk of the typefounder, which causes the metal to enter every little interstice of the matrix. All this has been accomplished, however. But while every other branch of the printing business has made rapid strides, this one labor of composition remains almost as it was left by Güttenberg four hundred years ago. It is no ordinary problem to construct a machine that shall answer all the various conditions required in the practical routine of a printing office with so many different kinds of work, different sizes of type, different characters and so many type of each character. And when we consider that it is a combined mental and mechanical operation, we confess that at first sight it seems like attempting the work of brains, but its real object is to facilitate brain labor by enabling the mental powers to work to the best possible advantage.

We alluded a year or two since to a machine then in progress by Charles W. Felt, of Salem, Mass. Mr. Felt has built some three or four of his machines as experiments, and has one of them now nearly completed of the pattern adopted for practical use. He has recently returned from England with orders for some of his machines, and has taken measures to secure European patents through the Scientific American Agency. This invention is much more comprehensive than any other for this purpose that has been brought to public notice. All previous inventions have included only the principal characters, the rest being put in by hand, while this machine not only contains all the characters that may be desired, but a due proportion of each, as such letters as *q*, *x* and *z*, are of very rare occurrence, while the letter *e* is found, by a very complete investigation, to average 12.57 per cent, or almost precisely one-eighth. There is also a method of "justifying" the lines, which is done by the machine, one line being "justified" while the next line is being composed, and a record may be made of the composition upon the principle of the Jacquard loom, by which the work may be distributed or reset by the machine at any future time and in any kind of type. These various features may be so arranged that they may be used or not as may seem desirable, which gives the machine a ready adaptation to the great bulk of the various kinds of work.

The machine is driven by steam or foot power, and controlled by the operator through a key-board, but the arrangement is, as far as may be, in close analogy with the present method of setting type. When it is desired to change the size of type, the cases are taken out of the machine and others put in their place, just as the cases are changed at present on the ordinary stands. The cases are of metal, and the types are arranged in columns, and are taken from the case by a small pair of steel pincers corresponding with the fingers, and gathered into a stick which holds but a single line, and has a little bell attached which gives the operator warning when he approaches the end of the line. When the line is finished the operator touches the justifying key, which throws the line out of the stick, and the line is justified, and leaded if desired, and fed out upon a galley ready for the press.

The machine both composes and distributes, and as one of these operations is but the reverse of the other, so in the machine, if the motion be communicated in one direction, it will set type, while, if communicated in the opposite direction, it will distribute. The type are used just as they come from the foundry. The arrangement of the letters on the keyboard is similar to that of the ordinary case, so that the compositor has only to use his present knowledge and a little more about the machine to accomplish four or five times his present labor and with greater ease. The keyboard, too, is quite simple, having only separate keys for each of the smaller letters, and a single key for the capitals, another for the small caps, &c., so that only thirty or forty keys would be needed for two or three hundred characters.

It is needless to enlarge upon the advantages which will flow from the general introduction of such an improvement in the art of printing, which has been justly styled "the art preservative of all arts," and we are glad to know that it will be pushed forward at home or abroad notwithstanding the calamities of war sometimes place a strong embargo upon such enterprises.

THE BROWN STONE OF OUR HOUSES CRUMBLING TO PIECES.

The people of England are earnestly discussing a subject which will probably, within a very few years, excite the greatest interest in this city. We allude to the decay of building stone. It is known that the new houses of Parliament in London were hardly finished before the stone of which they were constructed began to crumble to pieces. A committee of learned men was appointed to investigate the cause of the decay and to examine the various plans that were suggested for preventing it.

The material is a magnesian limestone, which has proved to be durable in other parts of England, but is destroyed by the peculiar atmosphere of London. The committee found the decay most rapid in the lower parts of the building and those which were most sheltered from the light and air. In regard to the various plans offered for preventing the decay some comprehensive remarks from the *Chemical News* will be found upon another page.

If any of our citizens will direct their observations to the subject they will see that the sandstones, so extensively used in the buildings of New York, are going the way of the British houses of Parliament. Even the stone so carefully selected for Trinity Church is rapidly disintegrating, and throughout the city steps, posts and sills, as well as the stone of our brown-stone houses are peeling off scales which fall to the earth a mass of rubbish. Some good mineralogists say that as a general rule sandstone will not endure exposure to the weather more than thirty years.

It will be seen that the editor of the *Chemical News* has strong hopes that his process for preserving stone will prove successful, but the committee speak very discouragingly upon this point. At all events, until some preserving process shall be proved to be successful, it would be well for those of our capitalists who wish to erect permanent structures to use a more durable material than our perishable sandstones.

General Rosecrans Among the Inventors.—In another column will be found an illustration of a lamp invented by the general who has made himself so illustrious by his brilliant operations in Western Virginia. M. Argand has secured a world-wide fame by the invention of his lamp, and it may be that the name of General Rosecrans will be more widely and more lastingly known as the author of this simple invention than as the able leader of armies and the winner of victories.

WHY DOES COKE KINDLE MORE QUICKLY THAN ANTHRACITE COAL?

Illuminating gas is made from bituminous coal. The coal is placed in small air-tight ovens or retorts, with furnaces underneath, and kept red hot for several hours. The gas passes off through a pipe provided for the purpose, leaving behind a mass of porous lumps, which are raked out into iron wheelbarrows, and cooled by sprinkling them with cold water. This is coke, and the gas companies, after using what they require in the furnaces under their retorts, sell the remainder to the citizens for fuel. It is the cleanest, pleasantest and cheapest fuel to be had in this market.

Coke is almost identical in composition with anthracite coal, being composed principally of carbon, but all who have used it are aware that a fire can be made far more quickly with it than with hard coal. This is owing wholly to the more porous structure of the coke. Carbon and oxygen will remain in contact with each other an indefinite period of time, at ordinary temperatures, without combining, but if they are heated to a high temperature and brought in contact they immediately combine, producing light, heat and all the phenomena of combustion. The lumps of anthracite coal being solid are good conductors of heat, and, consequently, when one side of a lump is heated the heat is rapidly conducted away, and diffused throughout the mass, rendering it impossible to heat one side of the lump to the burning temperature without heating the whole of the lump to the same point. Coke, on the other hand, is of a spongy structure, full of air cells, which make it a slow conductor of heat. Hence the heat which is applied to one side of a lump is not conducted away, and one side may be heated to the burning temperature while the other side is comparatively cool. A lump of coke, burning on one side, may be taken up in the fingers, but this is not the case with anthracite coal. In short, to kindle anthracite coal it is necessary to apply the heat a sufficient length of time to heat the pieces throughout their whole mass, while the pieces of coke require to be heated only upon one side.

FORESTS ON THE NORTH SIDES OF HILLS.

Dr. Stevens, in his last lecture on the geological history of North America, described, as will be seen in the report in our last issue, the great submergence of the continent after it had received nearly its present form. During this submergence, a cold ocean current swept over the land which was buried beneath the waters, from the north to the south, wearing away the rocks and carrying their *debris* upon their southern sides. Dr. Stevens stated that our most fertile soils are found in this drift.

At the close of the lecture Professor Mason, the President of the Association, remarked that several years since he happened to have a conversation with a man who had spent his life in buying and selling land, and the man told him that he very soon learned not to take up land upon the north side of a hill. Professor Mason said that his attention being thus called to the matter, he had made very extensive observations and inquiries which had fully confirmed the opinion of the speculator. He added, if any one who has occasion to ride from this city to Canada will observe, he will see that the lands are generally cleared for cultivation upon the south sides of the hills, while the forests are left standing upon the comparatively barren rocks on the north sides.