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NEW YORK, SATURDAY, OCTOBER 18, 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.

THE PRESSING NEED OF OUR NAVY.

There is need for a very thorough agitation of the question of the increase in the number of our naval officers; for it is certain that neither the people at large nor their representatives in Congress appreciate the very grave crisis which has been precipitated by the failure to make adequate provision for manning the new ships of the Navy. It is easy to understand, if not to excuse, the ignorance or indifference which exists with regard to this question, which is due doubtless to the fact that we are more affected by what we can see with our own eyes in the shape of big battleships, powerful cruisers, etc., than we are by statistical figures indicating the present and future strength of the personnel for manning these ships. For several years past it has been perfectly well understood in official circles that we were building new vessels very much faster than we were providing men and officers to man them; but up to the present time Congress has shown a strange apathy in dealing with the situation. The matter, however, has come to such a pass that this question will be one of the most, if not the most, important that will confront the next Congress, and as the following figures, given by the Secretary of the Navy, prove, the matter will not admit of the least delay.

At the beginning of the present year there was a demand for the proper manning of the serviceable ships of our Navy of 1,237 officers of the line, and at the same time there were 264 officers engaged on shore duty of various kinds. The total requirement on January the first was 1,631 officers. On the same date, however, there were in the Navy only 1,023 officers, including midshipmen, or 608 less than were required. Even if we allow for the fact that about one-fourth of the ships of the Navy are out of commission during peace times, there would still be a shortage of 300 officers.

So much for the present. With regard to the future the situation is even more alarming, for we have at the present time sixty or seventy vessels authorized, or under construction, of which several are the largest and most powerful of their kind in the world. To man these vessels will require 498 additional officers, and this estimate is made on the basis of a minimum allowance of officers per ship, the allowance being far less in our Navy than in any of the first-class navies of the world. This is proved by the fact that, while in this estimate the United States allows only seventeen officers to a battleship, Germany allows twenty, France twenty-six and England thirty-three, or practically double what we do. If we estimate that the usual proportion of officers will be on shore leave, sick, on furlough, or in transit from foreign to home stations or vice versa, we must have 623 officers on the lists to man these ships with the 498 that they require. In the intervening four years between the present date and the completion of these vessels, it is estimated by the Secretary of the Navy that no less than 160 vacancies will be created by the death of officers, or by their leaving the service through disability, or by resignation. Adding these to the total already arrived at, we find that 783 officers will have to be provided for the ships now in course of construction, all of which are expected to be in commission by 1906. Add this number to the 608 officers which we are short of today, and we find that by the date named, if we are to properly officer our fleet, even on the limited number per ship which we allow, there will be required 1,391 officers, or a total of more officers than we have in the whole Navy to-day.

But even these figures would not represent our total need in case of war, for, as in the Spanish-American conflict, a considerable number of naval officers would have to be transferred to auxiliary vessels which would be taken up by the Navy to meet the emergency. These officers could not be drawn from the Naval Academy, for in the coming four years the Navy can only reckon upon receiving 355 graduates from the Academy and this would still leave us more than a thousand officers short of the proper complement. It is true that the law allows promotion from the ranks; but at present the number must not exceed six per annum, and while it might be increased to advantage, it must be remembered that the duties of a modern naval officer require a man of an exceedingly broad range of knowledge, such as can only be gained by a thorough course of study for a period of years at the Annapolis Academy.

In view of the facts given above, it is evident that no measure connected with the defenses of the empire can be brought before the next Congress that will have anything like the urgency of the naval personnel bill.

BRITISH CRITICISM OF AMERICAN RAILROADS.

Discussion of American institutions by fair-minded and competent critics is always valuable and welcome. From time to time we receive visits of inspection from accredited experts of other countries, who are given every facility to examine our social and industrial institutions. In 1901 Col. W. B. Constable, the Manager of the Eastern Bengal State Railway in India, was sent over to examine the working of our railroads, and his report, which is characterized by well considered criticism, shows that he was well qualified for the task. His tour of inspection included a great many of our leading railroads and an investigation of their shops, rolling stock, track, stations and systems of signaling. With regard to the track, he thinks that our method of laying rails with broken joints, that is to say, with the joint of one rail immediately opposite the center of the other rail, is peculiar to this country; and while we differ from the rest of the world in this respect, he presumes that we have the best of reasons for the practice. He commends our use of from 2,500 to 3,050 cross-ties per mile of track, as compared with the 1,760 to 2,000 ties per mile used in India and England, since it cannot be questioned that the greater number of ties gives a smoother and stronger track. He also commends our shorter and narrower platforms as being cheaper than those used in India, and he would imitate us in permitting level crossings at small stations, claiming that the Indian practice of requiring overhead bridges at the small stations is too costly. On this last point we must admit that we can scarcely agree with his findings; for the large number of people killed annually at railroad crossings in this country suggests surely that more overhead bridges and fewer grade crossings, as in India, would be to the public advantage. He considers with much reason that our fencing is wretchedly poor; and that while the roadbed is often indifferent, the lavish use of cross-ties, as above referred to, compensates its defects, while the great length and weight of our cars conduces to their comfortable riding compared with the roughness of the smaller cars on Indian roads. The great Southern Terminal station of Boston is considered by Col. Constable to be the finest station in the world, a conclusion in which we think he is perfectly correct. He is of the opinion that pneumatic or electric power interlocking will take the place of manual interlocking at large stations, more particularly because of the reduction in plant and the necessary staff of operators. He was very favorably impressed by the use of automatic block signals in this country, and he has no doubt that English roads will ultimately adopt some form of automatic system, which will also be found indispensable in such large cities as Calcutta, Bengal and Madras.

To the New York Central Road he gives credit for having the best railroad joints that he found anywhere in the United States, and the criticism is well made. The New York Central have always used three-tie joints, that is joints with a tie near the end of each rail, and an additional tie immediately below the joint. This ample bearing, combined with the use of long six-bolt angle bars, has given a joint which, when it is kept in good condition, is so smooth as to be inaudible to passengers riding on the cars. It is curious to note that the critic was struck, as many everyday passengers have been, with the difference between the joints on the New York Central and on the New Haven lines. On the latter road short four-bolt angle-bars are used with a single tie at each rail end, and none immediately beneath the joint. As a consequence the joints are generally low, a point which did not escape the eye of this critic. He was favorably impressed with the American rails, which he characterizes as being heavy, tough, stiff, of great tensile strength, and with a broad head. He himself has always been an advocate of the heavy rail section, and he considers that he found a strong indorsement of his views in the good results obtained from their use in this country.

WHERE OUR MANUFACTURES GO.

Those of us who are watching the present wonderful commercial expansion of their country will be interested to learn what countries our manufactures are sent to and in what proportions. During the year 1901, 62 per cent of our exported manufactures were carried to Europe, and 23 per cent to North America, these two countries together taking three-quarters of our exports. Of the balance, 8.2 per cent went to Asia; 7 per cent to Australia, New Zealand, etc.; 6 per cent to South America, and something less than 3 per cent to Africa. The total value of the exports to Europe was $215,000,000, and to North America, outside of the United States, $96,000,000, the exports to other countries being in the proportions as given above. An analysis of the nature of these exports shows that the largest item of European exports was $44,000,000 worth of iron and steel manufactures. It will be a matter of surprise to learn that almost an equal amount of copper manufactures was exported, the total value being about $41,500,000, while the exports of refined or manufactured oil were not far behind, the total being $40,736,000. The values of the other principal exports were, of leather and manufactured leather goods, $21,000,000; agricultural implements, $10,500,000; drugs and dyes, $6,741,000; the balance of the total exports being made up of paraffine, wood manufactures, scientific instruments, etc., in decreasing amounts. The largest item in the exports to North America was iron and steel, which were sent out to the value of $43,518,000; the next items in point of importance being cotton manufactures, $6,628,000; and cars and carriages, $3,577,000. To South America, the largest exports were of iron and steel to the value of $8,750,000; to Asia of refined or manufactured oils to the value of $12,442,000; while to Oceania the principal manufactures exported were iron and steel valued at $8,872,000. Historically, it is interesting to note that in 1790 the total exports of manufactures from this country amounted to only a little over $1,000,000 and formed only 6 per cent of the total exports; in the decade 1791-1800 exports of manufactures averaged only about $2,000,000 per annum, and they never reached as much as $10,000,000 per annum prior to the year 1840. In the year 1850 exports of manufactures had reached a total of $17,500,000; in 1860 they reached the $40,000,000 mark, and in 1870 the total stood at $68,280,000. It was not until 1877 that they passed the $100,000,000 line, the total for the year being $122,577,000. Nineteen years later, in 1896, the total value passed the $200,000,000 mark and had risen to $223,571,000. In 1899 the total was $339,600,000 and during the present century the exportation of manufactures has constantly exceeded $400,000,000 per annum.

RAILROAD EXPANSION IN SOUTH AFRICA.

Following the declaration of peace in South Africa, and the return of the country to the normal order of things, a determined effort is to be made to develop the industries of the country, in order to render South Africa a formidable competitor in the great struggle for the world's trade. Primarily, a comprehensive extension of railroads is to be carried out, since it is only by the construction of a network of railroads throughout the country that its resources can be developed to the utmost, and its produce dispatched expeditiously, easily, and cheaply to the coast for shipment to foreign markets. At present, there is a tendency toward competition between the various railroads for the traffic, but it is desired to bring the various railroads together into one homogeneous whole, stop ruinous inter-competition, and establish a fair tariff for the conveyance of freight.

There is also another very great difficulty against which the railroads have to contend—the present unsatisfactory condition and deficiency of labor supply. The far-reaching influences of this problem are exemplified in connection with the Natal-Harrismith railroad either via Reitz or Wilge River, to some point on the Central South African Railroad's main line near Vereeniging. This railroad was extended for military purposes during the war for eighteen miles beyond Harrismith to Elands River, and surveys for the rest of the route are to be carried out. These surveys will be completed in about six months. The advantage to Natal of this connection will be very great. It will save about one hundred miles of uphill haulage, and will shorten the route from Durban to Johannesburg by over forty miles. It will also shorten the distance by rail from Durban to Cape Town considerably. But unless a solution is found to the native labor difficulty, or some means are adopted to provide skilled white labor, this railroad, in common with many others equally important, will be a long time in course of construction, even if work is immediately commenced upon it. The present railroad extensions scheme comprises the surveys for the following lines in the Transvaal:

1. A track from Springs over the High Veldt to a junction with the main railroad near Machadodorp.
2. The remaining unsurveyed portion of the railroad from Vereeniging to Johannesburg (direct route).
3. A track from Krugersdorp to Rustenburg.

In the Orange River Colony the projected railroads are:

1. A track from the present terminus at Elands River, near Harrismith via Reitz, or the Wilge River, to Vereeniging.

2. A road from the present terminus of surveys on the Bloemfontein-Ladybrand Railroad (Thaba Nchu), through Modderpoort to Ficksburg.

3. A track from Fauresmith to Koffyfontein.

The former surveys of the roads Harrismith-Bethlehem-Heilbron, Belfast-Lydenburg, and Pretoria to Rustenburg are already in hand. The survey from Fauresmith to Koffyfontein is an extension of the existing railroad from Springfontein to Fauresmith on which the track has not yet been laid.

The branch from Machadodorp to Ermelo, which was under construction by a company before the war, is to be completed by the company at its convenience. The earthworks were well advanced when work had to be stopped.

There are numerous other extensions well in hand, but in several instances, where the roads were commenced before the war broke out, and conflict with the latest arrangements or existing roads, they are in a state of chaos. This is notably the case with the Silati Railroad. The extension from Pietersburg toward Rhodesia via Tuli, is liable to be objected to by both the Cape and Rhodesian Railroads, and unless union of the schemes is effected such an extension would probably divert much traffic from the two last named. It is not considered advisable to construct any such roads through districts already adequately supplied with railroad facilities. The government is going to relay the whole of the main railroad through the Orange River Colony with 80-pound metal rails to allow the use of heavier and more powerful locomotives, and thus increase the train loads. A comprehensive system of light railroads connecting the main road to outlying districts is to be carried out to facilitate transport. A branch from Bloemfontein to Thaba Nchu will probably be completed in about six weeks, and it is the intention eventually to continue it to Ficksburg.

The new direct line from Vereeniging to Langlaagte or the West Rand, upon which the heaviest types of locomotives are to be used to enable heavy loads to be drawn, will probably be one of the first to be completed as soon as labor is available. All the embankments, etc., were constructed during the war, except about ten miles near the center, in a district then occupied by the enemy. The survey of these ten miles is to be proceeded with at once. In connection with this direct railroad the "coal road" along the reef will be completed, and also the sidings into the mines, involving the laying of some forty-five miles of track, chiefly in the sidings.

THE THREE HUNDREDTH ANNIVERSARY OF OXFORD'S BODLEIAN LIBRARY.

On October 8 and 9 the University of Oxford celebrated the three hundredth anniversary of its famous Bodleian. When it was first opened, November 8, 1602, in the building erected in 1487-8 over the Divinity School, by Humphrey, Duke of Gloucester, the library contained only 2,000 books. The Bodleian had its comparatively humble origin in the bequest by Bishop Cobham, of Worcester, of some books, for which was built in the later years of the fourteenth century a little room in an annex to St. Mary's Church. About a hundred years later, Humphrey, of Gloucester, who seems to have been a kind of Mæcenas, gave books and manuscripts to the university, which were only too zealously destroyed by the fanatical anti-Popery commissioners of Edward VI.

Sir Thomas Bodley, after whom the library was named, was born in Exeter in 1545. His father, John Bodley, on Mary's accession, fled to Geneva, where his son attended lectures on Hebrew and Greek, as well as those of Beza and Calvin on divinity. After the death of Mary the family returned to England and Thomas entered Magdalen College, Oxford, in 1563. He was elected Fellow of Merton. Entering the diplomatic service, Bodley became Elizabeth's Minister to the Hague. Disappointed by Burghley he retired into private life, resolving, as he tells us, to set up his staff at the library door in Oxford, and to restore that place, then in a pitiful state of ruin, to the public use of students. In order to accomplish this purpose he began the establishment of a library in 1598, using as a nucleus the few books of Duke Humphrey and Roger Lisle which had escaped the ravages of Edward VI.'s commissioners. In four years Bodley collected and catalogued about 2,000 volumes. Walter Raleigh and other friends aided him. Bodley induced the Stationers' Company, in 1610, to send to Oxford a copy of every work which they printed. Out of his own pocket he paid for a third story to the "Schools;" but he never lived to see the fulfillment of his labors. In his will he provided for the endowment and maintenance of the library.

In 1639 the Abbot of Osney, Thomas Huskenorton, reduced the public schools into one building. Archbishop Laud, John Selden, the Earl of Pembroke and Sir Kenelm Digby ranked among the earlier benefactors of the library. To the contents of the Bodleian have been added, during the last three centuries, the statues given in 1755 by the Countess Dowager of Pomfret, antique marbles presented by Selden's executors, and the inscribed marbles gathered by Thomas, Earl of Arundel, at his house in the Strand, London, which his grandson, Thomas, Duke of Norfolk, persuaded by Evelyn, gave in 1667 to the University. Of interest are also the Gough (topography and MSS., 1799), Ballard, Wood, Rawlinson, Malone, Douce and Sutherland collections. The auctarium on the chief stairway is reserved for the choicest books and illuminated MSS. Many rare portraits are to be found in the old library. The picture gallery contains Fouquet's models of ancient buildings; Allan Ramsay's portrait of Flora Macdonald, painted in 1749; portraits of Mary Queen of Scots, and Sir Kenelm Digby; some splendid busts, and the brass statue executed by Hubert Le Sœur from designs by Rubens of William, Earl of Pembroke. In an apartment known as the "Old School," may be found the Hope collection of 200,000 books and engraved portraits. So largely has the number of volumes increased that the printed books alone amount to nearly 600,000 in number, while the manuscripts number about 28,000, and so overwhelming has been the overflow that the contents of the adjacent Radcliffe were transferred forty years ago to the University museum in order to make room. The modern books have been removed into the Radcliffe, which is now called the "Camera Bodleiana."

AN EXAMPLE OF WIRELESS TELEGRAPHY'S EFFICIENCY.

A very adequate idea of the utility of the Marconi wireless telegraphic invention, and the wide and beneficial influence it will exercise from a commercial point of view, in connection with vessels engaged in the transatlantic traffic, was afforded recently by the log of the Cunard liner "Campania" on a round voyage from Liverpool to New York and back. The "Campania" left Liverpool at 4:30 P. M. on Saturday, August 30, and remained in communication until 6:10 P. M. with the same company's steamer "Ivernia," also fitted with the Marconi system, which was lying in the Huskisson Dock, Liverpool. From 7:05 to 8 P. M. she was in communication with the homeward-bound "Umbria" in the Mersey Channel. At 8:30 Holyhead was signaled, followed by Rosslere station at the southeast corner of Ireland until 3 A. M. on Sunday, August 31. Passengers and mails were embarked at Queenstown, and the ship sailed at 10:15 A. M. on Sunday, August 31. She was then in communication with Crookhaven from 11:40 A. M. until 3:15 P. M. At 1:35 A. M. on September 3 she came into communication with the homeward-bound "Lucania" and exchanged messages with her for some time. At 4:45 P. M. on September 5 she signaled Nantucket lightship, and continued in communication until 8:30 P. M. At 11:30 P. M. Sagaponack station replied to her call, and continued talking until 1:40 A. M. the next day, when she was abreast of Fire Island, distant about 60 miles, and the new station at Babylon, north of Fire Island, came into communication about the same time as Sagaponack ceased. She kept in touch with the latter until Sandy Hook lightship was passed at 3:18 A. M.

On the homeward passage the "Campania" left New York on September 13 and was in communication with the "Umbria," which was just arriving at that port between quarantine and dock. She then got in touch with the Babylon station at 7:40 P. M., and continued until 1:40 P. M. Then Sagaponack station followed. She next communicated with the inward-bound "Lucania" on September 16 at 11 P. M. and continued until 1:40 A. M. on the following day. On the 17th she conversed with the Atlantic Transport vessel "Minnehaha" for some hours. The Cunard homeward-bound "Saxonia" was signaled at 2:50 P. M. on the 18th, when she was 36 miles ahead of the "Campania," and the two steamers were in communication until the evening, when the "Saxonia" was 100 miles astern. Crookhaven was signaled on the 19th at 8:45 A. M. and conversation was maintained until 11:40 A. M. The "Campania" arrived at Queenstown at 12:50 A. M. on the same day.

From this log it will be seen that it is practically possible to cross the Atlantic, and to remain in communication with the land all the way across via various ships, which can act as retransmitting stations. If all the vessels plying between this country and Europe were similarly equipped with the Marconi apparatus, it would be possible for a man to remain *au courant* with home or the commercial world the whole of the five or six days' sea passage.

SUCCESSFUL TEST OF A TOWER ELEVATOR.

An experimental four-hundred foot drop of the Philadelphia City Hall tower elevator recently proved that the safety air cushion device installed will probably prevent any serious accident. Within the short distance of 84 feet the speed of the car was reduced from 2½ miles a minute to zero. In the car were placed eggs, delicate incandescent light bulbs and rats. When the car reached the bottom most of the eggs were found in good condition, the incandescent light bulbs were intact and the rats alive and well. The trip was made directly under the Penn statue, 372 feet 9 inches above the bottom of the shaft. The particular safety device used is the Ellithorpe safety air cushion.

SCIENCE NOTES.

In order to encourage the study of science among women, the Association for Promoting Scientific Research Among Women has offered two prizes of $1000 each for the best papers prepared by women. One is for the best work based on independent laboratory research in biological, chemical or physical science, and the other on any scientific study. The chairman of the prize committee is Miss Ellen H. Richards, of the Massachusetts Institute of Technology, Boston.

The United States Coast and Geodetic Survey has published a very handsome and serviceable map showing the lines of equal magnetic declination and of equal annual change in the United States for 1902. The lines of equal magnetic declination or isogonic lines are given for every degree and are based on a new observation up to July 1, 1902. The lines of equal annual change of the magnetic declination pass through all the lines where the annual change is of the same amount.

A woful cry is going up from the representatives of all the ologies, and one hears nothing but a doleful wail about shrinking incomes and curtailing of operations. Take the Palestine exploration fund, for example. Here the secretary laments a decrease of the society's income by nearly one-third within the past three or four years, and he attributes this in a great part to the war, the absence of so many of the most influential and wealthy officers and the corresponding anxiety of their families.

It is generally believed that the bite of sea serpents, or hydrophids, is not dangerous, but this is not so, and cases of death from this cause have been observed by Comtor in Japan, Fayrer in India, and Forné in New Caledonia. M. Kermorgant has published some new observations in the Annales d'Hygiene et de Medecine Coloniales. The geographical distribution of the sea serpents is very extensive, embracing a marine zone which is bounded on one side by the coasts of Asia and Africa and on the other by the west coast of Central America; Australia is included in this region. The species are numerous and they are all dangerous. These include the *Hydrophis nigra* and *H. nigrocyneta*, of the Indian Ocean and the seas of China; the *H. chloris*, of the Indian Ocean, also the *H. cyanocyneta*, as well as the *Pelamys bicolor* of the Australian coast. If the effects of their bite have not been more often pointed out it is because they are not mortal in a great number of cases. In many of the colonies of New Caledonia these serpents are found in abundance, and the opinion is so general that they are harmless that the snake charmers use them in their performances. In fact, they bite but rarely and with difficulty owing to the smallness of their mouth, and the dangerous effects are not frequent as they have only very small venom-glands and minute fangs. The head, which is small, is scarcely to be distinguished from the body, while the tail is flattened in the form of an oar. The length often exceeds three feet. A rat, when bitten by one of these serpents, dies in four or five minutes.

H. Rieder reports a continuation of the experiments begun by him in 1898 relative to bactericidal power of Röntgen rays. The bactericidal power of the Röntgen rays was tested against the cholera spirillum, the bacillus prodigiosus and the colon bacillus. The micro-organisms were inoculated into gelatine or agar and exposed to the action of the rays in Petri dishes, the covers being removed. After twenty to thirty minutes' continuous exposure to the rays many of the bacteria were killed, and multiplication ceased in nearly all. In every series of experiments, however, a few of the individual bacteria were not affected. Experiments have shown that the bactericidal power of the rays is not due to the fluorescent light, heat, ozone or electricity. So far as is known the culture media are not altered by the rays or made unsuitable for the growth of bacteria. Gelatine is never liquefied. It is not, however, to be assumed on the basis of the above experiments that the Röntgen rays possess any bactericidal action upon bacteria when present in the animal body. The evidence from animal experimentation is against such a supposition. As a rule, animals inoculated with pathogenic bacteria and exposed to the rays die sooner than similarly inoculated animals which are not thus exposed. It is not to be denied that in the human subject certain infectious diseases, particularly those of the skin, may be successfully treated by the Röntgen rays, but it does not seem probable, at the present time that such success is due to bactericidal action.