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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 798.

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SPEED IN OUR NEW NAVY.

We have heretofore pointed out that there appeared to be a conspicuous falling off in the speed of our new war ships as soon as they left the contractors' hands. We have also called attention to the fact that this is not the case with the large first class mail steamers in the merchant marine. These boats continue in active service, year in and year out, and yet maintain, on nearly every voyage, the same high speeds they originally exhibited on their trial trips. We have asked why our new naval vessels, built and supplied, as they are supposed to be, with the very latest and best appliances, should not, in like manner, be able to run at all times as fast as the contractors made them go. In time of war, in critical moments of action, celerity of movement might be of vital importance. In time of peace be prepared for war. We have suggested, in order to have our ships always ready and in good order for high speeds, that they might be kept in constant action by employment in carrying the mails, for example, and thus their speed, like the merchant steamers', would never be lacking. Our representative has interviewed the Secretary of the Navy and other officers, whose interesting views we have heretofore presented. We now subjoin the results of further interviews had by our representative with other officers:

Chief Engineer Melville, U. S. N., said: "As to the alleged falling off in speed of the new cruisers, I will have nothing to say. I do not wish to criticise the navy.

"The new cruisers, when they have been tried under the same conditions that obtained at the contractors' trips, have made even better speed than at the initial performance."

Asked to give the figures and the days on which these later trials were made, he declined, but said: "They are in the log books."

The SCIENTIFIC AMERICAN representative interviewed Assistant Engineer McFarland, who kindly exhibited the books, according to which, and to the statements of Lieutenant McFarland, the new cruisers have never equaled in speed the records made on the trial trips.

The reporter then asked Chief Engineer Melville, "What is the best way or method of keeping the engines and men up to their maximum efficiency?"

"The best way to accomplish this is to dock the vessel regularly every three months, clean her bottom, and sheathe her, put a sufficient and an efficient force aboard, and all will then have been done that is necessary. The idea of carrying the mails in the new cruisers is not a bad one, but for the fact that the naval vessels are not adapted to such service, and they would never prove satisfactory substitutes for the vessels now engaged in that service."

Assistant Engineer McFarland said: "The reason why the new cruisers have not made as good time on their subsequent trips as on their trial trips is that they have not been forced to it. It is unfair to say they have fallen short in speed, because there was no effort made to have them equal the speed developed on the contractors' trip. Economy is the great consideration in the management of the new vessels, and it would be an enormously expensive operation to keep the cruisers running up to anything like the trial speeds."

"Then the speeds of the later trials of the new vessels have not equaled the speeds of the trial trips?"

"No, because we did not wish to put them to their utmost speed, on account of the tremendous horse power required to run a cruiser at high speed. Take for example the Yorktown's performance at Newport. At a speed of 19·44 knots it required 3,225 horse power, a speed of 13·18 knots called for 1,025 horse power, and a speed of 14·82 knots, 1,585 horse power. In other words, the required horse power varies directly as the cube of the speed; and indeed at higher speeds the equation is $I. H. P. = K. S.^{3\cdot5}$. This increase of horse power calls for a corresponding increase in coal consumption, and it is apparent how extravagant it would be to keep the cruisers running up to their highest speed when no apparent benefit is to result.

"The press has been talking much about the Baltimore's performance on the recent trip to Sweden. Well, the figures of that voyage go to show that it is not an advisable nor an economical thing to force a cruiser up to her maximum speed when there is no absolute necessity. On the Baltimore's trial trip she reached a speed of 19·8 knots with a horse power of 10,100; and on the trip to Sweden she recorded a speed of 10 knots with a horse power of 1,500."

Chief Constructor Theodore D. Wilson said: "The new cruisers do not reach the speed established on the trial trip because they have never been put to it; and there is no reason why they should be. The trial trips, usually made before the vessel is accepted by the government, are life and death affairs, where a difference of one-quarter of a knot means thousands of dollars to the contractor. He, therefore, uses only the best picked coal, employs forced draught, and puts chief engineers aboard to act as firemen and oilers. We do not, therefore, in subsequent trips attain the speed of these contractors' trials, but, when the occasion requires it, we can, by thoroughly cleaning the bottoms and overhauling the ships generally, make a record for speed which will compare favorably, class for class, with any vessels in the world. The prevailing idea concerning the trial tests of vessels built for the United States government is that the trial trips are made on the measured mile and that speed is the quality which the contractors seek to demonstrate as being present in their vessels. This is a very erroneous idea, and to it many of the false conclusions regarding the new navy are to be attributed.

"The Baltimore and Newark, the Bennington, Concord, Petrel and Charleston, were not tried for speeds at all. Their contracts were based on horse power, and the contractors received one hundred dollars for each horse power over and above what the contract called for. There has been no deterioration whatever in the cruisers of the navy. I claim that any of them, taken with the same conditions as on the contractors' trials, with perfectly clean bottoms and under forced draught, can make the same speed at any time. It is a noteworthy fact, and one which the SCIENTIFIC AMERICAN pointed out in the interesting interview with Mr. Charles Cramp, of Philadelphia, that the Yorktown has made better speed since she has been handed over to the United States. The Philadelphia and the San Francisco were two vessels which, under the contract, were to have a speed of nineteen knots. Both of these vessels exceeded the stipulated speed, and there is to my mind no doubt but they can again at any time make as good speed as this. Indeed, I believe that with the same pressure a little more speed than this can be attained, because of the fact that the engines are worn down smoother, and are now better adapted each part to the other for working with the smallest amount of wear and tear. I do not believe that the ships after leaving the yards are ever forced up to the same degree as on the contractors' trials; and there is no necessity for it except in cases of great emergency.

"In connection with speed, it is necessary to consider coal endurance and weight of battery; and when all these factors are taken together, our cruisers will be found to compare favorably with those of foreign powers. This is certainly the case with cruiser No. 12, now building at Cramp's. This vessel is to be heavily armored and equipped with powerful batteries; will also have a great coal-enduring capacity, and be capable of high sustained speed. She will have a total displacement of 7,400 tons, with a sustained speed capacity of 21 knots, and be able, in an emergency, to reach a speed of 22 knots, in which case the indicated horse power will be 23,000. The plan of arranging the motive power appliances has been borrowed from the French, and consists in transmitting the force through three screws, one of which is located amidships and the other two forward, one on each side.

"The idea of this arrangement is to distribute the I. H. P. so that instead of 10,000 passing through one shaft, as would be the case if ordinary twin screws were used, each shaft transmits only 6,850. As the business of the cruiser is to destroy the commerce of the enemy, her general appearance will be similar to that of a merchant vessel; and to this end she will be minus military topmasts, and have her sides clear of projections. Another thing should also be considered when we hear talk of the slow speeds of the cruisers. There is a limit to the endurance of the men in the engine rooms, and it would be impossible for a crew of the size ordinarily on board a United States cruiser to continue under the great strain necessary to keep the furnaces and machinery in constant activity."

Lake Union and Washington Canal.

A provision of the last River and Harbor bill authorized a survey to be made for a ship canal to connect Lakes Union and Washington, back of Seattle, with Puget Sound, and appropriated $10,000 for this purpose.

The entire length of the canal, from tide water to deep water in Lake Washington, including the two miles of channel through Lake Union, will not exceed five miles. Less than two miles of this is through upland, and more than a mile is through the soft, muddy bottom of Union Bay, which is covered by from eight to ten feet of water. The upland excavation will be through the lower portages between Union Bay and Lake Union, and Lake Union and Salmon Bay, the former being three-eighths of a mile and the latter one and one-fourth mile in length. Through both of these portages flow streams of water—canals about the size of a millrace have been dug by private enterprise several years ago. The maximum cut will be in the neighborhood of forty feet, and there will be no excavating in rocky or difficult formations, while the elevation to be overcome by locks from the level of the sea to fresh water level is but ten feet. The building of this canal would afford Seattle some of the advantages possessed by Portland in the Columbia River.

THE Zalinski pneumatic gun has been tested at Shoeburyness, England, with marked success. At 4,000 yards range six projectiles were thrown into a rectangle $2\frac{1}{2}\times1\frac{1}{2}$ yards in size.

Progress of the Great Railway Tunnels under the Hudson River.

Independently of the engineering and mechanical difficulties pertaining to the prosecution of this remarkable work, the simple labor of removing the excavated mud or earth is a job of no inconsiderable magnitude.

The diameter of the excavation is 19 ft. 11 in., and the superficial area of the heading excavated is about 313 ft. For each running foot of advance made by the hydraulic shields about 313 cubic feet of excavated material must be removed. Up to the present time not far from 3,500 ft. of completed tunnel have been built, leaving a length of about 2,000 ft. yet to be bored before tunnel communication is established between the New York and New Jersey shafts. This refers to one of the tunnels only.

The other tunnel is not so far advanced. The quantity of excavated material daily removed from one tunnel is not far from 2,000 cubic feet, all of which has to be passed out through double air locks of only 3×4 ft. area.

Power to Grant Patents for Inventions—Proceedings of the Framers of the Constitution in 1787.

BY LEVIN H. CAMPBELL.

The proceedings in the federal convention relating to the insertion in the Constitution of a clause giving power to Congress to grant patents for inventions may be briefly told. On May 29, 1787, Edmund Randolph, of Virginia, opened the business of the convention by submitting a series of resolutions known as the "Virginia Plan;" then Charles C. Pinckney, of South Carolina, laid before it the draught of a federal government which he had prepared. There was no mention in either of these schemes of any power to grant patents. They were referred to a committee, and the committee subsequently reported in favor of Mr. Randolph's plan; which, however, had been amended in the committee of the whole house. Still no reference to such a power was made. Discussion of the "Virginia Plan" was postponed until Mr. Patterson, of New Jersey, could submit a plan. Both of these plans were referred to the committee of the whole, which reported again in favor of Mr. Randolph's plan as the basis of the Constitution. After debating the report for over a month, all the proceedings of the convention up to that time were referred to a committee of detail appointed for the purpose. Thirteen days later the committee made a report, but still there was no provision for granting patents. These details of the proceedings of the convention are only given to show that practically the Constitution had been agreed upon before it occurred to any member to suggest the power of granting patents. August 18, nearly three months after the convention had been in session, James Madison, of Virginia, arose in his place and "submitted, in order to be referred to the committee of detail, certain powers as proper to be added to those of the general legislature." Among these powers were two: "To secure to literary authors their copyrights for a limited time," and to "encourage by premiums and provisions the advancement of useful knowledge and discoveries." On the same day Charles Pinckney, of South Carolina, also submitted a number of propositions, among which were: "To grant patents for useful inventions," and "to secure to authors exclusive rights for a certain time."

The propositions of both these gentlemen were referred to the committee. On August 31 such parts of the Constitution as had not been acted on were referred to a committee composed of one member from each State, and among these undisposed parts were the propositions to give Congress the power to grant patents for inventions. Mr. Madison, but not Mr. Pinckney, was of this committee. On September 5 the committee reported and recommended, among other things, that Congress have the power "to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." This was agreed to without a dissenting vote. In the final revision of the style and arrangement of the articles in the Constitution this clause became paragraph 8, section 8, of article I., where it has ever since remained.

Thus it is seen that the distinction of submitting the proposals to give this power to Congress rests jointly with James Madison and Charles Pinckney. Both of them were revolutionary patriots of marked ability and wide legislative experience, but neither appears to have had any special interest in science or the useful arts. They doubtless were prompted to this action by the same motives advanced by Mr. Madison in a paper in the *Federalist* in adverting to this power. He wrote as follows: "The utility of this power will scarcely be questioned. The copyright of authors has been solemnly adjudged in Great Britain to be a right at common law. The right to useful inventions seems with equal reason to belong to the inventors. The public good fully coincides in both cases with the claims of individuals. The States cannot separately make effectual provision for either of the cases, and most of them have anticipated the decision of this point by laws passed at the instance of Congress."

Time has justified the equity of Mr. Madison's argument, and the neglect and failure of the States to grant patents for inventions since the adoption of the Constitution have corroborated its truth.—*Mag. of Amer. History.*

Coal Ammonia for Refrigeration.

Speaking recently to the N. E. Gas Engineers concerning the values of residuals from gas coals, Mr. G. Shepard Page said:

In New York, Baltimore, Washington, and scores of other cities and towns it has been found that even in the manufacture of twenty-five tons of ice per day it can be produced and sold at a profit in competition with natural ice. Cold storage warehouses are increasing, and the majority of them would not be profitable without this artificial refrigeration. The results which have been gained in that direction are such that, no matter how cheap natural ice is, or how easy it can be put into a building, an ice machine which will make twenty different temperatures in twenty different rooms will be preferred. There are all manner of articles, otherwise perishable, which can by artificial refrigeration be kept for one year, two years, or three years. Just under the Brooklyn Bridge, in two of the great arches, there is a cold storage warehouse; and Mr. McLean, of Brooklyn, a well known dry goods merchant, stops occasionally to call upon his son, who is one of the proprietors, and he will say, "Now, if you please, I will have a chop off that mutton that was put in here three years and a half ago. I think it is a little sweeter the older it grows." I frequently stood at the great warehouse on the Thames and have seen the barges that have taken out the carcasses of mutton from the big steamers that land them at the docks down below on the Thames, which are stacked up just like cord wood, handled like cord wood, and put under the great arches of the Cannon Street Bridge, in rooms holding 80,000. There you find mutton from New Zealand and South America, artificially frozen at the start, kept frozen on the voyage, stored in those storehouses under the great arches of the bridge, and delivered frozen to the retailers. All the meat that is being sent by Armour, Hammond, Eastman, and other shippers from this side across the ocean is preserved by artificial means. Hence the demand for the ammoniacal liquor of even the smaller gas works. Add the value of the ammonia to the price of coal tar, and the two added to the receipts for coke, is making a figure on the credit side that has never before been realized.

Ultramarine.

Friedrich August Kottig was the director of the laboratories of the Royal Porcelain Factory at Meissen, and, if every one were given his due, should be known as the discoverer of artificial ultramarine. This honor is usually divided between Guimet and Ginelin, who, however, were still fighting hard for the whole of it when Kottig first began to make ultramarine on a large scale.

In the spring of 1828, Kottig was in want of a glass free from lead, and set about making sodium silicate for this purpose out of a pure clay. The frit contained an earthy blue substance, which was speedily identified, and by January, 1829, artificial ultramarine was thrown on the market.

The Meissen ultramarine, says J. Heintze, in the *Journal fur Praktische Chemie* (1891, No. 2), was always a greater favorite and fetched a higher price than most other brands, and since the factory is now closed it is worth while to put on record the exact method which was there adopted in this manufacture. It was soon found that the slightest trace of sulphate or sulphite in the soda injured the brilliancy of the color, and chemically pure crystallized sodium carbonate was employed. The percentage of silica in the clay was also found to be an important point, and the kaolin of Seilitz, English porcelain clay, China clay, and kaolin from Zeltlitz by Carlsbad, rapidly displaced the porcelain clay of Morl by Halle, which is a little richer in silica than the aforesaid varieties. The sulphur was Sicilian roll crushed in iron roller mills, and the charcoal was from pine and similarly crushed.

Fifty parts of the sodium carbonate were thrown into a cast iron dish, shaped like an evaporating basin, 1 meter in diameter and 0·3 meter deep, placed directly over a fire. When the soda had melted in its water of crystallization, 20 parts of the levigated kaolin were added in small quantities, but pretty quickly, the mixture being kept stirred with an iron stirrer, and the fire kept low until the mixture had evaporated to dryness. The color basis thus obtained amounted to some 32 parts of the materials taken, and to every 19 parts of this 6 parts of powdered sulphur and 1 part of powdered charcoal were added. Should a brand of greener tinge have been required, the sulphur would have been reduced to 4 parts; in fact, all the different shades were made by altering the proportions. These materials were then most intimately mixed in a porcelain mill for 10 hours; the success of the subsequent processes depending on the intimacy of this mixture, it was only deemed sufficient when no individual particles could be detected in a thin layer of it. The mixture was then transferred to open, flat, round capsules, made of chamotte, a burnt clay, and of such a size that each would only be three-quarters full when it contained 250 grammes of material, forming a layer, when gently pressed down, some 3·4 centimeters deep; 50 kilogrammes of mixture were generally contained in 200 or 202 capsules. The capsules were then burnt in muffles. These were about 0·4 cubic meter capacity, and held at least 216 capsules in nine layers of 24 capsules in rows of six by four. Latterly, large crucibles were used, but the muffles were the best.

The craft of ultramarine making is in the first burning, which must not be too much or too little. If the muffle furnace is provided with a chimney which can be opened or closed, coal can be burnt, but care must be taken that the flame is oxygen free. At Meissen the temperature in the muffle oven was allowed to rise to yellow, which normally took 2¼ to 2½ hours, and the cooling was made as slow as possible by closing the dampers. If the burning is successful, the mass of raw color is very pale blue or bluish-gray and very friable. It should be homogeneous and easily rubbed down between the fingers and thumb; if it is underburnt it will not be uniform in color, and will be useless for further treatment; if, on the other hand, it is overburnt it will have sintered and will be destitute of blue color.

The next process is the removal of all soluble salts, which was performed at Meissen by washing with cold water till the washings left no appreciable residue. The mud was then dried in capsules in the oven and sifted through a medium sized mesh, through which it should be easily rubbed with the hand, unless it is overburnt. The color has now to be burnt a second time, in order to remove some greenish sulphur compounds by oxidation. The same capsules and muffles were used as in the first burning, only the capsules were so packed as to allow free access of air, but at the same time the muffles were closed to prevent entrance of furnace gases. There was sufficient air in the muffles for the necessary oxidation. The temperature was allowed to rise to red heat, but was regulated according to the success of the first burning; if the color had sintered at all, the temperature of the second burning was raised; if, on the other hand, it was underburnt, the temperature was lowered in the second burning. The color at first became nearly black and gradually more and more blue. Just before the full blue was reached the dampers were closed and the heating discontinued; the full color then developed during the cooling. The second burning generally lasted some 2½ hours.

The final operation in the preparation of ultramarine is nearly a mechanical one. Some 25 kilogrammes of the color are washed with water containing 100 grammes of magnesium carbonate, or 250 grammes of powdered chalk, and rubbed to a fine powder the while. Passing through a hair sieve, drying, and *adulterating the cheaper brands with clay,* completes the manufacture.—*Chemical Trade Journal.*

P. T. Barnum Dead.

The greatest showman on earth, as he prided himself on being called, died at his home, in Bridgeport, Conn., on the 7th inst., after a protracted illness.

Mr. Barnum was deservedly popular among all classes, and the city in which he had long lived, and where he died, has lost one of its most public-spirited and useful citizens.

Mr. Barnum's energy was exhaustless, and he took great pride and delight in his own achievements. He was a striking example of what perseverance and assurance can accomplish. Forty years of his life was devoted to the show business, in which he had no peer. He understood the business and enjoyed it, and he has left a large fortune as the result of his active life.

The veteran showman was probably the best known man in the United States. He has made a succession of generations of children happy, and his genial face, with "I am coming," which ornamented part of the gigantic bill announcing the coming show, will be recalled to the mind of multitudes in both hemispheres.

Chances for Inventors.

The Postmaster General has issued a public notice to patentees and their assignees inviting them to put in proposals for the use by the government of improved modes of construction of mail bags, of opening and closing mail bags, mail catchers, and devices for labeling mail bags. Proposals for the above will be received until September 2, 1891. Proposals for furnishing mail bag cord fasteners, iron, steel, brass, oil, and wastes, will be received until May 6, 1891. Particulars can be had by addressing the Postmaster General, Washington.

HON. DAVID A. WELLS, the eminent statistician and able writer on political economy, has been awarded a gold medal by the jurors of the French exposition of 1889, in recognition of his contributions to economic science and literature. A well deserved compliment.