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 Monthly (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.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, FEBRUARY 15, 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.

POSSIBILITIES OF A STEEL PANIC.

Of all our industries the manufacture of steel affords, perhaps, the most striking evidence of the unrivaled run of prosperity that the country is now enjoying. In spite of the fact that our production, both of pig iron and finished steel, greatly exceeds that of any other country in the world, the demand of the home market is such that it has overtaken our production, and even gives promise of exceeding it. One of the leading officials of the largest bridge company in this country considers indeed that we may shortly be confronted with a steel famine of serious proportions. So greatly has the home demand increased, that no contracts are being made for export, and importations from abroad are looked upon as inevitable. As illustrating the condition of affairs, the case may be mentioned of an important southern road which has been unable to secure delivery of a much-needed order for 25,000 tons of steel rails, and in consequence is now driven to the consideration of the question of immediately importing 10,000 tons from abroad. It has been customary to speak of the recent remarkable development of our export trade as the overflow of an industrial development which had exceeded the demands of the home market. We very much doubt if the ablest prophets of finance ever expected to see the day when the enormous and rapidly-increasing output of our steel industry would be overtaken by the demand for home consumption.

GERMANY'S EXPORT TRADE IN HER HOUR OF NEED.

Apropos of the question of export trade, we notice that in a report to the State Department on the business depression of Germany, by Consul-General Frank H. Mason, attention is drawn to the fact that it is to her splendid export trade that Germany owes her salvation during the period of financial depression through which she is passing. Mr. Mason would have American manufacturers keep this fact carefully in view. Says the Report: "If there is in the history of the present crisis in Germany one definite, pertinent, object lesson for the study of other nations—especially the United States—it is the manner in which many of its industrial commercial interests have been sustained and carried through this period of stagnant and inert local markets by a well-established and skillfully supported export trade. During the years of her prosperity Germany had laid the foundations of her foreign commerce broad and deep. She has trained her young men for efficient commercial service in foreign lands, has subsidized new steamship lines, and has sent her ships, bearing not only her manufactured goods, but her banking capital, her engineers, and her constructors, to the remote regions of the earth. The reward of all this wise foresight and careful preparation has already come." During the recent awful depression in which some of the oldest and most wealthy banking institutions and industrial corporations have suffered shipwreck, the extensive export trade of the country has been remarkably steady and shows, indeed, to-day signs of an increase. Foreign orders have served to keep going many an industrial establishment which, had Germany possessed only a home market, would have had to close its doors. As regards our own export trade, and especially that major portion of it which has been developed during the past three or four years, it must be admitted that in its inception it consisted largely of overflow production, and that its very existence may therefore be regarded as, in a sense, accidental. Hence there is a valuable lesson to be learnt from the experience of Germany as to the steadying effect of a well-established export trade. If, as a nation, we lay that lesson to heart, we shall make redoubled efforts, and efforts that have something of the German system and persistency in them, to cover new territory and strengthen our hold upon that which we have already entered.

DOUBLE-DECKING THE BROOKLYN BRIDGE.

After so many years of positive ineptitude on the part of the officials who were supposed to look after the interests of the Brooklyn Bridge, it is decidedly refreshing to note the very practical way in which Bridge Commissioner Lindenthal is taking hold of the very serious problem presented by the overcrowded condition of the Brooklyn Bridge. While the motive of his attempt to divert a portion of the traffic from that thoroughfare to the ferries is commendable, nobody knows better than himself that it is only a temporary expedient, or one from which we can look for only a temporary relief. The Bridge is frightfully overcrowded, and thanks to the incompetence or indifference, or both, of the late Bridge Commissioners, and the altogether inexcusable dilatoriness of the firm that is building the cables, there is no likelihood of any diversion of a portion of the Brooklyn Bridge travel to the new bridge for two or three years to come. And even when the new structure is opened, the Brooklyn Bridge is likely to be about as crowded as ever, for the reason that the increase in the volume of travel within the interim is likely to be as large as, or larger than that portion of the traffic now passing over the Brooklyn Bridge, that will seek the new East River Bridge. Hence we think it is altogether advisable to consider at once the question of the enlargement and strengthening of the Brooklyn Bridge. The proposal which has been made to double-deck the Bridge is quite practicable, for the reason that the additional load imposed could be taken care of by four supplemental cables lying above the present cables and in the same vertical plane. The towers are the one portion of the Bridge that can carry considerably more than its present load without any strengthening; and it would be a simple matter to add, if necessary, to the weight of the anchorages by building an additional mass of masonry. The provision of trolley tracks on an upper deck of the Bridge would necessitate a loop at the level of the present overhead foot-passenger platforms. This would probably involve some rather costly structural alterations at either terminal, as the present headroom would be insufficient. The cost and inconvenience would have to be faced, for the whole bridge problem has reached a stage at which it is a case of "needs must when the Devil drives."

THE TORPEDO-BOAT FIASCO.

In our last issue we described the great difficulty which the British builders are having in getting out of the latest torpedo boats the guaranteed speed; this week we have to record the fact that American builders are having trouble of the same kind and, if anything, more of it. In both cases the difficulty is due to the tendency to sacrifice strength in this class of vessels to speed. The "speed craze" of which we hear so much just now is no mere fiction. Not merely in the design of torpedo-boats, but in the largest battleships and armored cruisers there has been a disposition of late years to exaggerate the importance of speed. Admiralty boards, boards on construction, and naval designers in general, have been adding knot to knot, and in the case of the "Novik" class of cruisers in the Russian navy, the speed has been raised no less than five knots at a single jump.

All warship design is a matter of compromise, and it is inevitable that where so much weight is put into motive power, a corresponding amount of weight has to be deducted from some other elements of the design. Not even the steadily-increasing size of the modern warship, whether in the torpedo-boat or battleship class, has been able to stave off the inevitable reduction of weights in elements of the ship, other than those which conduce to high speed. Generally speaking, it is the accommodations and conveniences necessary to the adequate berthing and comfort of the ship's crew that have suffered. When it has not been these, the structure of the vessel itself has been called upon to pay the "pound of flesh," and scantlings have been cut down to a limit, which recent events have shown to be altogether impractical.

While there has been no visible evidence of a reduction of structural strength in the larger vessels, except where they have chanced to touch bottom, or run afoul of each other, or ventured to train the larger guns across the deck, as was possible in some of the older ships like the "Texas," on which the main battery was arranged *en echelon;* in the smaller types, and particularly in the torpedo-boat class, the lack of structural strength has produced unending trouble and occasional disaster. Hulls have been lightened and engine weights increased, until in the case of a boat like the "Cobra" we have engines of the indicated horse power of an ocean liner, carried within the frail shell of a craft of only 450 tons displacement.

The torpedo-boat question has been revived in this country by a most extraordinary request which has been made to the Navy Department by the builders of the torpedo boats and torpedo-boat destroyers which are now under contract for the navy. These boats have been so costly in construction that, with few exceptions, they have proved a loss, and in some cases a very heavy loss, to the contractors, who have therefore petitioned the Secretary of the Navy for additional payments, that will amount to an increase of over 40 per cent of the price named in the contract. As a commentary upon this curious condition of things, it should be mentioned that the bids for the construction of these boats were so low that the department, at the time the tenders were made, gave warning to the contractors that they would probably lose money on their contracts. Already two of the firms concerned have failed, and it begins to look as though the holding of the other builders strictly to the terms of their contracts might in some cases precipitate further disaster.

The Board reports that of the sixteen torpedo-boat destroyers, it is not likely that any one will attain the minimum speed which is necessary for acceptance, and that "not one of them is likely to be an entirely satisfactory vessel." This is news indeed. It will produce a sting of disappointment and chagrin throughout the country for which the public is but little prepared. Those who are conversant with naval matters, and who follow the development of our new ships with any attention, have been aware that the builders, both of torpedo boats and of torpedo-boat destroyers, have been having considerable difficulty in securing the contract speeds; but we must confess that we had no idea that these troubles were any greater than those that ordinarily attend the acceptance trials of torpedo craft. It begins to look as though in this matter of torpedo-boat construction, as in that of some other special lines, such for instance as the construction of automobiles, it is necessary that the builder should have behind him years of practical experience and a whole mass of slowly acquired data, before he can hope to turn out a really first class product. In Europe the only torpedo-boat builders that seem to be able to accept a contract with absolute certainty that they can live up to it, are those whose establishments are as old as the industry, and who, like Yarrow and Thornycroft in Great Britain and Normand in France, have twenty or thirty years' experience to go upon. Evidently this is the view of the question which is taken by our Naval Board, which says: "The building of successful torpedo vessels having the 'highest practical speed' is an occupation that requires designing talents of a high order and prolonged experience in construction. There are comparatively few successful builders of torpedo vessels in the world, but the attempt was made in this country to rival the best results obtained abroad with designs which were not based on the known results of a large number of previous vessels, and by builders whose knowledge and experience were of a limited character."

One lesson of the recent failure, both here and abroad, is that too much has been attempted. It is doubtful, we had almost said certain, that in the practical uses of war these sensational speeds of 27 to 35 knots will never be approached nor even attempted. If the destroyer were made about 50 per cent larger, her displacement being raised to say 600 tons; if her scantlings were strengthened to a point at which the craft would be able to stand the stress of hard driving even in a nasty jump of a sea; and if the trial speed conditions were to consist of a six hours' run at a full speed of 25 knots, the torpedo fleets of the future would be staunch, fast under service conditions, and thoroughly serviceable, neither of which qualities can be claimed for them under existing conditions.

RECLAIMING OUR COAST LANDS.

Holland presents the best example of a nation's attempt to reclaim valuable land from the sea, and France and England have followed suit in some notable instances; but the United States has, by virtue of its extensive coast line, possibilities and promises in this direction that must eventually eclipse anything heretofore attempted in Europe. Public and private interests are being awakened to the necessity of reclaiming coast marshes and in shutting out the sea permanently from beaches which offer excellent building sites for summer homes. The fact that coast marshes harbor and breed mosquitoes and poisonous fever germs is another reason for developing the lands so that such nuisances will be forever abolished. Tidal swamps and salt marshes are numerous all along the Atlantic and Pacific coasts, and their value as farming land has been repeatedly demonstrated, and their reclamation is a matter of great monetary importance, fully as much as the irrigation of the semi-arid lands of the West.

If at the same time the mosquitoes and malarial germs which lurk in these marshes could be abolished, the reclamation of the low, worthless seacoast property would prove of inestimable value to all who reside near the sea or go down to it for summer vacations. The investigations of the Department of Agriculture have been conducted for years with special reference to reclaiming the marshes economically and

permanently. As the low fens of England have been reclaimed to the extent of some 1,000,000 acres, it is believed that several times that amount of land along our two coasts can be converted into good farming land at an expense much less than that required to irrigate the semi-arid plains of the West. Agricultural engineers all along the coast have studied the problems presented, and in several instances private companies have undertaken the work of saving the salt meadows for farming purposes.

Closely allied to this subject is that of saving from the sea, land already formed and in excellent condition for building or farming purposes. The encroachment of the sea upon the land is steady and disastrous at many places along the coast, washing away valuable beaches and farming land during every heavy storm. So uncertain is this constant destruction of the coast that great engineering feats have been attempted in the past to protect the land. Lighthouses have had to be moved repeatedly on beaches threatened by the tides and currents, and valuable seashore property has been undermined and tumbled into the ocean until whole summer communities have been ruined. Breakwaters and other protective means have been constructed at great expense, but often without satisfactory results.

Ten years ago the Department of Agriculture decided that investigations on this subject should be made along a line that was somewhat novel to many. It was felt that grasses were the most effective agencies for shutting out the sea. Sand-binding grasses could hold the beaches in compact forms so that even the waves of the ocean could not break through the barrier. At Provincetown, on Cape Cod, the first most effective experiments were made with sand-binding grasses. These were planted to hold the drifting sands in place, and where the plants became thoroughly established, both the winds and waves were rendered powerless in moving the fine sands. Beach and sand-binding grasses are now being planted from Maine to Florida by private and public means, and they are gradually forming a compact, continuous barrier to the sea, which will be shut out for all time. The sand-storms of Cape Cod and Cape Hatteras are gradually being eliminated, and the beaches will change less and less as the roots of the grass spread.

In establishing permanent bulwarks against the encroaching sea, the government has provided working plans which all private property owners can adopt and follow. The first step is to convert the sea into a land-building instead of a land-destroying agent. This is accomplished by utilizing the tides and currents in depositing floating sand at desirable points. Hedge-rows of brush and spiles are built out into the sea at right angles to the currents and tides. These when deflected sharply to one side, deposit the floating sand particles in the acute angle thus formed, or if the water flows over the barrier the bushes and twigs catch great quantities of the loose sand and gradually build up a sandbar, and then a beach.

Whole beaches have not only been saved in this way, but new ones built up at little expense. The government has repeatedly saved valuable lighthouses from the sea by this simple method. When the beach is finally raised above the tide mark, sand-binding grasses are planted on it. These become established in time, and the powerful roots of the plants bind the land into a compact mass which can resist almost any power of the waves and tides. The whole coast is thus gradually being transformed and protected, and seaside property thus becomes of more permanent value than in the past.

A NEW POLAR EXPEDITION.

Another attempt to reach the North Pole is to be made by Capt. Joseph E. Bernier, a Canadian sea captain, who is at present in London completing his arrangements for the expedition. Capt. Bernier had prolonged experience of the Arctic seas and their peculiar characteristics while commander of a sailing vessel. He has followed with interest the movements of all expeditions having for their object the discovery of the North Pole. For six years he has been raising funds for the purpose of equipping an expedition of his own, and has received financial assistance to carry out his plans from a number of prominent men.

Capt. Bernier anticipates that his effort to reach the North Pole will occupy at least four years. His ship will be allowed to drift for three winters and two summers. By that time he expects to be within 100 to 150 miles from the Pole, and a final dash will then be made to cross the ice.

Capt. Bernier has prepared plans for a steel-sheathed ship, somewhat similar to the "Fram" used by Nansen, but possessing greater sail and steam power. She will be 120 feet long, 36 feet beam, and 18 feet deep. The vessel will be provided with a flush deck, and will be fitted with many modern appliances not hitherto possessed by Arctic explorers. The ship will be heated partly by electricity and partly by steam. A distilling apparatus will be carried, so that pure water will be always assured, and two electric stoves for cooking purposes will also be provided to maintain the vessel in an absolutely dry condition, for dampness is one of the greatest enemies of the Arctic explorer.

The ship will be equipped with a complete system of telephones, so that communication between the wheelhouses, engine-room, crow's nest and cabins will always be possible.

A telescopic pole is to be fitted to the mainmast, to enable it to be raised to a height of 200 feet if necessary, so as to permit of communication between the ship and parties on shore by wireless telegraphy. Capt. Bernier thinks by this means it will be possible for him to maintain communication with Dawson City, Alaska, during the first winter in the ice, and the second year he will endeavor to communicate with the world by wireless telegraphy to either Dawson City or Hammerfest, which latter port will then be 1,200 miles distant. In view of the fact that, according to several experiments that have been made from time to time, ether communication of this description is more easily maintained in a lower and cold temperature, Capt. Bernier should experience little difficulty in this direction.

The expedition will set out from Vancouver, on the Pacific coast, before July 1, 1903, so as to reach a point sufficiently far north by the arrival of the winter. The vessel will shape her course for Bay St. Lawrence, and will call at Port Clarence, to which port supplies will be sent ahead by a schooner.

Port Clarence will be the last port of call. The expedition will spend the first winter in the ice about 150 miles north of Point Barrow. Then in the spring the vessel will drift to a point about 150 miles distant from the Pole. As the expedition proceeds northward on this drifting voyage stations will be established, with food supplies, at intermediate points. The men sent out from the ship for this purpose will keep in communication with Capt. Bernier by wireless telegraphy.

For the final dash to the Pole, which Capt. Bernier will make across the ice, he intends to use two specially designed five horse power motor cars, each capable of holding 2,000 pounds. The motors are so designed that if the exigency arises they can be quickly converted into boats, each holding several persons.

Food stations will be established at mile intervals after Capt. Bernier leaves the ship, the food being intended for the return journey to the vessel. It will consist of condensed foods packed in cylinders, and each cylinder marked by a flag, so that its position can be readily detected. Dogs will also be taken on the journey across the ice from the ship to the Pole.

Fresh provisions for the party while drifting northward will be taken by Capt. Bernier in the shape of lambs, pigs and other live stock. The expedition will carry a balloon for the purpose of observing the condition of the ice far ahead, and likewise kites for aerial photography.

Capt. Bernier will provide for every emergency, and a man desiring to join the expedition must be prepared to stay at least four years in the North. A crew of fourteen men will be taken. The vessel will be equipped with two windmills, placed near the port and starboard lights respectively, to furnish power for heat and light. One of the windmills will also be connected with a pumping apparatus for keeping the ship clear of water when necessary.

NEW SALT OF GLUCINIUM.

Messrs. Urbain and Lacome have lately discovered a new volatile salt of glucinium which presents some remarkable properties. When the hydrate of glucinium is dissolved in dilute acetic acid and the solution evaporated in a water-bath, a mass of gummy consistency is obtained. This substance presents none of the characteristics of a definite compound, although it has been supposed to contain a basic salt. If this mass is treated with concentrated and boiling acetic acid, a solution is obtained which upon cooling gives in the first place a deposit of crystalline needles, and then, at a lower temperature, of octahedral crystals of a well-defined form, which finally remain alone. This new compound is insoluble in cold water, but boiling water dissolves and also decomposes it. It is but slightly soluble in alcohol and nearly insoluble in ether. It dissolves in concentrated acetic acid when hot, but at 17 deg. C. there remains scarcely one per cent in solution. Chloroform is by far the best solvent, and takes up a large proportion. At a temperature of 284 deg. C. this body melts to a colorless and mobile liquid. It distills without decomposing at the normal pressure at 331 deg., and its vapor may be heated as high as 360 deg. in presence of air without undergoing alteration. This property enabled the experimenters to determine its vapor density at the temperature of boiling mercury by Meyer's method, and they obtained for result D = 13.9. This figure corresponds to a molecular weight of 401. As the atomicity of glucinium is a disputed point, the new compound may throw some light on the question. Its molecular weight and analysis lead to the formula $[CH_2CO_3]_6$ $Gl_4O = 406$, admitting $Gl = 9$ and $GlO = 25$. It is impossible to conciliate the composition of the body and its vapor density by supposing $Gl = 13.5$ and $Gl_2O_3 = 77$. This result gives a new argument in favor of the diatomicity of glucinium. If the physical properties of this body are singular, one of its chemical properties is not less so, for this basic salt is formed in a solution which is extremely acid. Besides, in dissolving the body in concentrated acetic acid saturated with gaseous hydrochloric acid, the salt did not undergo any alteration, although it was heated for several hours in sealed tubes at 150 deg. C. It must be concluded that in this compound the basic function of the glucina is masked. The authors are carrying out further experiments on the subject.

SCIENCE NOTES.

The town of Molsen, Wash., recently went into bankruptcy and finally into the hands of a receiver. It is now in charge of a trustee.

The President of the Jersey City Board of Health has decided that the city hospital is so infected with disease germs that it should be burned, the sanitary conditions being so bad that it is impossible to remedy them.

A cinematograph picture has been taken of the Severn bore. It is believed that this is the first moving picture of a tidal bore. The film is 150 feet long and contains 2,400 individual pictures. About half the length is devoted to the bore itself, and the remainder shows the rapid current which follows and the filling up of the river.

The Police Board of Jersey City, N. J., have decided that a bronze cross shall be given to policemen who distinguish themselves by the arrest of desperate criminals, saving life or for any other cause which shows their courage and faithfulness. The cross is to be suspended from a bar which is to be inscribed "The Bronze Cross." In the center of the cross will be a representation of a policeman's shield. A certificate will be given to the man with the cross. For any flagrant violation of the rules the cross can be taken away.

In the High School in Sioux City, Iowa, the School Board has undertaken what is proving to be a very successful experiment in serving hot lunch to the pupils at cheap prices, says The Municipal Journal. A lunch room has been fitted up, and there the scholars can purchase many hot dishes at minimum rates. Everything is sold for checks, which can be obtained in lots of ten and twenty-five cents' worth. Much time is saved in this way, and it is possible to serve ninety boys and girls in ten minutes. A woman runs it for the Board, and is allowed to make a little out of it. Everything is clean and the food of the best.

Sir W. H. Preece, formerly chief electrician to the British Post Office, has been engaged for some time past upon a study of the magnetic influences upon the compass of the Manacles Rocks off the coast of Cornwall, and upon which the steamships "Mohegan" and "Paris" were wrecked. Sir William Preece states as the results of his investigation that if any navigator sets his course from Cherbourg to the Lizard without knowing the variation of the magnet that has occurred during the last five or six years he would run upon the Manacles. The variation was bringing the needle nearer to the North Pole, and in ten years it varied a whole degree. The difference of a degree in a magnet signified an error of one mile in a course of sixty miles, so that unless the captain's observations were maintained with all accuracy and care, if the Admiralty did not correct their charts from time to time, and if captains of ships did not make themselves acquainted with these different errors, then sooner or later disaster was certain to occur.

M. Santos-Dumont, upon his reception in England by the newly-founded Aero Club of Great Britain, discussed his forthcoming experiments with his new airship that is in course of building for use in 1902. It will be the seventh and largest machine he has yet employed. It will be fitted with two petrol motors of forty-five horse power each, as compared with the sixteen horse power motor of the previous vessel. At present he has decided to carry out his experiments upon the lines in which he has been so successful. It is his contention in connection with navigable balloons that aeroplanes should not be used. M. Santos-Dumont thinks that petrol will be the sole power employed for aerial traffic, since with a petrol motor half the motive power is derived from the air, thus minimizing the weight of fuel to be carried. Electric and other motors must carry all motive power in bulk. The outer balloon of No. 7 will be cigar-shaped as before, but it will have two inner cases instead of one. There will be no framework inside, the material being kept rigid solely by pressure. M. Dumont intends continuing his experiments with machines with a carrying capacity of one person only for the present.