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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.

UNIVERSITIES IN THE UNITED STATES AND GREAT BRITAIN.

Our English contemporary, Nature, in a recent article, makes a statistical comparison of the provision for university education in Great Britain and the United States, in which some truly remarkable results are shown. We were well aware before reading this article that in the wealth of their endowment, in the completeness of their equipment, in the numbers and qualifications of their professorial staff, and in the total enrollment of students, our universities were well ahead of those of the older country; but we were not prepared for such remarkable disparity as is shown in the article referred to. It seems that in the United Kingdom, with a population of 41,000,000, there are 25,500 university or university college students, or say five to each 10,000 inhabitants, while in the United States, with 76,000,000 inhabitants, there are 97,100 students, or 12.76 for each 10,000 inhabitants. After commenting on the important bearing which these facts must have upon the struggle for industrial supremacy, our contemporary proceeds to point out that the amount donated by private individuals for higher education in the period from 1871 to 1901 was eight times greater in the United States than that given for similar purposes in Great Britain; while, to say nothing of the income from state land grants, the amount provided by the state for higher education in the United States is six times as much as the government grants for the same purpose in Great Britain. In the older country there are but 13 universities and 20 university colleges, whereas in the United States there are 170 colleges with an endowment of over $100,000, and 49 of these have endowments of over $500,000, while three of them have an endowment of over $10,000,000. Even more significant is the fact that the value of the endowments of the institutions of higher education in the State of New York alone exceeds the total value of endowments for education raised during thirty years in the whole of Great Britain; while the same thing may practically be said of the States of Massachusetts and California. Perhaps the most striking comparison is that from which we learn that the total number of professors and instructors in universities and colleges, included in the list of the United States Commission of Education, is 17,000, whereas the number of day students in the university and university colleges of Great Britain is only about 20,500, so that there are almost as many university teachers in the United States as there are university students in Great Britain.

Of the many institutions of our country of which we are justly proud, there is none, surely, more splendid than our system of public school and university education. Even in Germany, of whose educational advantages we have lately heard so much, there are only 7.87 university students to each 10,000 inhabitants, as compared with 12.76 in the United States.

THE ALDERMAN AND THE ENGINEER.

When the present city administration came into office, it found two of the largest suspension bridges in the world in course of construction or about to be built across the East River, neither of which, unfortunately, could lay claim to architectural or æsthetic beauty. The first of these, popularly known as the New East River Bridge, was so far advanced that it was too late to make any radical changes designed to improve its appearance. Of the other, now known as the Manhattan Bridge, only one of the foundations was under way; and the new bridge commissioner, who is one of the foremost bridge designers in the world, took advantage of the backward state of the work to cancel the old design, which possessed no æsthetic beauty whatever, and drew up plans for a new structure, which has the double merit of possessing great architectural merit, and embodying features in its design and materials of construction that will insure its completion in a much shorter time than would have been possible under the old plan. Among other changes, the new design contemplates the use of steel chain cables instead of steel wire cables, and the greater speed of construction is due chiefly to the use of that type. Although at first sight this may seem like a return to an earlier and discarded form of construction, it is, as a matter of fact, a distinct advance in engineering practice; improved methods of manufacture, and the use of nickel-steel, render it possible to build a chain cable of the same strength as a wire cable, which will compare favorably with the former in point of cost, will weigh not so very much more, and will have the advantage—extremely valuable just now when there is such a call for improved communication across the river—of being capable of construction in considerably less time.

It was inevitable that such a bold and radical change as this should provoke criticism. The engineers who were responsible for the rejected design and also for that of the present East River Bridge, to say nothing of the contractors for the wire cables, could hardly be expected to look with a favorable eye upon such a sweeping change. In view of the inevitable criticism that would be provoked, the Mayor very wisely appointed a commission of three of the most eminent bridge engineers in this country to pass upon the new plans. They have recently returned a favorable report; and it would now seem the time is surely ripe to push forward this too-long delayed work to completion. Unfortunately the question of appropriations has to be determined by a Board of Aldermen, which, in spite of its distinctly lay character, has undertaken to criticise both the architectural and engineering features of the bridge, features upon which, in the very nature of things, it is quite unable to express an intelligent opinion. The Municipal Art Commission has passed favorably on the architectural elements of the bridge, which, by the way, were especially designed under its supervision, and the engineering features are indorsed by the leading bridge engineers of the day. The obvious duty of the Board of Aldermen is, then, to confine itself to its duty of voting the necessary funds for construction, and thus do its part toward hastening the construction of one of the most urgently needed public works of the day.

THE NEW ARMY RIFLE.

It is stated that during our campaign in Cuba there were no less than half a dozen different kinds of rifles represented in the American army of invasion. The fact that two entirely different types—the Krag-Jorgensen and the old Springfield rifle—constituted the main armament of our troops, the former being used by the regulars and the latter by the volunteers, was in itself a sufficient handicap to place our troops at a serious disadvantage, particularly when it is borne in mind that the weight, range, and rapidity of fire of the two weapons were widely different. Hence, it is encouraging to learn that the government has definitely decided to adopt the new army rifle of which we gave an illustrated description in the SCIENTIFIC AMERICAN of June 6. The new weapon is a most excellent piece, greatly excelling, as we showed at the time, the best of the existing military rifles on every point of comparison. It is shorter (only 24 inches long in the barrel), lighter, has greater velocity, greater energy both at the muzzle and at the longer ranges, than the Krag-Jorgensen, the celebrated Mauser, or the very excellent German military rifle. The new Springfield rifle is to be supplied to the regular army just as fast as it can be turned out from the government arsenal, which, if working at its capacity of 200 rifles a day, could supply our army of 60,000 men in about one year's time. The Krag-Jorgensen rifles of the regulars are to be passed on to the National Guard, and they will carry them until the regular army has been supplied with the new weapon, when the volunteers will be supplied with the new rifle in their turn. The advantages of arming the National Guard as well as the regulars with the same pattern of rifle, especially when it is such a magnificent weapon as this, are obvious.

THE GROWTH OF OUR FOREIGN COMMERCE.

The indications are that the foreign commerce of the United States for the year will prove to be the largest in the history of the country, the total imports exceeding, for the first time, a total of $1,000,000,000, and the exports being larger than in any preceding year except 1901. Taking the trade figures for the eleven months of the year, it is evident that when those for the month of June are added, the total exports will amount to about $1,400,000,000. The largest total commerce representing the imports and exports combined of any previous year was that of 1901, when they amounted to $2,311,000,000. During the first year of the century, our total trade amounted to $162,000,000. In 1850, it had grown to $318,000,000; in 1860, to $687,000,000, and in 1872, for the first time, it passed the billion-dollar line. In 1880 it had increased to $1,503,000,000, and in 1900 it first passed the two-billion dollar mark, the total being $2,244,000,000; while in the present year, as we have said, it seems likely to exceed $2,400,000,000.

A SHIP CANAL THROUGH SCOTLAND.

In addition to the two great canals which are likely to be built on the American continent at Panama and between the Great Lakes and the Hudson River, there is now under consideration, with the approval of the British government, a scheme for building a ship canal through Scotland, from the Firth of Forth to the Clyde, at an estimated cost of $50,000,000. This is not the first time that the idea has been mooted. The favorable topography of the country between the two great estuaries, coupled with the great advantages, commercial and military, to be secured by cutting this waterway, have naturally attracted the attention both of the British government, which has looked at the scheme from the view-point of its great strategic advantages, and of the capitalist, who has always been fully alive to the commercial facilities afforded by such a short cut from the North Sea to the Atlantic as would be provided by a Forth-Clyde canal. The British Admiralty is now constructing a great naval base on the Firth of Forth for the use of the North Sea fleet, and the cutting of the canal would at once double the strategic value of this base, since it would enable the fleet to reach the Atlantic by steaming a distance of only forty miles. Commercially, the canal would be valuable as opening up a direct route from the North Sea to Canadian and New England ports.

DESTROYING THE WATER HYACINTH BY A NEW CHEMICAL PROCESS.

During the last year experiments have been tried under the supervision of the government, with the idea of ridding the southern waterways of the hyacinth. As is well known, the variety known as the water hyacinth spreads so rapidly and has such a rank growth, in Florida and Louisiana, that it has seriously interfered with navigation and in some cases has completely blocked streams which had hitherto been available for the use of light-draft steamers.

The hyacinth has been especially troublesome on the St. Johns River, where various schemes have been tried to destroy it. One of the plans was to equip a steamboat with a propeller provided with blades having very sharp edges, with the view of cutting away the growth below the surface. It was believed that this treatment would cause the plants to die, but the benefit was only temporary. While lanes of open water were made by the action of the rapidly moving propeller, they were soon filled with the hyacinth and this scheme was abandoned. At some of the smaller wharves on the St. Johns, the growth has been so thick that it has been necessary to go out in boats and cut away with sickle and knife a large area, in order to allow a vessel to moor at the dock, while some of the smaller wharves have been abandoned, as the plant grows so thickly about them that a boat driven by quite powerful engines is in danger of becoming blocked in the midst of a bed, unable to extricate itself.

The method which is now being tried, however, seems to have solved the problem of how to destroy the hyacinth, and it is believed that if sufficient equipment is provided, eventually all of the southern water courses may be cleared of the pest permanently. A chemical has been compounded which has such an effect upon the plant that if it comes in contact with the stem or blossom these portions soon wither; but the solution is so powerful that it works its way down the stem, killing the root as well. Some of the ingredients of the chemical are known only to the inventor but a large quantity of acid is used in its preparation. The process of manufacture is very simple, the "laboratory" being placed upon a barge provided with two tanks each of which has a capacity of 5,000 gallons. Connected with the tanks is a boiler in which the ingredients are mixed at a high temperature produced by steam heat. The barge is of such light draft that it can be towed by the spraying boat if desired, but the latter is provided with three reservoirs each holding 3,500 gallons, which are filled by pumping from the barge. Pipes lead from the reservoirs to a steam pump which supplies the spraying apparatus. This consists of three booms. One extends directly in front of the vessel, being supported by a block and tackle attached to the bow deck. The others project from the sides of the vessel. The sprayers consist of hollow tubes which are perforated at intervals of about a foot and the holes fitted with miniature nozzles. The liquid is forced into the sprayers through lines of hose which are connected to the sprayers by couplings in the usual manner. The arrangement of the sprayers is such that the chemical can be distributed over a space 90 feet in width when the boat is moving. The boat containing the spraying apparatus is of the type of craft used on southern rivers, drawing but 4 or 5 feet of water. She is provided with very powerful engines in proportion to her size in

order to drive her through the masses of hyacinths, and is so modeled as to offer as little resistance to the obstruction as possible. Her reservoirs carry a sufficient supply of chemical to cover about 100,000 square yards, and on a portion of the stream where the growth is not too rank, the steamer will treat this area of surface in a day. In places where the side sprayers cannot be utilized on account of trees or other obstruction, the chemical is applied to the plants by means of ordinary hose operated by members of the crew.

Such is the destructiveness of the solution that within a few hours after it is applied the withering process begins and microscopic tests prove that the liquid penetrates the growth below the water, killing the roots, as already stated. Portions of the dead growth which have been pulled from the bottom of the St. Johns where the treatment has been applied show that the effect of the chemical is to rot the fiber and disintegrate it to such an extent that it no longer offers resistance to navigation. The solution kills the seed as well as the plant, and efforts are made to cover as much space during the seeding period as possible. The work has been done under the direction of the United States engineers. A. W. W.

MARCONI IN ROME.

Perhaps in no other country in the world is the work of the investigator in fields of scientific inquiry so little appreciated at its true worth as in the United States. To be sure, the newspapers see to it that no discovery, which can be readily colored with mendacious splendor to attract the public eye, is allowed to go unacclaimed as the most revolutionary that has been made in a century. But sensational recognition is hardly the desire of any true scientist.

If Americans seem cold, other nations on the contrary seem more than warm in their praise of scientific work. The opposite extreme of extravagant admiration in the form of popular demonstrations seems often to be reached in the southern countries of Europe. Not the least striking example of the heights to which the enthusiasm of a warm-hearted race may soar in its appreciation of the brilliant scientific achievements of one of its members, is afforded by the greeting accorded to Marconi on the occasion of his recent visit to Rome. We are as fully convinced of the greatness of our nation as Italians are of the glory of theirs. Yet, what American scientist or inventor was ever welcomed at a railway station by a deputation of city authorities and by a multitude of cheering countrymen? Still, such was the reception of Marconi in Rome on May 1 of this year. Not only the students of the colleges shouted an Italian welcome to him; but little school children seemed carried away by the popular fervor, and added their voices to the outburst of their elders. Not even a heavy downpour of rain could check the Italian ardor. The horses were unharnessed from Marconi's carriage, and men fought with one another for the honor of dragging him to his hotel. If the Italian papers are to be credited, his journey through Italy must have been a veritable triumphant procession. Indeed, the glamor of his presence in Rome waned only on the arrival of Emperor William, but soon regained its brightness after the departure of the Kaiser. At a special session of the City Council of Rome and in the presence of his family, Marconi was made an honorary citizen. In the great hall of the Campidoglio, reserved for kings and the highest dignitaries, and in the presence of the King and Queen and of a gathering composed of the foremost scientists and of Rome's aristocracy, he read a paper, seven thousand words in length according to his own statement, on his work in wireless telegraphy. The next day the Mayor drove him to the wireless telegraphic station on Monte Mario, where telegrams of congratulation were exchanged with other Italian wireless stations. Then followed a series of banquets at which orations were delivered, the chief topic being, of course, Marconi, who, it was plainly stated, was not only the most famous scientist of Italy, but even of the world. In a pretty speech, Marchesa Capranica del Grillo made him a member of the Italian Naval Institute in the house of Adelaide Ristori.

Much of this theatrical adulation, which to an American or Englishman is repulsive, can, of course, be explained by the effusive, emotional warmth which has ever characterized the Italian temperament. The feats of an Italian, be he scientist, soldier, poet, or painter, are generally viewed through a telescope and magnified out of all proportion. We are not prone to belittle what we have done in vanquishing other nations in the ceaseless war waged by commerce; we have not utterly disregarded the commanding place which we have lately assumed as a political power, and we certainly have not failed to impress upon our children something of the glory of American history. Yet, it seems quite beyond the power of the average American not only to award to his scientific countrymen that meed of recognition which is properly theirs, but even to remember their very names. How many Americans have ever heard of Langley and Remsen among living scientists, not to mention Henry and Marsh among those of the past?

It is hardly necessary to drag a scientist in his carriage to his hotel as if he were a prima donna; to wait upon him whenever he visits a prominent city, or to surfeit him with applause. Some encouragement, however, he surely deserves, and that encouragement should be given with becoming dignity and with somewhat more generosity than the richest country in the world, a country, moreover, which owes much of its wealth to the work of applied science, has been wont to bestow on its investigators.

AN ELECTRIC TRAMWAY OPERATED UPON THE LORAIN CONTACT BOX SYSTEM.

Some time ago a short section of street surface railroad operated upon the Lorain principle was laid down in this country for experimental purposes. The feature of this system is that instead of the current being supplied by means of a trolley and overhead wires, or the conduit, contact boxes are installed along the track at intervals of a car's length, so that the car always engages at least one of the contacts and receives the necessary current therefrom. The system was submitted to a nine months' test, but was never adopted by any company or municipal authorities, with the result that it fell into practical oblivion. Now, however, the town of Wolverhampton, England, is having its tramways operated upon the Lorain principle. When the town decided to convert its horse traction street railroads to electricity the overhead trolley system was adopted. One of the members of the civic authority, however, brought the Lorain system before the council, and although it was explained that this system would cost about $10,000 a year more to maintain than either the conduit or the overhead trolley service, it was decided to adopt it upon the condition that the Lorain company should lay down and maintain the test lines for twelve months, so that the authorities might study its operation and possibilities. If at the end of that period it had proved a commercially successful operation the council would then decide whether to adopt it or otherwise. In fairness, however, it was decided that the term "commercial success" should be taken in comparison with the overhead trolley system working under similar conditions, and the question of whether it was operated at an actual profit or loss during the year, was to be left out of consideration, since this is influenced to a very great extent by the receipts per car mile.

For the purposes of the test a section of about 11½ miles was converted at an approximate cost of $9,000 per mile, exclusive of the expenditure upon the track, which cost about $27,500 per mile, or a total of $36,500 per mile of track. This is more than what it would have cost to install the overhead trolley system, but less than the expense entailed in laying conduits.

The Lorain company have completed the conversion and the street railroad is now on trial. At first the plea that the contact boxes between the tracks would be a source of danger to pedestrians and horses was raised. Cases of persons who had experienced shocks by treading on the boxes while crossing the thoroughfare were at first reported, but when the matter was investigated these were found attributible to unskillful laying of the contact boxes. Col. Yorke and Mr. A. P. Trotter, upon their inspection of the first section of the line on behalf of the Board of Trade, drew attention to the projecting of the contact boxes above the level of the roadway and they condemned them in unmeasured terms as being at least undesirable. Mr. Trotter supplemented his report by raising the question of danger due to the mechanism in a contact box failing to act, that should the piece of iron which makes the electrical contact not fall after the skate has passed along, a man or a horse treading upon the block would in all probability be killed. However, no accidents arising from this source have as yet occurred and any defects which have presented themselves from time to time have been immediately remedied.

In the event of the system not commending itself to the council authorities of Wolverhampton at the expiry of the experimental term, the Lorain company will have to remove their contact boxes, and transform the cars so that they can be adapted for the overhead system, at their own expense. The cables have already been laid in case of such an eventuality, and thus the railroad could be brought into operation on the overhead trolley principle with but very little delay. At the present moment Wolverhampton is the only place in the world where the Lorain contact plate system is in use. Should the trial prove satisfactory and a financial success, it will be extended for another 11½ miles. Furthermore, once it has established its success in this case it will in all probability be adopted by other cities in the United Kingdom, as the trials are being followed very closely by the leading municipal engineers. Up to the present the system has proved highly successful, but no reliable data as to its operation, cost of maintenance, and working will be forthcoming until the termination of the experimental year.

THE UNION ENGINEERING BUILDING.

A formal organization of the joint committee representing the various bodies which have taken action with respect to the gift of one million dollars of Mr. Andrew Carnegie for a union building, was effected on the evening of June 18. The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Engineers' Club have taken final action and appointed their representatives upon a joint committee for accepting this gift. The American Institute of Mining Engineers has likewise taken action in so far as its rules permit. Its council has appointed representatives subject to changes in the rules of the organization, which have been proposed by the council for adoption at the next general meeting. At the present time a letter ballot for ascertaining the attitude of the members is being taken, which shows an overwhelming majority in favor of the plans proposed by the council.

The American Society of Civil Engineers at its recent meeting in Asheville referred the matter to its board of directors for recommendation, and directed that the matter be then presented to the members of the society for letter ballot.

The joint committee was organized by the election of the following officers: Chairman, Charles F. Scott, secretary, Prof. F. R. Hutton. The chairman was directed to indicate to Mr. Carnegie the acceptance of his gift by the joint committee representing the several organizations.

The joint committee placed the immediate work of developing plans upon an executive committee of five, consisting of one member from each of the five organizations named in Mr. Carnegie's letter.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1435, opens with an excellent description by Day Allen Willey of the biological laboratory at Wood's Holl, Mass., the only institution of its kind in the United States. The article is well illustrated. A new discovery which may have far-reaching results in the field of scientific investigation and do much toward a further solution of the problem of the molecular construction of matter, was recently made by Siedentopf and Zsigmondy. The discovery is treated under the title "A New German Microscope." The rôle of nitrate and phosphate fertilizers in the richness of wheat in gluten is a topic which will doubtless be of interest to the scientific agriculturist. The Paris correspondent of the SCIENTIFIC AMERICAN describes in detail some of the Paris-Madrid racing automobiles, illustrating his text with clear illustrations. A. Dastre reviews discoveries which have been made in the field of cathode rays and Röntgen rays. Prof. Fleming's four Cantor lectures on Hertzian wave telegraphy recently read at the Society of Arts are to be published in the SUPPLEMENT. The first paper appears in the current issue.

BORELLY'S COMET.

A comet was discovered by Borelly at Marseilles, June 21, in right ascension 21 hours 52 minutes and 52 seconds, and declination —8 minutes 10 seconds. The comet had a daily motion at the time of its observation at Kiel of —7 minutes in right ascension and + 44 min. in declination. A nucleus and a tail were observed.

Prof. W. W. Campbell, of Lick Observatory, states that Borelly's comet was observed by Aitken on June 22, in the right ascension 21h. 48m. 6.4s. and declination —7 deg. 0 min. 49 sec. Prof. Tucker states that the comet was observed by Aitken, June 23, in right ascension 21h. 50m. and 51.4s. and declination —6 deg. 09 min. 26 sec.

On June 24 Borelly's comet was observed by Aitken in right ascension 21h. 49m. 52s.; declination —5 deg. 8 min. 48 sec. The comet was also observed at Carleton College Observatory on June 23 in right ascension 21h. 50m. 50s. and declination —6 deg. 7 min. 38 sec.

ALEXANDER MELVILLE CLARK.

It is with deep regret that we are constrained to announce the death on June 3, at the age of 54, of Mr. Alexander Melville Clark, of London, England, who for many years was the head of the firm of Messrs. A. M. & William Clark, and in that position acted in the capacity of our London correspondent. Mr. Clark was a man of marked abilities, and was widely respected and admired in his profession. He was greatly interested in the "Chartered Institute of Patent Agents," and was largely instrumental in introducing rules which have done much toward raising the standard governing the registration of attorneys in Great Britain. Mr. Clark was himself a Fellow of the Institute. He was a gentleman of sterling character and pronounced ability, and as one of the leading members of the profession his loss will be greatly felt, not only on the other side, but among those in America who have had an opportunity of coming in contact with his agreeable personality.