SCIENTIFIC AMERICAN

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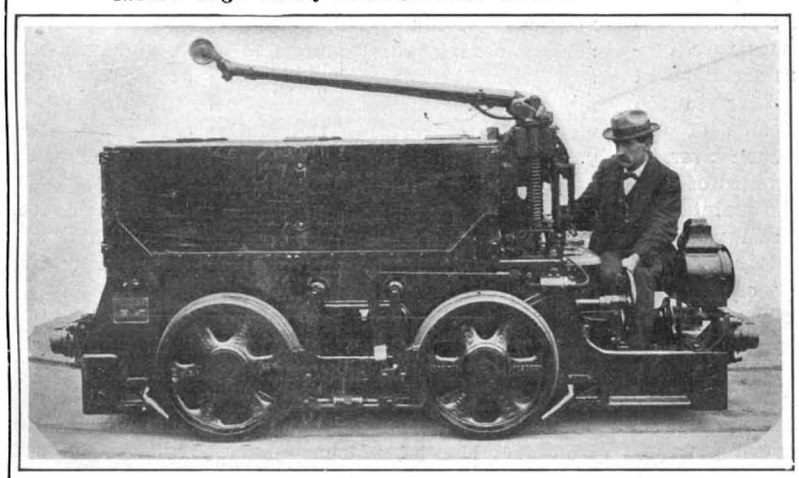
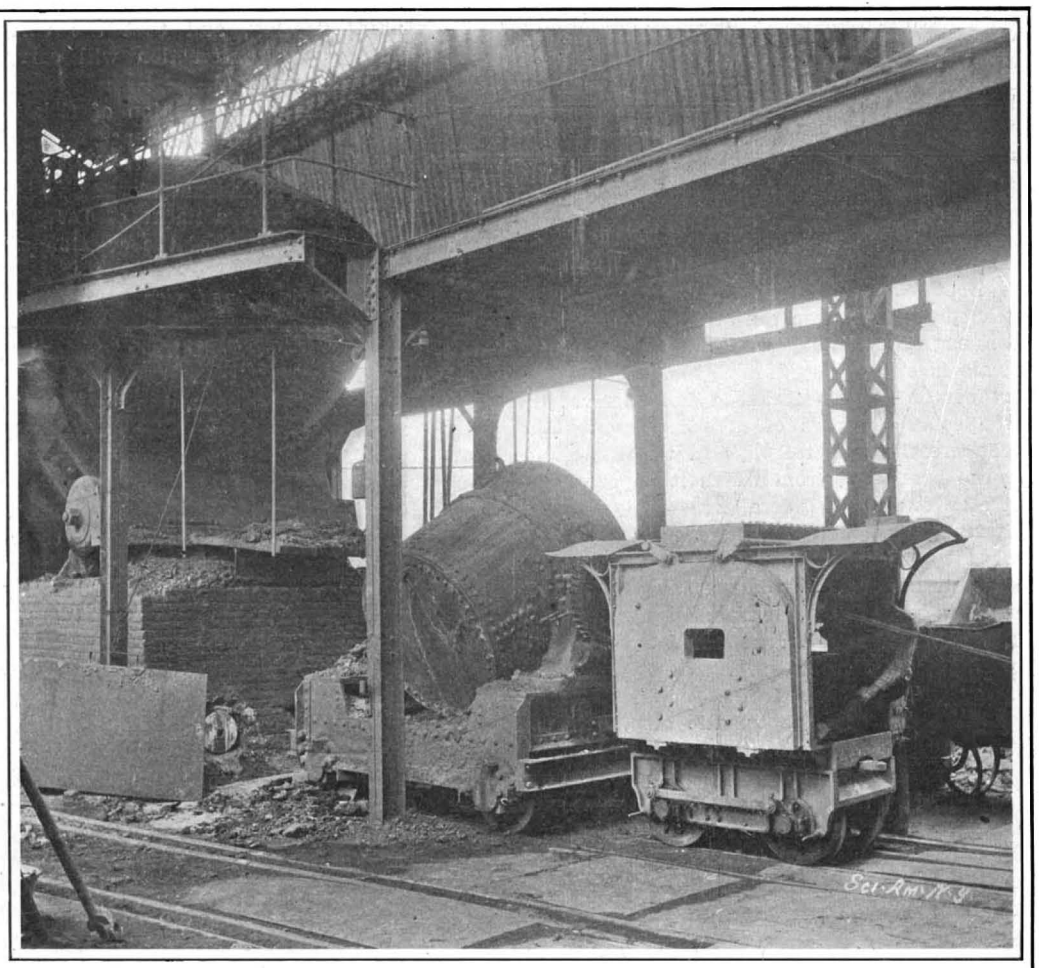
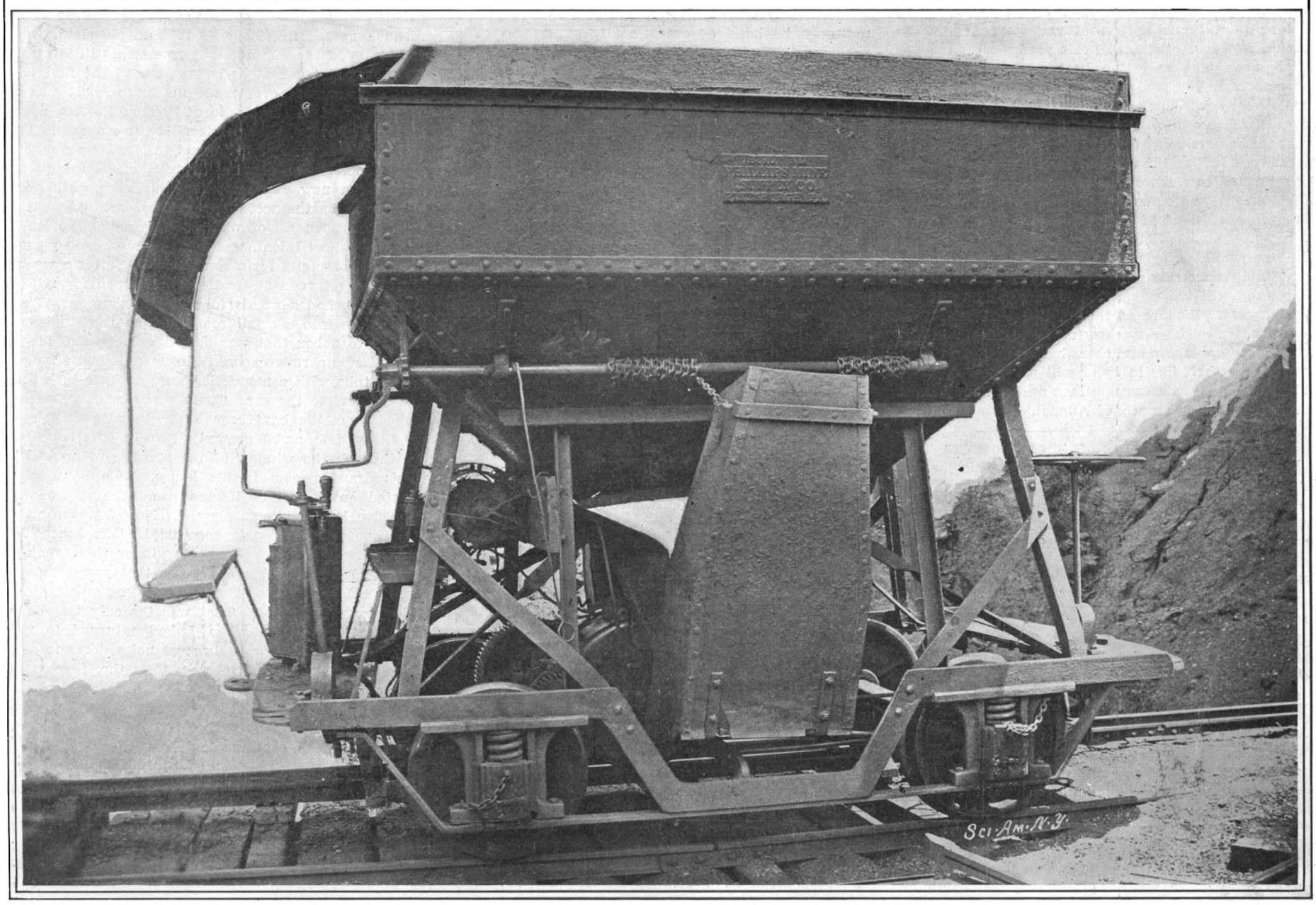
Narrow Gage Trolley Locomotive for Work in Rail Mill.



Electric Storage Battery Locomotive; Drawbar Pull 1,000 Pounds.



Electric Locomotive for Transporting and Tipping Molten Metal.



Electric Lorry for Coke-Making Plants.

ELECTRIC LOCOMOTIVES FOR YARD AND SHOP WORK.—[See page 172.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

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NEW YORK, SATURDAY, MARCH 7, 1903.

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.

BLOCK SIGNALS AND THE AUTOMATIC STOP.

The proposal to use the automatic stop as a check upon engineers who play fast and loose with block signals is evidently gaining ground. In a recent report of the Illinois Railroad Commission, there are given some statistics of derailments at interlocking grade crossings of railways in the State of Illinois for the past year, from which it appears that while, out of a total of 197 derailments only 7 were due to defective interlocking functions (including defects caused by snow, ice, etc.), and 27 were due to defective track or rolling stock, no less than 138 derailments were due to trains running against the signals. With such an extraordinary result of their investigation before them, there was only one thing for the Commissioners to do, and that was to recommend the use of an automatic stop, acting directly upon the engine. The attitude of the engineer to any signal system should be one of absolute obedience, first, last, and all the time. From the very moment when he begins to interpret block signals to suit his own particular judgment of the situation, the system loses its value, and in some cases may become worse than useless.

DIVERGING AGAIN.

It now begins to look as though the British and American yacht designers, after converging in their designs to a common type of racing yacht for the "America" cup contests, will this year show a marked divergence. The American boat will be even more extreme than her predecessors, with a comparatively shallow moderate-displacement hull, and excessive sail spread; whereas the British designers, apparently, have come to the conclusion that the extreme was reached in "Shamrock II.," and that better results can be obtained by returning to a more wholesome model, with larger displacement, and a more moderate sail spread. This divergence will lend added interest to this year's series of races. It is a curious fact, moreover, that the new challenger will conform more closely to the new rule of measurement recently adopted by the New York Yacht Club, than will the vessel that is now building at the Bristol yard. We are of the opinion that while the more moderate boat may show up to advantage in certain conditions of wind and weather, the extreme craft which Herreshoff has in hand will prove to be better suited to the prevailing conditions on the Sandy Hook course during the month of August.

THE EFFECT OF FIRE ON BRIDGE CABLES.

In connection with a letter written to this journal by Capt. F. E. Chadwick, president of the Naval War College at Newport, R. I., on the danger to the Brooklyn Bridge cables from a possible conflagration among the buildings beneath the shore spans, which we published in our issue of December 20, 1902, it is interesting to note that Admiral O'Neill, Chief of the Bureau of Ordnance, has recently had some tests made to determine the strength of steel wire at varying temperatures. Out of one group of five specimens the first, which was not subjected to heat, showed a tensile strength per square inch of 71,350 pounds, whereas a specimen heated to a dark red heat and tested at that heat showed a tensile strength per square inch of only 12,579 pounds, while two specimens tested at a light red heat showed respectively only 6,123 pounds and 9,911 pounds tensile strength per square inch. In another set of tests of similar specimens the tensile strength fell from 68,000 and 73,000 pounds at normal temperature to 15,378 pounds at a dark red heat, and as low as 6,810 pounds at a light red heat. The ¼-inch round soft-steel rods from which was made the wire for the tests above mentioned showed a strength of 67,471 pounds and 70,670 pounds per square inch.

The bearing of these tests upon the question of danger from fire to the cables of the Brooklyn Bridge is evident. The greatest risk occurs where the cables descend below the roadway at the point of their attachment to the anchorages, for here, especially on the Manhattan side, it would be possible for one at least of the cables to be heated beyond the danger point by a fierce fire occurring in the buildings beneath or adjacent to the bridge. Moreover, a fire on the bridge itself, especially if it occurred during a high wind, would find sufficient combustible material in the floor of the bridge to cause an extremely hot conflagration, and the risk would be especially great if both the floor of the bridge and the buildings beneath it were fiercely burning at the same time. We are pleased to note that the Commissioner of Bridges has given special attention to the question of fireproof flooring, and that the three new structures now under construction will carry only thoroughly fireproof material.

We think the question of risk to the cables from buildings immediately beneath or adjoining the Brooklyn Bridge cables, as noted by Capt. Chadwick, should receive, if it has not already done so, the consideration of the Department of Bridges. We understand that at the time of the erection of the bridge, some attention was given to the matter, and the height of these buildings was restricted.

THE NEW CUNARDERS

The task that the Cunard Company, aided by the British government, have set themselves of placing in the Atlantic service two 750-foot, 25-knot ships, is proving itself of formidable proportions at the very outset; for it seems that the announcement that these contracts had been let was premature, and that the builders are hesitating to put their names to a contract carrying such onerous conditions as are imposed in the case of the two vessels. According to the latest reports that have reached this side of the water, the vessels are required to show an average speed of 25 knots over several thousand miles of continuous steaming, the average speed to be maintained irrespective of the conditions of wind and weather. Now, while we believe that such conditions of trial speed as this are the only satisfactory ones, since they are conditions that exist in every-day service, it will be realized at once that they are enormously more burdensome than the requirement that a vessel should show a similar speed over the measured mile. If the new Cunarders are to be capable of maintaining an average speed of 25 knots on a westward passage, they must be prepared to do so in spite of a succession of westerly gales such as incoming vessels have recently reported. To accomplish this they must not only be built of exceptionally strong scantling, with special construction forward, to enable them to withstand the heavy seas that are certain to come aboard, but to maintain 25 knots in heavy weather they must be capable of at least 26½ or 27 knots speed in smooth water. We have seen the 23 1-3 knot "Deutschland" being pushed into a whole gale from the southwest, when her engines were indicating some 35,000 horse power; but the best speed that she could make under these conditions was 21 knots per hour, although she averaged 23 1-3 knots per hour on the run to the eastward in fine weather. Of course, the greater weight and power of the new Cunarders would be in their favor; but in any case they must have a large margin of power to enable tnem to maintain a 25-knot average in bad weather, while the construction of the bridges, deck houses, boat fastenings, deck rails, etc., will call for special consideration on the part of the designer.

DELAY IN THE CONSTRUCTION OF WARSHIPS

Rear-Admiral Bowles, Chief Constructor of the Navy, has submitted a report on the question of the great delay in the construction of United States warships. The document, which is too lengthy for full publication in these columns, will be found in full in the current issue of the SUPPLEMENT. The delays may in general be attributed to one or more of the following causes: First, inadequate plans, which were prepared in haste with a view to awarding contracts for vessels as soon as possible after their authorization by Congress. Second, changes in the disposition of armor, or armament, or in the details of the designs after the awarding of the contract; in some cases these changes have been so great as to include the lengthening of ships and the increase in their engine power and speed. Third, delays in the delivery of armor and ordnance, due to the discovery of improved methods of manufacture of armor, and in the case of the "Maine" class, by the refusal of Congress to authorize the building of the vessels until the contractors had agreed to furnish the required armor at a specified maximum price. Fourth, delays due to the very thorough system of government inspection, which Rear-Admiral Bowles believes is more complete than that given by any other nation. Fifth, delays due to slowness of delivery of steel and other structural materials by sub-contractors. As a matter of fact, the steel-makers, instead of delivering the plates and frames in the order in which they are required by the builders, prefer to roll the various sizes and shapes in such lots as will prove most economical and convenient to themselves. That is to say, deck beams are liable to be delivered at the builders' yard ahead of keel plates when the contractor finds that it is more convenient or profitable to deliver them in that order. Sixth, delays due to inadequate facilities or insufficient ability in the contractor's technical staff; and finally, delays due to inadequate supply of skilled workmen.

EXTRAORDINARY IMMIGRATION FIGURES.

If one were asked to name the strongest proof of the virility of the American race, he would not be far wrong if he pointed to the fact that we are able to receive and assimilate the enormous immigration which pours like a flood, year by year, upon our shores, without losing our strongly-marked characteristics either in the nation or in the individual. How vast is this immigration is shown by the statistics of the number of cabin and steerage passengers landed at the port of New York during last year, in which all previous records were surpassed. Of cabin passengers there were 139,848, while the enormous total of 574,276 steerage passengers was landed at this port. The previous year the figures were 128,143 cabin and 438,868 steerage passengers; while in 1900, 137,852 cabin and 403,491 steerage passengers were landed in New York city.

Evidently the tide of immigration is rising steadily. But just to think of it! Over half a million of foreigners of all nationalities, composed chiefly of the very poorest and most ignorant peoples of Europe, are absorbed by this country, so easily and naturally, that beyond the mere registration of numbers, this multitude makes, for all evidence to the contrary, no visible impression upon the routine of our daily life. The explanation of our easy assimilation of these heterogeneous millions is to be found in our magnificent public school system, which is undoubtedly the chief agency in making the immigrants' children who are native by birth, native also in sympathy and training.

THE SCIENTIFIC AMERICAN AND THE INTRODUCTION OF THE TELEPHONE INTO EUROPE.

The Chicago Chronicle in one of its recent issues published an account of the introduction of the telephone into Europe, which may not be without interest to the readers of the SCIENTIFIC AMERICAN. It seems that at a banquet recently given in Chicago for telegraph and telephone operators, Mr. Fernando Jones made a speech in which he told an anecdote which reflects upon the SCIENTIFIC AMERICAN no little credit. Mr. Jones stated that he saw and used the first telephone instrument ever made in Europe. "It was in Florence, and in the studio of Preston Powers, a son of Hiram Powers, the sculptor. It came about in this way: One day the mail brought to Mr. Powers a copy of the SCIENTIFIC AMERICAN which contained an account of a new and marvelous invention called the telephone. In the account were diagrams and particular descriptions, all of which Mr. Powers, who had a fine mechanical talent, understood almost at a glance. I then left the city for a short trip, but after a week's absence I returned and called again upon my friend. He said he had a wonderful thing to show me. Then leading me into a small room just off the studio, he pointed to a box that was set on another and larger one. It was a rude enough thing, but it had attached to it a tube with a mouthpiece and another tube that was adapted to the ear. There was a wire which extended from the box through the board partition of the little room, and I presently learned that it passed out through the window of the studio and up to his wife's drawing-room in his house. This house was situated on the Porta Romana, and the studio was some five hundred feet below it. Now I was for the first time to see the telephone used. 'Mr. Jones,' he said, 'I am going to ask you to dinner this evening, but first I will telephone my wife that you are coming.' This he did, and the answer came quick, clear and cheery, 'All right.' That was the only telephone then in Europe, and when I had returned to the United States, there probably were not a dozen in any American city." Thus it was that the SCIENTIFIC AMERICAN introduced the first idea of the telephone into Europe, and thus it was that from its plans and instructions, was built the first instrument of its kind on the European continent.

The inquiry by the French Naval Department into the cause of the recent explosion upon the submarine boat "Le Francais" has revealed a new danger in this type of craft. The accident established the fact that in stormy weather oxygen gas escapes from the electric accumulators on the boat, and remains within the vessel despite the ventilating arrangements devised to carry it away. The commander of "Le Francais" advises that the accumulators should be inclosed in wire gauze to prevent the gas exploding.

THE DEATH OF DR. RICHARD J. GATLING.

When Dr. Gatling visited the offices of the SCIENTIFIC AMERICAN on February 26, no member of the staff suspected that it was for the last time. For years he had made it a practice to call upon the Editor whenever he was in town, and to spend half an hour in conversation. His sudden death is for that reason all the more keenly felt.

Dr. Gatling was born in Hertford, N. C., on September 12, 1818. From his father, a well-to-do planter, he seems to have inherited the mechanical genius which found expression in inventions of world-wide repute. He studied medicine at the Ohio Medical College, receiving his degree in 1850. He never practised.

Of his early inventions, those that deserve especial mention are a screw propeller, a rice-sowing machine, the principle of which he later adapted to a wheat drill, and sowing-machines in general. But the invention which brought him more notice than any other, was the famous Gatling gun. Even in its original form of 1862, when it was still more or less crude, the gun had a firing capacity of 250 shots per minute. Now in its improved form, it can fire 3,000 shots per minute. When the gun was finally acquired by the Colt Firearms Company, Dr. Gatling had lavished on it some thirty years of hard work.

His more recent experiments in improving modern ordnance were not so successful. It was his idea that a cast-steel gun could be produced which would have the same ratio of energy to weight of gun, as a built-up gun, and stand the test of continued firing. In the trials which were carried out at Sandy Hook four years ago, the gun burst. In justice to Dr. Gatling it must be said that he always claimed that a mishap occurred at one stage of the manufacture of the gun which resulted in weakening the breech.

Latterly Dr. Gatling had turned his attention to motor-driven agricultural implements, and had invented a motor plow which is being exploited by the Gatling Motor Plow Company, of St. Louis, Mo. The idea was by no means a new one with him, for in 1857 he had invented a steam plow.

Although best known as the inventor of a terrible death-dealing weapon, Dr. Gatling was the gentlest and kindliest of men. The sight of returning wounded soldiers early in the civil war led him to consider how war's horrors might be alleviated. By making war more terrible, it seemed to him nations would be less willing to resort to arms. He devoted himself to the study of ordnance and ballistics, and finally invented what may be considered the first modern machine gun. As the inventor of that gun his name will probably be handed down.

TO DETECT FIRE AT SEA.

In the whole range of possible disasters to which shipping is exposed, there is none that is more insidious, and we may safely say, that strikes greater fear to the heart of the seaman, than that of the spontaneous combustion of a ship's cargo. When the various holds of a vessel have been loaded with such freight as cotton, which is always more or less liable to spontaneous combustion, and the hatches have been battened down, some anxiety must necessarily be felt as to the condition of the cargo. Should fire start in a hold from some cause such as the one above mentioned, it is usually impossible to detect it until it has been for some time under headway; and frequently the danger is not realized until the bulkheads have become so hot as to attract attention. The use of appliances for detecting the very beginning of a fire has not received the attention that the importance of the subject demands. Even if the ship is wired with fusible fire-alarm cables, it is necessary for their action that a fire shall have been under way for a sufficient length of time to raise the temperature to the fusing point. We recently had the opportunity to inspect at the docks of the North German Lloyd Company at Hoboken, N. J., an ingenious device for giving an earlier intimation of the existence of fire in the hold than is possible by any known system in use. The device, which is based upon the theory of the well-known maxim that "where there is smoke there is fire" is carried out in the following manner: At a convenient position on the ship there is placed an indicator station in which is mounted an electric motor which operates a suction fan. The fan acts upon the upper ends of a number of one-inch pipes, which extend down into the various holds and bunkers of the ship. Each pipe terminates with a flaring opening at the ceiling of its respective compartment; and the system is so arranged that when the fan is running, the smoke of any fire that may occur in a compartment will be drawn up and pass into the indicator station. The upper ends of the pipes, where they terminate in the station, are inclosed in glass panels, so that their ends are exposed to view. Mounted in the indicator station box is a clock which is provided with contact disks, so arranged that at a few minutes intervals, the motor fan will be started, an electric bell rung, and an incandescent lamp lighted. The starting of the fan draws some of the air from the ceiling of each compartment, bunker, or hold up into the station. Should a fire have broken out in any compartment, some of the smoke will be drawn therefrom and will issue from the upper end of the tube, where it can readily be seen through the glass panels by the watch in charge of the station, who within a few minutes after the outbreak of fire, can take the proper steps to quench it before it attains any serious headway. He would at once couple on a steam hose to the smokepipe and force steam into the particular compartment, thereby extinguishing the fire.

AMENDMENT TO THE UNITED STATES PATENT STATUTES.

At different times we have referred to the proposed amendment of the United States patent statutes, which will permit foreigners to file their United States patent applications during the year following the filing of the home application. While this is the most important amendment which appears in bill No. 17,085, which has been passed by the United States House of Representatives, and which is now before the United States Senate, several other striking changes in our patent statutes will be made when the bill is passed by the Senate and receives the approval of the President.

The general spirit of the amendment is to give to foreigners all the protection to which they are entitled under the articles of the International Convention. The amendment of Section 4887 of the United States Revised Statutes will not only extend the time in which foreigners may file their patent applications in the United States Patent Office, but an additional paragraph will be added to this section, which will provide that when an application is filed in the United States by any person who has previously filed an application for a patent in a foreign country which by treaty, convention, or law, affords similar privileges to citizens of the United States, the application in the United States shall have the same force and effect as though it were filed in this country on the date on which the application for a patent for the same invention was first filed in such foreign country. The effect of this amendment will be far-reaching, as for instance in interference cases, where the foreign inventor may claim the date of the filing of his first foreign application, for all purposes, as his date of filing in the United States Patent Office, although the actual filing of the application papers in the United States Patent Office was not made until nearly a year after such date. Under the amendment, foreign inventors will be obliged to file their applications for design patents within four months of the filing of their first foreign application.

Section 4902 of the Revised Statutes will be amended so that it will be possible for a foreigner to file a caveat. Under the present law, only citizens of the United States and foreigners who have declared their intention of becoming citizens of this country are able to take advantage of the provision of our laws which provides for the filing of caveats in the United States Patent Office.

Every patent attorney who has received many applications from foreign inventors must at times have had difficulty in filing the applications in the Patent Office, because of the fact that the inventors did not appear before some official holding a commission under the government of the United States, as in many cases an oath made before a notary public of a foreign country was not accepted by the Patent Office officials, and this although the present statute provides for taking oaths before notaries public in foreign countries. In many cases foreign inventors are obliged to travel a considerable distance in order to have the oath made before an official acceptable to the Patent Office. It is also now necessary to go to considerable trouble and expense to have ancillary letters of administration issued in the United States when a foreign inventor dies, for the United States Patent Office will not recognize a foreign executor or administrator as an applicant for a patent. The bill now before the United States Senate overcomes these difficulties by permitting foreign executors and administrators of deceased inventors to file patent applications in the United States. It is also provided that an oath may be made in a foreign country before a notary public, judge or magistrate having an official seal and authorized to administer oaths in the foreign country, whose authority shall be proved by a certificate of a diplomatic or consular officer of the United States.

The importance of this bill has, perhaps, been underestimated. It is considered, perhaps, by those who have not investigated its meaning and do not understand its spirit, that as it provides for expanding the privileges of the patent laws as affecting foreigners, it is of comparatively small importance, but it means far more than that. The failure to pass the bill by Congress would be an act of bad faith toward the other signatories of the International treaty. The United States has entered into a contract or treaty with certain other powers. This treaty is not operative within the United States, although it has been ratified by the Senate and signed by the President, for the reason that the Patent Laws have not been so modified as to conform to the terms of such treaty.

Under the existing conditions the foreign members of the International Convention are extending to citizens of the United States certain rights and privileges which the United States under the present patent laws refuses to grant to foreigners. This is neither fair nor honest, and it is the intent of the present bill to correct these inequalities and to extend to foreigners the same privileges that citizens of the United States enjoy who seek to obtain protection for industrial property in other countries of the Convention. There is every reason to believe that the bill now before Congress will be passed before adjournment.

SCIENCE NOTES.

Curator Wilcomb of the San Francisco Museum has recently received a number of Indian relics from the Moqui reservation, about one hundred specimens in all, many of rare interest. The collection includes an ancient firestick used in aboriginal times for kindling a blaze on a block of wood by rapidly twirling it on its pointed end; old water-bottles of basket-work, ceremonial drums of various designs, sacred paraphernalia rarely parted with, a complete costume of the kind worn by the priests in the famous snake dance, which was witnessed by Prof. Wilcomb; stone household utensils, now disused and hard to find, and many other specimens of great value as showing the habits of living in vogue among these interesting people before they came in touch with civilization. The collection will be unpacked at the earliest opportunity and placed in the ethnological room.

In a recently published book by F. Fischer, "Das Studium der technischen Chemie an den Universitäten und technischen Hochschulen Deutschlands und das Chemiker-Examen," it is said that there are about 4,000 chemists who receive their education in technical institutions, and only about 200 who follow chemistry purely as a science. In other words, about 95 per cent of German chemists are professional technologists. France distributes the 4,000 chemists referred to as follows: Chemical industries, 220; artificial fertilizers, 90; explosives, 50; petroleum, 50; chemical preparations (inorganic), 250; organic preparations and coloring matters, 1,000; beet sugar factories and refineries, 300; starch, dextrine, ferments, 50; fats, dies, 100; metallurgy, 400; other industries, 390; laboratories and agricultural experiment stations, 700; government bureaus, 100; apothecaries, 200; assistants in night schools, 100.

Enormous quantities of red lead are employed in industry, and it is important to ascertain whether it is in a state of sufficient purity. The different processes in use for testing red lead consist in converting it into an oxidized pulp, then reducing this oxide by a suitable reagent, so as to be able to dissolve the oxides of lead completely in nitric acid. The reducing substances employed ordinarily are oxalic acid and sugar. It is proposed to substitute for the employment of these substances that of oxygenated water. The following is the mode of operation: 2.5 grammes of red lead are treated with 20 cubic centimeters of dilute nitric acid (1 part of acid to 1.39 and 4 parts of water) and shaken. The red lead being thus converted into the oxide, the oxygenated water is added gradually while shaking. A few drops are sufficient to cause the oxide to disappear in a short time. If the red lead is free from colcothar, sand, barium sulphate, and other impurities, a solution, limpid or nearly limpid, will be obtained in a few minutes.—La Revue des Produits Chimiques.

Sir Samuel Wilks, writing to Knowledge, states that Fahrenheit's thermometer owed its beginnings to the invention of a thermometer by Newton, which was described in the Philosophical Transactions for 1701. Newton's instrument was a tube filled with linseed oil, and the starting-point of the scale was the temperature of the human body, which Newton called 12. It is worthy of notice that at this period, when numeration was based upon natural requirements, the duodecimal system was proposed for this, as it was in use for all other purposes. Newton accordingly divided the space between his datum and the freezing-point of water into 12 equal parts, and stated that the boiling-point of water would be about 30 of these degrees on the scale. Fahrenheit, when he began to work with Newton's thermometer, did not find the scale minute enough for his purposes. He therefore first doubled the number of degrees, making the scale number 24 instead of 12. Finding he could, by mixing ice and salt, obtain a temperature below freezing, Fahrenheit next adopted this for his starting-point and counted 24 degrees up to body heat, making the freezing-point 8 and calling boiling water 53. Later on he again divided his degrees into four. It will be seen that if the above figures are multiplied by four, the result is the thermometric scale called after him which is still in use.

A NEW DEPARTURE IN SHIP LOGS.

Mariners have long been looking for a ship log or speed-recording instrument which can be sufficiently relied upon to determine accurately a vessel's location in foggy or stormy weather, when observations cannot be obtained. The usual method of towing a heavy float or propelling wheel on a line many feet in length involves many difficulties. Whenever the ship stops the line must be immediately attended to, lest it, with its attachments, be lost; and every time the vessel starts, the log must be cast overboard, and care taken that the line does not foul the wheel. The log is also liable to injury from driftwood, and heavy seas interfere with its accuracy. A radical departure from the towing type of log has been introduced by the Nicholson Ship Log Company, of Cleveland, Ohio. The new log comprises, essentially, two tubes which project through the bottom of the vessel and extend vertically to an indicator mechanism located in the pilot house or any other convenient location. One of these pipes, which is shown on the left in our diagram, is open at the bottom and, therefore, permits water to flow in to a height equal to the draft of the vessel; while in the other pipe, since the bottom is closed and the opening is in the side of the projecting portion, the water will rise above the load-water line to a height proportional to the pressure caused by the speed of the vessel. Each tube is provided with a float. The float in the "speed-tube" is arranged to communicate its variations of level through suitable gearing to a vertical feed shaft. The upper end of this shaft is threaded, and at each end of this threaded portion a disk is mounted. These disks are connected by rods, which pass through a nut or hub threaded on to the shaft. It is evident that any change of water level in the speed-pipe will cause the feed shaft to rotate, thus raising or lowering the hub, which is kept from turning by the rods above mentioned. In order to compensate for changes in level due to variations in the load of the vessel, connection is made between the float in the "level-pipe" and the disks mounted on the feed-shaft, so that a rise or fall of this float will result in a compensating rotation of the disks and the rods which connect them. Thus the hub is rotated and fed up or down the feed-shaft according to the load of the vessel. The adjustment is such that when the vessel is at rest the hub will always remain at its lowest position, no matter what the level of water in the level-pipe. Suitably connected with the hub is a rack, which rises and falls with the same. This rack governs the motions of the pointer in the speed-indicator. It has been found that the water level in the speed-pipe varies approximately as the square of the speed, and therefore, it would obviously be confusing to have the rack operate directly on the pointer. A train of intermediate gearing is therefore used, as shown in our detailed view. This train includes a pair of compensating gear wheels, which are so designed that the upper member of the pair will move through the same arc for every corresponding increase of speed of the vessel. Thus a perfect record of speed is at all times indicated on the dial.

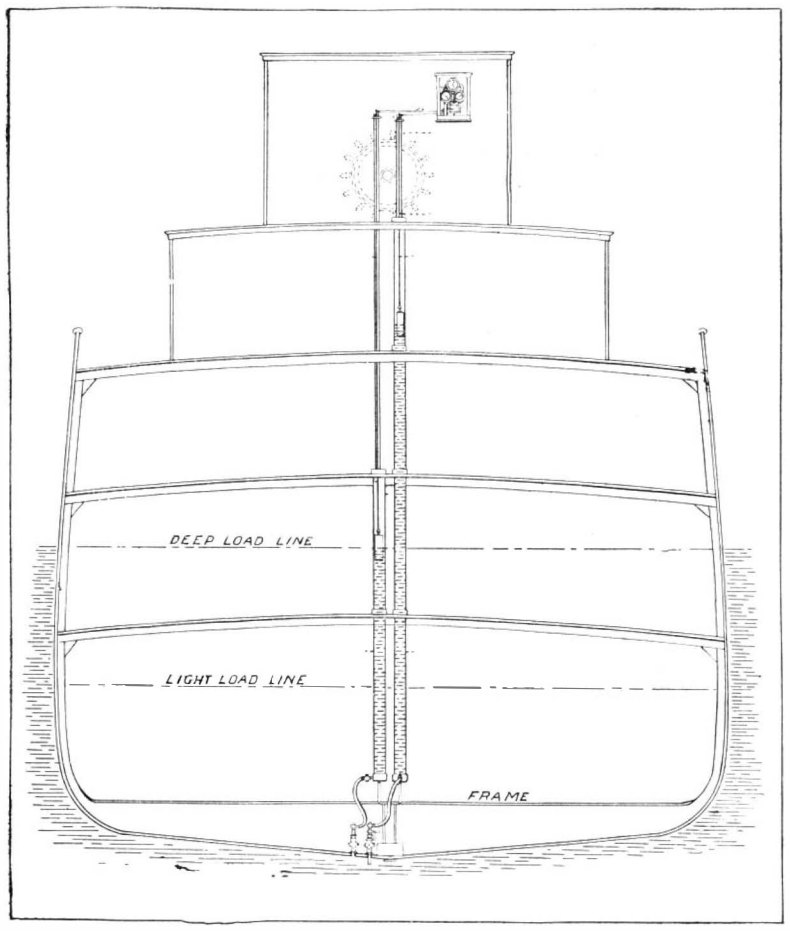
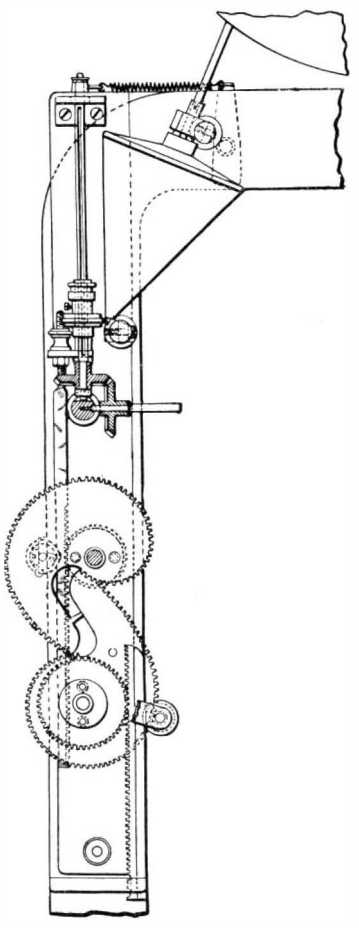


DIAGRAM SHOWING LOG INSTALLED IN A VESSEL.

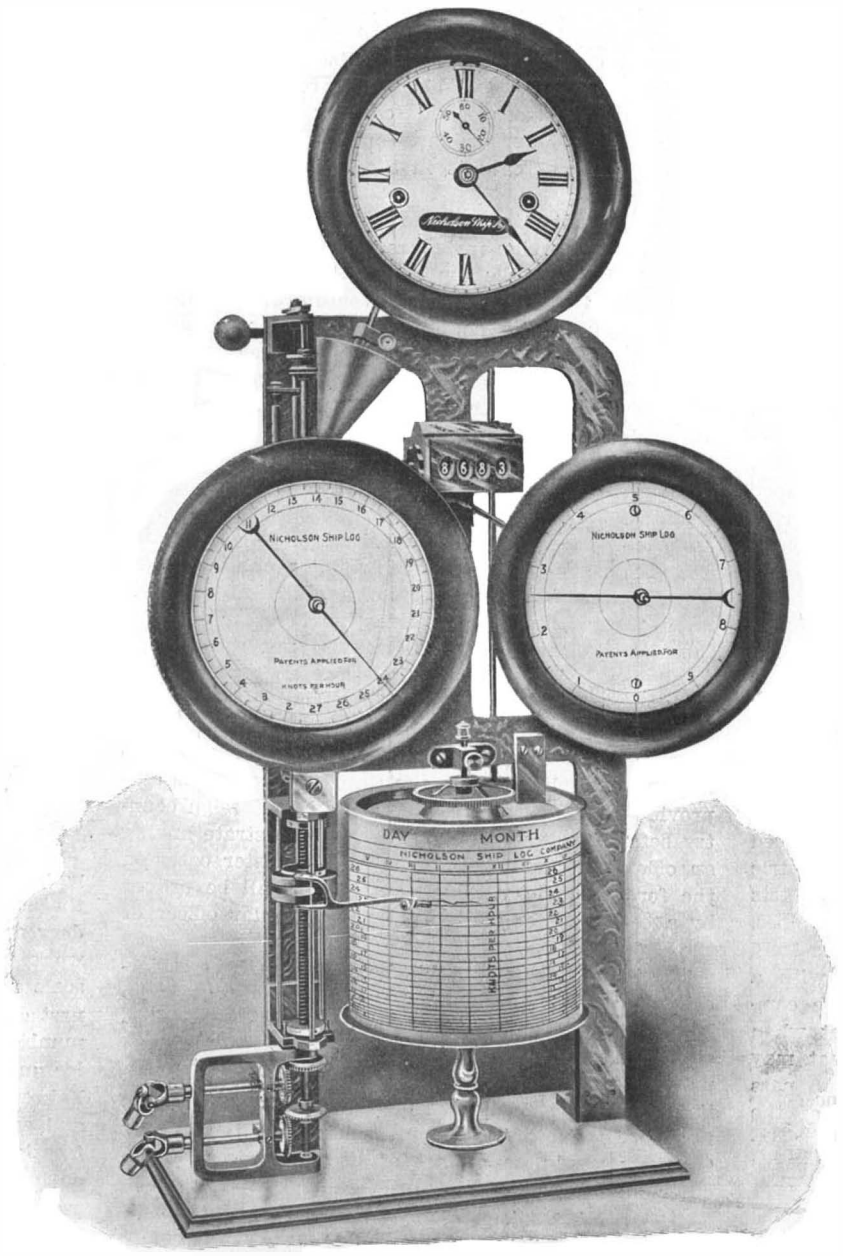
In addition to the speed-indicating mechanism is a speed-recording mechanism, which comprises a chart drum rotated at a uniform speed by clockwork. A pencil or marker is arranged to slide up and down with the speed-indicator hub, and all the variations of speed are recorded on the chart.

The distance-recording mechanism, as shown in our detail view, comprises a friction wheel, which is splined to a vertical shaft and rotated by engagement with the face of an inverted cone driven at a uniform rate by the clockwork at the top of the ship log. This motion serves to operate a small counter through the medium of a pair of miter gears. Since the distance covered by the vessel is equal to the time multiplied by the speed, a rack and gear connection is provided between the speed-indicator shaft and the friction wheel, whereby the latter is moved upward along the face of the cone as the speed increases. This causes the friction wheel to rotate more rapidly, so that the miles are counted off with a proportionately higher speed on the distance recorder. To the right of the counter is a dial which indicates fractions of a mile or knot, as desired.

A trial of the Nicholson ship log was recently made by the United States Navy, the torpedo boat "Porter" being equipped with this apparatus. The results of the trial were very favorable. The desirable features reported are briefly as follows: The actual speed of the vessel is shown on the speed dial at all times. Its accuracy is not affected by the conditions of the sea. It will not foul readily, though, in case of fouling, provision is made for clearing it by withdrawal of the tube. No towing line is required. The only portion of the log outside the hull of the vessel is a one-inch pipe sufficiently long to clear the eddy set up by the skin friction. The only attention required is the daily winding of the clockwork. The undesirable features mentioned are as follows: The height of float-pipe required is objectionable, particularly for vessels of low freeboard, such as the "Porter," on which it was necessary to rig a 3-inch pipe 20 feet or more above the deck. The size of the recording mechanism (31 x 19 x 9 inches) is large compared with that of logs in general use. The speed and recording dials should be graduated in tenths of knots, and the chronograph should be omitted. In regard to the first of these objections, the builders inform us that this has been entirely overcome, and pipes can be stored away between decks on the fastest vessels of low freeboard type without reduction of delicacy in registration. Obviously the second objection is far outweighed by the advantages offered by the log, and the third undesirable feature is merely a matter of detail, which can be easily remedied to suit requirements. In summing up these features, the Navy Bureau of Equipment consider that the inlet pipes are liable to become fouled when navigating in shoal water, where mud and sand may be stirred up. However, no such complaints have been received from users of the log. The Nicholson ship log has been installed on a number of the Lake steamers, and has given perfect satisfaction.



THE SPEED GEARS AND DISTANCE RECORDING MECHANISM.



IMPROVED SHIP LOG COMPRISING A SPEED INDICATOR, A DISTANCE RECORDER, AND A SPEED CHART.

Save Your Eyes.

If your eyesight is good, take care of it. Look away off yonder every time you get to the bottom of a page in reading. If it is defective, let no foolish pride prevent you from wearing the proper glasses.

There is no sense in handicapping yourself in life when a piece of glass before each eye will make your vision as good as it possibly can be. The oculist will not advise you to wear glasses if you do not need them any more than he will prescribe a drug you do not need.

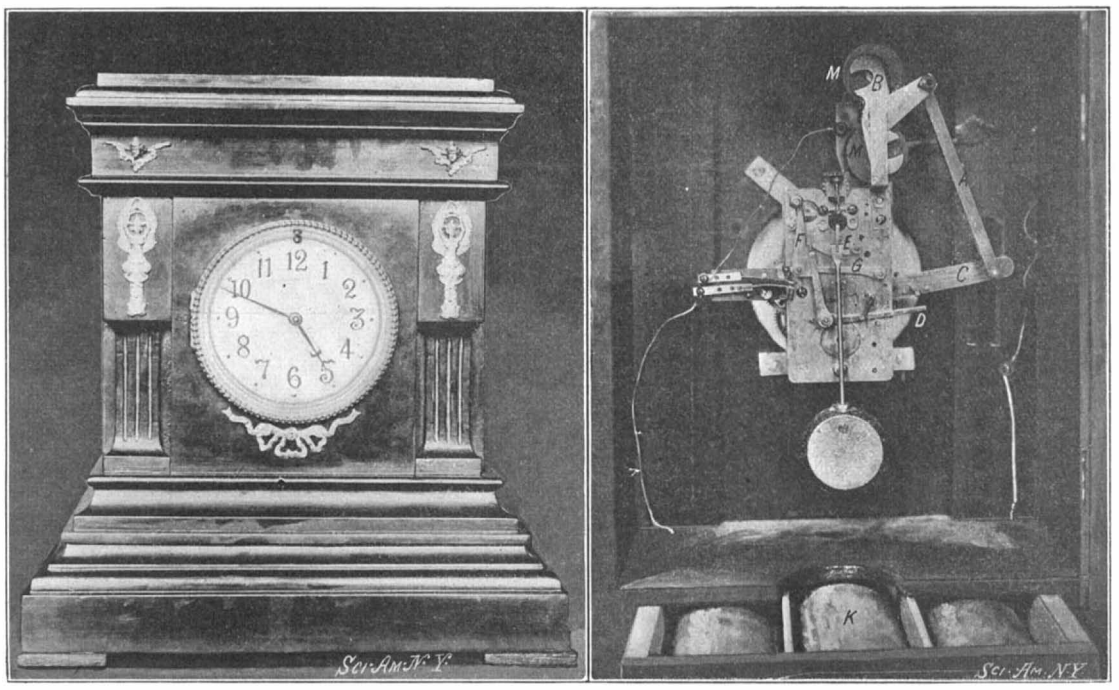
Plenty of people, though, do not know that they have defective sight because they have never really seen at all. They have headaches, inflamed eyes, sties, even much graver troubles, from the strain of trying to see with eyes that were put up wrong. There are cases where homicidal insanity has been completely cured when impaired vision has been corrected.—Harvey Sutherland in Ainslee's Magazine.

Prof. W. Noel Hartley, F.R.S., of Dublin, presented a report to the chemical section of the British Association, the first part of which deals with phloroglucinol and its derivatives. The aqueous solutions of phloroglucinol, prepared in different ways, all gave the same absorption band, and the benzenoid structure is confirmed. The second part, on the "Curves of Molecular Vibration of Quinone, p-Nitrosophenol, and Similarly-derived Substances," investigated by the same author, is interesting chiefly because it does not support the view that the special structure of quinone is common to colored organic substances. Von Baeyer and Villinger have recently studied the so-called halochromism—the formation of highly colored salts from colorless substances; there is no quininoid structure in these cases, so far as the spectroscopic evidence goes.

SELF-WINDING CLOCK.

BY DAY ALLEN WILLEY.

A simple winding mechanism for clocks has recently been perfected whereby a clock may be periodically wound by the action of an electro-magnet on an armature connected with the clock weight. In our illustration the connecting link *A* is weighted, and serves as the driving power for the clock movement. The link is secured at its upper end to an arm on the armature *B*. At the lower end it is connected to the lever *C*. A spring pawl on this lever engages a ratchet wheel, and the weight of link *A* serves slowly to rotate the wheel, which in turn operates the clock mechanism. When the weight drops to its lowest position, a pin on the lever *C* engages a bell crank *D*, which in turn lifts a latch *E*, out of engagement with a shoulder on lever *F*, permitting the latter to drop forward to the right. This movement brings the upper end of the lever *F* directly under a pin projecting from an extension of the escapement anchor of the clock. On the first swing of the pendulum toward the right, this pin is rocked downward, depressing the lever *F*, and lever *G*, on which it is mounted, and making an electric contact at *H*. The circuit of battery *K* through magnets *M* is thus closed. The magnets cause the armature *B* to swing on its axis, lifting the weight to its initial position. The contact at *H* is, of course, immediately broken on the return swing of the pendulum, and the parts are allowed to drop back to their normal positions. From five to eight minutes is required for the weight to reach its lowest position. In the ordinary-sized mantel clock, such as that illustrated, a battery of three dry cells is employed. These are placed in a drawer beneath the clockwork, and serve to wind up the clock for a period of about eight months without renewing. This system is also applicable to clocks with long pendulums, such as the cathedral type, the mechanism being, of course, proportionately larger and the magnets and battery more powerful.



SELF-WINDING CLOCK. VIEW SHOWING DETAILS OF WINDING MECHANISM.

THE ACTION OF A BIRD'S WING AND ITS BEARING ON THE PROBLEM OF MECHANICAL FLIGHT.

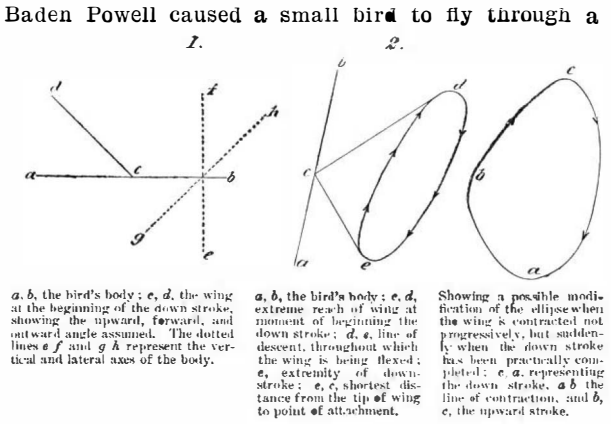
BY DR. T. BYARD COLLINS.

The precise action of a bird's wing is so difficult of observation that a close scrutiny has been persistently attempted only during comparatively recent years.

It has been shown that the muscles of a man are not adapted to the propulsion of wings, though the experiments of Lilienthal revealed some astonishing facts, as, for instance, that vibrating wings, of moderate size and of a certain form and structure, actuated by a kind of treadmill contrivance, could be made to lift half their own weight plus half the weight of the operator. This is the more interesting in view of the fact that almost at the same time these results were being obtained, and that with an apparatus admittedly crude and excessively heavy, a reputable engineer was demonstrating mathematically that a man-operated pair of wings, in order to lift the weight of a man, would have to have a surface of some acres in size. But while human flight with man-actuated wings attached to his body is highly improbable, the solution of the great problem by other means is now believed to be possible by the most competent thinkers on the subject.

The sailing and soaring birds have been profoundly studied; and, while there is no universally accepted theory as to the manner in which their wonderful phenomena are produced, it is still hoped by many that they may be imitated, and that some form of aeroplane or air-runner will eventually be evolved which will fulfill the demands of aerial navigation.

As bearing upon the same fascinating subject, the action of the wing of the bird in flight is being somewhat more carefully considered. Some years ago a writer for the Encyclopædia Britannica declared that the telling stroke was downward and forward, and that if it were otherwise, the bird would be pitched a somersault by its own activity. Prof. Hargrave asserted that a bird's wing revolved in a cone and acted as a modified trochoided plane. Prof. Pettigrew was the first, so far as I know, to try for a self-recorded diagram of a wing in action. For this purpose he used a sphygmograph, but his efforts seem not to have been very successful. Baden Powell caused a small bird to fly through a paper tube, the tube being smoked on the inside surface. When the tube was cut longitudinally and spread out, there were marks upon it from which Major Powell felt warranted in calling attention to the wing's alternate flexion and extension. Zanvrie remarked the change in the angle of incidence taking place in the course of a complete vibration, but, to this observer, the up and down strokes were delivered vertically.



DIAGRAMS SHOWING THE ACTION OF A BIRD'S WING.

For the purpose of either correcting or verifying some observations of my own, a common pigeon was held lightly in hand and moved suddenly so as to induce efforts at flight. During these movements, flashlight photographs were secured from which, together with a record of motion, some deductions were subsequently drawn.

A pigeon was selected because it was considered a representative bird for the purpose. It weighed 15 ounces and its wings were each of 12 inches reach and 5 inches wide at the base. In flight they assumed nearly the form of a triangle, so that their total surface was, approximately, 60 square inches.

The record of motion was obtained by leading fine insulated wires from a battery to a small incandescent lamp, which was fastened to the tip of the wing. The bird was then induced to make efforts at flight as before stated, and the moving wing with the light attached was exposed, in a darkened room, to a photographic plate through the lens of a camera. The lamp was loosened and finally beaten off by the violent motion of the member, this fact also appearing in the record, where the lines become irregular and heavy, the moment of detachment being marked by a final blot.

It is not claimed that a perfect record was obtained. Allowance must be made for the conditions under which the bird acted. Still, the transcript is legible, and that is, after all, the vital factor in an experiment of this kind.

Studying then the upper portion of the tracing, for the record is here more accurate than elsewhere, it would appear that, if the tip of the wing were to continue in the same plane, relatively to the vertical axis of the bird's body, throughout a complete vibration, it would describe an ellipsis upon the plane. But, while this complete vibration is being made, there is also a retraction and extension in the reach of the wing, as noted by Baden Powell, the flexion being indicated by the dip of the lines toward the left, or by their complete break, the tip being cut out of focus by some intervening portion.

At the beginning of the down stroke, the wing, extended to its utmost reach, assumes, relatively to the bird's body, an angle upward and forward of something like forty-five degrees, as shown in Diagram 1. It should be mentioned in this connection that the wing has not only the power of extension and flexion due to the movement of its joints, but the extent of surface exposed may be greatly modified from moment to moment by the opening and closing of the feathers upon themselves. Always in full flight, at the beginning of the down stroke, the greatest possible spread is exposed to the resistance of the air.

When alighting, the bird assumes nearly an erect posture, as any one may verify for himself by watching a pigeon alight in the street, and beats its wings *downward and forward*, and it is only when alighting that such movements are performed.

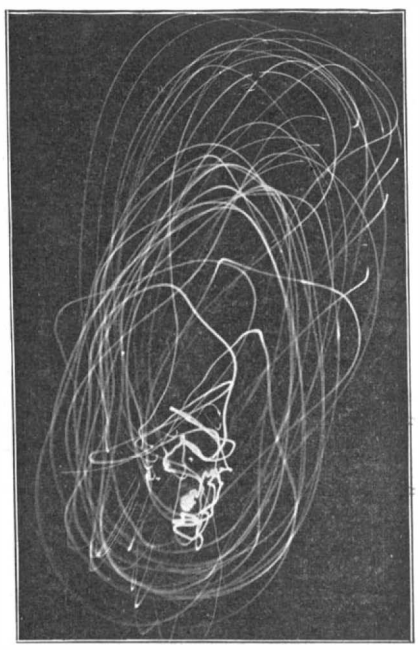


Fig. 3.—THE RECORD OF MOTION.

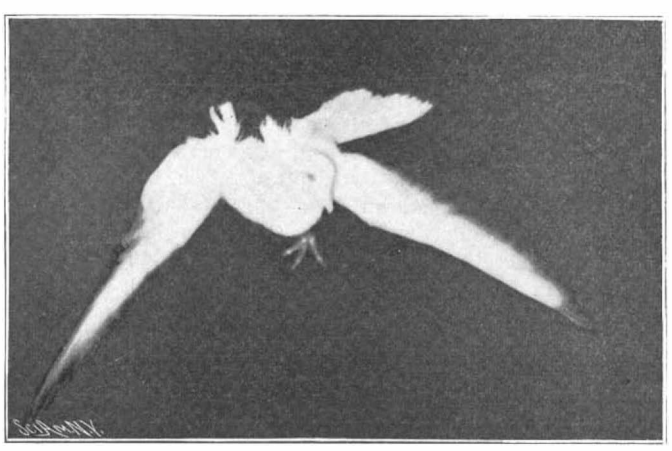


Fig. 1.—SHOWING THE ANGLE OF INCIDENCE WHEN THE WING HAD NEARLY COMPLETED ITS DOWN STROKE.

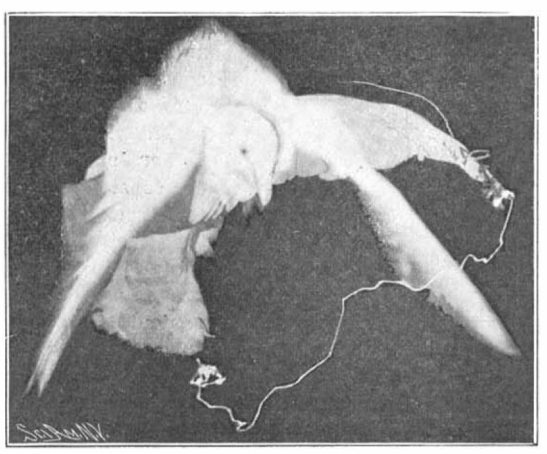


Fig. 2.—SHOWING THE WING AT THE INSTANT OF BEGINNING THE UP STROKE. ALSO THE EXTENDED WING WITH THE LAMP ATTACHED.

In Fig. 1 the wing has nearly completed its down stroke, and the point to be noted is the angle of incidence which it was making at the moment the camera caught it, an angle so small that but little of the surface is seen, giving the wing the appearance of disproportionate narrowness.

In Fig. 2 the plate was, by mistake, exposed twice and to different views. It is reproduced here because it was found impossible with the facilities at command to

catch the bird a second time in the particular position herein presented. It shows the wing at the instant of beginning the up stroke. The position of the wing relative to the body may be observed, and the change in the angle of incidence, the under side of the wing showing now, whereas in Fig. 1, the wing making its down stroke, it was the upper surface instead.

The other view on the same plate shows the extended wing with the light attached.

Fig. 3 is the record of motion. The vibrations were not uniform; long strokes, short strokes, and flutters are alike transcribed, but, in general, the elliptical movement may be readily made out.

Diagram 2 shows this ellipse in its relation to the bird's body, the upper end of the ellipse being above and forward of the wing's attachment. The line *c d* represents the extreme reach as it is extended preparatory to a down stroke. The tip then traverses the line of the ellipse, the wing being progressively flexed throughout the downward movement, so that, upon reaching the lowest point, the wing's extremity is nearer the body than at any other moment of the cycle. At *e* the angle of incidence is changed from negative to positive, and the wing shoots upward, forward, and outward, cutting the air like the edge of a knife blade, thus regaining, without resistance, a point from which to deliver another telling stroke.

It is believed by the author that these movements are variously modified in different birds, and that in the same bird they may be and are modified as occasion requires. For instance, in vertical flight, the wing would smite the air nearly broadside on during its downward movement, the air being avoided during the up stroke by the flexion of the joints, the contraction of the feathers, the angle assumed and the direction of motion; the reduction of surface exposed being accomplished, not progressively, during the entire down stroke, but suddenly, when the stroke has practically been completed. (See Diagram 3.)

Vertical flight would then be accomplished by means of a reaction from the air which is smitten by the broad side of the blade, the edge only advancing to the point of attack. Horizontal flight is performed by a broad backward beat, the thin edge only again advancing to the point of attack; and any intermediate direction of flight *is the result of a combination of these movements.*

Now, the question arises as to whether the beating wing should not be given greater prominence in our plans for the attainment of mechanical navigation.

The aeroplane has been thoroughly tried. The most competent and fertile minds have given it years of laborious study, incredible patience has been bestowed upon it, and large sums of money have been expended in experimenting with it. Nor have these efforts been in vain, surprising phenomena having been produced. The most encouraging structure of this form is Mr. Langley's aerodrome, which made, in comparison with what had hitherto been done, a really wonderful showing; but it demonstrated the fact that an aeroplane pure and simple can never be a success as a weight-carrying device.

But it is said: If the great birds can sail and soar, why cannot a man-made machine do the same thing? And since it is obvious that less power is expended in this form of flight than in any other, it would seem reasonable that the aeroplane principle is the proper one to pursue.

But there is not a sailing bird which does not beat its wings when it starts to fly. The start is the difficult achievement, both with the bird and the man-made machine. Moreover, no bird bearing away its prey—its load—ever proceeds otherwise than by flapping its wings. *The reaction obtained from this movement is the vital thing.* And *movement* is the vital thing for stability also, as shown, for example, by the bicycle and the gyroscope.

The bird above described weighed within an ounce of a pound, and had a wing spread of 60 square inches—less than half a square foot to the pound. The most successful air-runner ever built weighed between 25 and 30 pounds and had 54 square feet of sustaining surface—approximately 2 square feet to the pound.

Comparing power employed, the engine of the air-runner developed more than a horse power. The bird's power was considerably less than 0.01 that of the man-made machine, or 0.3 weight for weight.

What will account for all these factors in favor of Nature's flying machine, since it is much heavier in proportion to size, has far less sustaining surface in proportion to weight, and but a small fraction as much power available? *It is the beating wing.*

The sand-blast as a substitute for soap, water, and scrubbing brush is a novel idea, but this has been used recently in the renovation of the Government Printing Office and the Treasury Building at Washington. A Chicago company has had a portable plant built for the purpose and engages in the business of cleaning the fronts of marble buildings in all parts of the country.

ELECTRIC LOCOMOTIVES FOR YARD AND SHOP WORK.

During the past decade there has been an increasing use made of the electric locomotive for general industrial purposes, and it is being rapidly introduced in the large manufacturing plants both in this country and Europe. Industrial electric locomotives may be divided into the following classes: First, mining locomotives for underground work; second, surface, narrow-gage locomotives for transporting material in brick yards, earthworks of whatever character, or the surface workings of collieries; third, factory locomotives and switching locomotives for use on standard-gage tracks in hauling and switching cars in the factory or upon its sidings; and, fourthly, tipping or foundry locomotives for use in foundries and steel mills.

The locomotives of the first three classes are usually standard types, and are often made to stock patterns, while the last requires special treatment to suit each individual case. The standard types are each provided with two motors, one on each axle, which are either geared to the axles by means of straight-toothed, cut gear wheels, or directly connected to the axles without the use of gearing. Where two motors are employed, all the axles being drivers, the whole weight of the locomotive is available for adhesion, and there is no necessity for carrying ballast. In locomotives employing one motor only, but half the weight of the locomotive is available for adhesion, and, as a result, it is a common thing for the wheels to skid, long before the full power of the motors is developed. Some manufacturers attempt to solve the difficulty by coupling the two axles together, as in steam locomotives. An important advantage in the use of two motors is that the series-parallel control can be employed, and it is thus possible to travel at half speed without having resistance in circuit, that is to say, without waste of energy, for with the motors in series the starting effort is almost doubled for a given current. Yet another advantage is that the use of two motors provides a certain reserve in case of accident, a simple movement of the controller enabling one or other of the motors to be used singly, but, of course, with a reduced load. A two-motor locomotive is much cheaper in proportion to its power than a locomotive with a single motor.

The storage battery locomotive, it is needless to say, has great adhesion on account of the weight of the batteries.

By the use of storage batteries, moreover, the trolley, which is often troublesome, is eliminated, and for certain classes of work this absence of the trolley renders the type peculiarly suitable. Speaking generally, it may be said that where the fire risk is an important consideration, the use of the electrically-driven locomotive becomes almost imperative.

In shops, foundries, and manufacturing establishments where heavy material is moved on narrow-gage cars, the electric locomotive is particularly serviceable on account of its great handiness and of the fact that it runs with perfect freedom around curves of as low as 12-foot radius. Among the principal applications of the narrow-gage type may be mentioned its work in taking trains of trucks from the pit mouth or tunnel entrance to the various sorting and washing buildings, or to the standard-gage cars for loading. It is also in great demand at quarries, sand pits, blast furnaces, and at sugar, coffee, and other plantations.

The compact little trolley locomotive shown at the top of the front page of this issue is used on the three-foot gage tracks in the rail mill of the National Steel Company. It carries two motors, one on each axle, which operate at a potential of 220 volts. The drivers are 30 inches in diameter; the wheel base is 5 feet, and the total weight is about 8 tons. The locomotive is 14 feet long, 10 feet high, and 4 feet 8 inches in width. In electric locomotives of this class it is customary to estimate the drawbar pull as one-fifth of the weight on the drivers; but in practical work on tracks that are liable to be wet or greasy, as is generally the case in shops and mills, the driving wheels will slip before the estimated drawbar pull is reached, and sanding the tracks is usually necessary under such conditions.

As there are no severe limiting dimensions to be considered in the surface locomotive, it differs altogether in form from the mining locomotive, although the construction of the truck is much the same. Upon the truck is mounted a roofed-in cab, as shown in the illustrations just referred to, and the driver stands upright in a position where he has the controller, brake, sand-box lever, and alarm gong placed conveniently behind.

The storage battery locomotive, which is shown below the illustration of the trolley locomotive just referred to, has a drawbar pull of 1,000 pounds; the weight of the battery is about 6 tons, and the machine may be operated either from the trolley wire or by the storage battery; moreover, it may be charged from the trolley wire, a feature which renders this locomotive a very valuable and flexible machine. It will be noticed that the battery box is carried on the top of the locomotive. The connections are such that it may be charged at the same time that the motors are being driven with the current supplied through the trolley.

Much attention has lately been given in coke-making plants to the question of transporting the lorry from the bins to the coke-ovens. In the outfit here shown an equipment of electrical motors has been applied with very satisfactory results. The frames of the motors have been so arranged that a simple and efficient connection can be made with the axles of the lorry.

Another important use of the electric locomotive has been found in the yard work connected with large modern blast-furnace plants. We show an illustration of an electric locomotive which is equipped with a special motor for tipping the ladle. The combining of the ladle and locomotive in one machine has been found to be very advantageous because of the ease of operation, the reduction in space, and the smaller number of parts. It will be seen that this form of construction is suited also for the tipping of wagons loaded with earth, coke, or minerals. The particular locomotive here shown is at work at some blast furnaces at Seraing, Belgium.

Automobile News.

A new speed record of 27 seconds for the kilometer was made by the Hon. C. S. Rolls in Welbeck Park, Nottinghamshire, England, on February 26. A 72 h. p. Mors racer was used, and the rate at which it traveled was equal to 83 miles an hour. The best previous official record was 29 seconds, made November 17, 1902, by Augieres on a Mors car, in France. The record, which is 2 seconds better than the existing one, is not considered official, as the course was on a down grade.

The results of the 4,000-mile tire test conducted by the A. C. of Great Britain were announced recently. The tires awarded first prize were the Dunlop double tube; the Collier double-tube tires obtained the second prize; while the third prize was divided between three sets of Dunlop and one of Talbot tires. The Collier tire showed the least wear of any, but the dynamometer tests showed that the same car with these tires on pulled from 15 to 30 per cent harder than when fitted with Dunlop tires, and the resiliency was found to be less.

News comes from Worcester, Mass., that the Morgan Truck Company has completed and tested with success the largest automobile ever completed. The vehicle has a capacity of ten tons to a load, and is built entirely of steel. The motor used is a steam engine. The boiler is of the torpedo water-tube type. The automobile is so constructed that two or three loading bodies can be used, removing the trucks and running gear and placing them under another body, thus saving an enormous amount in time and expense of loading. Two big cranes are attached to the truck, operated by the engine, capable of lifting the largest steel beams or granite blocks. The total daily capacity of the truck is estimated at 400 tons.

The long-distance race on the Continent this year will be from Paris to Madrid—a distance over the route chosen of 531 kilometers, or 329¾ miles. The race will be run on three successive days—May 24, 25, 26. Among the French manufacturers who have entered machines are the following: Mors, 10 cars; Panhard-Levassor, 12; Renault Frères, 10; Dietrich, 9; Decauville, 4; Ader, 8. The manufacturers of the German "Mercedes" car have entered 6 machines; the makers of the Belgian "Pipe" machines have entered 4; England will be represented by Edge and Jarrott on Napier cars; and America by 2 Matheson machines, built by the motor car company of that name, Grand Rapids, Mich, and by H. S. Harkness and W. K. Vanderbilt, Jr., who will drive special cars which they are having built.

MM. Gobron and Richard have recently arranged a new classification of vehicles which is to be used in classifying the racers in the Circuit de l'Argonne. The idea is to use the total cylinder area, instead of the weight of the cars, as a basis of classification. The four classes to be arranged on this basis are as follows:

1. Total cylinder area equal to or less than 1.5 liters (91.53 cu. in.).

2. Total cylinder area equal to or less than 2.5 liters (152.55 cu. in.).

3. Total cylinder area equal to or less than 5 liters (305.11 cu. in.).

4. Total cylinder area equal to or less than 8 liters (488.17 cu. in.).

These four classes correspond to vehicles of from (1) 6 to 10 effective h. p.; (2) 15 to 18 h. p.; (3) 30 to 35 h. p.; (4) 40 to 50 h. p. The volume indicated is the product of the surface of the piston by the stroke and number of cylinders. Those who do not wish to reveal these dimensions, cannot enter the race; while the penalty of disqualification will more than suffice in case of fraud.

EXTENSION OF TRANSIT FACILITIES IN NEW YORK.

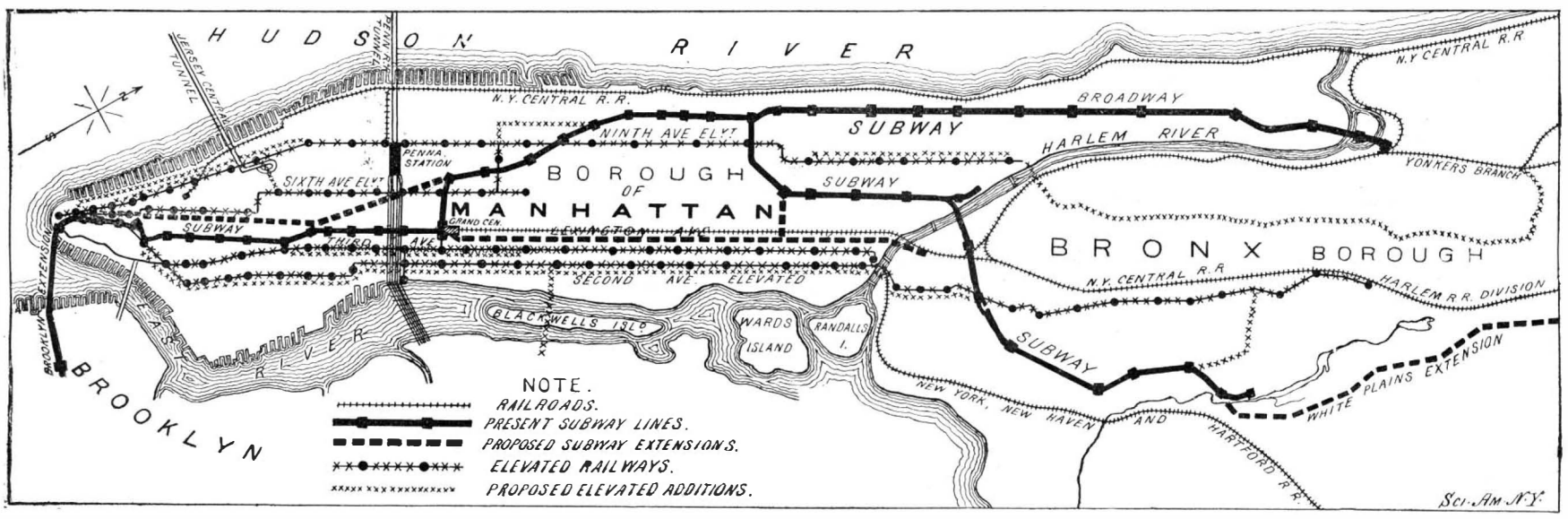
We present a map of New York city which shows in clear detail the present elevated and subway transit facilities and the elaborate scheme of improvements and extensions recently suggested by the Chief Engineer of the Rapid Transit Commission. In his report the Chief Engineer states that it has always been the intention of the Rapid Transit Board, when the finances of the city would permit, to lay out a thoroughly comprehensive system of rapid transit, and that the work at present under contract was mapped out with reference to and as part of this ultimate and more comprehensive plan. As will be seen from our map, the present report deals with Manhattan and the Bronx. Naturally, the first interest attaches to the proposed extensions of the subway system proper, and it is gratifying to note that the report proposes the construction of another north and south subway tunnel below Forty-second Street. The new line will run from the corner of Forty-Second Street and Broadway, below Broadway to Fourteenth Street, whence it will continue south below University Place, Wooster Street and Church Street to South Ferry. This will be a two-track structure. A short connecting branch will run from Broadway below Thirty-second Street to connect with the new Pennsylvania depot. From the present four-track subway at Fourth Avenue and Fortieth Street a three-track subway extension will be carried below Lexington Avenue to and beneath the Harlem River, to connect with the New York Central and Harlem River tracks at Mott Haven. A connecting branch will be carried from the Lexington Avenue line westward beneath 110th Street, to a junction with the subway at 110th Street and Lenox Avenue, thus providing a connection between the east and west lines north of Central Park, just as the Forty-second Street subway line provides a connection south of the Park. Shortly after leaving Mott Haven the subway line now under construction passes to an elevated structure, and is continued as such to Bronx Park. The proposed extensions include the continuance of the elevated structure along the eastern side of Bronx Park to the suburbs of Wakefield and Mount Vernon, while another branch is proposed, to extend along the Southern Boulevard, then westerly on 180th Street to a connection with the Third Avenue line of the Manhattan Elevated Railroad.

As the additional lines proposed, especially those in the subway, will require several years to complete, and as, during this interval, it is absolutely essential that early relief measures be provided, it is proposed to make immediate extensions of the Manhattan Elevated system, besides laying additional tracks on certain specified avenues. In the first place, it is proposed to double the capacity of the Second Avenue line, by the addition of two tracks from Harlem River to Chatham Square, where the new tracks will be carried over the Chatham Square junction and over the Park Row line in the form of a second deck to the City Hall. By converting the Second Avenue division into a four-track structure, and by extending it to the City Hall, an immeasurably better service will at once be provided for the east side of the city, and passengers from Harlem and the Bronx will be carried direct on express tracks to the City Hall. By connecting the rapid transit Westchester Avenue line with the suburban line at 149th Street, through trains can be run from as far north as Mount Vernon by a direct line to all points south of the Harlem River, including South Ferry. The Third Avenue line is to be increased in capacity by extending the third track from Fifty-ninth Street to Ninth Street, thereby giving a continuous express track from Harlem River to the latter point. North of the Harlem River it is proposed to add a third track on the Third Avenue Elevated from the south side of Harlem River to Westchester Avenue. On the Sixth Avenue Elevated line, in order to furnish special trains from the shopping district, and a connection to the terminus of the New York and New Jersey tunnel at Greenwich and Christopher Streets, it is proposed to extend the Sixth Avenue line along Christopher Street from Eighth Street station to Greenwich, and to lay a third track on the Sixth Avenue structure from Eighth Street northward. This would enable trains to run "local" as far as Eighth Street, and then pass to the third track and run express to Harlem. On the Ninth Avenue line it is proposed to extend the third track from Fourteenth Street south to Cortlandt Street, thereby enabiing the express service to commence from the latter point. A branch is to be run westerly from the Ninth Avenue road at Fifty-third Street to Tenth Avenue, and thence north to Fifty-fifth Street, where the new branch would be depressed into a subway and extended under Amsterdam Avenue to a connection with the subway at Seventy-second Street. This would give some measure of relief pending the completion of the present subway from City Hall Park to South Ferry. Another important extension is the continuing of the third track on the Eighth Avenue road from 116th Street north to 155th Street. An important proposal affecting the districts north of the Harlem River is to make an arrangement with the Putnam division of the New York Central Railway for widening the present Harlem bridge into a three-track structure, and then carrying the Eighth Avenue line across the Harlem River with three tracks to Jerome Avenue and northerly to Woodlawn, and thence westerly to a connection with the Putnam division in Van Cortlandt Park. This line would give rapid transit facilities to the largest area in the whole city of New York, which is to-day without rapid transit facilities.

If the consent of the railroads with terminals at Forty-second Street can be had, connections should be made at as many points as possible with the subway and elevated lines. The points where such connections can be made are with the suburban elevated at Fordham; with the proposed Jerome Avenue extension at Van Cortlandt Park; with the subway at Kingsbridge; with the Manhattan elevated at 155th Street, to both the main line and the Putnam division of the New York Central; with the subway to the New York Central at the Harlem Ship Canal; with the Lexington Avenue subway to the New York Central, Harlem, and New York and New Haven railroads at Mott Haven; and all so arranged that local trains from nearby suburban points can be run direct over the rapid transit lines and thus avoid the congestion at the Grand Central Station or the delay in transferring from one railway to another.

Finally, it is proposed that negotiations be taken with the New York Central Railroad Company for the removal of their tracks from the city streets south of Fifty-ninth Street and on the surface of Eleventh, Tenth, and other avenues and streets south to Beach Street, and the substitution in place of them of an elevated structure along the same route, or possibly along West Street, which might be continued south to Battery Place, and so provide not only a freight line, but also a passenger line along the water front. It is also suggested that a branch of the Second Avenue Elevated be constructed along Sixty-fourth Street, and over Blackwell's Island bridge to Long Island, and that on Long Island a plaza be arranged permitting the present surface lines in that district to deliver their passengers to the elevated, by which they can be carried by an express and local service to any point north or south in Manhattan, Brooklyn, or the Bronx.

Should the proposed extension be carried out, the city will own a complete railway system covering 37½ miles in the borough of Manhattan and the Bronx, with 100 miles of track exclusive of side tracks. Moreover, immediate relief is offered by an extension of the existing elevated railway facilities. Such an extension of the city's transit facilities, which together are equivalent to the addition of about 130 miles of single track, could be obtained for the expenditure of between $45,000,000 and $50,000,000, $25,000,000 of which would fall upon the city. Taken altogether, the scheme of extension seems to have been very carefully thought out, and we believe that the selection of routes is about the best that can be made to meet the immediate necessities of city travel.



MAP SHOWING PROPOSED EXTENSIONS OF THE SUBWAY AND ELEVATED LINES IN NEW YORK.

Expiration of the Brush Storage Battery Patents.

The two patents granted to Charles F. Brush in 1886, covering the construction of the Faure, or pasted type of storage battery plate, expire on March 6. These two patents—Nos. 337,298 and 337,299—covered very broadly the mechanical application of the active material to a storage battery plate. The patents were assigned to the Electric Storage Battery Company, which, having a monopoly of the pasted plate—considered to be the only practical form in the early days of commercial storage battery manufacture—built up a large business with its "chloride" accumulator. In the various suits for infringement instituted by this company against other concerns, the validity of these patents was always upheld. Consequently, the storage battery designers were forced to fall back on the original Planté type of plate, which has been much improved on this account.

Now that the Brush patents have become public property, inventors can make use of this type of plate in still further perfecting storage batteries; and it is to be hoped that eventually, perhaps by the combination of the two forms, a well-nigh perfect storage cell will be devised.

Tortillas—Bread of the Spanish-American People.

In conjunction with the systematic effort made in recent years by the United States to make known in Europe the food value, or rather, table value, of Indian corn, it may interest many housekeepers to know how tortillas are made. These tortillas are, as many know, thin cakes of corn, and are used in Mexico and other Spanish-American countries almost universally in lieu of wheat bread. The corn, selected clean kernels for best results, is boiled in lime water until soft. It is then washed thoroughly in water to remove all traces of lime, and rubbed between the hands to remove the outer husk of the corn. The clean corn is then ground, while wet, to a soft mass, which is easiest accomplished with a Straub peanut butter mill. The wet dough resulting from grinding is patted into thin cakes of convenient size and baked on a dry griddle (that is, without fat) and served hot. In the better class families it is usual to have one servant bake these tortillas continually during the course of a meal, so that the table may be supplied fresh from the griddle all the time. While these cakes are a radical departure to all English-speaking people, many soon develop a great liking for them. They are especially palatable when eaten with highly flavored meat dishes, such as the Mexican "chile con carne;" and also when spread with butter. It may be well to add that no salt is used in the preparation of these cakes.

The Current Supplement.

The current SUPPLEMENT, No. 1418, contains, among other interesting things, an article on Aluminography. Civil engineers will find in the "Simplon Tunnel and Its Construction" a most valuable article. Why the government vessels are so long delayed in construction is a subject which is treated at length. In the South it is the practice to employ convicts for the making of roads. Mr. J. O. Holmes, of the Department of Agriculture, describes in an entertaining way exactly how convict labor is utilized for this purpose. Mr. Fred T. Jane continues his account of the Naval War Game between the United States and Germany. M. Berthelot, the well-known French chemist, has made an analysis of certain ancient metallic objects, and has described his results in an interesting memoir.

THE LATEST HIMALAYA-CLIMBING EXPEDITION.

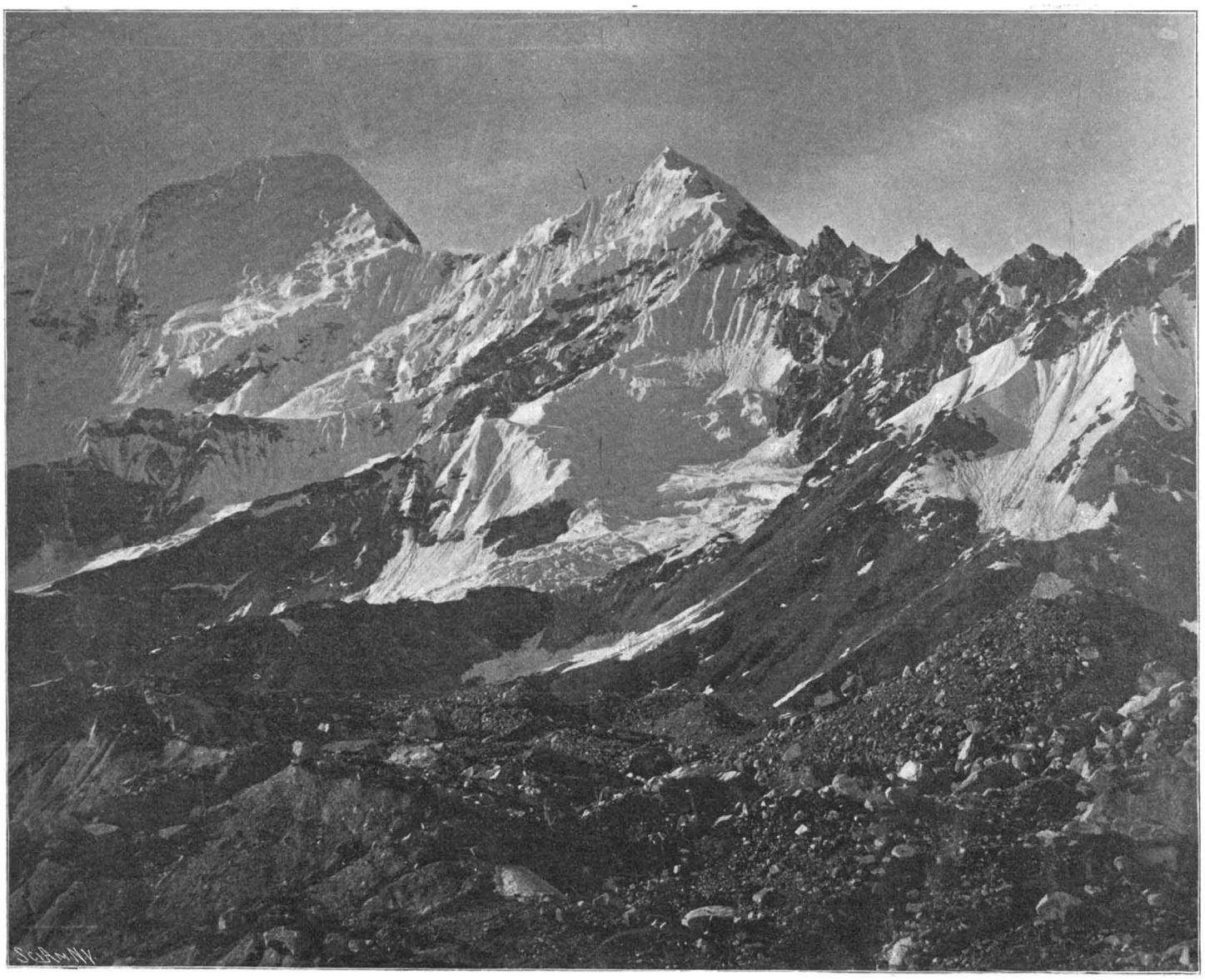
BY HERBERT C. FYFE.

A serious attempt is about to be made to ascend the highest mountain in the world, Mount Everest, which rears its stately head 29,002 feet above the level of the sea.

The highest point to which man has so far climbed is 23,080 feet. This is the height of Aconcagua, the loftiest summit of the main cordillera of the Andes. Aconcagua was scaled by the famous guide, Mathias Zurbrigger and Mr. Vines, two members of the expedition sent out by the Royal Geographical Society in 1887 under Mr. E. A. Fitzgerald, who himself failed to reach the summit. Before this event the record was held by Sir William Martin Conway's expedition, which in 1892 climbed a mountain in the Karakoram Himalayas 22,600 feet high. Mr. W. Graham in 1883 claimed to have ascended Kabru (24,015 feet), but his claim is generally disallowed. The new expedition, which has just started for the Himalayas, is under the direction of Mr. Eckenstein. Very few details regarding the plan of operations can be ascertained, but it is known that Mr. Eckenstein and his companions have set before themselves the task of ascending to the loftiest peak of the two highest mountains not only in the Himalayas, but also in the world, Mount Everest (29,002 feet) and "K 2" (28,250 feet).

Some day or other a mountaineer will succeed in scaling Mount Everest. There is nothing impossible in it. Two things are wanted, time and money; and provided these are forthcoming, success may very well be looked for.

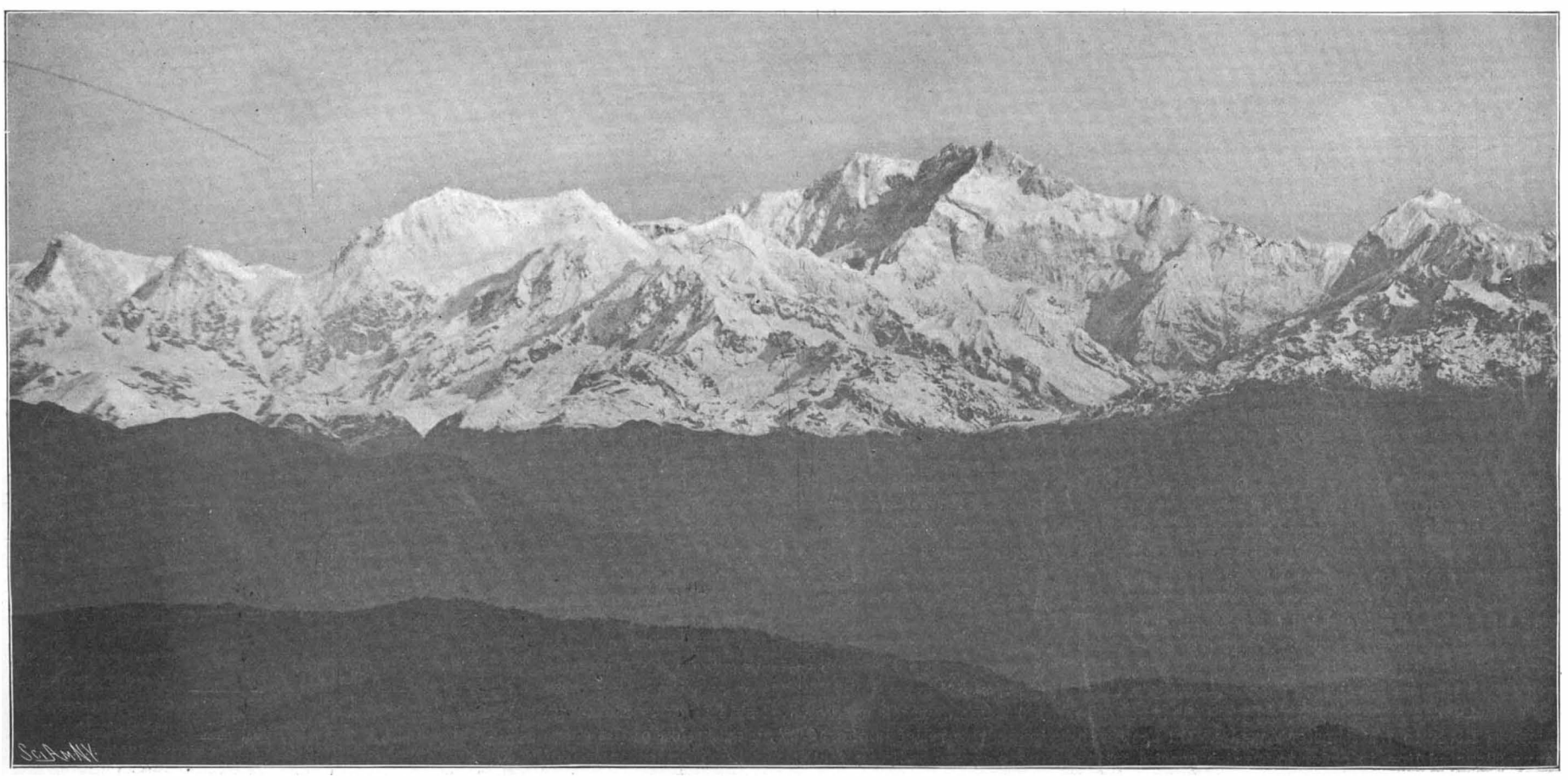
Most of the great climbers of to-day agree in affirming that man could exist at an altitude of 29,000 feet, provided of course that careful precautions were taken and that all the details of the expedition were worked out in a thoroughly practical manner. The climber must not attempt to ascend Mount Everest right off. He will have to take some years over it, climbing each year to a certain height and resting weeks here and there on the road in order to accustom his body to the unwonted altitudes. Supplies will be a great problem, but if he can manage to insure food, clothing, and other necessaries reaching him at the various camps at which he will be forced to remain for some little time, and if he is strong enough to withstand the cold and the rarefied atmosphere, it is possible that one day his ambition will be satisfied and that he will be able to take his stand on the highest point of the earth's surface and to rejoice in the fact that he has accomplished something which no one else has ever done since the world began. Let us see what the experts have to say respecting the possibility of scaling Mount Everest.



PEAK TO THE NORTH OF SINIOLCHU—SIKKIM.

Quite recently a paper was read before the Alpine Club by Dr. Malcolm L. Hepburn on "The Influence of High Altitudes in Mountaineering." Summing up his remarks as to the ascent of Mount Everest, Dr. Hepburn said: "Provided he has plenty of time, plenty of suitable food, and fine weather, I see nothing unavoidable in the conditions of the atmosphere at high altitudes to prevent a man with healthy organs from ascending the highest point on the earth's surface."

Among the speakers at Dr. Hepburn's lecture was Sir Martin Conway, who spoke as follows: "On the two occasions when I have been close on 23,000 feet I have felt that I could have climbed further, and that if I could have slept there I might have climbed much further. The problem of climbing Mount Everest will be comprised of two main difficulties—politics and finance. If the governor of India would persuade the government of Nepal to let the Alpine Club try, and if about £10,000 were forthcoming, and a good party, with an ample supply of porters, could devote two or three



THE HIGHEST MOUNTAIN PEAKS IN THE WORLD.—MOUNT EVEREST SEEN FROM DARJEELING. HEIGHT 29,002 FEET.

consecutive years to the attempt, there would be some chance of conquering the peak."

Another great mountaineer is Mr. Douglas L. Freshfield, who recently took an expedition to the Himalayas and attempted the ascent of a mountain in Sikkim, 28,156 feet in height, situated as far south of the Karakoram range as Etna is of Mont Blanc. Mr. Freshfield got no higher than a little over 21,000 feet, but he was the first explorer to take a party of over fifty men, most of them carrying loads varying from 15 pounds to 40 pounds, over a pass of above 21,000 feet, sleeping twice at close upon 20,000 feet. Here is Mr. Freshfield's opinion as to the climbing of Everest:

"There seems to me to be no sufficient reason for thinking that climbers may not attain 29,000 feet. Considering how much more gradually the rarity of the air increases between 20,000 feet and 30,000 feet than it does at inferior levels, I have every confidence that the highest mountain in the world will, if Nature has not forgotten a ladder to it, be some day trodden by human foot. I felt slack while we were above 15,000 feet, and on reaching the foot of the final ascent (21,000 feet) after wading over a long plain of snow, followed by a short, gentle slope, was completely out of breath. After a meal I found the ascent of some 500 feet to the pass, partly over rock, less fatiguing; and on the top, in the excitement of the discussion that ensued, I lost the sense of exhaustion, and it did not return."

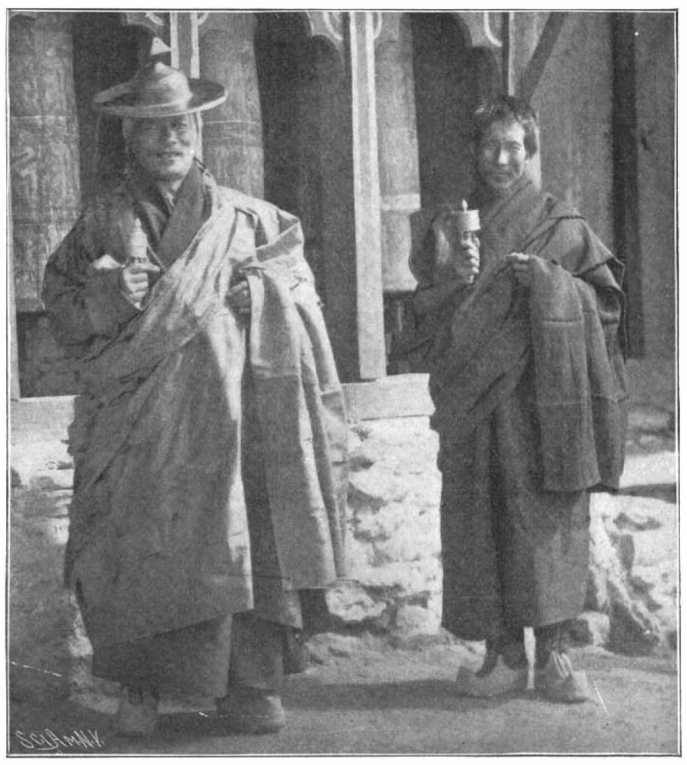
Those famous climbers, Mr. Whymper and Mr. Dent, agree in declaring that the ascent of Everest is not impossible, though it would be costly, laborious, long, and possibly not free from risk.

"If Everest were only in England," Mr. Dent has remarked, "the problem would have been solved long ago." It is agreed that the easiest side for the ascent is from the north, but the government of India do not care about travelers penetrating into Tibet, and it is possible after Mr. H. Henry Savage Landor's reputed experiences that the travelers themselves would fight shy of the Tibetans, who are not a kindly race as far as strangers are concerned.

Starting from the south side, the mountaineer will be exposed to malaria; but as it is now known that you cannot contract malarial fever provided you are not bitten by mosquitos, it is possible that this difficulty could be overcome. There are geographers who do not seem to be convinced that Everest is really the highest peak in the Himalayan chain, but we hope if Mr. Eckenstein does succeed in reaching the summit of Everest, he will not find a still higher peak awaiting the climber. The Himalayas have several peaks over 28,000 feet, and more than a thousand which have been measured, exceed 20,000 feet.

From any point of view to which Europeans have access, Everest fails to impress the observer with its great height. Indeed, it is difficult to believe that other mountains do not far exceed it.

"Owing to its great distance in the interior," says Major L. A. Waddell, in his book "Among the Himalayas," "behind the outer snowy peaks that tower in front of it, the enormous height is not apparent, and this was only revealed by the scientific measurement of the Indian Survey Department."



PHALDONG LLAMAS.

TWO LLAMA PRIESTS

About the year 1850 the Great Trigonometrical Survey of India extended their triangulation to the foot of the Himalayas, and measurements were made from this newly gained base to the snowy peak beyond the frontiers.

Between November, 1849, and January, 1850, it was discovered that in Tibet, at 27 deg. 59.3 min. latitude and 86 deg. 54.7 min. east longitude from Greenwich a peak rose to the enormous height of 29,002 feet, the highest measured elevation on earth. He who has never seen the Himalayas from Darjeeling has missed one of the grandest views the world can afford.

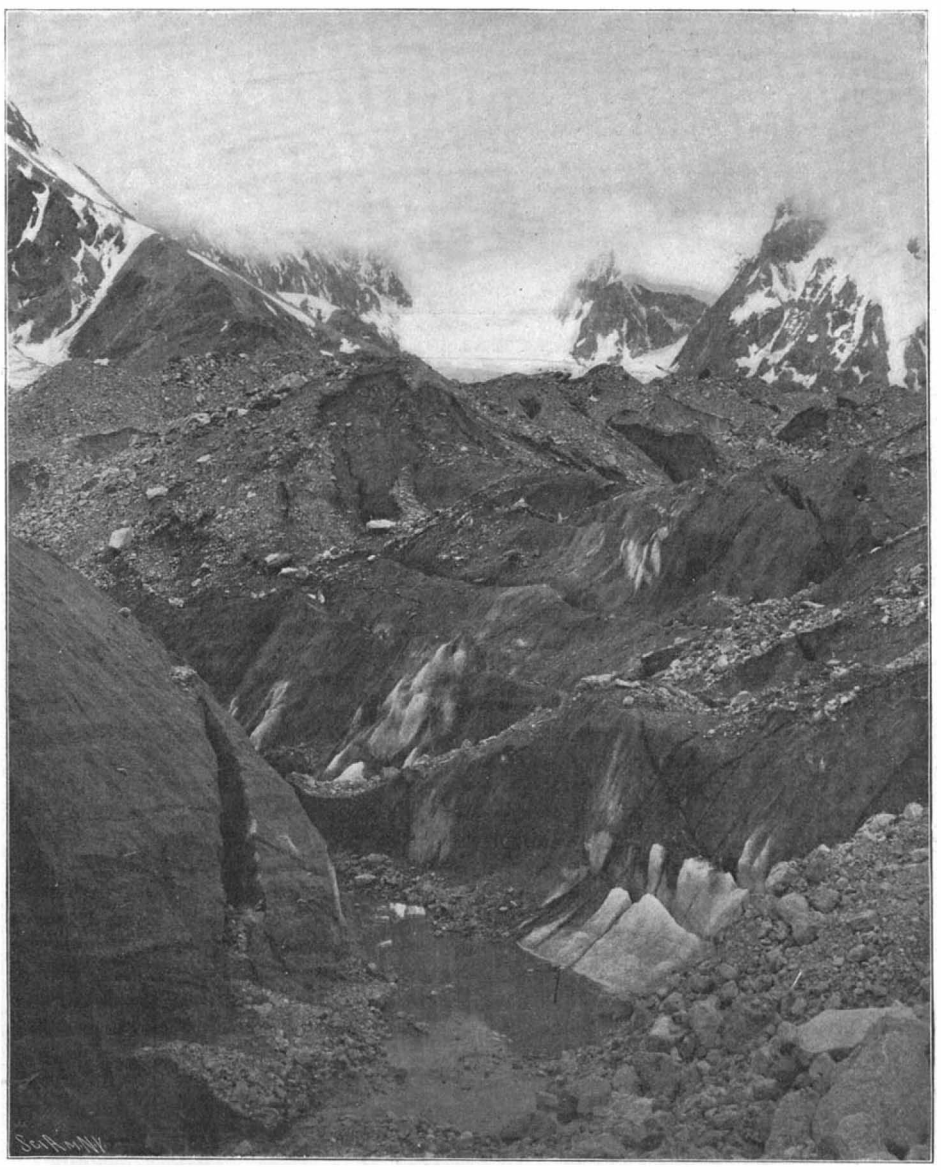
Darjeeling is within 24 hours of Calcutta, and Calcutta is less than three weeks from England, so the traveler who is weary of Switzerland and who knows his Europe well, may be recommended to betake himself to the Himalayas.

"Roads have penetrated," says Major Waddell, "the mountain fastnesses in nearly every direction in the state of Sikkim, a Switzerland of the East, situated in the heart of the Himalayas, within sight of the culminating pinnacle of the world, Mount Everest."

The traveler need not dread the terrors of the region, for the worst torrents have been bridged and travelers' staging houses have been erected along some of the chief routes, thus greatly facilitating the exploration of these mighty mountains.

Before concluding this article it may be interesting to recall the fact that the great Russian painter, Vassili Verestchagin, when traveling in Northern India, made an attempt to ascend the next highest mountain on the face of the globe after Everest and K 2, viz., Kazchenjunga, 28,000 feet odd above the level of the sea.

Verestchagin attempted the ascent in January when the mountain was covered with ice and snow, and he got no higher than 15,000 feet. He was considered a madman for trying to do that. "Some English officers in the neighborhood," says a recent biographer of the painter, "when first they heard of his project did all they could to dissuade him from it. With his characteristic obstinacy he simply thanked them for their advice and went on with his preparations for the ascent. 'At least,' they said, 'you will never take the lady?' Madame Verestchagin was with him, and had insisted on accompanying him. 'That will depend upon her,' said Verestchagin, and his wife went with him all the same. It was a frightful ascent. The coolies abandoned them when they had gone a very little way—these dark-skinned races cannot stand the cold—and at last they had only one man, who carried the color-box and drawing tools, the use of which was Verestchagin's main object in the journey. The painter wanted to go up there to study effects of snow and cloud. By and by even this man's courage failed him, it became so intensely cold. They were wading in snow up to the knees in some places and in others up to the waist. The ponies had been left below. There was no house or shelter of any kind. They called a halt, and the courier went back to get help, leaving Verestchagin and his wife on the mountain in the midst of the snow, with only a small wood fire between them and all but certain death, and with nothing but snow for meat and drink. They cowered over the fire till the falling snow put it out, and then for all that day and night till far into the next day they struggled as best they could for life. As a final and desperate effort, Verestchagin, taking leave of his wife, whom he never expected to see again, descended until he found men whom he forced to accompany him to the rescue of his brave wife."



A GAP IN THE SNOWS-ALTITUDE, 19,300 FEET; SHOWING HOLE IN GLACIER ALTITUDE 17,500 FEET.

The French Naval Department is evidently sharing the skepticism entertained by the naval authorities of other countries in connection with submarines, since the Minister of Marine has decided to complete only twenty of the fifty submarine boats at present in various stages of construction. There are various types of submarine vessels in the French navy, ranging from the 30-ton "Gymnote" to the 270 tons of the "Gustave Zédé." Thirteen boats each of 175 tons displacement are in course of erection, but work is to be stopped upon them. The French Naval Department for some reason is apparently antagonistic to these heavy submarines, since the twenty boats to be completed are only of 70 tons displacement.

VENOMOUS SERPENTS.—IV.

BY RANDOLPH I. GEARE.

There is a large group of serpents known as the Elapine snakes, in which the abdomen is supplied with broad band-like plates, the head is shielded and the tail is pointed. Most of them are non-poisonous, but in the few venomous forms the poison-fangs do not fold down as in the viper and rattlesnake, but remain erect. In some the fang is grooved, while in others it is perforated through nearly its entire length.

In this group attention is first invited to the King Cobra, or Hamadryas. This terrible serpent belongs to the same genus as the common Cobra (*Naia*). It feeds almost entirely on reptiles, venomous and otherwise. It is a comparatively frequent eater, requiring food at least once a month. As soon as the food is within reach, the snake hisses loudly, and, expanding its hood, rises two or three feet, and darts on it very much in the same manner as the Cobra.

The King Cobra has a wide distribution in Southeastern Asia, from Bengal, through the whole Indo-Malayan region to the Philippines. It is one of the most deadly of all snakes, and is known to follow persons and attack them. It is of gigantic size, one recorded specimen measuring sixteen feet nine inches. Fortunately it is not as venomous as the common Cobra, although it is doubtless responsible for a large share of the twenty-two thousand deaths which, according to official statistics, are caused annually in India alone by the poison of venomous snakes.

The King Cobra inhabits chiefly grassy jungles. Its favorite food seems to be snakes of all kinds. To this peculiarity is due the belief among the people of India that it receives royal honors from all other serpents, and hence its name "King" Cobra. It is occasionally handled by the Indian snake-charmers in common with other Cobras, but it is not quite so showy on account of its inability to expand its hood to so large a degree.

In South America is found the Labarri (*Elaps lemniscatus*), which is closely allied to the Harlequin Snake of North America. The Labarri is usually found coiled on the stump of a tree. or in some other place where it can hardly be distinguished from the object on which it is lying. It is mortally poisonous when adult. It may be described as rainbow-colored in life, but its brightness fades soon after death. It is said that specimens eight feet long have been killed.

A genus common in Natal, and occurring also in other parts of South Africa, is the Narrow-headed Dendraspis (*Dendraspis angusticeps*). It is long, slender, unusually active and a good climber. Its poison-fangs are very long, perforated, and permanently erect. It is olive-brown, greenish above and of a pale green beneath. It sometimes reaches a length of six feet.

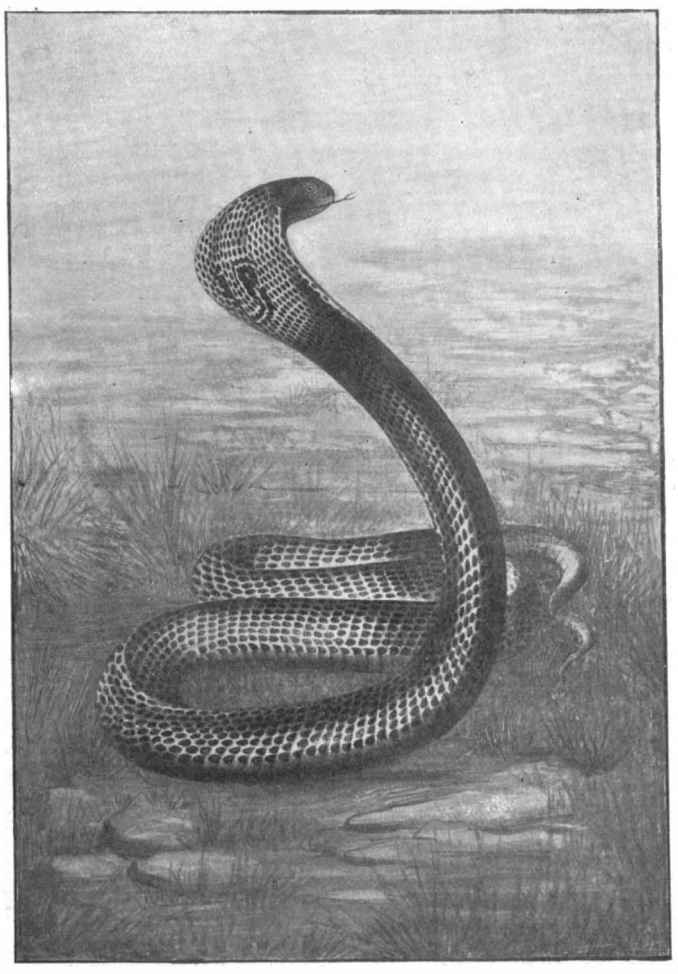
Another venomous serpent of South Africa is the Atractaspis (*Atractaspis irregularis*). Its fangs are longer in proportion than those of any other known serpent, reaching nearly to the angle of the mouth. It is believed to burrow in loose ground. It rarely measures over two feet in length, and its color is blackish-green above, shaded with orange-brown and orange-buff below.

There remains yet to be mentioned that fearful and deadly serpent, the Cobra of India (of which several species occur, and all of which are closely related, anatomically speaking, to the Elapidæ or Coral Snakes) and its relative, the African Cobra. The species most generally known is the common Cobra, or Cobra di Capello (*Naia tripudians*). When irritated, it has the power of bringing the "ribs" of the neck and fore part of the head forward. This action distends the skin, and displays the hood (or neck expansion) to the best advantage. On the back of the hood of many specimens are two large spots, like eyes, which are joined by a curved black stripe, and the whole resembles a pair of spectacles. This curious feature is the basis of an Indian legend, to the effect that one day when Buddha was asleep, a Cobra came near him and raised its body between him and the sunbeams, spreading its hood so as to shade his face. Buddha on waking acknowledged his thanks and promised to repay the snake. Now it happened that Cobras, huge and venomous though they are, had been liable to attack from a certain bird, called the Brahminny Kite; and this particular snake, fearing after a while that Buddha had forgotten his promise, petitioned him to grant him perpetual relief from the attacks of this bird. Buddha immediately granted his prayer, by placing a pair of spectacles on the Cobra's head, which so frightened the Kites that they have never since dared to attack a Cobra.

Another popular myth is that the Cobra loses a joint of its tail every time it emits poison, and this is just the reverse of the idea regarding the rattlesnake. namely, that it adds a new joint to its rattle for every person it kills.

There is probably no other snake which has been used so extensively as the Cobra by Indian snake charmers for displaying their supposed powers over serpents. It should be remembered, however, that these huge creatures are exceedingly indolent, and therefore less easily aroused to using their terrible weapon. It may also be that the charmer possesses means, not commonly known, of rendering himself proof against the effect of the venom. There are also certain remedies, said to be effectual, the knowledge of which would doubtless add courage to the charmer in his daring feats. One of these is the Birth-wort (*Aristolochia indica*). This is a creeping plant, the fresh leaf of which is very bitter and aromatic. It is not an universal specific, however, for some dogs which had been bitten by a Cobra and treated with the leaf of this plant, died apparently quicker than if the remedy had not been given them. It is said that human beings become cold as marble under the influence of the venom, whereas dogs are thrown into a high fever. The probabilities are that this plant is merely a powerful stimulant, and as such simply lessens, rather than counteracts, the effect of the poison.

The Cobra is said to be proof against its own poison, but a non-poisonous snake quickly succumbs to its bite. The venom is harmless if taken internally, the same being true of rattlesnake venom. Nor is it fatal when brought in contact with a mucous surface, such as the interior of the stomach or the eye. The color of the Cobra di Capello, which usually is from three to four feet long, varies greatly. In some species the body is brownish-olive, and the "spectacles" are white, edged with black. Another, also brownish-olive, is covered with irregular cross-bands of black.



INDIAN COBRA (NAJA NAIA).

Others are olive, marbled richly with brown below. Some are of uniform brownish-olive without any "spectacles," while yet others are black with white spectacles, and still others black without any spectacles. Those without spectacles are recorded as occurring in Borneo, Java, the Philippines and other eastern islands.

The African Cobra is fully as poisonous as its Indian relatives. Its native name is "Spuugh-Slange," or Spitting-snake, on account of its being able to project the venom to a distance of several feet. It is a furious fighter; seldom running away, and more frequently commencing the attack. It is fond of climbing trees in search of prey and is also a good swimmer. Its coloration is variable; sometimes a yellow-brown, uniform or covered with irregular patches. Others are black when full grown, while before maturity they have a series of broad yellow bands on the fore part of the body. The length of this snake ranges from five to six feet.

Several of the illustrations and some of the material used in the preparation of this article have been furnished by the authorities of the National Museum.

NOTE: In the SCIENTIFIC AMERICAN SUPPLEMENT for March 14, 1903, will be published the last installment of this series. The installment in question will deal with Serpent Venom.

It is said that a company is soon to attempt the sending of wireless telegraphic messages from San Francisco to the Hawaiian Islands.

Prospects of Niagara Power on the Canadian Side of the Falls.

BY ORRIN E. DUNLAP.

Prospects are exceedingly good that a large amount of electrical power will be available on the Canadian side at Niagara within a few years. Already two companies are at work there erecting plants for the development of not less than 100,000 horse power each, and now a third company has secured a franchise. This new company is known as the Toronto Niagara Power Company, and the Ontario government has granted it a franchise to develop 125,000 horse power. Its method of development will be identical with that of the Canadian Niagara Power Company. It will construct a large wheel-pit and a long tunnel, the portal of which will be close to the edge or behind the sheet of water of the Horseshoe Fall.

Inasmuch as the wheel-pit of the Toronto Niagara Power Company will be further upstream than the works of the Canadian Niagara Power Company, the tunnel will be longer by a few hundred feet than the one now building. The inlet of the Toronto Niagara Company will be above that of the Canadian Niagara Power Company; and in order that the water service of the latter company may be unimpaired, the Ontario government will cause the Toronto Niagara Power Company to build weir dams for its protection. The work contemplated under this latest franchise will cost in the neighborhood of $5,000,000 and will take two or three years to complete. The Toronto Niagara Power Company's objective point for transmission is the city of Toronto, and it is intimated that the street railways and the lighting plants will receive power from the new company.

Each franchise granted adds materially to the revenue of the commissioners of Victoria Park. The Ontario Power Company, which has right for two developments, pays $30,000 a year rental. The Canadian Niagara Power Company pays an annual rental of $15,000, and the Toronto Niagara Power Company will also pay $15,000 a year, making a total revenue at this time of $60,000 a year, payable in semi-annual installments. But when the companies get to developing power they will, in addition to this annual rental, make payment at the rate of one dollar per annum for each electrical horse power generated and used and sold or disposed of over 10,000 electrical horse power up to 20,000 electrical horse power, and the further payment of the sum of 75 cents for each electrical horse power generated and used and sold or disposed of over 20,000 electrical horse power up to 30,000 electrical horse power, and the further payment of the sum of 50 cents for each electrical horse power generated and used and sold or disposed of over 30,000 electrical horse power; that is to say, by way of example, that on generation and use and sale or disposal of 30,000 electrical horse power the gross rental shall be $32,500 per annum, payable half yearly, and so on in case of further development as provided, and that such rate shall apply to power supplied or used either in Canada or the United States.

Dr. Brooks Again Honored.

Dr. William R. Brooks, director of the Smith Observatory, and Professor of Astronomy at Hobart College, has been awarded the comet medal of the Astronomical Society of the Pacific, for the discovery of his latest comet. This is the seventh meda' awarded to Dr. Brooks by this society for his cometary discoveries—now twenty-three in all. He also has the distinction of holding the first medal ever awarded by this institution.

The Possibility of Another Peary Expedition.

The Peary Arctic Club is trying to fit out another expedition early in the spring.

Nothing definite toward such an expedition, however, has been done yet. Everything depends on raising enough money in time. The "Windward," Mr. Peary's old ship, has been sold, and in the first place another vessel will be required.

Mr. Peary is negotiating with the Italian government relative to the Arctic exploration vessel of the Duke of the Abruzzi, the "Stella Polare," which approached nearer the Pole than Nansen's ship, the "Fram."

Some time ago Lieut. Peary said $100,000 would fit out an expedition; now he thinks that $200,000 is necessary, or at least $150,000. With such backing he is confident that he could reach the Pole.

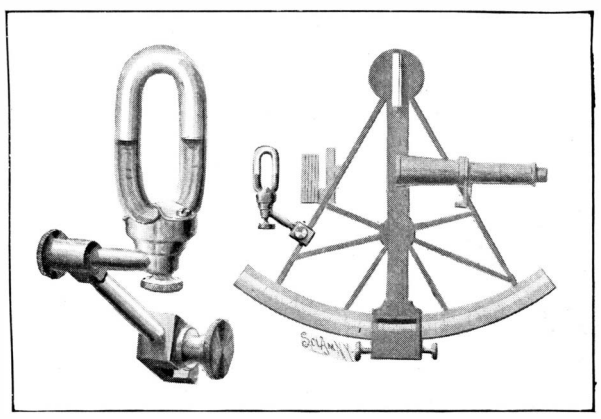
The "Stella Polare" is one of the few ships suitable for Arctic exploration. She was originally a Norwegian whaler, and is a 500-ton vessel—the minimum size for an Arctic expedition.

According to a dispatch to a London paper, the electrical equipment in use at the Indian durbar at Delhi was the largest temporary plant ever erected. There were sixty tons of overhead cables and fifty tons of buried lines.

Patent Department

ARTIFICIAL HORIZON.

An improved artificial horizon, more especially designed for use on marine sextants, has recently been invented by Mr. Joseph T. Edwards, of New Bedford, Mass. The device has a very simple construction, and may be readily applied to enable the observer to quickly and accurately bring the eyepiece and horizon glass in proper horizontal position when making an observation. Our illustration shows the simple construction of the device. It consists of a glass tube bent to the form of a flattened ring or link, and partly filled with mercury or some other suitable liquid. This ring is vertically pivoted to an arm, which is horizontally pivoted to a bracket adapted to be clamped to the



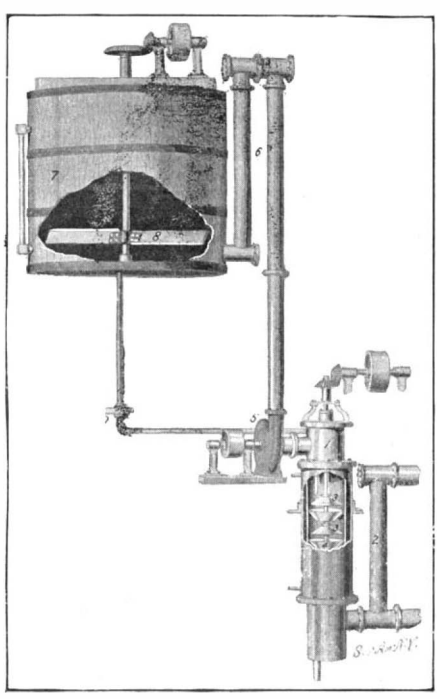
ARTIFICIAL HORIZON FOR MARINE SEXTANTS.

frame of the sextant. Provision is thus made for proper adjustment of the artificial horizon, to bring the level of the liquid into axial alignment with the horizon glass and the eyepiece. On sighting through the eyepiece the observer can easily determine whether the sextant frame is held in proper position; for when slightly tilted the surface of the liquid in one leg of the device will rise higher than that in the other leg, and not until a proper position is reached will they both perfectly coincide with the axial vision.

This device will be found particularly useful at night or on occasions when the natural horizon is blurred from the sight, or, if used on land, when the true horizon cannot be determined by reason of irregular topography. By making the artificial horizon in the form of an endless tube, no errors will result by reason of unequal air or vapor pressure in the two legs of the device.

A NEW ACID CHAMBER FOR SULPHITE WORKS

The acid chamber illustrated herewith—the invention of Mr. William A. McKee, of Hinckley, N. Y.—is designed to cause a thorough mixing of the lime water



A NEW ACID CHAMBER FOR SULPHITE WORKS.

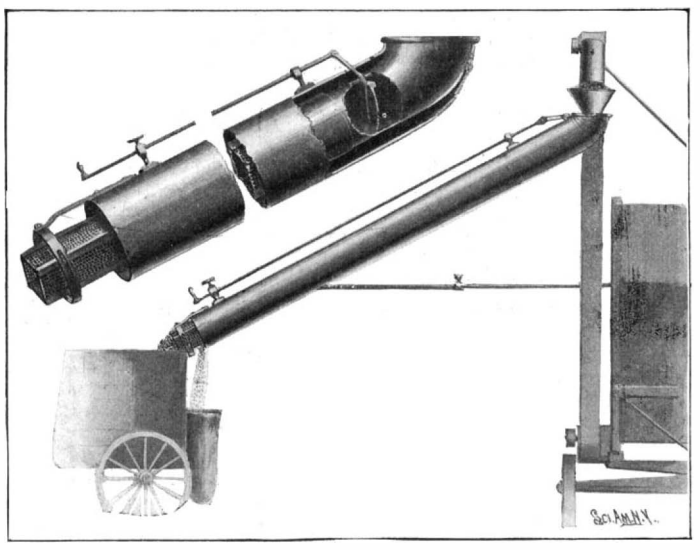
and the sulphur dioxide gas in forming the bisulphite of lime liquors needed in the sulphite process of making pulp.

The mixing chamber consists of a water-jacketed cylinder, 1, containing conical hoppers, 4, hung from brackets on the interior wall of the cylinder, which is of thin sheet lead. Interspersed between these hoppers, but mounted on a revoluble central shaft, are similar inverted cones, 3, adapted to act as splashers and to spread the lime-water as it trickles down and dash it, by centrifugal force, against the wall of the cylinder, whence it flows into the next hopper and from there on to the next cone, etc.

The gas is drawn in through pipe, 2, by means of the fan, 6, and it follows a sinuous course around the outer edges of one set of cones and through the center of the other set, thus coming into intimate contact with the lime-water, and being absorbed by it. Any gas that is not so absorbed passes through pipe, 6, and up through the tank, 7, filled with the liquid, where it is bound to be absorbed. The lime-water in the tank is constantly stirred by the paddles, 8, and its flow into the mixing chamber is regulated by valve, 9.

SEED-CLEANER FOR GRAIN SEPARATORS.

The seed-cleaner illustrated herewith is adapted to be used in connection with a threshing machine, to save the expense and labor of transporting with the wheat a lot of refuse which must subsequently be separated at a loss to the farmer. The improved cleaner may be readily adjusted to clean different kinds of seeds from grains, discharging the refuse into bags instead of permitting it to accumulate beneath the separator. The invention comprises a delivery spout, which is arranged to receive the grain from the elevator of the threshing-machine; this spout is so hung from the threshing-machine as to permit its being swung to any desired position. Within the spout is a series of screens which have meshes of different sizes. These screens are united together in a manner to produce a chute of square cross-section. This chute is of such size as to fit snugly into the spout. A hopper is provided at the upper end of the spout, and serves to direct the grain through a feed-tube, into the screen chute. A regulating gate is hung pivotally in the feed-tube. This gate may be operated by the sliding rod on the spout, to limit or cut off the flow of grain into the screen. The rod may be secured at any desired position. The grain is cleaned by flowing down over the lowermost screen. The refuse passes through the meshes of the screen, and is collected in a bag hung beneath the lower end of the spout, while the grain flows on through the chute into any suitable receptacle. By rotating the screen-chute, screens of different sizes may be brought into position as desired. For instance, one screen may permit grass-seed, mustard-seed, and buckwheat to pass through, while the wheat passes over the screen; the second screen may separate grass-seed and mustard-seed from flax; a third screen may separate foul seed from barley and oats, and a fourth screen may permit wheat to drop through the meshes, while the wild-oat seeds pass over the screen. The inventor of this seed cleaner is Mr. Levi Thortvedt, of Glyndon, Clay County, Minn.



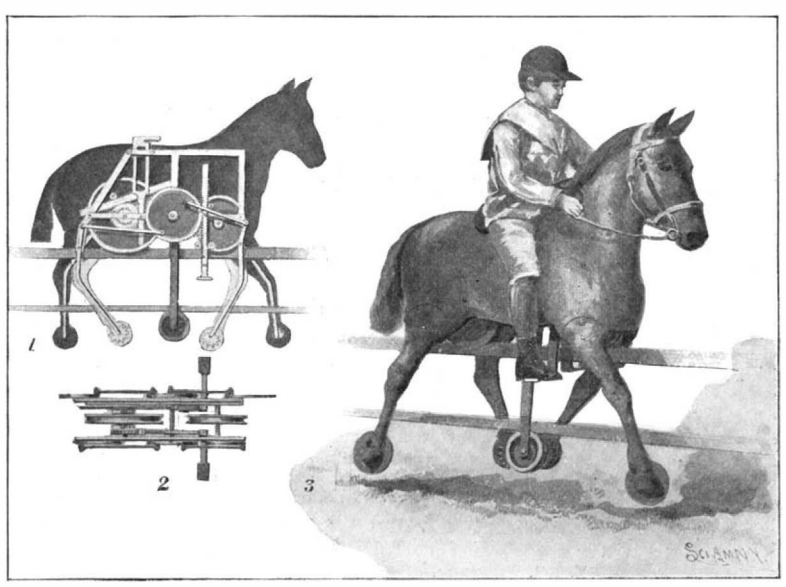
SEED-CLEANER FOR GRAIN SEPARATORS.

MECHANICAL TOY.

The meek little donkey and sturdy Shetland pony which give children such delight in our parks and recreation grounds, are now threatened with extinction by the advances of civilization, just as is their giant relative, the horse. A mechanical genius has invented an automatic pony which, when propelled by the rider, goes through all the motions of a trotting horse, even jolting the saddle up and down in perfect imitation of real life. The inventor of this device is Mr. Franz Hubsch, care of Joseph Hubsch, The Castle, Tarrytown-on-Hudson, N. Y.

The mechanical pony is mounted to travel upon a track consisting of two rails, one being arranged above the other, as shown in our illustrations. Two flanged wheels engage the upper rail, and a guide roller which travels on the lower rail prevents the machine from toppling over. The stirrups are connected to a pair of racks which mesh with the driving gear. The driving gears actuate the flanged wheels through ratchet devices which prevent backward movement. The parts are so connected that the downward motion of the stirrups causes the saddle to rise, then by jouncing the saddle down the stirrups are raised. Thus by alternately depressing the stirrups and the saddle the toy is, of course, propelled. The legs of the animal are hinged near the top, and connected at their upper ends to crank disks which are operated to give them the desired motions.

As a substitute for the real live animal this contrivance certainly affords a great many advantages. The anxious mother or the preoccupied nurse need have no fear of accident. The mechanical beast is a model of patience and docility. It will neither bite nor kick, nor run away, no matter how cruelly it is beaten. The young rider needs only to push the pedals down, and away goes his fiery steed, jouncing him up and down in the most realistic manner. What more could the young sportsman desire?



MECHANICAL TOY.

A Machine for Extracting Essence from Lemon Peels.

News comes from Messina, Sicily, that an inventor of that city, Giovanni Serravalle, has patented a machine for extracting the essence of lemon peels.

The important part of this machine consists of two disks of about 4⅞ inches diameter each, the surfaces of which are indented like a nutmeg grater, so as to hold the peel in place. The disks are placed opposite each other. In the first movement, they separate about 3½ inches, and receive a half peel (previously deprived of the pulp) from a wheel, the spokes of which project about an inch above the rim, which places the peel between the disks just before they meet. The disks revolve in opposite directions and squeeze the essence from the peel without breaking it. The peel is then ejected automatically and a fresh one is inserted. The essence as it is extracted is gathered in sponges placed under the disks. The disks can hardly be seen, being hidden by two cups, which prevent the escape and evaporation of the essence.

All the work is done automatically, except placing the peels on the spokes of the wheel which supplies the disks. This work, being very simple, is done by women and boys, who receive 80 centisimi (16 cents) for ten hours' work. The capacity of the machines is 16,000 half peels per day of ten hours.

A New Utilization of Yeast.

Mr. A. J. Oxford, of Walton-on-Trent, Derbyshire, England, is the inventor of a fodder obtained by heating yeast, to burst its cells and liberate their liquid albuminous contents, then separating the liquid constituents from the solid matter, and combining them, with or without concentration, with suitable meal. A top dressing or fertilizer may also be prepared from yeast, which may have undergone decomposition before heating to burst the cells, the product being dried or mixed with some absorbent, as kiln dust or desiccated malt culms. In the case of undecomposed yeast, the liquid constituents may be used for the preparation of food, and the solid matter dried for use as a fertilizer. A fertilizer may be prepared directly from the yeast by mixing the latter with quicklime.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

ATTACHMENT FOR DISK PLOWS.—J. P. MULRONY, Plaza, Wash. The attachment is especially adapted for use with a disk plow of the type wherein a horizontal cutter-blade is employed which will effectually pulverize the soil as it is plowed, will separate surface soil from the sub-soil, and spread the latter on top of the plowed ground, and also that will thoroughly separate the roots or tubers from the soil, as it undergoes the plowing operation, and dispose such material at the rear upon the surface of the plowed ground.

HARVESTER.—E. A. MAINGUET, Evangeline, La. Mr. Mainguet's invention has for its object among others, to provide a novel construction of framing, whereby the team may operate in the rear of the cutting apparatus of a harvester. A simple means is also provided for raising and lowering the cutting and binding apparatus.

Electrical Devices.

OVERHEAD TROLLEY.—J. J. BOUCHARD, Bradford, Pa. Provision is made in this invention for mounting the wheel-carrying fork on the trolley-pole in such a way as to enable the wheel to change its position when passing around curves and under cross-overs in the line of the overhead conductor, thereby minimizing the tendency of the wheel to "jump" this conductor.

TELEGRAPHIC SYSTEM.—J. DOYLE, Norwood, N. J. The system invented by Mr. Doyle is such that no circuit closers are employed, and the normal position of the key keeps the line closed. It is only when the key is depressed that the line is opened, so that business cannot be suspended upon the line by accidently moving the circuit-closer.

ELECTRICAL VEHICLE-BRAKE.—C. J. SPECHT and C. R. KRUEGER, New York, N. Y. The present invention is especially adapted for use on electrically-driven street cars and it comprises a shoe which forms the pole of an electro-magnet, and which upon the energization of the magnet attaches itself to the wheel, thus tending to retard its revolution. The magnetism is communicated to the wheel also which adheres to the rail, so that a double braking power is obtained.

Engineering Improvements.

ROTARY ENGINE.—H. NIELSEN, Brooklyn, N. Y. The object of the present invention is to provide an improved rotary engine of simple construction, which utilizes the motive agent to the fullest advantage, permits convenient reversing, and allows of cutting off the steam at any desired point of the piston stroke to use the steam expansively.

Hardware.

MICROMETER-CALIPERS. — R. MILLER, Chambersburg, Pa. Mr. Miller's invention provides a pair of calipers having several nice adjustments for the purpose of increasing the precision of the instrument. The instrument admits of all the uses of ordinary calipers and can be used as rapidly as the same, but offers the additional advantages of fine adjustments when desired.

TACKLE-BLOCK.—A. H. F. STRAUB, Portland, Ore. This tackle-block relates more particularly to the type used for hoisting or pulling rigging. The invention embodies novel details of construction which afford a light, strong and durable sheave-block, that is adapted for a general service. Provision is made for the convenient lubrication of the working parts as well as their disconnection from each other when repairs are necessary.

Mechanical Devices.

SAW-OPERATING MECHANISM. — J. MEIKLEJOHN, Sedro Woolley, Wash. The present invention relates to improvements in mechanism for operating cross-cut saws, the object being to provide in connection with a saw, steam or other pressure actuated pistons that operate to draw the saw through the work in both directions instead of with a pushing motion, which might cause a buckling or breaking of the saw.

AMALGAMATOR.—O. H. BURDEN and T. F. ADAMS, Kaslo, Canada. Gold or other precious metals may be thoroughly and economically collected and separated from sand, gravel and other earthy substances by means of this improved amalgamator. The apparatus is provided with means by which the stream of ore-bearing sand and gravel may easily be reduced to a thin layer during its passage through the sluice-box, at which time it is impregnated with mercury and the metallic particles are thoroughly amalgamated.

FIRE-ESCAPE.—T. B. BARBER, Norwich, Conn. The invention provides a simple construction which can be supported upon the top of a building and will include a ladder which can be lowered automatically by means of devices operated by an occupant of the building whenever the ladder is required. The device will automatically sound a signal to the fire and police departments which would prevent a burglar or other wrong doer from using the apparatus as a means of escape.

FEEDING-MECHANISM FOR PICTURE-BEARING STRIPS.—C. H. KAYSER, West Orange, N. J. Mr. Kayser's improvement is applicable to feeding-mechanism for kinetoscopic and projecting machines and provides means for preventing the vibratory movement of the picture-strip as it is passed by lens. The dazzling effect which forms such an objectionable feature of all such machines is thus avoided.

Railway Contrivances.

SIGNALING APPARATUS.—H. S. HOOVER, Silvercreek, Neb. A simple signal is provided in this invention which will be automatically operated to indicate to the engineer of a passing train how long it has been since a previous train has passed. The device automatically returns to its normal position after a predetermined time, ready to be operated upon by the next train.

Vehicles and Their Accessories.

DRIVING-GEAR FOR AUTOMOBILES.—E. RAWSON, Moscow, Idaho. An improved driving gear for automobiles is herein provided. The mechanism is arranged to allow the chauffeur to readily throw the driving gear in or out of action, to change the speed of the vehicle, and to reverse and brake the vehicle without changing the speed of the motor or stopping the same.

TIRE-TIGHTENER.—O. R. GOULD, Marion, Ia. Mr. Gould is the inventor of a device whereby the felly of a wheel can be tightened within the tire, by spreading the felly-sections. This is done by operating upon the spokes to spread the felly, thus providing an opening between the adjacent ends of the felly sections which can be filled to tighten the wheel within the tire.

KNEE FOR SLEIGH-RUNNERS.—H. BLOW, Elliston, Mont. The purpose of this invention is to provide a sleigh-runner so constructed that the splitting of the bunk will be obviated and an oscillation of the runner is permitted of at least five inches at either end, thus preventing any twisting action on the bunk; for one end of the runner may drop freely while the other end rises without straining any portion of the structure above.

Miscellaneous Inventions.

NUT-LOCK.—B. TUCKER, Moncton, New Brunswick, Canada. Provision is made in this invention for a lock that may be readily applied upon the threaded end of a screw-bolt and that will hold a nut that is screwed upon the bolt from removal until the nut-lock is purposely released.

DEVICE FOR WASHING AND DRYING FILMS.—E. W. NEWCOMB, New York, N. Y. This washer and drier is adapted to accommodate any desired length or width of films to wash and to speedily dry the films without marring them. Two or more adjustable posts may be used as guides for the films and the post supports may be adjusted in many ways relative to each other, so that the film in band form can be held in the most convenient manner.

SILO.—E. W. GILBERT, Philadelphia, Pa. Mr Gilbert's invention relates particularly to the construction of doors and doorways of silos. A special construction of brace is employed for holding the door posts apart These braces do not interfere with free access to the ensilage through the doorway and will efficiently hold the doorposts apart. They will also constitute a ladder leading to the top of the silo.

FISH SKINNING AND SCALING DEVICE.—W. KADLETZ, Lemhi Agency, Idaho, and W. J. FULLER, Crowcreek, S. D. These inventors have made improvements in devices for scaling and skinning fish. The improved device embodies a means for slitting the skin of the fish, together with a clamping device which may be attached to the skin and by which the skin may be drawn from the fish with one hand while the other hand holds the fish.

AUXILIARY IRONING-BOARD.—R. H. JACKSON, Rochester, N. Y. Mr. Jackson herein provides an auxiliary ironing-board arranged for convenient attachment to an ordinary ironing-board to allow of ironing shirt-sleeves, shirt-waists, skirts, and the like. The construction permits of swinging the auxiliary ironing-board into an inactive position to leave the main ironing-board unobstructed for its legitimate use.

SOAP-LOCK.—J. C. COREY, Minneapolis, Minn. Mr. Corey's invention provides an improvement in soap-locks whereby a cake may be suspended by a chain so that it can be conveniently used and cannot be taken away. The device comprises two interlocking sections, which are to be inserted into the soap-bar from either end and cannot be removed until the soap has been entirely worn away.

SHADE AND CURTAIN-POLE BRACKET.—E. H. B. LINDHORST, Sacramento, Cal. The shade support is adapted for convenient adjustment horizontally and vertically, so that it may be readily secured at windows having different widths and by which windows of corresponding width may be held in operative position thereat. The combined fixture is also arranged to support wooden curtain poles or metal curtain rods of various lengths.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 3865.—For the present address of the American Computing Scale Co.

AUTOS.—Duryea Power Co., Reading, Pa.

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Inquiry No. 3867.—For makers of rotary steam engines or turbine engines.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 3868.—For manufacturers of small steam or water heating plants.

Coin-operated machines. Willard, 284 Clarkson St., Brooklyn.

Inquiry No. 3869.—For makers of chemical fire engines.

Dies, stampings, specialties. L. B. Baker Mfg. Co., Racine, Wis.

Inquiry No. 3870.—For dealers in small furnishings or model parts, cams, small springs, gearing, etc.

Blowers and exhausters. Exeter Machine Works, Exeter, N. H.

Inquiry No. 3871.—For parties engaged in making steel stirrups of original design.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 3872.—For makers of oil pumps for gasoline motors.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 3873.—For makers of felt swabs for axle boxes of electric tramways, etc.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 3874.—For makers of copper and steel cylinders suitable for use for fire extinguishers, etc.

SAW MILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 3875.—For the present address of the American Vacuum Company.

Special and Automatic Machines built to drawings on contract. The Garvin Machine Co., 149 Varick, cor. Spring Streets., N. Y.

Inquiry No. 3876.—For the manufacturers of the Missouri Steam Washer.

Manufacturers' Advertising Bureau, New York. Trade mediums a specialty. Lowest known rates. References. Correspondence solicited.

Inquiry No. 3877.—For makers of small furnaces such as are used by manufacturing jewelers.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3878.—For manufacturers of water motors.

Crude oil burners for heating and cooking. Simple, efficient and cheap. Fully guaranteed. C. F. Jenkins Co., 1103 Harvard Street, Washington, D. C.

Inquiry No. 3879.—For manufacturers of horseless vehicles to be used in the storage and van business.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 3880.—For dealers in straight grained hardwood marble blocks of special dimensions.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3881.—For parties to make the Toilet Package Cabinet.

A New York Commission House, represented by a traveling agent (commercial engineer), will represent specialties in England, France and Germany. Address A. B. Box 773, N. Y.

Inquiry No. 3882.—For makers of seamless aluminium tubing one inch in diameter.

FOR SALE.—Patent rights and tools for the manufacture of a Practical Pocket Cigarette Maker, now selling freely by mail orders and giving satisfaction. Address X. Y., P. O. Box 1117, New York.

Inquiry No. 3883.—For manufacturers of fiber pails.

PATENT FOR SALE.—Automatic envelope sealing and feeding machine, 250 office envelopes per minute. Great labor saver. Recently patented. See half page notice, this paper, October, 25, 1902. W. W. Gavitt & Co., Bankers and Brokers, Topeka, Kansas.

Inquiry No. 3884.—For a power knitting machine for knitting woolen stockings.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines, Early Patents signed by Presidents of the United States. Valentine's Manuals of the early 40's. Correspondence solicited. Address C. A. M., Box 775, New York.

Inquiry No. 3885.—For a machine for cutting down buggy spindles and for cutting threads on ends of spindles.

INTERESTING to manufacturers of agricultural implements and to grain seed merchants. There is to take place at the city of Buenos Aires, Argentine Republic, under the management of the Argentine Rural Society, an Exposition of Agriculture, which will be opened on the 20th of May and closed on the 10th of June, 1903. Foreign products will be admitted in competition: there will be exhibited agricultural products and those that come from them in the first transformations. There will be also a horse fair and a show of all kinds of animals bred for slaughter. The exposition will also comprise vegetable, mineral and chemical manures; grains for seed, agricultural implements of all kinds, as well as agricultural machinery, and also the utensils and machines for industries, such as vitiviniculture, wine culture, silk worm culture, grist mills, breweries, textiles, sugar, fisheries, apiaries, hunting and other kindred industries. *All products, implements and machinery will be entered free of duty*; duty demanded only when entered for sale. The parties wishing to exhibit at the exposition, who need further information upon the matter, will please address themselves to R. A. de Toledo, Argentine Consul General, Room 124, Produce Exchange Building, New York.

Inquiry No. 3886.—For makers of knit cotton mop cloths.

Inquiry No. 3887.—For makers of machines for embossing leather and fiber chair ends, also dies for same.

Inquiry No. 3888.—For a second-hand "Star" foot power lathe, 11-inch swing.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8858) W. H. P. writes: Would you please tell me what is the best way to keep the boilers clean and from rusting when they are out of service? At the plant where I am engineer we have three boilers, but only two in use at a time, and the third one is what we call out. Now what I would like to know is the following: Is it best, when the boiler is not in use, to keep the water in the same or shut the water out as soon as possible and keep boiler dry? We use boiler compound, and have no scale in boilers, but what I would like to know is the best way to preserve the boiler when not in use. The boiler generally stays out for four months. A. A boiler to be laid up for a time should be filled with water to the safety valve at boiling heat, to discharge all air from the water. The boiler should then be closed up, to keep out air, outside and inside. Pure water does not rust the iron.

(8859) J. A. C. writes: I have a room 8 x 20 feet with one 32 candle power lamp. Can I warm the room with a heater by connecting the current to it? Also would it consume any more current than the lamp? And could you tell me how to construct one? I can put more lamps in if need be. The current is 110 volts. A. You can make a heater to carry one ampere, the same current as a 32 candle power lamp on 110-volt circuit, and it will do something toward heating your room; much depends upon the difference of temperature between the air outside and inside. A heater to carry one ampere on a 110-volt circuit must have 110 ohms. This will require of No. 24 wire, B. & S., 330 feet of German silver, or 715 feet of iron wire. Coil the wire into a spiral by winding it around a rod about ⅜ inch in diameter. Then wind the spiral around a frame of iron which has been carefully covered with asbestos. This must be done with care, as a short circuit would be dangerous. The use of a heater would require the consent of the insurance company insuring the premises, since its installation is especially covered by their rules.

(8860) S. B. P. writes: For the purpose of using water economically to cool the jacket of a 10 horse power gas engine, what method is preferable? We are now using a wooden cask holding about 110 gallons, but we find that the water becomes very warm, and probably too much so for the purpose. If we should expose the outlet pipe at the outlet instead of being submerged, thereby allowing the water to flow over an exposed surface to cool, would the circuit be impaired or cease to act? The writer thinks he saw a device of this kind at the Ohio State Fair on a portable engine, but did not make a very close examination at the time. We tried a system of this kind, but it did not work, owing probably to improper elevations, the outlet or warm water pipe being about six feet above the engine at the outlet. A. An iron tank is generally used for cooling the jacket water of gas engines. The iron is a better radiator than wood. Discharging the hot water over a plate will tend to liberate a large amount of vapor, which will carry off the heat. Using large pipe connections will also facilitate radiation of the heat. This should not obstruct the water circulation if the plate is close to the surface in the cask.

(8861) J. S wants to know whether it is possible to change the alternating current of a Ruhmkorff inductor into a direct current, so that it can be used for one or more electric incandescent lamps (16 candle power). In short, can I use one or more Ruhmkorff inductors instead of a dynamo or accumulators, to get a direct current for incandescent lamps? A. If the secondary of an induction coil were wound to give 110 volts, it would be possible to use the current it would give for lighting 110-volt lamps. There would be no need to change the current to direct, since an alternating current will light an incandescent lamp as well as a direct current will light it. Indeed, such a current cannot usually be transformed into a direct current, except by means of a motor and a second generator. There seems to be no reason for making all these transformations when the original current can be used just as well to light the lamps directly. Each transformation is made at a loss, and as the voltage is raised the amperes are lowered in the same proportion. There is no cell or battery which could be transformed in this way, so far as we know.

(8862) W. N. C. presents the following problem: Supposing that on the rear end of

a train running at the rate of 1,000 feet per second a cannon were placed, pointing in an opposite direction to that which the train was running, and at a given milepost the cannon be fired. That the velocity of the cannon ball was also 1,000 feet per second, at the end of the first second, where would the ball be in relation to the milepost? A. The ball would move forward with the motion of the train at a velocity of 1,000 feet per second, and backward with a velocity of 1,000 feet per second by the force of the powder. It would therefore fall vertically to the ground as if not in motion at all. This is a simple application of Newton's First Law of Motion: "A given force will produce the same effect, whether it act upon a body at rest or in motion, whether it act alone or at the same time with other forces." The case is the same as if you were to jump from a moving car, and should push yourself backward as you jump with the same velocity as you were moving forward with the car. You would stop in midair and drop to the ground without any tendency to forward motion, as probably you may have done many times.

(8863) N. A. B. asks: What is the lowest point below freezing C. or F. that has yet been attained? A. The lowest temperature which has been attained by man is by the freezing of hydrogen. You will find in the issue of the SCIENTIFIC AMERICAN for November 22, 1902, the statement that this is 14.1 degs. absolute. These degrees are Centigrade, and are the same as 259.6 degs. below zero C.

(8864) P. J. M. writes: I wish to transmit wireless signals a distance of about 150 feet, under a line of telephone and telegraph wires; will above wires interfere? How high should the copper plates be? And is it necessary to have them outside of the building? Does it make a difference in what position the induction coil and receiver are placed relative to each other? If so, what? A. It would not seem that telephone wires should interfere with wireless telegraph signals at a distance of only 150 feet. An experiment will quickly determine the matter. It is better to use a vertical wire than metal plates for sending the signals. Wires 15 feet high will be higher than are necessary under ordinary circumstances. The sending and receiving instruments may be placed in any desired position relative to each other. We have published several descriptions of apparatus for the purpose and for 60 cents we can send papers (at ten cents each) which contain plans and descriptions of instruments.

(8865) E. S. asks: Have you any SUPPLEMENTS, or can you give me the formulæ for the following? 1. For a method of treating paper so that when placed in circuit with a battery it will act as a conductor of electricity, but not be decomposed by the current. A. Paper having pores filled with plumbago will conduct electricity without electrolysis. Any other form of carbon will answer the same purpose. If an electrolyte, such as potassium iodide or sodium sulphate, is used, the same result with electrolysis will be obtained. 2. The formula for this: If a body of water 6 inches long and 2 inches in diameter (in a pipe) be moving at the rate of 30 feet per second, what pressure will the water exert if suddenly stopped? A. A body of water 6 inches long and 2 inches in diameter, moving at a velocity of 30 feet per second in a pipe, will strike a blow of 20 foot-pounds. The water weighs nearly two-thirds of a pound, and moving 30 feet per second will strike a blow of $30 \times 2\text{-}3 = 20$ foot-pounds. The water will strike a blow in this case like that of a solid, a stone or bar of iron, of the same weight.

(8866) E. R. A. writes: Will you kindly inform me how to prepare colored cements from shellac, which dry hard and can be French-polished immediately? Can the shellac be colored with anilines, and what is the process? A. The shellac may be simply melted and mixed with mineral pigments, such as ocher, umber, Venetian red, etc. If too hard, a small amount of wax can be melted with it.

(8867) O. W. asks: Is there any danger in shooting Dupont smokeless powder? Is there any difference between nitro-glycerine powder and smokeless powder? If there is, what is it? A. Dupont's smokeless powder with ordinary care in handling, is safe. Nitro-glycerine is one of the components of smokeless powder. The other ingredient is guncotton.

(8868) F. O. M. asks: Could you tell me as to the value of mica plates as an insulator for the electric current as compared with glass or vulcanite, etc.? A. Mica constitutes a most excellent insulation for the primary of an induction coil if large pieces can be found, so that the air gaps between the pieces will not furnish a path for sparks to pass. Shellac and not glue is the proper adhesive for retaining the sheets of mica in place. Several sheets should overlap, like shingles. Glue naturally absorbs moisture, which will ruin the insulation. We cannot advise the method of winding the secondary which you propose. No coil of any length should be wound back and forth in a single layer. It would rupture its insulation and spark from one part of the secondary to another part of the secondary very soon. All coils of any size are wound in sections. All books upon coil making give full instruction for doing this. See also SUPPLEMENT No. 1124, which contains full plans for a coil giving a 6-inch spark.

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Coming, as it does, from a Sibley College professor, this work is entitled to more than ordinary consideration. Its purpose, as its author tells us, is to put into permanent form a single and standard drafting-room system, which will tend to alleviate unnecessary burdens. The system that has been evolved and embodied in this book is intended to be the average of the drafting-room systems which are in use in the United States at the present day. The book is published with blank pages alternating with printed ones and with the illustrations in the back. Undeniably, this arrangement has its merits.

A DICTIONARY OF PHILOSOPHY AND PSYCHOLOGY. Written by Many Hands and Edited by James Mark Baldwin, Stuart Professor in Princeton University, with the Co-operation and Assistance of an International Board of Consulting Editors. Vol. II. New York: Macmillan Company. 1902. Small Quarto. Pp. 892. Price $5.

With the second volume, the Dictionary of Philosophy and Psychology is completed. It has been the task of the editors to explain terms in philosophy and psychology by clear definitions and to interpret the movements of thought through which the meanings thus determined have arisen. The pedagogical portion of the book states formulæ and well-defined results; it does not discuss. It has been the purpose of the editors to present science—physical, moral—with a fullness of authority not before undertaken in a work of this character. We have had occasion to use the first volume of this dictionary not a little, and by the test of use it has proven itself one of the most serviceable reference books which has ever found its way to the editor's desk. An excellent feature of the second volume is the admirable general index of Greek, Latin, German, French, and Italian terms.

CHEMISTRY. By Observation, Experiment, and Induction. A Laboratory Manual for Students. By J. I. D. Hinds, Ph.D., Professor of Chemistry in the University of Nashville. 12mo. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1902. Pp. viii., 192, 46 figures. Cloth. 75 cents net.

This volume is designed to accompany the author's "Inorganic Chemistry." The object of the course outlined is to make the student practically familiar with the elements of chemistry, and to lead him, by processes of inductive reasoning, to the general principles of theoretical chemistry. The manual is to be used simply as a means to the acquisition of knowledge. No attempt has been made to introduce into this work any features of qualitative analysis.

LETTERS AND LETTERING. A Treatise With Two Thousand Examples. By Frank Chonteau Brown. Boston: Bates & Guild Company. 1902. Octavo. Pp. 214. Price $2.

This work contains a most varied collection of standard forms arranged for convenient use and intended primarily to present the letter shapes, but displayed so as to show also how the letters compose into words.

THE A B C OF PHOTO-MICROGRAPHY. A Practical Handbook for Beginners. By W. H. Walmsley, F.R.M.S., F.A.A.S. New York: Tennant & Ward. 1902. Pp. viii., 155.

The author has endeavored to aid the novice by teaching him the elements of the subject of photo-micrography, and to explain as clearly as possible the simple but indispensable methods. The book has not been written for advanced scholars. Care has been taken to explain many things which would seem to be self-evident to those already familiar with the use of photo-micrography apparatus, but which are often insurmountable obstacles to the beginner.

THE CONQUEST OF THE AIR. By John Alexander. 16mo. Pp. 160.

This book does not purport to be a scientific work, but contains many interesting accounts of airships old and new.