Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico..... $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876)..... 5.00 "
Scientific American Building Edition (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
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MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, AUGUST 19, 1899.

OUR SHIPBUILDERS AND THE PROPOSED NEW CRUISERS.

Among the more important lessons of the late Spanish war are the supreme value to a warship of a powerful battery, of high speed, and large coal supply. The United States navy needed no admonition with regard to its batteries, for its policy has ever been to mount upon the decks of its ships every gun that they could conveniently carry. With regard to speed and coal supply, however, there was room for improvement, and one of the first effects of the war was to produce a demand for a higher speed than 16 knots in the three battleships of the "Maine" class, whose construction had only recently been authorized.

The events of the war showed that it is scarcely possible to attach too much importance to the question of speed in warships. It was the good average sea-speed of the "Oregon" that enabled her to make her rapid run around Cape Horn and be in at the death of Cervera's squadron, and it was the fine condition of her engines and boilers that enabled her to overtake the "Cristobal Colon" and force her surrender. On the other hand, had the motive power of the Spanish fleet been in good condition and the boats capable of their proper speed of 18 or 19 knots instead of the 10 knots at which the majority made the run, it is possible that all of them, except the torpedo boat destroyers, would have run through the zone of our fire in time to escape without mortal injury, for it is a fact that the highest average speed of the pursuing ships during the chase was only about 13 knots, the "Indiana" indeed being capable of only about 7 knots an hour and the "Iowa" a few knots more.

In the days of the sailing frigate, to possess the "weather gage" of the enemy was to have the battle, other things being equal, half won; to-day, superior speed gives a similar advantage, for the faster ship can accept or decline an engagement, and when in action she can choose the fighting position which enables her to bring her battery to bear to the best advantage. So clearly are these advantages recognized, particularly with respect to cruisers, that naval designers are willing to sacrifice other elements of a ship's efficiency before they will cut down the speed. A glance at the tabular comparison, given elsewhere, of our new cruisers with those of other navies shows that while none of the foreign ships has a speed of less than 20 knots, one of them is credited with 22·4 knots and another, the latest design of them all, with 25 knots.

Our Naval Board of Construction, we greatly regret to see, has produced a design for the six new cruisers recently authorized, which is possessed of two exceedingly grave faults, as we have clearly shown on another page of this issue. Although these vessels are to carry a battery of normal strength, they are to be practically of the obsolete unprotected type, and they are to have a speed of only 16½ knots, which is from 3½ to 8½ knots less than that of the fully protected cruisers of the same size which are under construction or already completed for foreign navies.

We do not hesitate to say that these designs are the least attractive that have ever been produced by the department, and are altogether unworthy of a bureau which has turned out such efficient ships as the "New York" and the new "Maine." As compared with these ships, the proposed cruisers are a distinct retrogression, and in the interests of the country and for the reputation of the department, it is sincerely to be hoped that the ships, as designed, will never be built.

Fortunately, there is a loophole of escape in the fact that shipbuilders will be allowed to make proposals for the construction of the ships, either in accordance with the plans as so laid down, or in accordance with plans and specifications submitted by themselves; and there is a suggestion that the department is not very well satisfied with its own design in the fact that "preference will be given, other things being equal," to those bids "which guarantee the greatest speed, the greatest coal capacity, and the greatest amount of hull protection in the form of a protected deck."

Here then is a splendid opportunity for our private shipbuilding firms to show what advance they can make upon the best work of foreign designers in producing an up-to-date cruiser of 3,500 tons full load displacement on a maximum full-load draught of 16 feet 8 inches. We are fully satisfied that working under these conditions such firms as the Union Iron Works, Newport News and the Cramps will be able to produce a high-speed protected cruiser which will embody all the essential elements of the class and be at least the equal, if not the superior, of any of the fine ships enumerated in the comparison given elsewhere in this issue. In any case, whether the designs of the contractors are accepted or not, the department's designs as they now stand must never be built. The idea of the United States navy entering upon the construction of six unprotected cruisers of 16½ knots speed in this year of our Lord eighteen hundred and ninety-nine is simply preposterous and certainly does violence to its brilliant traditions.

ENGLISH AND AMERICAN LOCOMOTIVES.

The present importation of American locomotives for use on leading English railroads is certain to exercise a far-reaching influence on the locomotive-building industry of Great Britain. Decidedly the most interesting phase of the controversy which has been awakened by this significant event is the attitude of The Engineer, the leading English journal devoted to the interest of civil and mechanical engineering. Time was when this journal was wont to steadily ignore criticism of English engineering work and practice, particularly if it happened to come from this side of the water, and the publication of any remarkable work performed by American locomotives either in the way of hauling heavy loads, or the accomplishment of high speeds in passenger service, was sufficient to bring forth an indignant and clumsily facetious repudiation of these performances, and a cumbersome demonstration of their impossibility on general theoretical principles. Of late, however, The Engineer has shown that it has taken a broader outlook upon the situation, not merely as regards the locomotive industry, but the engineering trade in general. This is particularly noticeable in a recent editorial, which was provoked by letters from two correspondents of the The Engineer who happened to live at opposite corners of the earth, one of whom makes a series of sweeping condemnations of the English-built locomotive because of its utter unfitness to run over the uneven and curved tracks which are found in the colonies and newly developed countries, while the other attempts to make an entire rebuttal of the charges so laid down.

The Engineer fully indorses the criticisms of the average English-made engine in respect of its rigidity and unfitness for pioneer railroad work. "From various parts of the world," says our contemporary, "statements reach us to the effect that the comparatively roughly made American engine is a more satisfactory machine than its beautifully finished English or Scotch made brother. We see no reason why such statements should be made if they are not true. . . . We may say that we can call to mind one instance in which six-wheeled engines, with the rigid plate frames and comparatively long wheel base, were set to work against American engines of much rougher make, with four wheels coupled and a bogie (truck). The English engines burst the road, ran off it, and did such mischief that they were thrown on one side, and the American engines did all the work. We can call to mind another case, in which two beautifully made engines, built to special design for the 5 foot 3 inch gage, made such havoc with a very bad road that they had to be practically rebuilt, the wheel base shortened and the axle-boxes cut away to give side play, before they could be used. . . . We need scarcely say that it affords us no particular pleasure to write thus; but, on the other hand, we have the best interests of the locomotive builders of this country at heart, and we should wholly fail in our duty if we said pleasant things and maintained that the typical English locomotive must be the best for Australia, or South America, or China, or Africa, just because it is the best for the railways of the United Kingdom."

While it is rather late in the day for our contemporary to have made this discovery, it is certain that if the English builders do not wish to entirely lose their trade in the colonies and more recently settled countries, they will have to adopt the American type of locomotive, with its flexible wheel base and general handiness and accessibility to parts. The typical English and American locomotives are the outgrowth of the respective conditions under which the great railroad systems of each country were built up. At the very outset it was realized in America that it was not possible, nor, indeed, desirable, to build our railroads on the expensive lines adopted by the English engineers, of which the Great Western Railway, which cost a fabulous sum per mile to construct, is a notable example. In this particular case the line was made as nearly straight and level as means and money could accomplish; hills were tunneled, costly viaducts built and deep cuttings opened, in the effort to produce a line which would be ideal for its purpose. The rails were, for that early date, unusually heavy, and the roadbed of first-class construction. With this solid, smooth, and straight roadbed there was no necessity for giving much flexibility to the engines that ran upon it, and hence, in the early English locomotives, there was practically no provision for sideplay and easement in running around curves or surmounting vertical irregularities. English track has always continued to be of first-class construction, and although heavier curvature has been adopted in building some of the later roads, there is nothing in that country to compare with the mountain lines which exist in America and in many of the English colonies.

While it is true that the swinging truck has been adopted on many of the English roads, it still appears to be a fact that the typical English locomotive is lacking in the flexibility which is so excellent a feature of the American machine.

Here, in America, from the very first, our railroad builders and locomotive builders seem to have been governed by that broad principle of utility which has been one of the great if not the greatest secret of our success. Our engineers were able to see no reason why a locomotive should not climb a hill and go swinging round a curve, and hence in laying out our lines they have chosen to go around a hill rather than cut through it, or if that could not be done, the engineer had carried his line over the hill, skillfully laying his lines to suit the topography of the land. When his sinuous and undulating roadbed had been graded, and the light rails and ties necessitated by a not overloaded purse had been laid, the mechanical engineer stepped in and produced a locomotive and cars that were perfectly adapted to traveling upon a track that was neither level nor straight, nor smooth in its running. Swiveling and swinging trucks enabled our rolling stock to negotiate the curves, while equalizing levers served to smooth the vertical irregularities of the track. It was easier, cheaper, and obviously the more common sense policy to accommodate the locomotive to the track rather than the track to the locomotive.

THE EDUCATION OF GERMAN CONSULS.

All attentive readers of current newspaper discussion in Germany have noticed the earnestness and intelligence with which the leading journals have seconded the plans which are now understood to be under consideration by the Imperial government for the reorganization of its consular service. The reforms have been dictated by the new and enlarged functions which are imposed upon the foreign service of Germany by the expansion of her foreign trade and by the valiant fight which this country is preparing to make for a permanent place in all foreign markets. While Germany was an agricultural state without colonies or any large export trade, her consular service organized on the old lines served satisfactorily for the protection of German subjects residing abroad, and such other incidental duties as was required of it. Under that system consuls who were educated as lawyers and diplomats underwent a period of training in the Foreign Office and became typical Prussian officials with a good command of languages, a fair knowledge of diplomacy, national law, and the history of treaties, but no practical acquaintance whatever with industrial processes, commercial values, or mercantile usages. These German officials, as it is now stated by the German press, even evinced a certain contempt for trade and those engaged in it and rejected requests for commercial aid and information as forming no part of their official duties. The last ten years have created a demand for a radical reform of the whole consular system, stimulated, it is broadly hinted, by the recognized efficiency of American and other consuls in obtaining valuable information and promoting export trade.

There are two propositions now under consideration. First, to retain practically the present consular organization and to strengthen the commercial efficiency of the consulates by assigning to them commercial attaches, a plan which has been found to work well in the German consulates in the United States. The second proposition is to abolish permanent consuls and appoint in their stead experienced and capable merchants, who will give to the consular office a definite commercial character, while its legal and purely official duties are performed by young attachés trained in the usual manner. No matter which of the plans is adopted, there is a general demand that the consular service shall remain, as now, a life career. In this they are undoubtedly correct provided that the proper men are selected in the first place, but the whole efficiency of the service rests upon this point. They also demand that the basis of its personnel shall be a corps of consular pupils selected by competitive examination for their intelligence, energy, and efficiency as students of modern languages, commercial law, and technology, trained by special studies for their career and then sent out to foreign parts to begin their life work as apprentices. For the purpose of this service the world will be divided into four or five districts, for each of which the consular pupil will be specially educated in all that relates to language, history, and commercial conditions. The consular pupil once prepared will be assigned to one of these districts, where he will remain during his career, thus saving the reckless waste of valuable knowledge and experience which occurs

where a competent consular officer familiar with the languages and commercial uses of one foreign country is suddenly transferred to another, an evil under which Germany has long suffered.

The new German system will be a step farther on than any which has been taken by any other government, and the immense advantages of such a system are patent to all and the results will be immediate and lasting. The bureaucratic system of consular administration has been carried to its extreme limit by Germany, and now the government appears to have learned that the higher and more valuable work of the consuls requires special attainments and capabilities, not only in different countries, but even in different districts of the same country. Germany has set herself the task of remaining what she has become—one of the foremost manufacturing and exporting nations in the world. What she lacks in native materials and resources she will make up for by superior education, organization, energy and mastery of details, and in the furtherance of this policy every energy of the government and people, from the Emperor to the factory operative, will be enlisted and exerted with a persistent, unswerving patriotic purpose. The consular service is to be made, like her great subsidized steamship lines, the effective agent of the government for pushing the trade of German merchants into every corner of the civilized world; and our very efficient Consul-General at Berlin, the Hon. Frank H. Mason, considers that it will be organized, trained and equipped for this work with the same scientific thoroughness that characterizes the military, industrial and educational systems of Germany. As has already happened in law, medicine, engineering—in nearly every field of applied science—the day of the all-round man with a smattering of many things, but a thorough knowledge of nothing, is definitely past, and the success of the future will be won by the nations as well as by individuals who can bring the highest attainments, the largest experience, and the most consummate proficiency to bear where competition is keenest and the richest prizes are to be won.

PAWNBROKING.

A large part of a recent Bulletin of the Department of Labor is given to a report on pawnbroking in Europe and in the United States, by Dr. W. R. Patterson, of Iowa University. The facts obtained by Dr. Patterson are most interesting, although the precise origin of the pawnbroking business is still shrouded in obscurity. He is disposed to conclude that the banker of to-day is a descendant of the old pawnbroker rather than that the pawnbroker of to-day has derived his business from the ancient banker. In Holland the pawnbroking trade can be traced to 1534, when a pawn bank was set up by a Flemish priest at Ypres. Holland adopted a system in 1614, and France appears to have done so in the same year. It was not until 1591 that a pawn bank was established in Germany, although it is believed that an experiment was made as far back as 1198.

In the Continental countries generally, the government has undertaken the pawnbroking business for the benefit of the poor. This was doubtless in pursuance of the general governmental policy of suppressing the Jews, who had been for so many centuries the moneylenders of Europe and against whom charges of merciless usury and distraint had always been outstanding. This seems to account in some degree for the religious tinge given to the pawnbroking business wherever a Continental government has gone into it. The idea of saving the poor from oppressive interest-rates has caused some ventures to take the form of a gratuitous loan system; but as the theory has grown that the pawnbroking industry had a business side quite as important as its charitable side, and that its successful conduct and permanent usefulness depend upon its being on a self-supporting basis, the laws affecting it have been constantly liberalized to keep pace with the progress of the times. In Belgium, the interest varies from 4 to 16 per cent a year; in Holland, from 5 to 18 per cent; in Germany, the maximum rate is 2 per cent a month for sums of $7.50 or less and 1 per cent on all larger sums. In France the maximum rate was reduced to 6 per cent in 1887, with a fixed charge of one per cent on the sum loaned.

England, like the United States, has steered clear of governmental participation in the pawnbroking business. King Richard I. fixed the rate at 10 per cent in 1199; the Jewish brokers continued to charge from 45 to 65 per cent, so that they were expelled in 1290. The Lombards, who succeeded them, do not appear to have been much better and were driven out in 1530. Several sovereigns, including James I., Charles II., William III., and George I., tried various plans for regulating the trade. Laws have been finally framed which surround the trade with such restraints that the poor are protected.

In the United States the general tendency has been to leave pawnbroking as free as any other business, so that it does not become in any way an abettor of crime. Pawnbroking flourishes only in an urban district and in general in a rather congested locality. License fees and bonds are general, and the interest charges vary greatly in the different States. In Maine pawnbrokers can charge only 6 per cent a year on loans of $25 or more; while in one county of Virginia the interest may be as high as 10 per cent a month. In some of the States the sale of unredeemed pledges is required to be by public auction, and the laws which protect both the pawnbroker and his clients are legion. In Boston there is the greatest measure of police control. Pawnshops are in charge of some thirty detectives, five or six of them visiting each broker daily, and at least two-thirds of the robbers arrested in Boston were tracked by the pawnshops. There are laws in some States governing the articles which may be accepted in pawn, but usually the city ordinances adjust this matter. As a general thing it seems to be assumed that the pawnbrokers are quite an honest lot of men; even their patrons show a great deal of confidence in them, and where the population is settled, as in Philadelphia, it is not uncommon for regular pledgers to leave articles without taking any receipt, and in Providence the tickets are often left with the broker for safe keeping. Although the government does not go into pawnbroking in this country and every reasonable encouragement is given to pawnbrokers, there are a few privately capitalized corporations and societies having a benevolent aim in view, and the maintenance of them unquestionably acts as a check upon the rapacity of some of the brokers who are in the business for gain alone.

SAVING IN ISOLATED PLANTS.

BY ALTAN D. ADAMS.

Isolated electric plants are those devoted to the lighting of individual buildings, manufacturing plants, and institutions, as opposed to general public service. The electric machinery for isolated plants is usually located on the premises to be lighted, and driven from some previously existing source of power, or by an engine or water-wheel especially installed for the purpose. The cost of power per horse power hour delivered to the dynamo will vary with a variety of circumstances, but may be taken to range between 0·8 cent and 3·33 cents per horse-power hour in nearly all cases.

Taking a suitable cost of power for any given case, the cost of electric light may be found when the charges for interest on first cost of electric equipment, its depreciation, the amount for lamp renewals and attendance are known. Basing estimates on the use of fifty-watt, sixteen candle power incandescent lamps, the following named prices are very nearly correct: First-class makes of dynamos may be had in medium and large sizes at about twenty dollars per kilowatt capacity, which amounts to one dollar per lamp capacity, since 1000÷50=20, which number of fifty-watt lamps can be operated per kilowatt of electric energy supplied. The cost of electric wiring and fittings is not quite so uniform as that of dynamos, but varies with the quality and style of fittings and the kind of building in which they are used.

In factory, warehouse, and other buildings where the electric wires may be erected in plain sight on porcelain supports, the average cost of all electric wires and fittings from the dynamos to but not including the lamps may be fairly taken at $2 per lamp. In office buildings and other places where the electric wires are drawn into iron or other conduits, the average cost of all electric wirings and fittings will be about $4 per lamp. Neither of above estimates is intended to cover the cost of the expensive brass fixtures sometimes used for electric lamps as well as gas, but the figures for open work include flexible electric cords for drop lamps, and the price for conduit work includes plain iron pipe fixtures for the support of lamps.

If ornamental fixtures are desired for the support of lamps, they may be had at a variety of prices, but their cost can hardly be included in the necessary cost of an electric plant. The engineer who has charge of the power plant usually gives the necessary attention to the electric equipment without additional compensation, but an average allowance of 0·01 cent per lamp hour may be made to cover extra services in all cases.

Depreciation and repairs, including the cost of oil and waste, may be safely taken at 10 per cent per year on the cost of dynamos, and an annual interest charge of 5 per cent should be made on the same cost. On cost of wiring, the repairs and depreciation will be covered by 5 per cent, and the interest by another 5 per cent per annum, making a total of 10 per cent. Incandescent lamps at the market price of twenty cents each, and burning four hundred hours on the average, which is hardly more than one-half the time they are frequently kept in use, cost 20 ÷ 400 = 0·05 cent per lamp hour. Taking as the average cost of one horse power per hour the mean of the maximum and minimum rates of 0·8 cent and 3 33 cents, above stated, the average rate becomes (0·8 + 3·33) ÷ 2 = 2·06 cents per horse power hour. Now, as one horse power is equivalent to 746 watts, it will operate 746 ÷ 50 = 14·92 fifty-watt lamps, so that the cost of power will be 2·06 ÷ 14·92 = 0·138 cent per lamp hour. Since, however, the average dynamo of medium size will only deliver as electric energy about nine-tenths of the mechanical power supplied to it, the actual cost of power per lamp hour will be 0·138 ÷ 0·9 = 0·153 cent.

The interest, depreciation, and repair charge on dynamos being 0·10 + 0·05 = 0·15, or 15 per cent per annum, and the first cost $1 per lamp capacity, these charges amount to 100 × 0·15 = 15 cents per year per lamp capacity; and on the basis of three thousand hours per year, or ten hours per day for three hundred days, the expense for interest, depreciation, and repairs is 15 ÷ 3000 = 0·005 cent per lamp hour.

On the exposed class of wiring at $2 per lamp, interest, depreciation, and repairs, at 10 per cent, amount to 200 × 0·1 = 20 cents per lamp capacity per year, or 20 ÷ 300 = 0·006 cent per lamp hour. In case of the wiring in conduits at $4 per lamp, the yearly charge is 400 × 0·1 = 40 cents per lamp capacity per year, or 40 ÷ 3000 = 0·012 cent per lamp hour. The total cost per lamp hour is the sum of above items, as follows:

Cost of power	0·153 cent per lamp hour.
Cost of lamp renewals	0·050 " " " "
Cost of attendance	0·010 " " " "
Interest, depreciation and repairs on dynamo	0·005 " " " "
Interest, depreciation and repairs on wiring	0·012 " " " "
Total cost to operate fifty-watt lamps	0·230 " " " "

This estimate for the cost of light in isolated electric plants is based on the most expensive style of wiring, and an ample allowance in other directions, so that it is probably higher than the actual cost in many cases, where cheaper power, less lamp renewals, no extra attendance charge, and less expensive wiring and fittings are had. It should be noted that nearly all the above charges occur only in operation of the plant, so that when not in operation the only charge is for interest and a small part of the depreciation named. To compare the cost per lamp hour of electric light from a public supply and from an isolated plant, the interest and depreciation, cost of wiring and fixtures may be omitted from both charges, as they would be the same for each, and the cost of lamps for public supply may be taken as included in the common charge of fifteen cents per thousand watt hour, as this is a usual practice, the supply station furnishing the lamps

At fifteen cents per thousand watt hour, the cost to operate a fifty-watt lamp is found from (15 × 50) ÷ 1,000 = 0·75 cent per lamp hour, while deducting the item for wiring in cost above found gives 0·230 — 0·012 = 0·218 cent per lamp hour as the cost with isolated plant. Dividing the cost per lamp hour with isolated plant by the cost from public supply gives 0·218 ÷ 0·75 = 0·29 or 29 per cent, showing the cost of light from the isolated plant to be only 29 per cent of the cost from public supply. Taking gas at $1 per thousand cubic feet, or one mill per foot, the cost for a 5 foot burner, corresponding to a sixteen-candle lamp, is 0·50 cent per hour, or 0·5 ÷ 0·23 = 2·17 times the cost of a sixteen-candle fifty-watt incandescent lamp in an isolated plant.

With the cost of electric light in isolated plants at less than one-third that from public supply, and not one-half that of gas, it is no wonder that the increase in the number of these plants has been one of the most marked features of electrical development during the past ten years; but the wonder is that in so many large buildings and institutions sums are still paid for lighting by gas or electric power that often in one year, and in very many cases two years, would cover the complete cost of a complete isolated plant. To prove this last fact, it is only necessary to remember that the cost of first-class electric machinery and wiring is only about $5 per lamp capacity, and then compare this figure with the yearly charge for gas or electricity from the public supply.

Assuming light to be required three thousand hours per year, the charge for electric power per lamp year at three-fourths cent per lamp hour is 0·75 × 3,000 = 2,250 cents, or twenty-two and one-half dollars; while with gas at one-half cent per lamp hour, the cost per lamp year is 0·5 × 3,000 = 1,500 cents, or fifteen dollars. If lamps burn so little as one thousand hours per year, or three and one-third hours each working day, the yearly outlay for gas is enough, and for electric power one and one-half the amount required for a complete electric equipment. This wide difference in cost between light from isolated plants and public supply is inherent in the circumstances of the two methods and cannot be overcome.

The cost of power to the public supply company is somewhat less, usually, than to an isolated plant, but these companies' fixed charges are enormously greater, and a large part of their capital must be invested in electric circuits between the central station and the consumer, on which there is a heavy charge for interest, depreciation, and repairs per lamp capacity. Isolated plants seem certain to prove in the future, as in the past, one of the most important fields for the application of electrical equipments.

THE shortage of pig iron has been causing some inconvenience, particularly in the West, where some founders have had to shut down, owing to the lack of raw material. It is not thought that the famine will last very long.