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NEW YORK, SATURDAY, SEPTEMBER 6, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

VENTILATION OF UNDERGROUND ROADS.

The New York Subway, which gives every indication of being in regular service by the close of next year, will have a distinct advantage over the majority of the London tunnel roads in the fact that the greater part of it lies very near the street surface. This advantage will be felt both in respect of the ease of access (elevators being necessary only at a few stations) and in respect of that most important point, ventilation. The official investigations which have been recently carried out to test the quality of the air in the London tunnels possess considerable interest for the residents of this city, although we have every reason to expect that the air in our Subway will be purer and sweeter. The tests referred to show that in the London "tubes" there is normally 100 per cent more carbonic acid gas than the law recognizes as healthy and allowable in English factories and workshops, where the maximum amount permitted is seven parts in 10,000. At street level the average is four in 10,000. As compared with this, the tests on air taken from the Charing Cross station of the Central London Railway showed that there were 13.8 volumes of carbonic acid gas in every 10,000, while in the crowded cars it rose as high as 27.5. While there is no special danger in these conditions, it is considered that in granting franchises for future underground roads it will be advisable to call for better provisions for ventilation than exist in those which have been already built. When these roads were constructed it was supposed that the air would be kept in constant circulation by the piston-like effect of the trains as they moved through the tunnels. It was found that while the trains do keep the air in circulation they have no tendency to draw in fresh air, or expel that which is vitiated. With a view to meeting this defect the engineers who have made the investigation suggest the provision of special outlets, placed where they will best serve their purpose. Special air inlets are also to be provided at each station; and in order to produce the necessary suction to draw the pure air into the tunnel behind a train it is proposed to provide trapdoors at each station, which can be closed immediately after the last car of a train has left it. By this arrangement each length of tunnel, with its moving train, will form a sort of mammoth air pump, and the air throughout the whole system will be in a condition of constant renewal and purification. The plan proposed appears to be thoroughly practicable and simple, and no doubt it will command the attention of our Subway engineers. Of course it would be impossible to adopt this system on the main four-track road, where the tracks are only separated by lines of supporting columns; but on those portions of the road where the track lies in single tube this method could be applied, no doubt, with good results.

WEST POINT METHODS FOR SANDHURST.

It will be remembered that one of the most undisputed facts brought out by the recent South African war was that while the British officers were conspicuous for courage, many of them were woefully lacking in professional ability. The reforms which have been brought about by the war in the British army have included the appointment to the command of the Staff College at Sandhurst of Colonel Kitson, an officer well known in this country, who has always been a great admirer of West Point methods, and who, indeed, since his appointment has openly announced his determination to remodel that institution on the lines of our own military academy. Americans have always been proud, and justly so, of this famous and historic institution, and it is distinctly gratifying to know that the methods which have made this institution known the world over are to be adopted by the leading nation of the Old World. Hitherto, Sandhurst has been more a social and aristocratic institution than a military one; certainly it has never been noted for the hard work and severe curriculum for which West Point is renowned. Should Col. Kitson succeed in infusing into the pupils at Sandhurst the principles and *esprit de corps* that characterize West Point graduates he will have earned the lasting gratitude of the British nation, and will be found to have done more to promote the efficiency of the British army than any military man in England since the days of Cromwell.

A POINT IN BOILER CONSTRUCTION.

In an article in which it was shown that flaring the tubes after they have been expanded in place increases the holding power about 300 per cent, a strong plea is put in for the flaring, as against the mere expanding, of boiler tubes by our contemporary, The Locomotive. Among the many valuable full-sized tests which have been carried out from time to time by that journal, was a series to determine the holding power of tubes that were set in various ways. It was found that when tubes 3 inches in external diameter were merely expanded into the tube-sheet it required a pull of about 6,300 pounds to withdraw them, whereas it took about 19,700 pounds to withdraw those which were expanded and flared. From these data it is shown that a 4-inch tube, running under a pressure of 200 pounds per square inch, and merely expanded into place, has a factor of safety of 2.5, which our contemporary considers to be entirely too small. With the tubes properly flared, the factor of safety under like conditions would be 7.8, which is considered to be quite large enough. While it is admitted that there are many water-tube boilers that are running satisfactorily to-day with tubes that are merely expanded into place, it must be remembered that there has been a great rise in pressures of late years, and that constructions which may have been thoroughly up to the standard fifteen or twenty years ago are considerably below it in this day of pressures of 200 pounds to the square inch and upward. These conditions, we think, should render the practice of flaring the tube ends an indispensable feature of first-class modern boiler construction.

OUR FASTEST BATTLESHIP.

For the first time in its history the American navy possesses a battleship with a speed of 18 knots and over. The distinction belongs to the new "Maine," which, on August 23, was sent over the Cape Ann course for her official speed trials. The contract calls for a speed of 18 knots an hour on a run of four continuous hours. The lowest speed on any stretch of the trial was on a 6-mile leg on which she averaged only 17.35 knots an hour, while the fastest stretch was made at a speed of 18.9 knots. The result was that the mean speed developed, disregarding tidal allowances, was announced as 18.3 knots an hour. These figures, however, were made by the builders of the boat, and are subject to correction when the official results are made known. Although the "Maine" has slightly exceeded her contract speed, the result for an American warship was rather disappointing, for the reason that our battleships have been accustomed to exceed their contract trial speeds by a knot or more an hour when steaming over the Cape Ann trial course. Thus, the "Oregon" made 16.8 knots an hour, or 1.8 knots more than the contract speed; the "Iowa" showed an advance of 1.1 knot, and the vessels of the "Alabama" class are 1.1½ knots faster than their trial requirements. On the other hand, we understand that the trial of the "Maine," unlike those of some of her predecessors, was carried out under normal conditions as regards coal and stokers, and, therefore, the speed achieved is more likely to be maintained when this vessel is in regular service than that of vessels whose trials were run under abnormal conditions.

ELECTRIC GLASS SMELTING.

A large electric installation for the smelting of glass by the electric current, which is being erected at Deutsch Matrei in Tyrol, will be in working order in the course of a few months. These are the first works constructed for the manufacture of glassware by electricity; though several experimental plants have been laid down, and the electrical process of glass-making has been practised for some time past at Plattenberg in Westphalia, where there is an installation of 2,000 horse power, water and steam combined, for supplying the necessary current. The first successful attempts at glass manufacture by the aid of the electric current were made some four years ago at Cologne by F. Becker, a glass-maker. Glass-making by electricity is rather a difficult process, since there is a great danger of devitrification through the heat generated by the arc being too intense. To surmount this difficulty Becker devised an ingenious arrangement of a series of arcs, and the glass in a molten state followed into crucibles which were heated by coal or some other means. But Becker found this process of combining electrical and ordinary heat unsatisfactory. Volker, his collaborator in these experiments, suggested another process by which he to a certain extent availed himself of the conductivity of the glass. On each side of the receptacles he ranged electrodes, and by this means kept the glass in a molten condition for some time. But in this system there was the danger of the glass being deteriorated by the crumbling carbon, by which its purity was ruined, and it was rendered unsaleable. To obviate this difficulty the electrodes were placed behind perforated diaphragms. Völker also devised a system by which he could melt the glass, not with the arc, but by a direct current of high resistance, by making briquettes of the smelting materials and the carbon, and thus fusing the components. The Industrie Verriere et des Dérivés of Brussels, in conjunction with the glass works at Plattenberg, took up the invention and reduced it to practice at Plattenberg and Brussels; but at first it was not found to be a very satisfactory process. The consumption of the current was too heavy. For example, a kilogramme of glass required 4 horse-power-hours to produce it. This consumption of current, however, has now been reduced to 1½ and 1¼ horse-power-hours. The cost of production will be still further cheapened at the works of the Matrei Compagne, the electric furnaces for which are to be simpler and more durable. A potential of 3,000 electric horse power will be utilized. Whether this electric process of manufacturing glass will become of any commercial utility it is yet too early to say; but the material at present produced by the electric current has no special advantages over that made by the conventional smelting process to recommend it.

THE EMERALD INDUSTRY OF COLOMBIA.

The British Foreign Office has published an interesting report concerning the emerald mining industry of the Republic of Colombia. According to this report the finest emeralds are discovered at the mines of Muzo and Coscuez, the property of the Colombian government. They are at present rented to a British company. Up to the year 1875 all the emerald mines in the country were the property of the nation. After that date the government granted the right of exploration and working to private enterprises, reserving only the right to the two foregoing mines. Since then several companies have been formed and considerable capital expended, with very poor results. The most promising of the latter appears to be the Somondoco mines, worked by a British company. The department of Boyaca, from a mining point of view, is of a totally different geological formation to the mining departments of the republic, no gold or silver being found except in the few rivers emptying into the Magdalena.

The one great mine of production is that of Muzo, famous since the year 1555 for the production of the finest emeralds of the world, a stone, in the rough, weighing 2,330 carats having been taken from one of the many veins of this mine. These mines are the property of the Colombian government, which leases them for periods of five years to the highest bidder at public auction, which takes place in the capital of the republic one year previous to the expiration of the term in force. The value of the production of these mines has always been kept a secret by the lessors.

The mode of working is similar to that generally adopted in large quarry mines. The top soil is removed by a hydraulic monitor washing until the slate rock is left bare, this being cut away by means of stout long bars handled by native labor, which is cheap, abundant and very good, and with the aid of blasting with black powder manufactured at the mines and employed where no danger can be done to existing veins. The precious stones are then extracted from the veins, which run in no given direction or angle in this slate rock formation. The stones are found chiefly in pockets, but occasionally some are found isolated from the veins, necessitating constant care and vigilance. The immense amount of debris which necessarily falls from the quarry, is carried away by means of discharges of water from reservoirs at an elevation above the workings. The flow of water is regulated automatically, great care being taken conveniently to direct this great discharge of water so that no damage may be done to existing productive veins. The short term of the lease does not admit of any very extensive system being adopted, (as for example, at the Kimberley diamond mines in South Africa,) to prevent stealing of the stones, but special care is taken in the selection of the workpeople, who, in turn, watch most carefully all operations on the banks. The stones, after extraction, are arranged in their respective classes, ranging from first to sixth quality, by the superintendent in charge, who forwards them insured to the markets.

The major portion of the stones are sent to British India to be cut, and afterward the better qualities to the markets of Europe for sale.

The theory of the genesis of the emerald is that the silicate of glucina and alumina ran in the fissures of the veins and their cooling off formed this particular hexagonal crystal, and according to its abundance pro-