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SCIENTIFIC AMERICAN SUPPLEMENT

No. 588.

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COAST DEFENSES.

The report recently made on heavy gu[illegible] material for coast defense, by a committee of the [illegible] of Representatives, furnishes additional proof [illegible] even intelligence and honesty, if not properly informed, may be led into error.

The reasons of the committee for its refusal to sanction the giving of contracts for the heavier caliber guns will find commendation among the judicious and informed. When we have shown our ability to make six and eight inch guns of the new pattern with dispatch and certainty, it will be time enough to undertake the far more difficult construction of twelve and fifteen inch guns; whereas, to begin without experience upon these monsters would, like enough, prove a waste of both time and money.

When the committee discusses the steel *vs.* iron question, its information seems meager and its logic untenable. Here are its own words:

"It may be asked why the amount appropriated is so small, and why no provision is made for a still larger gun, and why the appropriation is restricted to steel and excludes cast iron? The answer of the committee to these interrogatories may be briefly stated. Steel was selected because the committee believe it to be much the best material for large guns, as proven by actual test, and it would seem to be a manifest truth to the ordinary mind from common observation."

These answers, besides that they are "briefly stated," are, we fear, incorrect.

It has hardly been "proved by actual test," nor is it "manifest to the ordinary mind," that steel is "much the best material for large guns."

So far as cast iron guns are concerned, as has already been pointed out in these columns, they have stood a test fully three times as great as it has been thought advisable to subject steel guns of the same caliber to, and have been fired hundreds of rounds under a pressure of nearly seventeen tons to the square inch of bore.

The committee suggests an appropriation for mortars. The importance of mortars—rifled mortars of the new type for coast defense—can hardly be overestimated; for, if the experiments in France with the new French monster mortar have not been exaggerated, it is peculiarly adapted as a powerful auxiliary to the work of a torpedo boat defense. The report winds up with the following lucid statement of our most pressing needs:

"There is no harbor defense, in the judgment of this committee, that can be reached so quickly and so cheaply, nor which can be made more complete, than that made by the use of torpedoes, torpedo boats, and submarine mines. The sole protection necessary to cover and guard them can be improvised with great ease, when we have guns and men who know how to handle them. The dynamite torpedo upon a torpedo boat will, ere long, revolutionize all opinions and plans for harbor defense, unless this committee have failed in forecasting the future. We are so sanguine in our judgment that we appropriate this sum to give assurance to the inventive genius now studying the torpedo system and the use of dynamite therein that, upon the consummation of their plans, they may readily expect recognition from this government in a substantial form."

It is to be regretted that a committee which shows such a just appreciation of what is most required for harbor defense, which, in fact, admits in set terms that torpedoes, torpedo boats, and submarine mines are most urgently required, should suggest the appropriation of only $600,000 for them, as against millions to be turned over to the circumlocution office to start a wild goose chase for high power steel guns that will not burst.

An Extensive Water Supply.

The water supply for large cities or groups of cities is becoming a matter of serious difficulty all over the world. There are many questions involved, and sometimes there are so many conflicting rights that, no matter what steps are taken, they seem inevitably to lead toward interminable lawsuits. It is interesting, therefore, to note that the cities of Paterson, Raritan, Newark, and Jersey City have a fair prospect of getting pure water at a very reasonable cost, and that they are enabled to get it without outlay of capital. By the payment of a fixed sum per million gallons, the water is to be supplied to each city in its own service reservoir, according to its needs. At present, the cities below the Great Falls of the Passaic River are taking their water from the river by pumping works. Of course, the pollution of the river by the cities, factories, and residences on its banks renders the water far from desirable for drinking and cooking use, and many plans have been proposed to secure better water. One of the chief obstacles to the adoption of any of these plans has be n the vested rights of riparian owners, who could not be dispossessed except by an action at law under the right of eminent domain. But to apply this law on the motion of one city might cut off the right of another city in the same watershed to condemn the water rights necessary to its supply. And it [illegible]tain that if Jersey City took steps to control the [illegible]ter of the upper Passaic, she would meet the opposition of not only the owners whose rights would be at stake, but also of Newark and Paterson, who might thereby find themselves deprived of their natural supply of water. Among so many conflicting interests, it would be very uncertain whether eminent domain would be a sufficiently potent rod with which to smite the rock.

But while the interested municipalities have been thus hampered, a way seems to have been opened on different lines. A company, known as the West Milford Water Company, was formed expressly to secure the right to sufficient water above the Great Falls to supply the population below that point for many years to come. The Society for the Encouragement of Useful Manufactures, of Paterson, chartered in 1791, owned the perpetual right of using the water of the Passaic River above the Great Falls. This society is under contract to supply water to many manufacturers, and any interference with the water by proceedings under eminent domain would entail the payment of enormous damages when the condemnation should be made. But the society was not averse to parting with the right to use the surplus water, and this right was bought by the West Milford Water Company. Here, therefore, was provision for many millions of gallons of pure water during the greater part of the year. But, as there is a period of low water in summer, lasting generally about two months, further provision was necessary. Lying up in the hills of northern New Jersey are several ponds or small lakes, whose water is very pure. The West Milford Water Company selected several of these, carefully surveyed the land, and bought the land completely surrounding these ponds. The chief of these in importance was Dunker Pond, near the New York, Susquehanna and Western Railroad. It lies in a deep gorge, across which it is proposed to build a dam about 100 ft. long and 50 ft. high. The water will then be backed up to a depth of 35 ft. over an area of about 600 acres.

Another large reservoir will be formed at Macopin Pond. Other sources of supply secured were at Oak Ridge, Montville, Great Notch, Splitrock Pond, Hauk's Pond, and the overflow of Pequannock and Rockaway Rivers.

All the titles have been carefully settled, and the company has no hostile rights to fight. It proposes to build all the dams, aqueducts, gates, pipe lines, and other means of storage and supply, so that none of the cities will be called upon to raise or expend money for works. It is proposed to sell water to the cities, delivered to them in their service reservoirs, at less than thirty dollars per million gallons, less than three mills per one hundred gallons. The height of the reservoirs above tide level is so great that the water would rise far above any height at which it would be needed. The present cost of pumping and interest on the plant in Newark now amounts, with insufficient head, to about thirty-five dollars per million gallons.

The great interest to engineers in this matter will be the construction of the dams, aqueducts, and pipe lines, the system being practically equivalent to associating and consolidating the chief sources of water supply in a large and important watershed.

De Bange Guns.

A series of experimental trials with these guns has just been going on at Christiania, Norway, before a special committee, and the results are so satisfactory that the important question De Bange *versus* Krupp has, no doubt, been definitely decided in favor of the former, as far as Norway is concerned. The guns have a caliber of 8·4 centimeters, and the number of shots fired, amounting to 1,000, have not effected the smallest trace of extension, the diameter measured before and after the 1,000 shots agreeing to a hundredth part of a millimeter. The accuracy and the range of the firing have also been entirely satisfactory. Some minor drawbacks in connection with the gun carriages and the regulating screws, both of which suffered somewhat from the powerful recoil, have been removed, and those now used have stood the last 600 rounds without the least hitch. De Bange's obturator packing—consisting of two-thirds asbestos and one-third sheep's tallow, covered with sailcloth—has also proved most effective, although quick series of thirty, forty, and even fifty shots have been fired without cleaning the barrel or other parts.

The Telephone as a Source of Infection.

At a meeting of the Caucasian Medical Society, Dr. A. P. Astvatzaturoff, of Tiflis, drew attention ("Proceedings of the Caucasian Medical Society," November 17, 1886, p. 263) to the danger of infection arising from the promiscuous use of the mouthpieces of public telephones. To prevent any accident of the kind, he recommends that the mouthpiece should be disinfected every time after or, still better, before it is used. In other words, some disinfectant fluid should be kept at every telephone station, and the speaker should, first of all, dip the mouthpiece into the fluid, and then wipe it with a clean towel.—*Brit. Med. Jour.*

On the Explosion of Meteorites.

We have received from M. Hirn a *tirage a part* of a communication to *L'Astronomie*, in which he discusses the various phenomena accompanying the explosion of meteorites, with a view to explaining their causes.

M. Daubree, a long time ago, pointed out how very striking and difficult of explanation the noises are which are often heard in connection with the passage of meteorites, and called in question the explanation which had been given of their being really due to a veritable explosion.

M. Hirn, in his paper, begins by considering the causes which are at work in the production of the thunder which accompanies electric discharges, and of this he writes as follows: "The sound which we call thunder is due, as everybody knows, to the fact that the air traversed by an electric spark, that is, a flash of lightning, is suddenly raised to a very high temperature, and has its volume, moreover, considerably increased. The column of gas thus suddenly heated and expanded is sometimes several miles long; as the duration of the flash is not even a millionth of a second, it follows that the noise bursts forth at once from the whole column; but for an observer in any one place it commences where the lightning is at the least distance. In precise terms, the beginning of the thunder clap gives us the minimum distance of the lightning; and the length of the thunder clap gives us the length of the column. It must be remarked that when a flash of lightning strikes the ground, it is not necessarily from the place struck that the first noise is heard." M. Hirn then gives an interesting case which proves the truth of this remark. He next points out that a bullet whistles in traversing the air, so that we can to a certain extent follow its flight. The same thing happens with a falling meteorite just before striking the earth. The noise actually heard has been compared to the flight of wild geese or the sound produced when one tears linen. It is due to the fact that the air rapidly pushed on one side in front of the projectile, whether bullet or meteorite, quickly rushes back to fill the gap left in the rear.

The most rapid cannon shots scarcely attain a velocity of 600 meters a second (over 1,500 miles per hour), while meteorites penetrate the air with a velocity of 40,000 or even 60,000 meters per second; and this increased velocity gives rise to phenomena which, although insignificant where cannon shots are in question, become very intense and important when we consider the case of the meteorite. With that velocity the air is at once raised to a temperature of from 4,000° to 6,000° C. The matter on the surface of the meteorite will be torn away by the violence of the gaseous friction produced, and will be vaporized at the same time by the heat. This is undoubtedly the origin of the smoke which meteorites leave trailing behind them.

We have, then, precisely as in the case of lightning, a long narrow column of air, which is expanded, not so instantaneously certainly as by lightning, but at all events in an extremely short time and through a great length. Under these circumstances we should have an explosion in one case as in the other—a clap of thunder followed by a rolling noise more or less prolonged. If a cannon ball could have imparted to it a velocity of 100,000 meters per second (nearly two hundred and fifty thousand miles per hour), it would no longer whistle, it would thunder, and at the same time it would produce a flash, as of lightning, and would be instantly burnt up. M. Hirn depends upon this line of reasoning to show that meteoric thunder need not necessarily have anything to do with an actual explosion. He then points out that the intensity of the noise produced in every point of its trajectory depends, first, on the height; second, on the velocity of the meteorite; third, on its size; and fourth, on the configuration of the country over which it passes. He refers to the observation of Saussure that a pistol fired at a height of 5,000 meters makes very little noise. He then points out that at a height of 100,000 meters the density of the air is reduced to the small value of 0·000,000,004 krg.; the temperature being supposed to be —200° C. In such a medium as this a meteorite could produce no sound, although it might give out a very brilliant light, because its temperature and light depend, not on the absolute value, but on the rapid change of density.—*Nature.*

A New Theory of Boiler Explosions.

M. Hochereau, formerly a works manager in Belgium, has recently published a curious theory of what he calls fulminating explosions of steam boilers. He attempts to demonstrate that these fulminating explosions are to be attributed principally, if not exclusively, to the ignition by an electric spark of a mixture of air and more or less highly carbureted gas produced in the boiler. For this it is necessary to establish three points: First, the possibility of an electric spark in the normal conditions of working boilers; secondly, the production of a more or less pure hydrocarbon gas; thirdly, the presence of the air necessary for the formation of an explosive mixture.

As to the formation of an electric spark, it is known that electricity is generated from the friction of steam escaping from narrow orifices; and M. Hochereau says he has witnessed the appearance of sparks when steam has escaped from a crack in a plate. He declares also that if the steam escaping from the safety valve of a boiler is observed in the dark, under favorable conditions, an electric aureole of 0·20 or 0·30 meter in diameter may be perceived round the valve. The spark is also produced when the steam valve is opened, as well as at the opening of the slide valve of an engine. Then the presence of hydrogen, more or less carbureted, is ascribed to the decomposition of organic matters, especially of a fatty nature, which find their way into the feed water, particularly when condensed water is returned to the boiler. Finally, the necessary air is supposed to be derived from that dissolved in the water and given off when it is vaporized. It is a fanciful theory, and requires verification.

Nazography.

La Science en Famille says that a new journal is soon to appear as the organ of the science of "nazography."

Nazography, says the author of the system, permits of divining the character, habits, and inclination of people by a simple inspection of their noses.

According to this system, the nose should be as long as possible, as this is a sign of merit, power, and genius. Example: Napoleon and Cæsar, both of whom had large noses.

A straight nose denotes a just, serious, fine, judicious and energetic mind; the Roman nose, a propensity for adventure; and a wide nose with open nostrils is a mark of great sensuality. A cleft nose shows benevolence; it was the nose of St. Vincent de Paul.

The curved, fleshy nose is a mark of domination and cruelty. Catherine de Medici and Elizabeth of England had noses of this kind. The curved, thin nose, on the contrary, is a mark of a brilliant mind, but vain and disposed to be ironical. It is the nose of a dreamer, a poet, or a critic. If the line of the nose is re-entrant, that is, if the nose is turned up, it denotes that its owner has a weak mind, sometimes coarse, and generally playful, pleasant, or frolicsome.

A pale nose denotes egotism, envy, heartlessness. The quick, passionate, sanguine man has a strongly colored nose of a uniform shade. With the drinker the shade becomes more pronounced toward the tip.

Steel for Heavy Guns.

In a paper on this subject by E. B. Dorsey, C.E., before the U. S. Naval Institute, he says:

The Duke of Cambridge, Commander-in-Chief of the British Army, said in the House of Lords, on April 30, 1876: "Out of seventy heavy guns employed against the southwest of Paris (by the Germans) thirty-six were disabled during the first fortnight of the bombardment by the effect of their own fire." This is strong language from very high authority, and shows that even Krupp's guns may fail when tested by actual service. The preceding also shows the great necessity of investigation before adopting for our guns the treacherous hard steel.

All who have worked large pieces of hard steel have noticed that serious cracks and fractures originate in very slight cuts, nicks, or punctures in the metal; in fact, on this class of metal all such injuries are carefully avoided, and when they unavoidably occur are, if possible, carefully cut out. In working hard steel, in order to prevent the starting of these cracks, no holes are punched unless carefully reamed out afterward, and no edges cut or sheared unless afterward planed. Mild steel is not affected in this manner.

In battle, these large guns must receive many dents or cuts from shot from small cannons and machine guns. These injuries may not be sufficiently large to cause direct weakness of the gun, but they are ample to originate the fatal cracks so common and unaccountable in hard steel. The formation of these cracks will be accelerated by the firing of the heavy service or fighting charge of the gun. Of course, if the gun is entirely protected from the fire of small cannon or machine guns, this risk will be avoided; but, owing to the great length of modern guns, it is doubtful if its entire length can be protected from machine gun fire. Before finally adopting this class of metal for our large guns, it would be well to make experiments, to see how guns made from it would act under the same conditions as in battle. They should be subjected to a severe fire from small cannon and machine guns, and afterward fired repeatedly with the usual severe fighting charge.

Conclusions.—If it is necessary or desirable to have light guns, these can be made by using many thin hoops, or cylinders, made of mild steel, building one over the other on the barrel, instead of the thick hoop of hard steel, as called for in the ordnance specifications. The strength and reliability of the gun will increase for the same weight proportionally as the thickness of the hoops decreases to a practical limit. All that is necessary is to find out by experiment what is the proper thickness of hoops consistent with weight, strength, and cost. This thickness may be found to vary with the size and use of the gun. The gun to be used in fortifications need not be so light as that for use on shipboard. Suppose, for illustration, that instead of using thick hoops of hard steel, twelve hoops made of mild steel be used, placing one over the other. By putting the proper amount of work on these, the tensile strength can be raised very high without impairing the quality. Moreover, if by any chance one or two of these hoops should break or fail, the remaining ones will be ample to sustain the strain, as they would always be used with a large factor of safety. A gun, if properly constructed and proportioned, made in this manner, of mild steel, could not fail, even with any reasonable amount of bad treatment. This is a practical application of the old adages: "In union there is strength," and "Not to put all your eggs in one basket."

The steel that I advise to be used for making guns is the ordinary mild steel of commerce, made by a great many establishments in the United States in large quantities, and which can be had at any time in any desired quantity. It is now selling at about sixty dollars per ton.

The hard steel called for in the specifications is a special product, not used to any extent in commerce, being too unreliable and expensive for any commercial use. It must be manufactured to order, and owing to this and to the severe specifications, the cost will be great.

By the use of many and thin hoops, or cylinders, of mild steel, properly built up and proportioned, a gun can be made that will be at all times safe, reliable, and unfailing. If hard steel, or steel of high tensile strength, in thick hoops is used, the gun will be more costly, and of greater theoretical strength, but practically much weaker, and will fail when least expected, and without any apparent cause or reason. If it is necessary to have thick hoops, as called for in the ordnance specifications, make them of mild steel, giving the necessary strength by additional material. This may make a heavier gun, but it will always be safe and reliable. Hard steel should not be used until much more is definitely known of the supposed improvement of oil temper on large pieces or masses of metal.

Protection of the Ears under Cannon Firing.

Dr. Samuel Sexton, of this city, says: "It is the experience of many officers that the vibrations of great intensity which are given off from somefield pieces and bursting shells, charged with high explosives, are more disagreeable than the heavier sounds of great guns. The metal itself vibrates under these circumstances similarly to a tuning fork.

"A very disagreeable jar is imparted to the temporo-maxillary articulation when the individual is near a great gun being fired off. This is lessened, it is believed, by standing on the toes and leaning forward. Some simple precaution, to be employed by officers and men during artillery practice, would seem very much needed, since aural shock is not only painful and distressing, but orders cannot be well heard while the confusion lasts.

"There is probably no better protection than a firm wad of cotton wool well advanced into the external auditory canal. In suggesting this protection, it is believed that harm can seldom take place from pressure of air from within, since it is known that the violent introduction of air into the tympanum from the throat, by means of Politzer's method of inflation, seldom ruptures the drum head, though, if such a volume of air were suddenly driven into the external auditory canal, the drum head would in nearly all cases be ruptured."

Hand Fire Grenades.

An analysis of the contents of one of Hayward's hand fire grenades has been communicated to the *Chemisch-Technische Zeitung* by Herr A. Gawalovski, of Brunn. He finds that it is full of a colorless liquid of sp. gr. 1·1986, neutral to test paper, and giving the following composition on analysis: Chloride of calcium 18·329, chloride of magnesium 5·700, chloride of sodium 1·316, bromide of potassium 2·179, chloride of barium 0·265, water 72·211, with traces of iron and aluminum chlorides. The flasks have a volume of about 600 c c., are filled at ordinary atmospheric pressure, and can be made at a very trifling cost. Harden's fire grenade consists of a solution of common salt and sal ammoniac, and Schonberg's of a solution containing one part soda to three parts common salt. The value of the solutions in these three grenades he estimates at about 3, 5, and 1 pfg. respectively per flask, or in English coinage at one-third, one-half, and one-tenth of a penny.

The Causes of Paper Turning Yellow.

The author contends that the yellowing of paper is due to an oxidation determined by light, and especially by the more refrangible rays. This discoloration is more striking in wood papers than in rag papers. Dry air is another important condition for the preservation of paper. The author thinks that in libraries the electric light is inferior to gas, on account of the large proportion of the more refrangible rays present in the former.—*Prof. Wiesner.*