SOME SMOKELESS POWDER CONSIDERATIONS.

BY FREDERICK H. M'GAHIE.

An interesting discussion relative to the merits of certain smokeless powders and processes is now in progress in the columns of the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT. There are certain considerations that may escape the interested lay reader in forming an opinion, and yet they are of absolute importance in reaching correct conclusions. A bridge may be correctly designed and yet fail through bad workmanship in construction. Such was the case of the Ashtabula bridge some years ago, for expert engineers checked the calculations and plans after the accident and found them correct. A wrecked gun does not necessarily settle the fault upon a powder at once. Good judgment requires that such a conclusion must be reached through a process of elimination of other causes that have a possibility of existence. A smokeless powder must conform to certain general conditions such as chemical stability, mechanical stability, uniformity, absence of dangerous ingredients, convenience of loading, ability of being manufactured commercially. Yet a powder exhibiting a high degree of value in all these essential properties may be delivered by one company as a trustworthy article, and by another company as an equally dangerous explosive. The personal equation of the factory management and equipment determines the value of a powder. To state that a given formula and process is a commercial commodity is not equivalent to stating that any set of ignoramuses can "shove it out" satisfactorily. To manufacture a good smokeless powder requires a well designed factory, good materials, and a large enough corps of explosive engineers, thoroughly trained, practically and theoretically, who understand the limits bounding the production of a reliable powder. Those limits are known to the trained men, for the experience gained with the early smokeless powders and the investigations of conditions occurring in gunnery are at their command. Though cordite is held to be too erosive by the majority of ordnance and powder experts, the English government has an enormous amount on hand, and is satisfied by wide tests that it can be relied upon. Yet cordite has to its record several guns destroyed and many lots rejected as dangerous. Properly made within proper limits it appears to be safe for storage and use. Made outside of those limits it becomes so warped as to be dangerous. The early experience of the United States with brown prismatic powder consisted in rejecting more than it accepted. The Ordnance Department of the army finally detailed an officer to study the question, and he succeeded in putting the matter on another basis altogether.

A good illustration may be had from the meteoric career of the Leonard powder. In 1890 Dr. R.C. Schüpphaus brought out a first-class nitroglycerin powder, the demand being at that time for the ballistics possible with such powders. The nitrocellulose he adopted was one determined after long investigation of many varieties to be the best adapted for incorporation with nitroglycerin. The safe proportion of that explosive he placed after another series of experiments at 60 per cent. Being ahead of the times he retired until 1893, when he and Hudson Maxim grappled with the problem of a gun-cotton powder with the ballistics of nitroglycerin powders. Meanwhile an assistant in that early work who had picked up some crude ideas of the subject helped to launch the powder in question upon its erratic course. Using a very poor nitrocellulose for the purpose, the nitroglycerin was increased to 75 per cent on the general idea that too much could not be had of a good thing; of course the powder (?) "sweated" and the men susceptible to nitroglycerin effects at the proving grounds developed big headaches. Storage in winter brought out the ugly "nature of the beast." At Sandy Hook, samples gave spectacular exhibitions of ballistic variations. A charge giving 24,000 pounds one month gave 40,000 pounds the next. The navy lost an 8-inch rifle through similar circumstances. While samples of good nitroglycerin powders keep in excellent condition, I have seen Leonard powder of 1894 crumble away between the fingers in 1897. But we cannot condemn nitroglycerin as an ingredient for powders upon these experiences, although the navy experts gave it an undue prominence in fixing their attitude upon the matter. The trained explosive engineer would have thrown the powder out of consideration at once upon the grounds of its formula. The known limits had been clearly exceeded and dangerous qualities were to be naturally expected. Again, those early samples, such as were shown at the World's Fair, exhibited careless manufacture, many lumps of unconverted nitrocellulose being apparent in the individual grains. When the Russian government destroyed a lot of cordite it had purchased, what was proved was that the lot had been badly made, since satisfactory orders of magnitude have been delivered since.

If I may venture the opinion, the average American powder manufacturer does not pay enough attention to this personal factor. Machines are more reliable than men only when a high intelligence is connecting and limiting them. The so-called "practical" man must give way to the trained experts in chemistry, machinery, manufacture, and mathematics, before the era of first-class powders is ushered in. A good formula and process are not going to run themselves in desired directions, while superintendents are ignorant or more concerned with quantity than with quality. Yet it must be confessed that Congress and the departments do not aid matters any. The one is averse to encouraging ideas, the other is backward in necessary appropriations, and the inventor generally gets disheartened between the two.

There is generally plenty of money for making mud holes navigable, or for other philanthrophic propositions for constituents, but a plan to catch up within a few years of Europe brings out patriotic denunciations of our infidelity in not relying upon God to keep our powder dry and win our battles.

With the official board's new ideas arose the frigidity of atmosphere that makes liquid air a luxury. A man who has had extensive dealings with the government stated the case as follows: "Do not try to educate the government if you desire to declare dividends. Sell them what they think they want. If they wish to call red sand smokeless powder, furnish it if you see a profit in it." And the trouble is that the government, willing to give a $500 politician a $2,500 position, is continually haggling on prices for articles in regard to which the question should be quality, and not price. This puts a stress upon manufacturers to cut prices when they should not, and cover it by questionable economies, or forcing the output.

The smokeless powder business is no Klondike, for accidents are costly, business variable, and new things liable to make a plant archaic. One company is said to have dropped $200,000 in explosives during the last three or four years. Liberality—to please Congress in our phrases—should be the order of the day to secure the means of offense and defense, upon whose quality millions will depend in the future.

THE PLANT PRODUCTS OF THE PHILIPPINE ISLANDS.

The Department of Agriculture has recently issued a report on the plant products of the Philippine Islands, which is particularly interesting at the present time. The report deals with the agricultural resources of the islands as they now exist, and shows that although an agricultural country, the islands do not produce enough food for the consumption of the inhabitants. In order to supply the deficiency, it is the custom to draw upon rice-producing countries, such as Cochin China. About one-ninth of the area of the Philippine Islands, or 8,000,000 acres, is devoted to agriculture. When the natural fertility of the soil is considered and the large amount of the rich land not yet cultivated, it can be assumed that with better agricultural methods the products of the islands could be increased ten-fold. Rice forms one of the most important food products of the islands; more than a hundred varieties are grown; the annual production is about 36,000,000 bushels. This is, of course, far below the actual requirements of the population, even when supplemented by other vegetables and fruits. Maize, next to rice, is one of the most important of the grain products of the Philippines, and the sweet potato follows maize in turn. Fruits grow in great abundance, bananas heading the list. Large quantities of sugar cane are grown, but owing to crude methods of manufacturing, the sugar is inferior in quality, and is sold for a low price. Cotton is not as valuable a product for the islands as it was once, owing to the successful competition of British fabrics. Formerly indigo was also one of the important products of the islands. Coffee plantations thrive well, but the coffee is not of the best quality and the plantations are not well managed. In most of the islands of the archipelago tobacco is grown, and over one hundred million cigars are annually exported from Manila, and the shipment of leaf tobacco averages about 20,400,000 pounds. The islands also furnish spices and the medicinal plants are abundant, but most of them are little known.

PHOTOGRAPHY OF PAINTINGS AND DRAWINGS.

At a lecture given before the Photo Club of Paris, M. Sanger Sheperd brought out the results of his experiments as to the best method of photographing paintings, drawings, manuscripts, etc. In the case of paintings, he dwells upon the importance of having the picture lighted in the proper manner.

For pictures in which the tints are delicate, such as water colors, he recommends exposure by diffused daylight, but for those whose color is somber, such as that of old pictures or oil paintings, he prefers exposure in the open air as being more suitable, for in this way details in the shadows are obtained which it is impossible to have otherwise.

If artificial light is used, the sources of light should be placed to the right and left, and rather near the picture.

If they are too far off, and too near the camera, disagreeable reflections are produced.

In the reproductions of drawings, writing, or printed matter, the lecturer recommended the use of a blue screen, and a small diaphragm. The focus must be carefully made, a full exposure being given, and once the negative is fixed, it should be plunged for several seconds into a bath of reducing liquid (hypo and red prussiate of potash), in order to obtain complete transparence in the whites of the negative.

As to the method of development, it is found that hydroquinone and kindred developers bring out first the blues, then the greens, and lastly the reds. However, as the development of a negative with these substances requires from 10 to 30 minutes, it is to be feared that the reds will not be produced. On the contrary, metol and other similar developers cause the whole of the image to appear at the same time, and proper density may always be obtained by prolonging the development.

THE "REINA MERCEDES."

With the arrival of the protected cruiser "Reina Mercedes" at an American port, the navy secures at once a useful addition to its fighting strength, and the most valuable trophy of the war. When the ill-fated "Maria Teresa" was floated and started for the United States, it looked as though we would secure at least one of the big 7,000 ton armored cruisers of the Spanish navy, which, under a new flag but retaining its old name, would perpetuate the brilliant victory in Cuban waters. But that was not to be, and for awhile it looked as though the many small gunboats and launches captured in the Philippines and a few that were secured in the West Indies would afford us no naval trophy of the war much over a thousand tons in displacement.

The "Reina Mercedes," however, is a very serviceable vessel of 3090 tons displacement, or a little less than the "Raleigh," her trial speed also being about 1½ knots less, or 17½ knots an hour. She was built at Carthagena, in 1887, or three years later than the "Atlanta" and "Boston," and was one of the ships of the earlier period of the reconstruction of the Spanish navy, when the design and building of Spanish vessels was largely carried out by British naval architects. Presumably, therefore, she is a well-built ship and capable, after overhauling and re-arming, of being made into a serviceable modern cruiser of the protected type. Her original armament consisted of six 6·2 inch Hontoria guns; two 2·7-inch, three 2·2-inch, two 1·5-inch and six 1·4-inch rapid-fire guns, with two machine guns. She was fitted with no less than five torpedo tubes, and as all of these are above water they will probably be closed up, the above-water discharges being now considered as constituting a greater danger to the ship that carries them than to the enemy.

The new armament will consist of six 6-inch American guns of the new long caliber, smokeless powder pattern, and the miscellaneous sizes at present in the secondary battery will be replaced by our standard 6-pounder and 1-pounder rapid-fire guns. The new navy 6-inch gun will be a more powerful weapon than the old 6·2 inch Hontoria weapons; and that the latter were destructive was shown by the havoc wrought by a shell from one of these weapons which was fired from the Socapa battery and entered the forward battery of the "Texas," putting it out of action for the time being. Those who wish to see what such a shell can do will find illustrations of the damaged plates in the SCIENTIFIC AMERICAN of August 20, 1898.

It so happens that the comparatively slow speed, 17·5 knots, of the "Reina Mercedes," her size and battery, will render her practically a sister ship to the half dozen cruisers authorized by the last Congress. These ships are to be of 3,100 tons displacement and 16·5 knots speed. They are to carry an armament of ten 5-inch rapid-fire guns, and will have a trial coal capacity of 470 tons. The coal capacity of the "Reina Mercedes" is 600 tons. Allowing for depreciation of her machinery, it will be seen that her speed is about the same and her coal capacity greater than the new cruisers, thus rendering her admirably adapted to the particular class of service for which they have been designed.

COMMERCIAL PRODUCTION OF LIQUID AIR.

The General Liquid Air and Refrigerating Company, of New York, has been for several months erecting a plant in New York city, which is now practically complete. The apparatus is upon a scale suitable to be operated by a steam engine of 200 horse power. The liquefying apparatus is the invention of Messrs. Ostergren and Burger, the engineers of the company. The first experimental run was made on May 25 and resulted in complete success. The liquid air is said to have poured from the discharge pipe at a rate which indicated the easy production of one gallon a minute at full load. This quantity is the amount which the inventors had predicted in advance as the output of the machine. During the experimental run the average pressure maintained in the compressor was 800 pounds, while at full load the pressure to be carried is 2,000 pounds. When the success of the plant was evident, the men employed in the factory went wild with enthusiasm, took Mr. Ostergren upon their shoulders and carried him around the works in triumph. We expect to present to our readers in an early issue a full and illustrated account of the plant, with details of the process employed.