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AVERAGE LIFE OF AN IRON OR STEEL BRIDGE.

A correspondent writes from one of the smaller New England towns to say that a proposed improvement in the shape of a $50,000 steel bridge is meeting with opposition from many of the citizens on the ground that the average life of such a structure is limited to twenty-five years, and, therefore, the benefits derived would not justify the expenditure. He wishes to know whether the stated term of life is correct. Without pausing to comment on the admirable and all too rare regard for the interests of posterity shown by the obstructionists in question, we hasten to assure our correspondent that their estimate of the length of life of steel bridges is altogether too limited. The permanence of a steel bridge will depend upon three conditions: the design, the loading, and the maintenance. If it be properly designed for a specified maximum loading; if oversight be exercised that this loading is never exceeded; and if the steel work is thoroughly accessible and painted at regular intervals, there is no reason why a bridge should not last for centuries. As a matter of fact, however, these conditions are too often ignored or imperfectly fulfilled. In the first place, although bridge designing should always be intrusted to a specialist, even if the structure is to cost no more than the sum named above, many of the county bridges and those constructed in the smaller towns are built from the designs (so-called) of the local surveyor, who may have the vaguest ideas as to the strains to which the various parts are to be subjected and the best way to proportion the different members and connect them into a finished structure. The construction also should always be carried out by a recognized bridge firm, for the local blacksmith or machinist's shop is usually no more fitted for building good bridges than it is for building lathes and locomotives. It is questionable whether amateur bridge building can produce a structure with a useful life of twenty-five years.

To secure the best results the county officers, Board of Aldermen, or whoever it is that has the matter in hand, should first determine exactly what uses the bridge is to be put to and the greatest possible loading to which it will ever be subjected. This information, together with the location and other data, should then be published for the benefit of the competing bridge companies, who should be given a free hand as to the style of structure best adapted to the case. In this way a better bridge, and a cheaper, will be secured, even in the case of insignificant structures, whose construction it might be supposed the bridge companies would not be at the trouble to undertake. When such a bridge is completed, the question of its life will be one of care and maintenance. If every inch of the steel work receives a periodical coat of the best non-corrosive paint, and care is taken that the bridge is not strained beyond the limit agreed upon when it was designed, it will probably outlast its usefulness. The popular belief that a subtile process of crystallization is slowly weakening the metal of all the bridges is a fiction, pure and simple. The metal can only lose its life when it is strained beyond its elastic limit, and so long as the designed loading is not exceeded, this contingency can never happen.

AUTOMOBILE MOTORS.

The motor car has now been so thoroughly tested under different conditions of work that the public is able to judge for itself of the comparative value of the different forms of competing motors which are in the field for recognition. The requirements of a practical automobile are so numerous and differ so widely, according to the service to which it is to be put, that it is at present impossible to pick out any particular type of motor and say that it is the best for every type of work. Not only does the service differ, but there is now, and will be yet more markedly in the future, a wide difference in the requirements of the user. The present indications are that certain types of motors will become identified with particular forms of service.

To-day the motors which are most in evidence and give the best promise of permanence are the electric, oil spirit, and steam motors, and those which are driven by compressed air. There seems to be a general impression that for passenger transportation in and around our cities the electric automobile is the best; although for private use its high cost is likely to restrict its use for some time to the wealthy. It has the great advantages of being silent, free from odor, simple in construction and gearing, capable of ready control, and having a considerable range of speed. Its objectionable features are its great first cost, the limited distance which it can run without recharging, and the necessity of operating it within easy reach of a charging station. At present it holds the record for speed. In a recent trial in France an electric automobile covered a distance of two kilometers at the speed of 65·6 miles per hour.

Rivaling the electric motor is the oil or vapor driven motor. As compared with the electrical automobile the first cost is less and the running expenses are very much lighter. The weight is moderate, and there is the advantage that a much longer distance can be covered for one charging. While the speed for short distances has never on trial equaled that of the electric motor, in long distance runs it has naturally out-distanced its rival. Thus, in the motor car race from Bordeaux to Paris of last May, the distance of 351 miles was covered at an average speed of 30 miles an hour; and in another race over the Orleans-Vierzu road, a distance of 60·2 miles was covered at an average rate of 35 miles an hour. In both of these competitions the winning machine was driven by an oil motor. The chief objections to the oil or vapor type of automobile are the vibration and the odor. The vibration, due to the explosions in the cylinders, is a serious objection and it is engaging the earnest attention of all makers of this type. It ought to be possible to moderate, if not entirely control, the noise of the exhaust by some muffler, such as has been used to good effect on stationary engines.

The steam motor car will probably show its best results in the heavier classes of work, for which it is admirably adapted. As compared with the oil motor it is necessarily, on account of the large amount of cooling water that has to be carried, the boiler weights, etc., heavier in proportion to its power. Steam motor cycles are being used for pacing some of the fastest riders in the United States, but their performance would indicate that as at present constructed they are not thoroughly reliable.

There remains the automobile driven by compressed air, of which we have heard so much recently in New York. Compressed air undoubtedly possesses some very attractive features, such as its cleanliness, the absence of noise, odor, and dirt of any kind. Where it is used in connection with a large central power station, we know of no reason why it should not hold its own, in the matter of cost and convenience, with electricity, and in respect of large horse power as applied to individual trucks for use in heavy hauling we think it ought to more than hold its own with the steam motor.

At the present time France is easily maintaining the premier position which is hers by right as having first seriously started the automobile industry. Germany and England were later in the field, and we have been the last country to take up this new industry in earnest. Judging from the large amount of capital which is being interested, we may look for very rapid developments in the next two years in this country, and we think it will not be long before our American machines equal and surpass those of French manufacture in the important features of appearance, running qualities, and cost.

AN AMERICAN RAILWAY IN CHINA.

If existing arrangements are carried out, the proposed American railway line in China will prove an important link in a system connecting all of China with the outside world. Railway lines now actually built or under construction as well as those which are only projected form a great circle, sweeping across Europe and Siberia to the Pacific, thence southwardly to China, skirting the Pacific coast, thence eastwardly to Burma and India to the Indian Ocean and the Arabian Sea, and pushing thence through Persia, will complete the grand circle of all the continental mass of Europe and Asia. The Canton-Hankow line which the American syndicate has agreed to construct and for which it is expected that the Chinese government will confirm the concession stretches northward from Canton to Hankow, where a Belgian syndicate has a concession for the construction of a road northward to connect with the existing line now reaching Pekin, the capital of China. Should the Belgian syndicate omit to take advantage of its concession, the American syndicate has an option for the right to construct the Hankow-Pekin line also. From Pekin a road will connect with the Trans-Siberian Railway, which is now under construction to Port Arthur, thus making the American line an important link in the great system which will stretch from St. Petersburg by way of Siberia and Port Arthur through China to Canton on the coast, immediately opposite the Philippine Islands, which are only 600 miles away.

From Canton westward to Southern China, British interests have projected railway lines to the southwestern extremity of China, where they will connect with the present railway system of Burma, and in turn with that of India, which already has more than 20,000 miles of railway in operation. It is only a few hundred miles from the western terminus of the Indian railway lines to the point in Persia toward which Russian engineers are now pushing surveys for railway lines. This is a gap which can be easily filled whenever British interests deem it desirable to have direct railway intercourse between India and the railway systems of Southeastern Europe. From this it will be seen that the proposed railway line in China will form an important link in what promises to be, in the comparatively near future, a great railway system, bringing the Orient into direct railway communication with all Europe both by the northerly and the southerly route.

A COMMERCIAL NEED.

Three of our consuls stationed in South America have thus far this year called the attention of the State Department to the advantage Europe holds over the United States in the commerce of all that region. Perhaps not unnaturally each one suggests the stereotyped and threadbare idea or remedy of the establishment of direct lines of transport between the leading ports of the United States and of South America. It has so often been pointed out that such subsidized lines can only carry goods, but not sell them, and that goods so transported must be in every respect as salable as those with which they come in competition, that it is a rather serious commentary on the brief duration of the average consular incumbency, and consequent inexperience, that such reports should continue to appear with remarkable regularity.

Any observant commercial traveler in Latin America must be impressed with the presence of two prime factors that mainly account for our trade inferiority in those regions. The first of these is the greater intimacy with the life, social and political, of the people from whom they are seeking trade privileges that is maintained by European representatives in those regions. Your German manufacturer's agent, for example, will be found, quite seven times in ten, to have married into a native family and to have thoroughly cultivated those social side issues which are so effective in increasing influence. On the other hand, the American representative too often is "right from New York," making a flying trip from port to port, spending less time along the entire mighty stretch of the Atlantic seaboard, from Maracaibo to Buenos Ayres, than it should take him to become intimately acquainted with the trade needs and peculiarities of one of the many ports entered. Hence, it very naturally follows that in too many cases the American manufacturers never get a fair idea of the intense Latin conservatism of those markets, and of the fact that it is not "Yankee notions" that are wanted, but South American notions made with Yankee thoroughness and at prices made possible by our ingenuity.

The other factor in the problem is one of credits. Europe gives six, nine and even twelve months; America, the complaint is often made, seeks to collect the bill almost before the goods have been unpacked.

Both these prime difficulties in the way of our taking our natural position as first in the South American trade are to be overcome in one way. Let the manufacturer or the commission house intending to conquer a given trade territory appoint as representative a man resident in that territory, preferably one who is of the people or, at least, married into and socially identified with them. Such a man will be useful in proportion as he reverses the present American procedure; i. e., he will take flying trips to America to personally acquaint his employers with what he knows, rather than, as now, take them from America, to return to his chiefs to tell them what he guesses.

FIRING HIGH EXPLOSIVES.

The test which was recently carried out at Sandy Hook of the firing qualities of a new type of high-explosive shell which is designed to be used in service guns, using smokeless or other powder, is by far the most successful as yet attempted. The Isham shell, which is named after the inventor, is divided in its explosive chamber into many smaller compartments by transverse diaphragms. The designer's object is to so far reduce the shock of firing that the most sensitive of high explosives may safely be used as a bursting charge. The shell which was used in the test was of 12 inches caliber and was both longer and heavier than the 12-inch projectiles used in the new army 12-inch rifle, its exact weight being 1,036 pounds. The Isham shell was loaded with 113 pounds of explosive gelatine, one of the most powerful of known high explosives; a firing charge of 450 pounds of brown powder, which is the regular service charge of the gun, was used. The gun was fired with a slight elevation in order to bring the point of contact with the water well

within the range of vision. On firing, the shell left the gun without exploding and struck the water at a distance of about two miles from the shore, where, after richocheting twice without any explosion, it sank. The result was extremely satisfactory, showing that one of the most powerful of modern high explosives may be used in a modern rifle of the ordinary service type.

The next test was carried out with a new explosive known as thorite, the invention of Dr. Tuttle, of Tacoma, Washington. An ordinary 8-inch service shell, charged with 13 pounds of thorite, was fired out to sea with a charge of brown powder, and failed to explode. In another test an armor-piercing shell, loaded with thorite, was fired at a 4½-inch steel armor plate, and passed through without bursting. The significance of these experiments can hardly be overestimated. All that is now needed to allow the explosives to exert their full theoretical destructive effect is a projectile which will be burst into fragments of a proper size for penetrating and wrecking the interior structure of a vessel. Hitherto, the disadvantage of high explosives when used in projectiles has been their tendency to burst the shell into fragments too small to do effective work within the vessel.

BRITISH PATENTS IN 1898.

The report of the Comptroller-General of Patents for the year 1898 has been issued. For the first time since the 1884 Act came into force there has been a falling off in the number of applications for patents. In 1898 they numbered 27,659, while in the preceding year there were 30,952 applications, showing a decrease of 3,293 or more than 10 per cent. The comptroller is of the opinion that the rapid growth in the number of applications which took place in 1896-97 was to be attributed to the activity in the cycle industry. Still, out of 6,000 applications made in 1897 in connection with cycles, only 2,300 were completed, much less than the average. In the total number of applications, naturally the major part came from England and Wales, 17,389 coming from the two countries. There were only 1,395 applications from Scotland and 502 from Ireland. The three foreign countries from which the largest number of applications came were the United States with 2,629, Germany with 2,599, and France with 1,133. This shows that American inventors fully appreciate the great advantages of a British patent. There were only eight other countries from which as many as a hundred applications came. There has been an increase among certain chemical classes, notably those which are connected with the acetylene industry.

Since the passing of the "Workmen's Compensation Act," the number of applications relating to guards for the prevention of accidents with machinery has been very largely increased. A single death or injury will often make considerable difference in the number of applications. For instance, after a railway accident caused by a luggage truck falling on to the line in front of an express train, there was a great increase in inventions for railway platform luggage trucks. As showing the relations between passing events and the course of invention, it might be mentioned that the publication in a London morning paper of a letter relating to the waste of horse-feed in London was followed within five weeks by no less than 34 applications for patents for nose-bags for horses, while the average number up to this time had been only 12 annually. This is an excellent example of the advantages which accrue to the inventor by the publicity which is given to legitimate wants. There is little doubt that many of our important inventions have been suggested by chance statements which have appeared in various papers as to the actual need for machines or processes.

LIQUID AIR IN MEDICINE AND SURGERY.

The subject of liquid air in its application in medicine and surgery has been treated in a dispassionate manner by Dr. A. Campbell White in The Medical Record. The general properties of liquid air have already been described in the columns of the SCIENTIFIC AMERICAN at considerable length, so that it is not necessary to dwell upon this phase of the subject.

In applying liquid to the tissues of the body, Dr. White has used it in the form of a spray and by means of a swab dipped into the fluid. If a spray of liquid air is applied to the skin, the part at once becomes anæmic and perfectly colorless. If the application is made only for a few seconds, the color as quickly returns and the skin is congested for some minutes thereafter. Within much less than a minute's time, by means of a spray, the part is frozen as hard as ice, but strange to say, in a few minutes circulation returns without any injury to the tissue, provided the part is not in the end of some extremity. There is no pain in the application excepting at the very beginning, but there is a slight burning or tingling. It also completely anæsthetizes the part to which it is applied without freezing it solid. Dr. White has tried liquid air as a local anæsthetic in a number of cases with invariable success. It has one important advantage; that is the absence of hemorrhages during the operation, enabling the operator to apply the dressing before any hemorrhage sets in, the dressing then being sufficient to stop any oozing. Dr. White has found the use of liquid air beneficial in the local treatment of ulcers, etc. He states that an abscess, boil or carbuncle in the early stages is aborted absolutely with one thorough treatment. If it is more advanced several applications at intervals of twenty-four hours are necessary. Liquid air has also been used with advantage in cases of sciatica, neuralgia, etc.

An interesting experiment was tried in a case of ivy poisoning, involving the entire left forearm and hand. A band around the forearm about three inches wide was slightly frozen by the spray, and then the usual treatment was applied to the entire poisoned area, including the part which had been treated with the liquid air. At the next dressing the part which had been treated with the air was very distinct, and this portion was greatly improved, the inflammatory process having subsided. A number of other diseases have also been treated with liquid air with marked success. Where no loss of tissue is desirable, liquid air should be applied by the spray and not by the swab. Dr. White takes issue with Mr. Hampson, whose article appeared in the SUPPLEMENT, No. 1226, entitled "Liquid Air." Dr. White is undoubtedly correct in advising the greatest possible care in using the new substance which science has placed at the disposal of the surgeon. Even such cooling agents as the ether-spray should be used with great caution, and liquid air should be applied only by those who have had some experience in its use.

In conclusion, Dr. White considers that we have reason to hope that we have in liquid air a therapeutic agent which will remove many otherwise obstinate superficial lesions of the body and cure some lesions which have hitherto resisted all treatment at our disposal, including the knife. He is of the opinion that in the use of liquid air in medicine, that is to say, in pulmonary diseases, in the reduction of fever, etc., a large field is open which presents many obstacles at the very start, and possibly holds out much hope in the future.

ACTIVITY OF AMERICAN CONSULS.

Only a few years ago it was a common experience to hear a good deal of fun poked at our consular service. This was due, no doubt, to the lax system of political appointments which formerly prevailed. A great change, however, has taken place in regard to our foreign service, and there is no doubt that recent administrations, especially the present one, have done much toward bettering the service and raising the standard of our representatives abroad. The political hack who is out of a job will no longer do, and the modern requirements of the office demand that our consular representatives should be men of character; the obtaining of information concerning trade and commercial conditions and the preparation of reports required by the government renders the office no longer a sinecure. That the work that is being accomplished by our consuls is beginning to be appreciated by our people is evinced by the interest that is taken in their Reports* by the public, and especially by the commercial classes. That this work is regarded with some misgivings by foreigners is shown by the rather suspicious attitude that was exhibited toward our consuls in some parts of Germany during the past year. A most interesting article appeared in a recent issue of London Engineering, and we take pleasure in publishing it entire, under the title there given it:

"The great industrial and commercial activity which at present prevails in the United States is due to many causes, some of which we have noted from time to time. No doubt the immediate cause was the war with Spain, which called into action so many of the forces which were lying latent, but the general economic and industrial conditions were favorable. A new spirit seemed to seize the Americans. The Monroe doctrine was forgotten, and they determined to become a world power. That spirit has entered their consuls stationed in the various countries of the world, and they have become active agents for pushing American industry and commerce. This is clearly shown by a document which was recently published by the State Department at Washington. To a superficial observer, it does not appear to be a publication of much importance, as it only professes to be an index to the consular reports; but when it is closely examined and taken in conjunction with the instructions to United States Consuls issued by the State Department in August, 1897, it throws some interesting light on the new activity of American Consuls, and on the efforts which the State Department is making through the consular service to enhance the position of the United States as a country exporting manufactured goods. As we some time ago explained, the State Department has now a very complete system for the publication of consular reports. From the beginning of 1898 they have been issued daily, instead of monthly as was formerly the case. The information is thus always fresh. The consuls were instructed to be prompt in furnishing their reports, and their notice was directed to a wide range of subjects on which information was required. They were, in short, constituted advertising and information collecting agents for the United States in all parts of the world. Their reports took the shape of a daily bulletin, which reviewed the condition of the world's trade, and gave information which was intended to help the United States to obtain as large a share of it as possible. This bulletin is sent to all the newspapers for publication, and to all the Chambers of Commerce for the use of their members, and otherwise is made as public as possible. In fact, it can be obtained free of all cost by any manufacturer or exporter who cares to take the trouble to get the Congressman from his electoral district to enter his name on the State Department list. The index which was recently published covers the first year of the new series, and is contained in a book of 78 pages, and includes in round numbers 4,600 entries. This, however, only means about 1,550 reports, for each report is thrice entered: under the name of the consul forwarding it, under the subject of the report, and under the country from which it comes.

A study of a few of the reports written by American Consuls shows that they have a most intense belief in their own country and in everything which comes from it. They are most optimistic in their views regarding the future of American trade in all parts of the world, and have little hesitation in expressing the opinion that American goods have only to be known in order that they may obtain a pre-eminent position in the district they represent. It must be admitted that they display wonderful alertness in pointing out any likely opening. No important contract is open without its being made known to American manufacturers; and if a strike takes place, those who are engaged in the industry concerned are immediately notified, and advantage is taken to push their goods, a fact which should be carefully kept in mind both by employers and workers when they are inclined to quarrel about wages or conditions. Many of the American Consuls are men who have had experience on newspapers, and they have often obtained their posts as rewards for party services. These men, as a rule, are trained observers and are able to present their case in the most favorable light; and it is quite evident that their newspaper experience has been of use to them, for both the matter and the arrangement of their reports are superior to the average of those published by the British Foreign Office. Although a great improvement has taken place in these latter in recent years, still many are evidently the work of men who have no practical experience in the department on which they are writing, or in making reports which are likely to be useful to manufacturers or merchants. The new duties which have been placed on American Consuls are rapidly revolutionizing the service. It is no longer the refuge of the partisan who has been able to influence an election; the public scrutiny which is now given to their work demands a high standard of efficiency, which is only possible by men who have the requisite knowledge and experience."

* See weekly issues of the SCIENTIFIC AMERICAN SUPPLEMENT.

STEEL DREDGES FOR NEW YORK HARBOR.

The Maryland Steel Company has just closed a contract with the contractor who has undertaken to dredge out the east channel of New York Harbor for two great ocean-going dredges somewhat similar to the ones used on the Mersey in England. They will be built throughout of steel and will cost about $450,000 each. They will take up the mud, clay and gravel on the bottom of the bay by a suction pipe and this material will be deposited in its own hold instead of on a barge and when full will steam out to sea and dump it. The dredges will be 320 feet long, 48 feet beam and the depth of the hold will be 26 feet. The twin screws will be driven by two triple-expansion, four-cylinder engines. The hydraulic pumping and suction apparatus will be operated by independent tandem compound steam engines. The dredges can make 12 miles per hour when loaded and they move at the rate of 3 miles per hour while gathering up material. The hoppers will hold 3,500 tons. When once started they will stay out night and day, ample accommodations being provided for officers and the crew. The first dredge will be delivered about May 1, 1900, and the second a short time after.

A PRIZE FOR A LIFE-SAVING APPLIANCE.

It has recently been announced that a prize of $20,000 will be given for a life-saving device to be known as the "Pollok Life-Saving Appliance." The American Security and Trust Company, of Washington, D. C., is the custodian of the fund, which is offered by relatives of Mr. and Mrs. Anthony Pollok, who perished in the ill-fated steamer "La Bourgogne." Particulars of the nature of the appliance have not yet been made public, but our readers who are of an inventive turn of mind will be informed of all the requirements as soon as the conditions governing the competition are definitely formulated.