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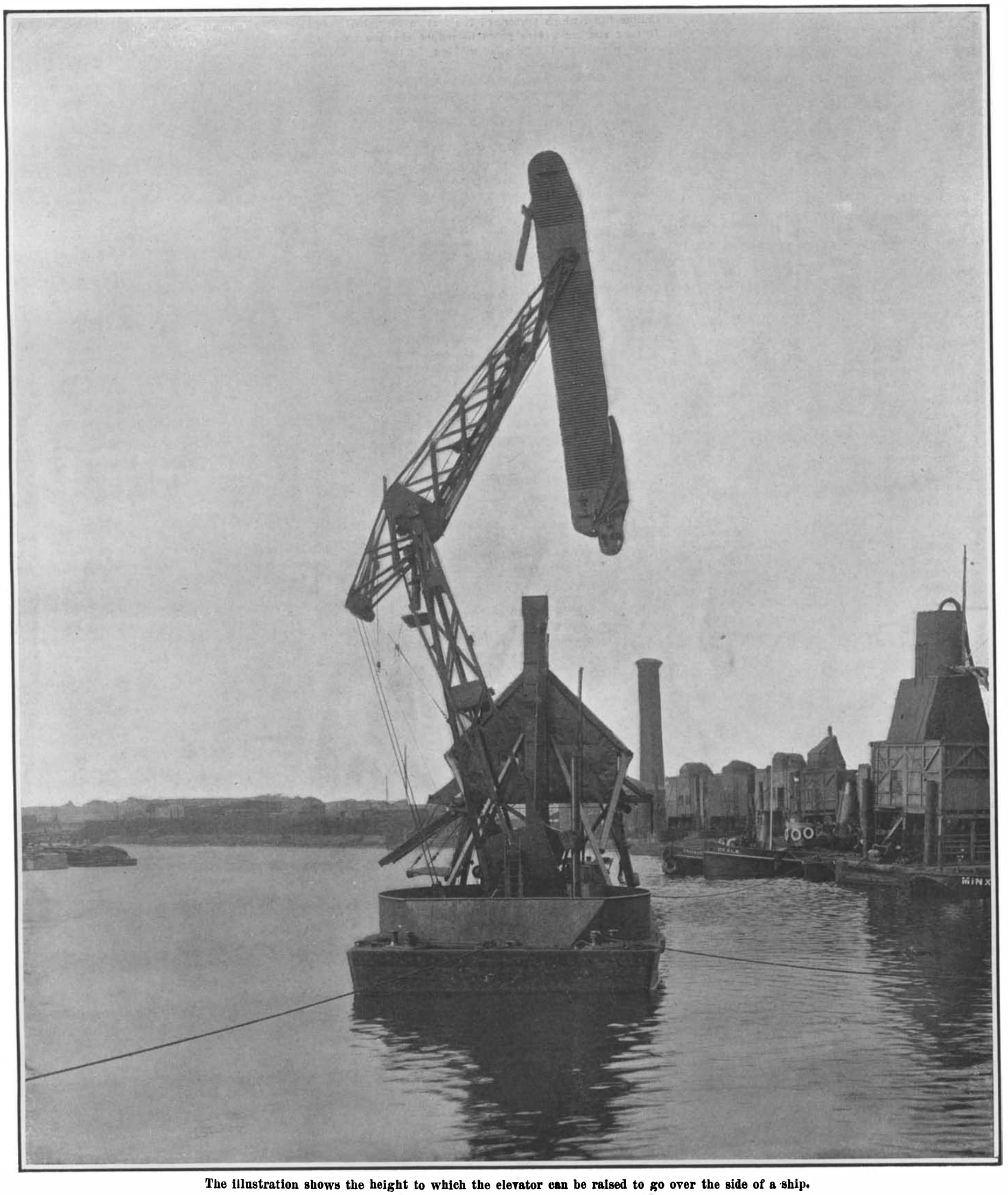

The illustration shows the height to which the elevator can be raised to go over the side of a ship.

A REMARKABLE GRAIN ELEVATOR FOR DISCHARGING VESSELS.—[See page 182.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, SEPTEMBER 11th, 1909.

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.

DR. COOK AND THE NORTH POLE.

To set a question mark, however small, against the message from Dr. Cook, announcing that he had reached the North Pole, would be to betray a spirit of ungenerous and captious criticism. The conditions of complete isolation which must necessarily surround the man who launches himself, with two native helpers, into that uncharted sea of eternal silence and frozen desolation, are such that the waiting world to which he returns—if he ever return—must needs accept his story of a successful quest without expectation of absolute verification or disproval. For the theoretical point which we call the North Pole lies, as was generally supposed, and as Dr. Cook has now proved, in a vast field of eternally drifting ice. Any monument set up by the explorer at the exact axis of the earth in attestation of his crowning triumph, would be carried steadily down over the dome of the world, to be ultimately lost in the more southerly seas, or cast up, with other flotsam and jetsam, on the northerly coasts.

In the interests of scientific accuracy there will, of course, be a subsequent verification, as far as it is practicable, of the distances covered and of the observations of the sun as taken, during this wonderful journey; but this investigation will not be made because of any doubt as to the actual presence of Dr. Cook, on the twenty-first of April, nineteen hundred and eight, at the North Pole.

The man who can look Death full in the face throughout all the cruel sufferings of a two years' search for the secret of the frozen North, is built upon lines too noble to admit of the slightest subterfuge or misrepresentation; and there are certain features of Dr. Cook's expedition, notably the total absence of ostentation in the manner of his setting out, which should at least have sealed the lips of those who have received the news of his success with outspoken incredulity.

Most of the great achievements of science, whether in the way of invention or discovery, may be regarded as the total result of the separate efforts of individual men. To some one among the many it has been reserved to win the coveted goal and have his name written forever above its portals; and he above all others realizes, and is only too glad to acknowledge, how greatly his success is due to the unrewarded labors of his predecessors. Each unsuccessful seeker for the North Pole gathered his quota of valuable experience, and the facts as thus recorded have been of priceless value to those who came after. Dr. Cook, himself an Arctic explorer of no little experience, will be the first to acknowledge his indebtedness to that splendid band of men, beginning with Sir. John Willoughby in 1553 and ending with Peary, who blazed the way for his own magnificent success.

THE TRANSATLANTIC RECORD.

It has been stated, and with much truth, that the degree of perfection of a country's transportation facilities may be taken as a fair measure of its industrial and commercial development; and from the very first it has been realized that the value of any system of transportation is dependent very largely, and in some cases primarily, upon its speed. Hence, there has been a constant effort to obtain the highest possible speed compatible with consideration of safety and reasonable economy. Because of the old-time dangers and the, to many people, present-day inconveniences and discomfort of ocean travel, the attainment of high speed has been nowhere so eagerly striven after as on the great oceans which divide continent from continent, and particularly on that three-thousand-mile stretch of water which lies between the old world and the new.

The contest for what has popularly come to be known as the "Blue Ribbon" of the Atlantic has always possessed a certain fascination for the public, both for those who frequently make the crossing and those who never go at all. The interest dates from the days, in the early forties of the last century, when the "fliers" of that time were fighting it out between themselves at a speed of ten knots, down to the present day of turbine-driven liners that can reel off their 650 knots a day at speeds of twenty-five to twenty-six knots.

When the first line of steamships to cross the Atlantic on a regular schedule of sailing was established, now some seventy years ago, it took about fourteen days to make the trip from Liverpool to Boston. The first vessel to cross in less than ten days was an American boat, the "Pacific" of the famous Collins Line, which performed the feat in May, 1851. It took another twelve years to reduce the passage below nine days, the "Scotia" making the passage in eight days and three hours, in 1863. To the Inman, now the American Line, is due the credit of bringing the passage below eight days, a feat accomplished in 1869 by the "City of Brussels," in seven days, twenty-two hours, three minutes. The seven-day limit was first passed by the "Alaska" of the Guion Line, which made the trip in 1882, in six days, twenty-two hours; and seven years later, in 1889, the "City of Paris" of the Inman Line, now the "Paris" of the American Line, brought the record below six days, by making the crossing in five days, nineteen hours and eighteen minutes.

It was not until the advent of the steam turbine that the record was brought below five days, the "Lusitania" accomplishing this feat in 1907 by crossing to the westward in four days, nineteen hours and fifty-two minutes. In the two years that have intervened since then, changes have been made in the propellers of both boats, which have considerably increased the speed; and on her last trip, concluded on September 2nd, the last-named vessel, crossing at an average speed of 25.85 knots, covered the Atlantic course in four days, eleven hours, and forty-two minutes, thus bringing the record for the first time below four days and a half.

The question has been raised as to whether this high speed is not gained at too great a cost. For it is a fact that both the "Lusitania" and "Mauretania" burn on an average about one thousand tons of coal per day. The answer is that, although the aggregate consumption is large, the amount of coal burned in proportion to the size of the vessel is no larger and indeed not as large as that burned by the other fast Atlantic liners of less total displacement. Thus the "Deutschland," of 23,500 tons displacement, when steaming 23.5 knots, burns about 570 tons per day, which is over one-half the consumption of the "Lusitania," whose displacement is nearly double that of the "Deutschland," and whose sustained sea speed is about two and a half knots greater. Moreover, there is a large and ever-increasing number of people who, either for business reasons or because of a dislike of ocean traveling, are perfectly willing to pay the higher rates which are necessary to make these high-speed vessels pay. Furthermore, the advantage in the acceleration of mail service, alone, is probably in itself sufficient justification for cutting down the time of transit between New York and London by twenty hours, as compared with other routes. For the adoption of Fishguard, on the west coast of Wales, as a port of call, and the installation of a service of fast steamer trains between that port and London, made it possible for the mails and passengers, on the last trip of the "Mauretania," to leave New York at 10 A. M. on Wednesday and reach London at twenty minutes past 7 on the following Wednesday evening.

As to the possibilities of the future, it can safely be predicted that the question of bringing the transatlantic record below four days, is one of finding some new form of motive power. It will never be accomplished by the turbine-driven ship. Whether the producer-gas engine can be developed to a point of compactness and efficiency that will enable it to perform the feat, is a question which the future must decide.

ECONOMIC LOSS OF OVERCROWDING.

That the present overcrowding in the congested and poorer districts of our cities is to be condemned on humanitarian grounds goes without saying. The suffering which results therefrom, the multiplied miseries, not merely of the poor, but of a considerable section of the artisan class, of the tenement districts forms one of the most tragical phases of modern city life. All of us who have given any thought to the matter, are convinced of this; but it is reserved for the social economist to show that the discomfort, suffering, and death directly resultant from overcrowding, rerpesent also a great annual monetary loss.

The method of stating the evil results of disease and accidents in dollars and cents has come into vogue of late years, and although the practice has been made the subject of some criticism and ridicule, we consider it is justified on sound economic grounds. A recent analysis of this character is the statement issued by the Committee on the Congestion of Population, which estimates that the annual economic waste in this city from certain preventable diseases has reached the high figure of between $37,000,000 and $41,000,000. This estimate is based on the loss of time of the wage earners through illness and death, which are traceable largely to congestion of population. The Health Department has made the following classification of preventable diseases: Typhoid fever, pneumonia, broncho-pneumonia, diphtheria, smallpox, cerebro-spinal meningitis, diphtheria and croup, measles, scarlet fever, whooping cough, diarrheal diseases, tuberculosis pulmonalis. The committee argues that if the above diseases are preventable, and the economic waste of the community in the way of loss of wages, etc., amounts to $40,000,000 a year, it would be the part of wisdom to make a more careful study of the predisposing conditions, and particularly of means to prevent overcrowding.

In arriving at the above estimate, it is considered that the prospective earnings when death occurs between the ages of 20 and 69 have an average value of $2,000 for men and of $1,000 for women. For the four years from 1905 to 1908, it is estimated on the above basis that the waste from death, due to certain preventable diseases in New York, may be conservatively estimated at over $95,000,000, and that the economic waste from sickness due to these same diseases may be placed at over $71,000,000, making a total economic loss of over $166,000,000.

THE ELIMINATION OF GRADE CROSSINGS.

Although the advent of the automobile has attracted public attention in a most tragical manner to the peril of railroad grade crossings, the loss of life among the users of automobiles represents only a certain proportion of the annual number of fatalities due to this cause. The time will come when our increasing regard for the sanctity of human life will lead, either to a total abolition of crossings at grades, or to such an ample protection as will place the responsibility for accidents of this character almost entirely upon the highway traffic, whether pedestrian or vehicular.

There are at the present time in New York 10,544 points at which railroad tracks encounter public highways, and at 1,698 of these points the crossings at grade have been removed. The protected crossings number altogether 3,676, distributed among the different railroads according to the following percentages: Long Island Railroad, 51; New York Central, 43; Delaware, Lackawanna & Western, 42; Erie, 31; Delaware & Hudson, 30; New York, Ontario & Western, 30; Lehigh Valley, 20.

During the last five years the different railroads, with the assistance of the State and municipalities, have been actively engaged in reducing the number of grade crossings on their lines by either elevating or depressing the tracks. These grade crossings have been reduced in certain percentages of the total from 22 on the Long Island Railroad down to 10 on the Delaware & Hudson Railroad.

The work outlined by the Long Island Railroad Company includes the removal of 14 grade crossings on the line to Manhattan Beach, 45 grade crossings on the Bay Ridge line, the elimination of some very dangerous crossings on 14 streets by the construction of a tunnel under East New York Hill, and the removal of some 203 grade crossings in Queensboro. During the last Legislature a bill authorizing the city to share the expense of removing these last-named crossings failed of passage; indeed, for the first time in many years, the Legislature at its last session failed to make any appropriation for continuing the work of grade crossing removal in this State. Up to the present time, the Long Island Railroad has spent $12,500,000 in improvements involving grade-crossing elimination, while the city's share in the improvements involved the expenditure of $3,750,000. The company is prepared to spend an additional $6,000,000 in getting rid of the 203 crossings at grade which still remain in Queensboro, provided the city would continue its former policy of contributing one-half of the expense.

In view of the fact that grade-crossing removal not merely eliminates a most serious menace to public safety, but that the elevation of the tracks results in a quickening and all-round improvement of the train service, it would seem that there are very good reasons why the Legislature should enable the city to continue its former policy of contributing to a work which may be justly considered as a public improvement. The city, of course, should never have allowed the tracks to be laid through the streets at grade in the first instance. On the other hand, a large proportion of the mileage, now lying within city limits, was surrounded by open country when the rails were first laid.

ENGINEERING.

What is claimed to be the record torpedo shot of our navy was made during the recent maneuvers of the Atlantic fleet off Provincetown, when the submarine "Cuttlefish," selecting the battleship "Vermont" for attack, fired a torpedo at a range of 3,800 yards, hitting the "Vermont" squarely amidship.

A gas-driven street car is now under construction in Philadelphia, which is to be tested on the line of the Metropolitan Street Railway Company of New York in competition with the electric cars of the company. It will be driven by two 4-cylinder motors, each of 24 horse-power. These will be water-cooled, and piping will be led from the motor jackets around the interior of the car to heat the latter during winter service.

The fast steam yacht "Winchester," which is now being built by Yarrow, will attract considerable attention because of the up-to-date character of her motive power. Steam will be supplied by water-tube boilers fired exclusively with oil fuel, and the yacht will be driven by Parsons turbines of 2,400 horse-power operating three single-propeller shafts. The vessel, which is of 180 tons, is 165 feet long, 15 feet 6 inches beam, and 9 feet 9 inches deep.

The French battleship "Iena," which a few years ago was wrecked by an explosion of the smokeless powder in her magazines, is being used as a target, and several important problems are to be determined relating to the effect of shell fire. Recently, after caged animals had been placed on board the ship, she was attacked by the cruiser "Latouche Trouville" with high-explosive shells. The deadly effect of the gases of the explosion was shown by the asphyxiation of several of the animals.

There is no doubt that one cause of the objection to motor cars on the part of a certain section of the public is the use of headlights of dazzling brilliancy. The Technical Committee of the Royal Automobile Club are making experiments with a view to finding a lantern which will give sufficient light for vision, but will at the same time be so controlled as not to dazzle the drivers of approaching vehicles or pedestrians. The tests are being made with acetylene, petroleum, and electric lamps.

Last week we made note of the retirement of two famous record holders, the "Umbria" and "Etruria," from the Atlantic service. It is now announced that the "Lucania," which was recently burned at her pier in Liverpool, will not be repaired, but will go into the hands of the underwriters. She was the first vessel to make the transatlantic trip at over 22 knots an hour. Her place will be taken by a new turbine 21-knot ship of 25,000 tons.

The work of installing the roadbed, rails, and operating equipment of the recently completed D tube of the Pennsylvania tunnels below the East River, was begun in Long Island City last week. Of the four tubes, the two inner tubes, known as B and C, are nearing completion; and all four can be finished and in readiness for operation between Long Island City and the Pennsylvania Terminal on Manhattan Island by the first of next year.

The Cleveland Industrial Exposition, which we recently had the pleasure of visiting, has been successful beyond the expectation of the Chamber of Commerce, which is responsible for its promotion. The exhibits were more numerous and of a higher character than was anticipated, and the attendance has run up to as high as 30,000 daily. It looks as though the huge national exposition, which as in the case of the St. Louis Fair had grown to an altogether unwieldy size, will in the future be replaced by local expositions held in the larger cities.

Everyone who is familiar with the valuable historical collection of scientific appliances now at South Kensington, London, will regret to learn that "at present these treasures are huddled together in makeshift buildings quite unsuitable for the purpose of a museum." The commissioners of the great exhibition of 1851 offered $500,000 and a suitable site for a properly equipped science museum, provided the government would undertake to maintain it. A delegation representing all the scientific interests in Great Britain have urged the government to give their immediate attention to the proper housing of this collection.

The grand total of excavation on the Panama Canal during the month of July was 2,843,260 cubic yards, which is 52,533 cubic yards less than the total for June, and 1,037,077 less than the highest record, made during the dry season in March of the present year. Of the amount removed from the canal prism, 1,684,663 yards were taken out by steam shovels, and 1,107,814 yards by dredges. The mean rainfall was 10.66 inches for the month, in which there were twenty-six working days. Incidentally it may be mentioned that the Tariff Act, approved by the President August 5th, authorizes a bond issue of $290,569,000, in addition to the $84,631,900 heretofore issued for canal construction.

ELECTRICITY.

During the recent rioting at Barcelona, all the gas and electric-light plants were out of commission, and the city was illuminated only by the searchlights of warships in the harbor.

At the annual convention of the Association of Edison Illuminating Companies, the licensees under Mr. Edison's patents, held last week at Scarborough on the Hudson, was celebrated the thirtieth birthday of the incandescent lamp.

In order to compete more effectively with the gas company, which lets kitchen and other stoves, the municipal electric light plant of Aberdeen, Scotland, has laid in a stock of electric heating and cooking apparatus, which it proposes to offer for hire at proportionately low rates.

An electrical exhibition will be held in Boston from the 15th to the 25th of November, at which all the latest labor-saving and comfort-giving devices will be exhibited, with elaborate and novel decorating and lighting effects. Prizes will be awarded for the inventions and ideas of amateurs, and space set aside for the exhibits of amateur wireless operators.

Our allusion last week to a power shovel as an unlikely machine to be successfully electrically driven, has caused our attention to be drawn to an electric well-drilling machine produced by the Keystone Driller Company of Beaver Falls, Pa., and successfully operated near Chicago. From the very wide range of its operations, often remote from habitation, let alone power plants, the driller certainly seems an even less likely machine to be operated electrically than the shovel; but the supply has doubtless been created by a demand, and in districts where prospecting or other drilling is carried on within reach of electric wires, the machine should have great advantages.

The Montreal Light, Heat, and Power Company has announced that it will engage in the ice business, obtaining water from artesian wells and freezing it by electric power into blocks of any desired shape and size, so as to avoid cutting. This is an example which might with advantage be followed by many a smaller plant. Every lighting plant must be capable of carrying a certain maximum load at the time of night when most lights are in use, but for at least 18 hours out of the 24 the load is from half as much in large cities to almost nothing in small country places, where there is little industrial use of electrical power, so that during the greater part of the day much of the capital invested is earning no dividends. The surplus power might just as well be used in making ice and providing another source of revenue, particularly as the time when the "peak" load is of shortest duration coincides naturally with that of the largest consumption of ice.

Remarkable results have been obtained by an electrical ozone-generating apparatus recently installed at the public library on Michigan Avenue and Washington Street, Chicago. It appears that complaints had constantly been made of the unpleasant odor from accumulated human emanations, and this in spite of an excellent purified-air ventilation system, the nuisance becoming such that an attempt had to be made to counteract it. Direct current at 110 volts is converted to alternating at 120 by a rotary converter, and the latter stepped up to 8,000 volts by a transformer. This high-tension secondary current discharges between the plates of the ozonizer, through which is drawn the air led to the ventilating apparatus above. Enough oxygen is converted to free ozone to kill any living organisms in the air and neutralize any kind of odor. The most remarkable result of the installation appears to be the substitution for unpleasant if not actively unwholesome air of an atmosphere actively healthful.

The Electrical Review suggests that "trackless trolleys," such as are successfully used in Austria and elsewhere in Europe, that is to say, electric vehicles running on ordinary roads, but taking power from overhead wires, might be advantageously used to take the place of horse-drawn stage coaches, which still connect with the railroads numerous villages having no other means of transportation, even in the most populous parts of the country. It is pointed out that such stage lines rarely have a traffic which would encourage the projection of electric railroads to take their place as a profitable venture; but figures are quoted to show that of the cost of roadbed, track, and electric-line construction in electric railroads, only 15 per cent or less is for overhead conductors and poles; considering therefore that electric road vehicles are obtainable for a much lower cost than railway cars, and that the power-generating plant would be so much less for a little line operating only three or four stages back and forth per day, it is obvious that such a trackless trolley system could be undertaken for a tenth of the cost of an electric railway, and with a much better chance of profitable operation.

SCIENCE.

Plans have been filed for a new home for the American Geographical Society at 156th Street and Broadway. The building will form one of a group that now includes the Hispaño Society's home and the Numismatic Museum, although it has no connection with either institution. The building will be erected from funds provided by Mrs. C. P. Huntington. The estimated cost of the building will be between $250,000 and $300,000.

Prof. Charles Richet of Paris has devised a means for purifying the air in rooms. According to press dispatches, his apparatus is an air filter which mechanically sterilizes air. Very fine drops of glycerine are scattered along the walls of a cylinder containing a suction fan. Each particle of air drawn in by the fan is freighted with glycerine, and hence tends to drop, thereby carrying with it the germs, dust, and microbes with which it may be laden.

The peculiar odor of clay is unquestionably due to organic ingredients. Although these cannot be isolated or detected by chemical analysis, they can be classified according to their physiological effects, which vary widely. Rohland has succeeded in transferring the odors of clay to saccharate of iron and has thus recognized ten distinct varieties. Louis has made similar observations, employing ammonia as a vehicle for the odors.

Charles S. Philipp has produced a variety of glass which is a good conductor of electricity by fusing together 32 parts of sodium silicate, 5 parts of borax, 0.8 part of lead oxide, and 0.2 part of sodium antimoniate. The glass is not attacked by acids. Its electrical resistance is about 1,000 times smaller than that of ordinary glass. It is used chiefly for the disks of electrometers and electroscopes. Filaments of the new glass may even be substituted for the gold leaves of an electroscope.

A human hair of average thickness can support a load of 6¼ ounces, and the average number of hairs on the head is about 30,000. A woman's long hair has a total tensile strength of more than five tons, and this strength can be increased one-third by twisting the hair. The ancients made practical use of the strength of human hair. The cords of the Roman catapults were made of the hair of slaves, and it is recorded that the free women of Carthage offered their luxuriant tresses for the same use when their city was besieged by the Romans.

In the early part of the present year the French Academy of Sciences discussed a communication in which it was asserted that the human body emits radiations which affect photographic plates. In the course of the discussion De Fontenay demonstrated that the effects which had been attributed to radiations could be explained perfectly by the warmth and moisture of the body. Later, an attempt was made to sustain the theory of human radiations by the statement that the Lumière company had been compelled to discharge several employees who fogged the plates that passed through their hands. De Fontenay investigated the matter and found that nothing of the kind had ever occurred at the Lumière factory. Every case of fog was due to accident and to well-known causes—finger marks, packing strips, lantern fog, etc.—not to any mysterious human radiation. In regard to animal magnetism, unknown natural forces, and other occult agencies, it is bad enough to be assailed with crude experiments and unproved assumptions, without the aid of false testimony. Legends of this sort are easily propagated and hard to kill. Ten years hence the alleged experience of the Lyons plate makers will doubtless be still adduced as a proof of human radioactivity.

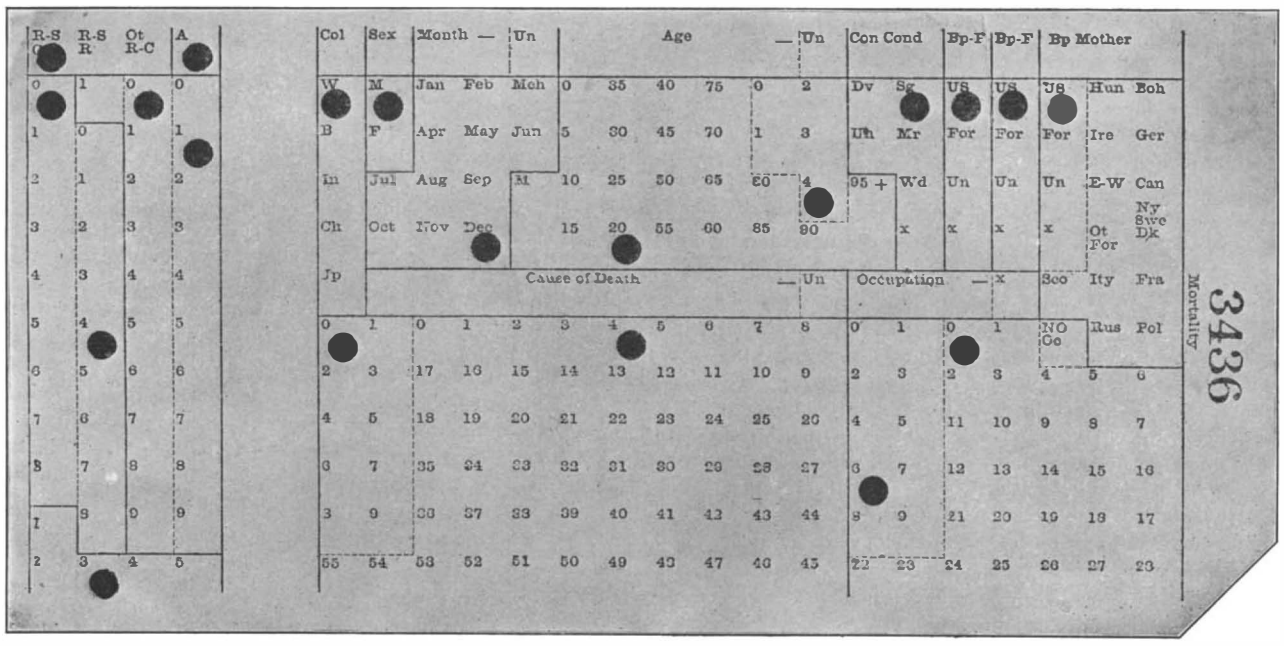
A. Kuerth has obtained the following results in a series of experiments on the effect of heating on the hardness of various metals: A bar of very uniform copper was cut into five pieces, 2½ inches long and 8/10 inch broad. In the cold all pieces showed exactly the same hardness. They were heated in oil or saltpeter baths to temperatures of 300, 570, 660, 700, and 840 deg. F. respectively for from one to thirty minutes, and allowed to cool, the hardness in each case being determined at the temperature of about 70 deg. F. The specimen heated to 300 deg. F. showed a hardness which was almost independent of the duration of heating, the coefficient of resistance being eighty kilogrammes per square millimeter, but in other cases very great variations were observed. With the bar heated to 840 deg. F. the value of the coefficient fell in one minute to 40, and thereafter remained almost constant at 37. Other experiments were made with specimens of nearly pure nickel, aluminium, zinc, and tin, and with various Krupp steels. The temperatures used ranged from —116 deg. F. to 900 deg. F. In general, the hardness of steel decreased as the temperature rose, up to about 390 deg. F., at which point there was a slight increase in hardness, which was followed by a diminution as the temperature was raised still higher.

COUNTING OUR PEOPLE BY MACHINE.

BY M. HAMILTON TALBOT.

The counting at the end of each decade of every man, woman, and child in the United States is one of the biggest undertakings the government is called upon to assume. To facilitate counting, machines will be used invented by Mr. James Powers, a mechanical expert of the Census Bureau, for use in the thirteenth census, which were successfully tried in the recent Cuban census, and now in use in the Division of Vital Statistics of the Census Office.

The mechanical method for counting the census requires two types of machines, which are of equal importance, and each essential to the successful use of the other. The keynote of the system, however, is a punched card, which contains the data collected by the enumerators, who travel from house to house in every nook and corner of the land. The data include the nature and extent of our industries, the amount of our wealth, etc. By means of the punched card a tabulating machine mechanically classifies the data thus sent in to the Census Office by the enumerators. The location of the holes on the cards means everything to the tabulating machine, as will be seen later; for the special position of a hole within the limits of certain boundary lines on the cards means one thing, and in another position another thing. It is this location of a punched hole on a card that enables the tabulating machine to transfer the value of that particular position of a hole on a card to a number of counters, which classify the data and obtain totals.



One of the punched cards.

The punching machine which was used in the eleventh census, and again with improvements at the twelfth census, was a rather simple affair, in which the pressure of a lever by hand was necessary for the punching of each and every individual hole. The machine recently invented for punching bears no resemblance to the old apparatus, and is run by electricity instead of hand power.

The new machine is built on the plan of a typewriter, with 240 keys. The operator instead of punching one hole at a time presses as many keys as may be necessary. After all the facts have thus been recorded by the keys, a bar resembling that of a space bar on a typewriter is pressed, which brings an electric motor into play, whereupon all the holes are punched at once without any effort on the part of the operator. The average number of cards punched per day at the Census Office with the hand puncher was 900, while with the new machine a speed of 4,000 cards per day is attained. In the old punching machine a hole was punched in a card every time a key was depressed. If an error was made the card had to be thrown away, thus wasting not only the cards but the operator's time. In the new machine each key is depressed independently of the others, and can be released at will without punching a hole or recording a fact until the operator is ready to press the motor bar, which punches all the holes at once. Before the operator punches any holes the operator can look over the depressed keys and ascertain whether all are correct. If an error be discovered, the wrong key can be released and the error rectified before any punching is done. The color of the keys for each field of the card is different, which enables the operator at a glance to locate the keys representing the different fields of information. The cards are fed to the machine from the back by electricity.

To make this method clearer, study the accompanying picture of a card, which is now in use in the Vital Statistics Division of the Census Office, and which is representative of all cards used in their new punching machine, a change in the symbol keys of the machine making it available for population work.

The holes are divided into two classes by the vertical lines on the left-hand side of the card. The first class, aided by the large numerals at the right-hand edge, identifies the person, and enables the census expert to find immediately the original entry from which the card was made; the second class gives all the statistical information regarding the person for whom the card was made. For instance, the *W* means that this person was white; the *M* means that the person was a male; the *Dec* that he died in December; the 20 and 4 that he was 24 years old; the *Sg* that he was single; the *US* in the next three fields that he was born in the United States, as were both his parents. The two fields immediately below show his occupation at time of death, and also the cause of death. A similar card is being made in the Census Office for each death reported in the United States, and one will be punched for the many million inhabitants reported by the enumerators in the forthcoming census.

In connection with the invention of this new machine, it is interesting to note that it will render it possible to announce the total population at the next decennial enumeration in record-breaking time; for automatic counters are attached to the keys, and register on a dial every time a hole is punched. Thus, just as soon as the 90,000,000 cards (more or less) representing the people of the country have been punched, the Census Office will be enabled to announce immediately the totals as to the different classes of our population—males, females, natives, foreigners, white, colored, married, and single. Under the old system, when all the punching was done by hand, these figures were not available until the tabulating work was started.

After the transfer of information to the cards has been completed, the schedules from which the information is derived are filed among the government records, and all the work of statistical tabulation is done with these cards. One notices that the clerks working on them cannot tell the names or addresses of the individuals for whom the cards stand, and that thus in the presentation of census tables the personal element is entirely lost.

After the cards have been put through the punching machine, they are ready for the tabulating machines. The operator puts the cards, one at a time with her right hand, into a box with a multiplicity of little spring-seated pins above the card and a corresponding series of mercury cups below it. As she moves her hand from the machine to pick up another card she touches a spring on the lower edge of the pin box, which brings an electric motor into play. The pins which are in line with the holes of the second class on the card descend through the holes, and by touching the mercury below make so many electric contacts. Each pin and its mercury cup are terminals of a separate current passing through an electro-magnet controlling a counter or dial. Thus, referring again to the card, the current entering the field for *Col*, or *Color*, would have five possible paths. The routes diverge at the five points where holes in the cards might have been. Of these five routes four are closed by the surface of the card, and the current is compelled to go by the fifth, where the hole has been made, and is guided to the dial for *Color*, and so on in each field. These dials contain the various combinations of statistical information, from which the tables as finally set forth in the census volumes are made.

Front view of the card-punching machine.

The new tabulating machine.

Rear of the new card-punching machine.

COUNTING OUR POPULATION BY MACHINE.

An automatic recording and printing system—on the plan of the familiar stock ticker—is connected with each dial. When the operator wishes to make a reading of the dials a button is pressed, with the left hand, and the figures on the dials are printed on the ticker paper, from which they can be read. The dials are automatically reset. In the machines used in former census work the dials had to be read and the results recorded by hand—a proceeding productive of many errors—and then all the dials had to be reset by hand, a time-consuming operation. The daily output of the old machines averaged 18,000 cards, while the new machines are counting 28,000 cards per day.

An occultation of Mars occurred on September 1st, which was observed by many astronomers, although the event is not of much scientific importance.

HOW SUDD CHOKES THE NILE RIVER.

BY DAY ALLEN WILLEY.

The actual head of navigation of the Nile River is considered as at the town of Gondokoro, for the reason that the depth of water is sufficient to float a steamer to the famous city of Khartoum, a distance of 1,081 miles to the northward. South of Gondokoro are stretches of water available for light-draft boats, but the interruptions to navigation are so numerous that this portion is not considered a practical route for water traffic. When Mr. Roosevelt concludes his African hunt at the banks of the Nile, his expedition will take a special steamer at Gondokoro and attempt to reach Khartoum by water. The word "attempt" can be appropriately used, for the reason that the channel may be blocked by sudd in the river to such an extent that the party must go overland for some distance if they would reach Khartoum at the date expected.

Just how the word "sudd" originated is a mystery, but every Egyptian traveler knows perhaps too well what it is, for many a time this vegetation has choked the upper Nile to such an extent that boats have been held weeks at a time until a way could be cut, burned, and pulled through it. So dense, so thick, is the water growth, that if allowed to continue, it forms a literal mat over the channel, so compact and so strong that such animals as the elephant, even the hippopotamus, have been seen to go across it, and without breaking through the matted roots, branches, and leaves. In short, the rapidity with which the sudd spreads over the water, and its parts interlace, is such that in a few weeks a space of the Nile once clear of it will be completely hidden by a mass of waving papyrus, but underneath is a combination of water plants that

Detail view of water papyrus or sudd.

attach themselves to the papyrus stalks, and form what is literally a cover of vegetation, through which not a foot of the river may be visible.

In all of the thousand and odd miles from Gondokoro to Khartoum, and even above Gondokoro, does this water growth flourish, and consequently the engineers of the Egyptian government have no small task to keep open a channel for the steamer service. Although but one boat monthly plies regularly between the places mentioned, there is considerable tourist and other traffic near Khartoum, and a fleet of craft are in service to remove this curious growth. To clear a channel even large enough to admit the smaller type of vessel is not an easy task, since the sudd is so dense and so difficult to pull out—the usual way of getting rid of it. Where the Nile is wide and the water of sufficient depth, the vegetation is left untouched unless it entirely closes the channel, so a boat may make a detour of several miles out of the ordinary course, skirting one of the strange floating islands. In fact, the growth along the upper Nile is so enormous that patches of it skirting the shore may be seen for distances of a hundred miles without a break or gap to the land itself. Islands of the stuff a half dozen miles in area are sometimes carried down in the Nile flood current until they lodge against a projection of the shore or ground in shallow water. Thus it is that new "islands" of it are created often far downstream from the region where the sudd is most abundant.

In clearing the river channel of sudd the engineers have devised several schemes. The top growth frequently becomes so dry that they can burn it over like so much grass. This removes much of the weight of the plants, but they are so matted together, that saws are actually used to separate the growth, as it cannot be removed in any other way. The vessels employed for sudd clearing, while light-draft boats, are strongly built and have blunt bows, so that they can be forced against the bank of vegetation. They are provided with steel cables or hawsers, saws, and axes, and carry crews of natives who are experts in working upon the sudd.

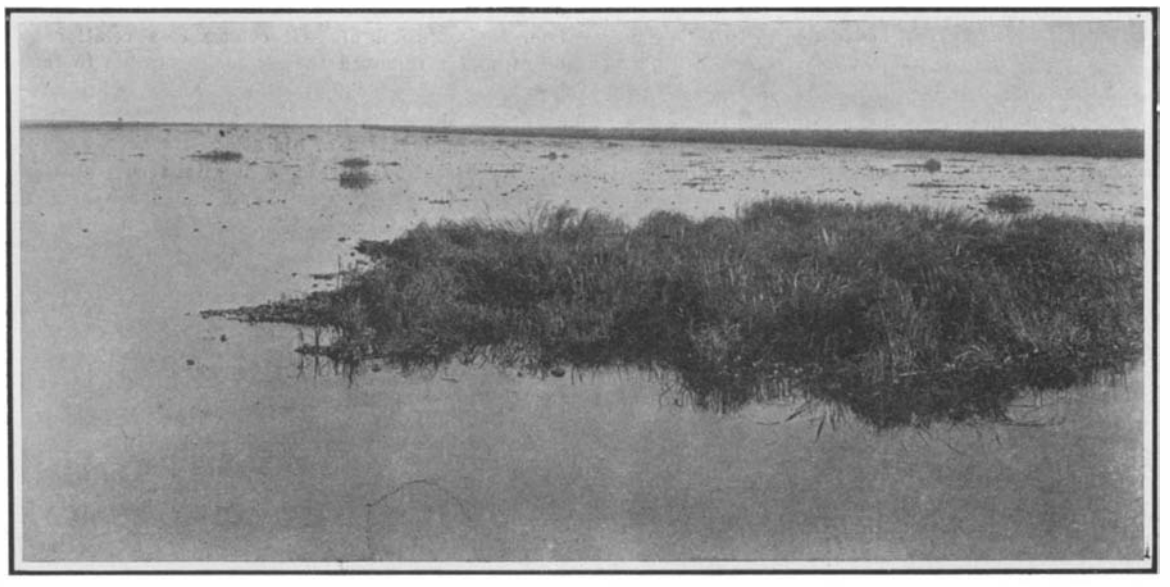
The way in which the channel is cleared is as follows: Often the water is so completely hidden, that the first difficulty when you are encountered by a barrier of sudd, is to discover where in this sudd the river bed runs. This is done by a method of "sounding" through the sudd. The average depth of water in the sudd may be only a few feet, but when the true river bed is reached this suddenly increases to a depth of 15 to 18 or 20 feet. Having found the real river bed, the first thing to do is to cut down or burn the top growth, consisting mostly of papyrus. A curious and unexplained fact noted by the engineers is that when papyrus is fired, the flame frequently spreads along what is afterward discovered to be the true bed of the river.

Section of upper Nile, showing channel nearly filled with sudd.

Having cleared the top of the sudd "block," the men are landed with large saws to cut along the true river bank, which may be either submerged with a few feet of water over it and papyrus and sudd on it, or solid ground with ant heaps, the solid ground never being of any great extent and always surrounded by swamp. Cross and parallel cuts with the saws are then made through the sudd, dividing it into blocks of a convenient size for the steamer to tear out, the size of these blocks of course depending on the consistency of the sudd and the power of the steamer.

Having cut the sudd into convenient blocks, the bow of the steamer is run into the block; the loop of steel hawser, both ends of which are made fast to the steamer, is passed over the bows of the steamer, where it is taken by the men on board and placed in what is called the trench cut, and held down with their feet. The steamer then goes full speed astern, the men all standing on the hawser to keep it in position. In the case of tough sudd, as many as twenty trials may have to be made in this way before the block of sudd eventually tears away. In the case of shallow light sudd, the hawser may be trodden down too deep and slip underneath, in which case the block will be cut free but has to be again gripped by the hawser and towed away. When the block is torn out, the steamer goes slowly astern till the mass is pulled clear into the current—if there is one—when it is cast adrift to float downstream, where it is gradually disintegrated. If there is no current, it is towed to a piece of open water, where as a temporary measure it can be tied by ropes to the bank, leaving a wide enough channel for the steamer, and on the appearance of a current, be cut adrift to float downstream.

The chief growths in the sudd are papyrus and tiger or elephant grass, a kind of bamboo growing to a height of 20 feet or more. To these climbs a creeper of a kind of convolvulus. Another portion of the sudd consists of ambatch and a long sword-grass that cuts like a knife, known as "oom soof." The steamer could cut its own way through this latter, which in the presence of a current would be broken up and float downstream, offering no obstruction. In calm water, however, it does not float away, but ob-



View of upper Nile, showing full-grown sudd and young plants appearing just above the water surface.

structs the steamer by constantly fouling the paddle-wheel. There is another very light kind of duckweed which covers some of the small open pools, and in the absence of a current, is a great nuisance for the same reason.

Strange as it may seem, the sudd interferes but little with the flow of the river, and the Nile passes under it with little resistance. This is because the growth is principally near or on the surface. As the river is over a mile wide in some places, and the deep channel may be only a hundred feet, it is often hard to tell where to find the channel to clear it, as all of the water may be hidden. Men with long poles push them through the sudd to the water, and by this method of sounding locate the channel, when the sudd clearers get into operation.

The water papyrus plant so often seen in the sudd has given rise to the theory that the growth is composed of papyrus, but an analysis by naturalists shows that there are four vegetable elements that are the principal creations of this strange natural bridge. They are known scientifically as the *Papyrus cyperus*, the *Panicum pyramidale*, the *Phragmites communis*, and the *Typha australis*. They form the framework of the mass, but interlaced with them, as stated, are several species of twining and climbing plants that greatly strengthen this strange fabric. It may, as already stated, support even the weight of an elephant where it is thick enough. The papyrus with its wide top covers the sudd, and thus gives the idea that it is the only obstacle, when as a matter of fact this is a great water carpet, woven as deftly and strongly as if by the loom.

The Highest Flight of a Balloon.

The unprecedented elevation of 95,250 feet, or 18 miles, was attained by an unmanned registering balloon which was recently released at the Belgian meteorological institute at Uccle. At this elevation the barometric pressure is only 2/5 inch. The greatest height ever attained by a manned balloon is about 6.7 miles, or 35,400 feet. The Berlin aeronauts Berson and Suering, who established this record, were unconscious when they reached the highest point of their flight.

The Belgians adopted Hergesell's plan of attaching the instruments to a small and partially inflated balloon, suspended from a larger and fully inflated one. The large balloon rises until it bursts, and the small balloon falls slowly, so that it can be easily observed and brings the instruments safely to earth. At the maximum elevation, 18 miles, the thermometer recorded a temperature of —82 deg. F., but a lower temperature, —88½ deg. F., was registered at the comparatively small elevation of 8 miles. These observations appear to support the hypothesis that some of the ultra-red solar radiation is absorbed by the higher strata of the atmosphere, but additional observations will be required to solve the question.

The Current Supplement.

What is probably the very highest branch of the molder's art is the casting of bronze figures and statues. The opening article of the current Supplement, No. 1758, discusses this art most thoroughly. The ultramicroscope and ultramicroscopic objects are discussed in simple language. Charles Engel tells something of the economy of cold in modern life. Of the many problems that confront the American housewife, the subject of vegetables for her table during the winter months is not the least important. How that problem can be solved is told by J. F. Breazeale in an article entitled "Canning Vegetables in the Home." Prof. E. H. Starling points out the lesson of evolution. The importance of ferments in organic life is dwelt upon by Dr. A. Zart. Sir Andrew Noble recently read a paper before the Institution of Engineers and Shipbuilders on the history of propellants. That paper is reprinted in the current Supplement. "The Aerial Propeller, Its Form and Construction," is the title of an article by Lucien Fournier. Sir J. J. Thomson's brilliant paper on recent studies of electricity and matter is concluded.

An epidemic disease known as the "white" of oak has been studied recently by Griffon and Maublanc. It prevailed in France especially during 1908. The disease is properly called oïdium, and it is not confined to the oak, but also attacks the ash, elm, and chestnut. It is also found in Algeria. The disease is supposed to be due to a micro-organism known as *Microsphera alni*. The question as to whether it is indigenous or not has not been determined. It increased in France during 1907 and 1908 in an unusual way. Should we suppose it to be imported like blackrot or mildew, this would appear bad for the future, while if it is indigenous it is likely to disappear again. Some persons advocate a treatment with sulphur, but others claim that this has no effect. One important point in any case is the time of the year when the treatment is made.

Correspondence.

THE NUMBER OF OUR ANCESTORS.

To the Editor of the Scientific American:

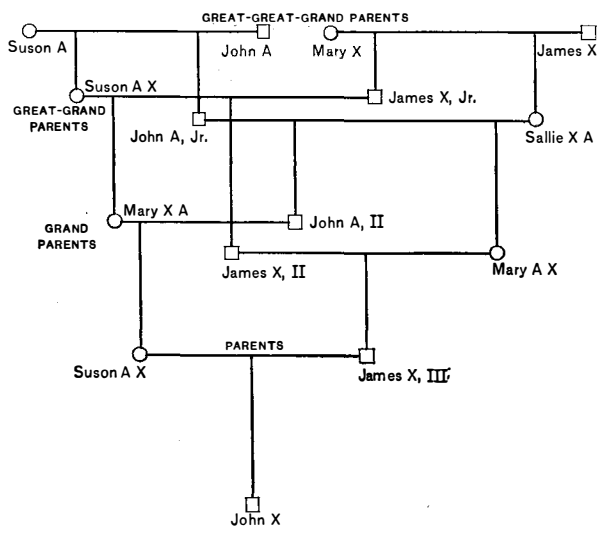
If it is not too late, I would like to add a few words to the correspondence which appeared recently in the Scientific American concerning the number of our ancestors.

Your first correspondent, Mr. A. K. Venning, comes to the conclusion that long before the 5,000 or 6,000 years of authentic history is reached, the number of our ancestors would be so large that there would not be standing room for them on the face of the earth; while your second correspondent, Mr. Ernest McCullough, is inclined to ridicule this, and thinks that the figuring is more apt to work the other way. Permit me to offer the following explanation: The explanation lies in the difference in the ages of our ancestors. There is usually a considerable divergence in the ages of our grandparents; and going back farther, the difference in age increases with each generation, so that by the time the fifth or sixth generation back is reached, some of our ancestors would be new-born babes, while others would be in their graves. It is readily understood from this that the number of our ancestors is just as liable to decrease with each generation, owing to the ravages of the grim reaper Death, as to increase. If our grandparents were all born the same year, all married the same year, and both couples had children the same year, Mr. Venning's conclusions would be correct, provided no one ever died. When I say grandparents in this case, I mean all our ancestors indiscriminately.

East Canaan, Conn. Dewey C. Canfield.

To the Editor of the Scientific American:

I notice in one of your recent issues a communication from Mr. Venning of Los Angeles, Cal., in which he seeks a solution of the puzzling question of accounting for the discrepancy between the apparent



number of a man's ancestors as given by the rules of geometrical progression and the lesser number which experience shows to be the case. I think the solution is to be found in the simple fact that our ancestors have been in the habit of intermarrying with their cousins, sometimes this relationship being near and sometimes more distant. Otherwise we would inevitably enjoy our allotted number of 2^x ancestors for any given generation. Thus one set of one's great-grandparents on the maternal side are often one's great-parents on the paternal side also. For instance, a man whose ancestors for two generations had intermarried with their first cousins would have the lamentable misfortune of possessing but four great-grandparents, as shown by the inclosed diagram, when by all the rights of arithmetic he should have sixteen to be proud of. Of course this relationship is often so far removed that it is impossible to trace it, but each time one's parents have a common set of ancestors, no matter how far removed, it is evident he is being deprived of his allotted share of ancestors to that extent at least, and it might be mentioned it would be next to impossible to find any two Englishmen to-day who had not in common an innumerable number of ancestors. F. W. A.

Knoxville, Tenn.

To the Editor of the Scientific American:

Publication of this problem has not as yet brought any solution, but it has cleared the air to some extent, I am glad to see. May I point out to Mr. King that the question of relationship of descendants has not really anything whatever to do with the answer? He is leading the hunt off on a false scent. If we leave out of consideration altogether the present inhabitants of the earth, and start from the premise that there is only one person alive to-day—say Mr. Constable's John Brown—the problem remains unaltered, only being thrown back a few centuries.

The revised problem is: If, x generations back, John Brown had 2^x ancestors, then it is only a question of time—of a few thousand years—for the number then alive to be so great that there would not be standing room for them upon the globe. The existence of 1,500 million or so of other persons, and those, moreover, composed of different races, to say nothing of the vast animal life, only adds to the mystery. If we limit the inquiry so as to bring it more clearly within the focus of human understanding, say to 1,000 years, we find that one single Englishman alive to-day had, at the time of Alfred the Great, 1,094 millions of progenitors living at that time, as mentioned in my original letter.

Five hundred years gives a proportionally similar result, as incomprehensible and puzzling.

Los Angeles, Cal. A. K. Venning.

THE RECENT CURIOUS ECLIPSE OF THE SUN.

To the Editor of the Scientific American.

The recent eclipse of the sun was both annular and total, an anomaly which becomes intelligible if we consider the data given in the American Ephemeris and Nautical Almanac for 1909, under the head of "Eclipses and Phenomena Accompanying the Same." The interesting phenomenon was not caused *per se* by the varying distance of the moon, which could not be possible, but by the varying distances on the earth where the moon's shadow or better where the shadow caused by the moon reached the earth's surface. Let me say that the phenomenon is a rare one and can occur only when the sun, moon, and earth are so situated that the moon's position with relation to the other two bodies gives it such an angular diameter that the nearest point of contact of its shadow on the earth will just cover the sun's disk, thus giving us a total eclipse. This condition we might call a critical one; for should that distance be increased by a few hundred miles between the moon and the point of contact of its shadow on the earth, there would be an apparent decrease in the angular diameter of the moon's disk, thus allowing an annulus of light from the sun to pass over its edge, and thus producing an annular eclipse.

Now this is just what happened in the last eclipse. The first annular phase was about the latitude of Tomsk in Siberian Russia in the early morning; and as the solar rays had a large angle of inclination, they had to travel much farther before they reached the earth than when the sun was in the meridian at midday.

The same conditions were present when the sun was low in the western horizon, i. e., the solar rays reached the earth's surface at a low inclination, thus repeating the annular phase on the west coast of Greenland in the evening.

Just at what points on the earth's surface the total phase commenced and ended, I am uncertain. I do not believe that the points have been worked out, owing to the fact that the duration of the eclipse at any one place would be so short that astronomers did not deem it worth while to consider it as of enough value to send an expedition, even should it have been in an accessible part of the world. As the total phase was likely all within the Arctic Circle, it goes without saying it wasn't worth while. Data are given in the American Ephemeris by which the problem can be solved for any part of the path of the eclipse.

I made a search through Grant's "History of Astronomy," and found no similar eclipse noted; but Dr. Schlesinger, director of our observatory at Allegheny, tells me that it may occur once in about a hundred years. Yet when we think of the many anomalous motions of the moon, we cannot but have the most profound respect for the mathematical astronomer who can sift out from the intricacies of these anomalies such a marvelous solution of the problem of eclipses as noted above.

I trust this note will be of some use to my old-time friends of the Scientific American. Too often my humble contributions on astronomical subjects are sadly distorted, and before they have traveled the rounds of newspaperdom have been made sensational, to my regret, but I am always content if I have added only a little to the sum of human knowledge and human happiness. John A. Brashear.

Beaumaris, Ont., Canada.

The stirring of chemicals in the solution tanks of the Oberlin, Ohio, water softening plant, states the Engineering Record, is accomplished by the use of power furnished by a Pelton water wheel. The wheel is 12 inches in diameter, operates under a pressure of from 9 pounds to 22 pounds per square inch, and consumes about 50 gallons of water per minute. The wheel drives a main shaft, which drives the stirrers, or revolving arms, through the medium of a belt. The waste water from the water wheel is used for preparing the lime solution. The speed of the wheel is 180 revolutions per minute; of the lime agitator, 38 revolutions per minute; and of the soda agitator, 13 revolutions per minute.

THE SEVEN BRIDGES OF KÖNIGSBERG AND OTHER PUZZLES.

BY J. F. SPRINGER.

The ancient and university town of Königsberg is situated on the river Pregel, which here forms an island called Kneiphof. There are seven bridges over the river, five of which connect with the island. In the earlier part of the nineteenth century a discussion arose as to whether it were possible for a person to pass over all the bridges in one continuous trip and without covering the same path twice. In fact, this problem attracted the attention of the celebrated mathematician Euler. In order to understand the question clearly, refer to the map. The start may be made from any point. The problem is really insoluble, try however you will. However, if it be considered allowable to cross the Pregel by the railroad bridge below the town, the problem may readily be solved. Thus, beginning at a point on *D* one passes over the Holz Bridge, then over the Schmiede Bridge to the island, then back to *C* by the Krämer Bridge. One now makes a detour, passing over the Pregel from *C* to *B* by the railroad bridge, then passes to the island by the Grüne Bridge, returns over the Kötte Bridge, goes over the Hohe Bridge from *B* to *D*, and finally completes the journey by crossing the Honig Bridge onto the island. Thus, seven—in fact, eight—bridges have now been crossed and no part of the path has been covered twice.

This type of problem may fittingly be termed a *traveling puzzle*. It is in reality a very ancient kind of thing. Thus, there has come down to us from the time of Pythagoras, who flourished in the sixth century before the present era, a very simple example in the shape of the Pythagorean star, an illustration of which is annexed, Fig. 2. This figure may readily be traced by one continuous line and without duplication of the path.

A story is told to the general effect that a disciple of Pythagoras once fell sick at an inn, where he was cared for very kindly by the innkeeper. Instead of getting better, however, he grew worse. At last, with the expectation of dying and being unable to repay his kind host, the Pythagorean asked for a board. When this was brought, he traced out the single-line star. Giving this to the innkeeper, he desired him that it should be displayed outside. Some time after his burial, a stranger happened along. Upon observing the star, he made inquiry, and was informed of the particulars related. He then, in order no doubt to make the story complete, handsomely rewarded the innkeeper for his unselfish care of the unfortunate Pythagorean.

Another figure of the single-line type is that known as Mohammed's signature. This is shown in the annexed drawing, Fig. 3. It is understood to have been drawn by Mohammed upon the sand by a continuous and unrepeated movement of the point of his scimetar. Beginning at *A* and following the course indicated by the letters *ABCDEBFGA*, one may see how it was possible to accomplish this result.

An extension of the Pythagorean star is shown in Fig. 4. This may be solved by following the routes indicated by 1 2 3 4 5 1 4 2 5 3 1, 1 2 3 4 5 1 3 5 2 4 1, and 1 4 3 1 5 4 2 5 3 2 1. In these it will be noticed that two or more exterior sides are taken consecutively. If it be required that this shall not be the case, the problem is perhaps somewhat more difficult. Nevertheless, it is soluble, as may be seen by following out the order indicated by 14315325421.

We must not be deceived by the apparent simplicity of a given case of this type of puzzle. Thus Fig. 5 discloses the very simple figure made by a circumference and two diameters. Try as you will, you cannot cover this figure by a continuous line that nowhere duplicates itself. On the other hand, figures that are apparently very complicated frequently admit of a ready solution. Thus, the six-pointed star shown in Fig. 6 may be quickly solved by the method shown in Fig. 7. To work the puzzle given by Fig. 8—that is, the star of Fig. 6 with the including polygon—observe Fig. 7. This does not in its present form, perhaps, suggest a solution, for the reason that beginning and ending at the point indicated, we have no opportunity to draw the inclosing hexagon, either as a preliminary to starting or as a sequel to finishing. But at the moment when we have arrived at the tip of *any* of the six points of the star we may draw this hexagon, and then continue according to Fig. 7.

Refer now to Fig. 9. This is apparently a very complicated design. There is a very simple solution, however, which Figs. 10, 11, and 12 will assist in developing. It is easy to see how to draw Fig. 10, no matter where we elect to start. If we start at the tip of a point, the including polygon of Fig. 9 may easily be drawn as a preliminary or a sequel (Fig. 11). There is just one thing to see, and that is how the remainder of Fig. 9 may easily be made by forming a kind of loop at each of the inner points, *A*, *B*, *C*, *D*, *E*, *F* (Fig. 11). The method of making this loop is indicated in Fig. 12.

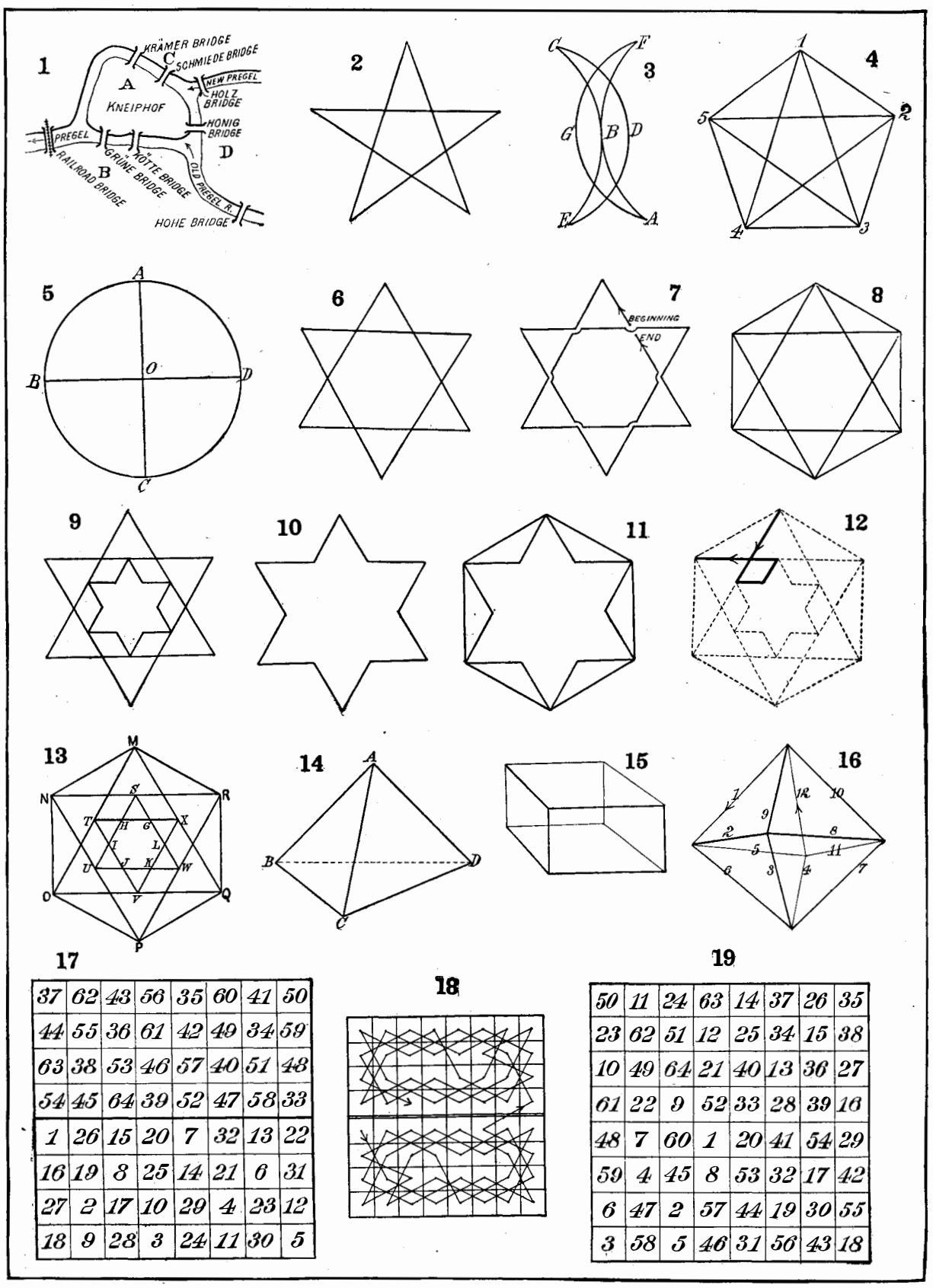
To draw Fig. 13, we proceed as per Fig. 9, except that the moment of arrival at *any* one of the points *G*, *H*, *I*, *J*, *K*, *L* is selected as the time to draw the innermost hexagon. A complete solution is afforded by the course indicated by *M T H S N U I T O V J U P W K V Q X L W R S G* **H I J K L G** *X M* **N O P Q R M.** The heavy letters indicate where the innermost and outermost hexagons are added.

Comparing Figs. 5 and 13, it may seem hard to realize that one puzzle may be worked and the other not. Perhaps some readers may be inclined to think Fig. 5 soluble. An actual solution will of course prove that they are right. In the meantime, the following considerations may prove of interest: There are in all five junction points—*O*, *A*, *B*, *C*, *D*. If we do not start or end at such a point, we must recede from it for every approach; and conversely, for every recession there must have been a previous approach. Approaches and departures are thus paired off. At a starting point, however, it is possible to have a departure without a previous approach; this would occur when we begin, and only then. Likewise at a finishing point, we may have an approach without a following departure; this would occur at the end, and only then. That is to say, there can not be more than two points (the start and finish) where an odd number of lines join. In Fig. 5 there are *four* such points—*A*, *B*, *C*, *D*. This shows sufficient reason for pronouncing this figure insoluble.

Let us turn now to solid bodies, and look at some of the simpler cases. Take the tetrahedron shown in Fig. 14. It is certainly a matter of indifference at which vertex we begin, so we start at *A*. We have the choice of three beginnings. It is also evidently a matter of indifference which of these we follow, so we pass to *B*. Here again the two possible choices are alike, so we go to *C*. Here the two routes lead to different results—*C A* completing a triangle (*ABC*) and *C D* closing no figure. First we try *CA*. Arrived at *A*, we are compelled to go to *D*. We have now two lines to draw—*D B* and *D C*. We may cover one, but not both. So then we return to *C* and try *C D*. Arrived at *D*, we see that if we go to *B* we shall be unable to go any farther. So then we go to *A*, and thus are forced to *C*. Here we stop, with *D B* undrawn. Referring, however, to the discussion of Fig. 5, we observe that the tetrahedron comes under the head of the impossible figures, as there are four points where an odd number of lines join, viz., *A*, *B*, *C*, *D*.

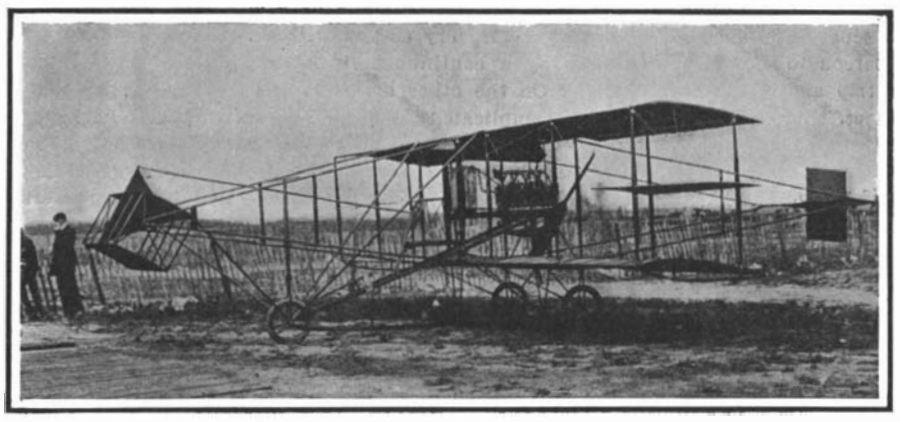
Fig. 15 is likewise an insoluble case, having eight points where three lines join. Fig. 16 is an apparent advance in complication. But we observe that all six vertices are junction points for an even number of lines. It is, in fact, a soluble case, as may be seen by following the course indicated by the numerals.

Another variety of this same general class of puzzle is the problem which requires the knight to start from a position on the chessboard and cover the whole board by a continuous series of moves, no position to be taken more than once. A convenient way of trying this puzzle is to rule with a sharp instrument on a slate the sixty-four squares of the chessboard. Wherever you elect to start the knight, you mark 1. His next position you mark 2, and so on. The slate en-



THE SEVEN BRIDGES OF KÖNIGSBERG AND OTHER PUZZLES.

ables false starts and errors to be readily corrected. This kind of puzzle has attracted a good deal of attention, and has received a multitude of solutions. Thus we may instance the solution given in Fig. 17. Here the lower half of the board is covered before any beginning is made with the upper half. The two halves are precisely symmetrical with each other, as may be seen by referring to Fig. 18, where the path of the knight is indicated by a continuous line. This division of the solution into two duplicates is not necessary, but is an added refinement. In one sense it simplifies matters, as we have but half the board actually to solve. We are restricted, however, as to the point of termination. Thus in the present example, the point of beginning, 1, having been determined, the point 33—the beginning of the second half—is thereby fixed, so 32 must come where it is at present or must be at position 6. Fig. 19 is an illustration of a solution where the resulting arrangement of figures has some of the properties of a magic square. Thus every column and every horizontal line sums up 260. If the diagonals each totaled the same number, 260, then the whole would form a perfect magic square.



The Curtiss biplane which won the International Aviation Trophy.

This machine made one circuit of the course at the rate of 47.73 miles an hour. It traveled 18.63 miles in 15 minutes 50⅗ seconds (47.04 miles an hour) in winning the International Trophy.

TERMINATION OF THE RHEIMS AVIATION MEETING.

THE WINNING OF THE INTERNATIONAL TROPHY.

As briefly noted in our last issue, Glenn H. Curtiss won the Bennett International Aviation Trophy on August 28th at Rheims. This trophy—a beautiful model of a Wright biplane held aloft by a female figure—was contested for the first time on the date above mentioned, France being represented by two monoplanes—a Bleriot and an Antoinette—and one Wright biplane, and America by one tiny biplane with a powerful 8-cylinder motor. The real race was between Curtiss and Bleriot, the champions of the biplane and the monoplane types of flying machines respectively; and that the former accurately sized up his rival soon after he reached France is shown by the fascimile reproduction of the postal which he at that time sent our Aeronautic Editor.

The Bleriot monoplanes in front of their sheds.

The No. 22 machine was fitted with an 80-horse-power, 8-cylinder motor. It made the fastest round of the course at the rate of 47.78 miles an hour.

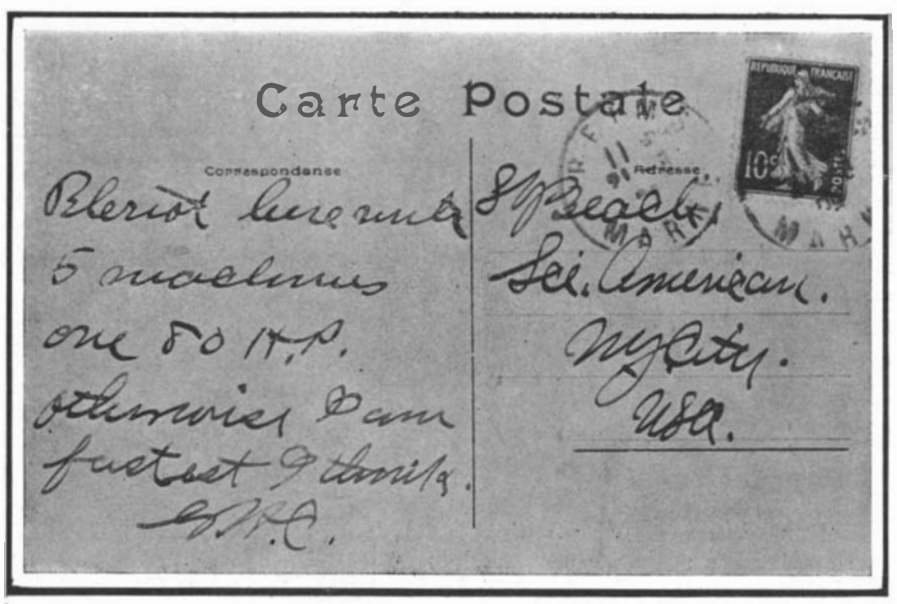
The morning of August 28th was mild, calm, and hazy at Rheims. As the weather conditions were so favorable, Mr. Curtiss brought out his machine a few minutes after 10, and immediately started off on a preliminary round of the course. Despite the fact that he made rather wide turns and that the aeroplane pitched considerably, the time of the round was but 7 minutes, 55 1/5 seconds—a decided improvement over Curtiss's former fastest round of 8:09 1/5, and 9 1/5 seconds less than Bleriot's fastest lap. Mr. Curtiss decided to try for the trophy at once. His small gasoline tank was refilled, more water was put in the radiator, and, after signing the official paper, he quickly rose for the second time. After circling around once in front of the grand stand, he crossed the line at full speed. The aeroplane still pitched perceptibly, and the turns were, with the exception of the very last one, all rather wide; but nevertheless both rounds were made in record time, the second one being 4 1/5 seconds faster than the first and 2 seconds faster than the time in the trial flight. The times of the rounds were 7:57 2/5 and 7:53 1/5, the total being 15 minutes, 50 3/5 seconds, which corresponds to an average speed of 47.04 miles an hour.

The 4 1/5 seconds gain in time on the second round, Mr. Curtiss attributed to a slight change in the mixture which he effected by turning a small wheel he had conveniently at hand. He ran the engine at its fastest speed all the time, but during the second lap thought that it started missing explosions on one cylinder, so he made a slight adjustment. The pitching of the machine seems to have been due to the fast speed at which it was being driven in conjunction with the sensitiveness of the horizontal rudder control. When the machine would pitch downward and Mr. Curtiss would turn it upward again, the shock was so great that he said it was like striking a bump when riding in a fast automobile.

The other main event of the day—the Prix du Tour de Piste, or 10-kilometer speed test for one circuit of the course—did not bring out any contestants, since the two events could not be run together, and since competitors were obliged to state for which prize they were competing. But one trial was allowed for the International Trophy, also. After Curtiss's excellent flight, no other machines were brought out till about noon, when M. Bleriot made a slow round with his 80-horse-power "No. 22" monoplane. About 2 P. M. he tried another propeller, but only succeeded in making a round in 8:14 1/5. An hour later he had changed the 2-bladed propeller for a 4-bladed one. He attempted to make a round, but was obliged to descend before completing it. After working at the monoplane where it alighted for over an hour with the aid of several mechanics, he at length flew back to his shed. As it was now almost 5 P. M., and as no start was allowed after 5:30, he made hurried preparations for the test. It was 5:10 before the start was made. The monoplane flew splendidly without any rolling or pitching. The time of the first round was but 7:47 4/5, which was 5 2/5 seconds faster than Curtiss's second lap. If Bleriot could do as well in the second round, he would be the winner. There was intense excitement among the spectators at the grand stand. The machine finally rounded the last pylon. The timers called the seconds remaining before his time would be up, but it was 5 3/5 seconds over Curtiss's 15:50 3/5 before the indomitable Frenchman crossed the line. After conquering the Channel he had finally been defeated for lack of speed. Nevertheless, the performances of his and Latham's monoplanes remained unsurpassed for stability, even in strong winds. The latter started in the cup competition just as Bleriot was finishing. He flew at a great height—about 150 feet—and covered the course in 17 minutes, 32 seconds, thus securing third place. Lefebvre, the third French representative, with a Wright biplane fitted with a 40-horse-power motor, was fourth in 20:47. Mr. Cockburn, who represented England with his Farman biplane, got half way around the course when the end of one plane struck a standing shock of corn, whirling the aeroplane around and bringing it to the ground. Latham met with a similar mishap afterward when carrying M. Sariano as a passenger in the passenger-carrying competition. This was won by M. Farman, who, after making a round with one passenger in 9:53 4/5, afterward carried two around the course in 10:39 2/5, or at a speed of 34.96 miles an hour. The total live weight lifted by his machine was in the neighborhood of 450 pounds. A Wright biplane carried Franz Reichel around the course in 11:05 4/5. Farman's biplane was the only machine that succeded in carrying three people. Bleriot's "No. 12" monoplane, however, was the first aeroplane to accomplish this feat, which it did at Douai last June, when a total weight of 1,234 pounds was carried at about 30 miles an hour with a 30-horse-power motor. Farman's biplane had a 50-horse-power Gnome revolving-cylinder motor. This engine was fully described in Supplement No. 1729.

In addition to winning the International Trophy Mr. Curtiss, the following day, carried off the first prize ($2,000) in the 30-kilometer speed contest, known as the Prix de la Vitesse. His first attempt was made early in the afternoon. The three rounds of the course were made in 24 minutes 15 1/5 seconds. Believing that Latham had made better time, he made another attempt. This time he made very short turns and drove his machine at even greater speed. The three rounds were made in 7:49 2/5, 7:48 2/5, and 7:51 1/5, the total time for the three laps being 23 minutes and 29 seconds, or a speed of 47.6 miles an hour. The second lap was made at a speed of 47.73 miles an hour, which was the fastest time for the course by any machine, with but one exception. Because Mr. Curtiss did not start in this contest on the first day of the meeting, he was penalized 1/20th of his actual time, so that his official figures were 29 minutes and 49 seconds. Latham made another attempt to better his previous record, but in this he was unsuccessful.

Bleriot started about 10 o'clock with the intention of making another trial in this competition. He crossed the line and made the first turn at a rapid rate, flying at a low elevation. He finally disappeared from



Postal card showing how Curtiss sized up his opponents.

THE RHEIMS AVIATION MEETING.

view at the far end of the long side of the course. It was supposed that he had passed out of view in the depression at this point, which was called by Curtiss the "Aeroplane Graveyard" on account of the strong wind currents there and the many machines which met with accident at that point. Soon, however, a column of smoke arose, and upon going to the spot in an automobile it was found that Bleriot's machine had dived to the ground, caught fire, and was rapidly being consumed. M. Bleriot was rather badly burned and received numerous bruises. His only explanation was that something must have broken about the rear horizontal rudder, which caused him to lose control of the machine so that it dashed to the ground. The gasoline tank was broken and the fuel quickly ignited from the motor.

Another machine which was wrecked at this time was a rather heavy biplane built and flown by M. Louis Bréguet. This machine made its short flight the evening before. On Sunday morning a short flight of about 300 feet was made, the machine alighting without injury. The next time flight was attempted, however, the machine shot upward to a height of about 100 feet and, after traveling a short distance and tipping to the right, it descended at a sharp angle until the low end of one plane struck the ground and swung the machine around, while it at the same time reared up on its prow. Fortunately, M. Bréguet was not injured.

The results of the Prix de la Vitesse were therefore as follows:

First, Glenn H. Curtiss, with his 60-horse-power biplane. Time 23:29; official time with penalization, 25:49 2/5.

Second, Hubert Latham, with "No. 29" Antoinette monoplane. Official time, with penalization, 26:33 1/5.

Third, Tissandier, with his Wright biplane. Time 28:59 1/5.

Fourth, Lefebvre, with a Wright biplane. Time 29 minutes.

Fifth, Count de Lambert, with a Wright biplane. Time 29:02.

Sixth, Latham, with "No. 13" Antoinette monoplane. Time, with penalization, 29:11 2/5.

Seventh, Paulhan, with a Farman biplane. Time 32:49 4/5.

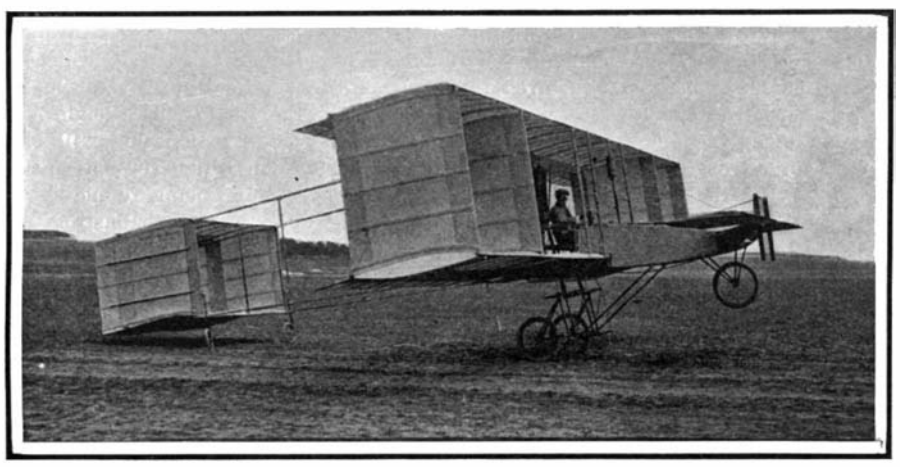
Eighth, Bunau-Varilla, with a Voisin biplane. Time, with penalization, 42:25 4/5.

The other speed contest, the Prix du Tour de Piste, which was for one circuit of the 10-kilometer (6.21-mile) course, was won by M. Bleriot, who covered the distance in 7:47 4/5 (47.78 miles an hour). Curtiss's time of 7:48 2/5 for one round in the Prix de la Vitesse gave him second place in this contest.

The Prix de l'Altitude, or Height Competition ($2,000 prize) was won by Latham, who reached a height of 155 meters (508.5 feet), as recorded by a barometer upon his monoplane. Farman was second with a height of 110 meters (360.9 feet), Paulhan third with 90 meters (295.3 feet), and Rougier fourth with 55 meters (180.4 feet).

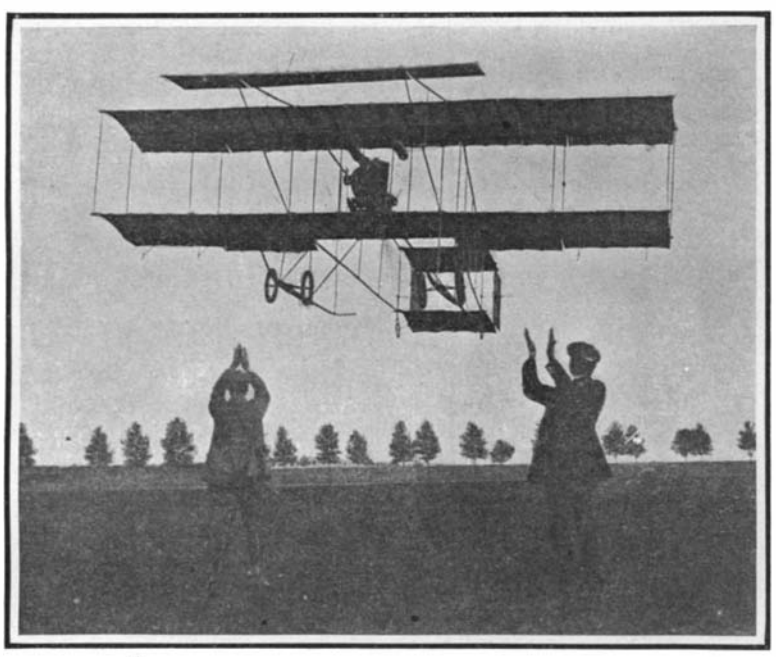
The Prix des Mecaniciens was won by M. Bunau-Varilla with a distance of 100 kilometers (62.1 miles) to his credit, while M. Rougier was second with 90 kilometers (55.9 miles).

The Prix des Aeronauts ($2,000) for the fastest five circuits of the course, a total distance of 50 kilometers (31.06 miles) was won on Sunday by the large dirigible "Col. Renard," the time being 1:14:49. The smaller dirigible "Zodiac" covered this distance in 1:25:01. The average of the winner was 24.9 miles an hour.



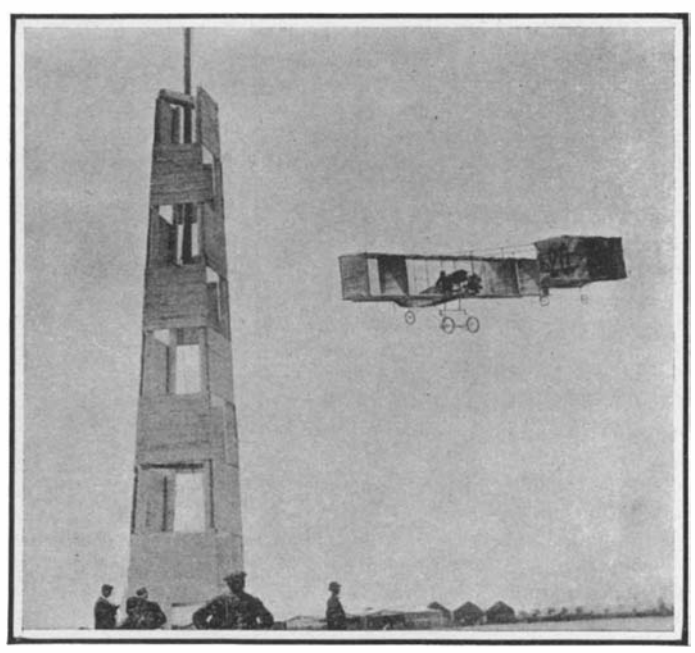
One of the winning Voisin biplanes.

General view of the aviation field, as seen from the grand stand.

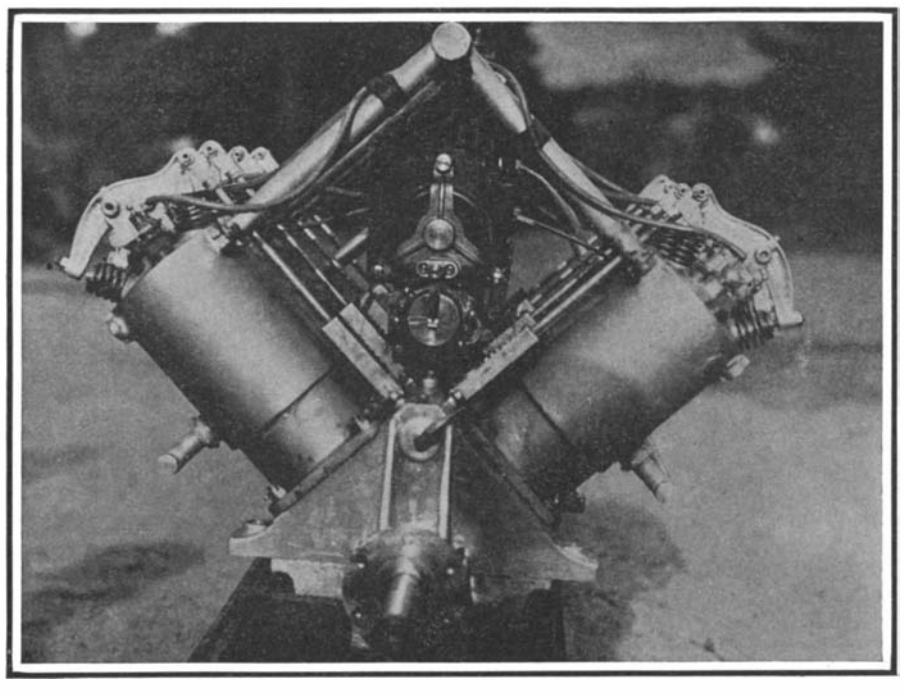


Sommer flying in his Farman machine.

Roger Sommer, aviator.



Paulhan circling a pylon in his record endurance flight.



60-horse-power, 8-cylinder water-cooled motor of the winning Curtiss biplane.

All valves are mechanically operated and the ignition is by magneto. The bore and stroke are both 4 inches. The weight is 200 pounds.

Glenn Curtiss, the winner of the International Aviation Trophy, at the wheel of his biplane.

Weight of the aeroplane loaded, 700 pounds; total surface 225 square feet. Speed 47.73 miles an hour. Thrust developed by propeller, 280 pounds.

THE RHEIMS AVIATION MEETING.

A NOVEL CANTILEVER GRAIN ELEVATOR.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The discharge of grain from the holds of vessels economically and efficiently, as well as expeditiously, is a problem which involves the solution of many problems of a peculiar character. During the past few years many developments in this direction have been carried out at the discharge ports of England in the handling of the grain received from abroad, especially in regard to the port of London. There the conditions are probably unique, for not only has the grain to be discharged from the vessel's hold to dock elevators, but also to lighters and other craft for conveyance by water to numerous other points.

Many applications have been devised from time to time for accomplishing this work to the best advantage, and recently conspicuous interest has been centered in a new cantilever elevator with which the grain-handling equipment of the London Grain Elevator Company of Silvertown, E., has been reinforced. This plant has been designed by the grain company's engineer, Mr. Alfred H. Mitchell, to whose courtesy we are indebted for the accompanying illustrations and information, and its operation and convenience in working has compelled general approval. It is designed for discharging grain from a ship's hold to accompanying craft, and as may be seen from the illustrations, it is of the self-propelling pontoon-contained type. It is so constructed that it can be brought to work either side-on or end-on to the ship, and has the additional advantage when working end-on that it can deliver to two barges at the same time, whereas should the conditions, such as a narrow dock or a tideway, necessitate its being worked side-on, its advantages are in no way less.

The outstanding feature of this apparatus depends not so much upon the formation of the elevator proper, as upon the mechanical combination of levers whereby it is manipulated. As is well known, the conditions of working grain from ocean-going steamers vary very considerably in point of size of the steamers to be unloaded and the manner in which the grain is stowed. On commencing to discharge, the grain, being right up in the hatchway, is probably at a height of some 15 or 20 feet above the waterline, necessitating the means of putting the lower end of the elevator into the grain at this height and delivering in the manner required. Shortly afterward, when the elevator has sunk well into the cargo of grain, the bottom point may require to go as low as 20 feet below the waterline; that is, to the bottom of the ship.

When the vessel is discharged, it is necessary to lift the bottom end of the elevator over the highest point of the ship's coamings, which may then be as much as 40 feet above the waterline. This means that the lower or digging end of the elevator must have a vertical range of some 60 feet to comply with the foregoing conditions. It is equally apparent that the clear length of the leg below the supporting arm must be sufficient to bottom the deepest hold of any ship, which may extend to 40 feet for a moderate-sized steamer, and of course much more in some ocean-going grain carriers. Another vital factor in connection with the ship is the width of beam, Most craft being divided by longitudinal partitions placed amidships, and in the after hold by a tunnel over a propeller shaft, it is of the utmost importance that the elevator should be adaptable to working on either side of the ship's center line.

The general method by which this end is accomplished is either by means of a portable machine lifted into the ship by means of the latter's boom, and resting upon beams placed across the hatch coamings, or by means of a pneumatic machine. The first is accompanied by grave risk in lifting the machine in and out, and moreover is slow and costly in operation, owing to the time involved in installing the appliance and removing it when done with, the time consumed in this operation often being in excess of that occupied in withdrawing the grain. With the pneumatic machine great expense is incurred in manipulation, owing to the enormous wear and tear as well as the horse-power required, though it is admittedly useful for dealing with awkward stowages, such as in forepeaks and lazarettes.

The peculiar conditions prevailing therefore can best be met by some such appliance as this new cantilever system, which is independent of the ship's gear, excepting in so far as the latter is used for plowing the grain to the leg of the elevator after it is lowered into the hold. In ordinary discharge elevators an arm of considerable length is fitted to the top of a tower, and counterbalanced by a weight mounted on the back end. In floating elevators, the disadvantage of this arrangement is that in the first place the enormous topweight necessitates the use of a very large pontoon; and secondly, that owing to the radius of the arm being definitely fixed, it cannot be adapted to ships of different widths, or for working to port or starboard of the partitions referred to, except by the slow and difficult process of booming the barge off from the ship, or the ship off the quay if the latter type of machines are used.

The elevator at rest upon the pontoon's deck for transit. This view well shows the parallel motion of cantilever arm and balance weight.

The elevator in mid-position as it would be when half way down into a ship's hold.

The first development in the evolution of the cantilever elevator was the bringing down of this top balance weight, and carrying it on levers at the back of the post. If the lever be equal in length to the back end of the jib, and the suspending link be equal in length to that portion of the post above the link, a parallel motion results, whereby the weight is moved equally with the back end of the jib, and balances it as before. The result of this arrangement is that the top weight, formerly required to balance an effort of some 400 foot-tons in an ordinary-sized machine, is greatly reduced, which brings about a corresponding reduction in the dimensions of the pontoon.

The final development of this design by Mr. Mitchell is that shown in the accompanying photographs. Here the post, which in the former designs was rigid, is now itself supported by a trunnion at the top of a frame, which is mounted on a turntable on the pontoon deck. By this combination it becomes possible to shorten the length of the cantilever arm by the amount which the vertical post could swing forward, thereby not only bringing about an appreciable reduction in the weight of the cantilever jib, but also reducing enormously the amount of weight which is required to balance it. Assuming the elevator leg to be perfectly balanced by the jib balance weight, the center of gravity of the whole combination will pass through some definite point on whichever side is uppermost of the post. This point being found, it becomes possible by ballasting the lower end of the tilting post to bring the center of gravity of the whole combination to the middle of the trunnion pin, at which point it will remain, no matter what the position of the elevator. This arrangement not only secures the bringing down of the weights to a very low point, but by means of the compound balance thus obtained, the elevator can be worked side-on or end-on, in broad or narrow ships, without imparting to the barge the slightest tendency to list or alter trim, so that a very small pontoon can be used to carry it. The smaller the dimensions of the latter can be made, the easier it is to handle and tow, and what is more important, the less space it occupies at the ship's side or in dock. This is a distinct advantage in connection with ocean liners, where often general cargo has to be handled at the same time as grain is being discharged.

In actual practice the full weight of the elevator leg is not absolutely balanced, there being a certain excess allowed on the elevator end for sinking the leg into the grain. This excess in the ordinary way would produce a list or alteration of the trim of the pontoon; and so in order to counteract this, a weight is fixed under the turntable at a certain distance aft of the center line, and of such proportions that the amount of the weight multiplied by that distance is equal to the excess moment of the other side. As a result the horizontal balance remains constant and perfect, and will not produce any list so long as the cantilever jib remains horizontal. When the jib is raised or lowered out of the horizontal, however, it will be apparent that there is a very slight alteration of moments, which however is not sufficient to produce any perceptible alteration of trim in the pontoon.

The elevator shown in the accompanying illustrations is among the first of its type to be constructed on these lines, and is now doing duty in the elevator dock on the Thames at Silvertown. Its leg is telescopic, and has a length when extended of 41 feet clear under the suspending pin. The buckets are carried upon an endless chain, and are so arranged that as the telescopic leg is lifted, the exact amount of chain that is let out on the front of the leg is taken up in the back, so that the chain remains of the same length and of an even tension throughout. The buckets, which are 10½ inches apart, have a capacity of 100 tons of wheat per hour, working at full speed, and deliver at the rate of 320 buckets per minute.

The elevator, carried at the end of a cantilever jib, is 25 feet long center to center, 9 feet 6 inches at the back end, and the weight of the leg is partly balanced by the weight at the back, connected by means of the parallel bars and lever shown and already described. The grain is discharged from the elevator head by means of suitable adjustable chutes on to an endless conveyer band, carried on the inside of the jib. This band is of canvas with rubber on one side, and is provided with diagonal ribs on the face, to facilitate the grain running up hill when the jib is

lowered into its lowest position. These ribs are placed diagonally, to permit them to run freely over the supporting rolls, which carry the slack side of the belt. At the top of the post this belt discharges into a second receiver, which by means of the long telescopic chute shown discharges into the boot of a second elevator, which is placed on the deck, which in turn raises the grain and empties it into the weigh-house or hopper, from which it is delivered to lighters alongside.

The jib of the elevator is carried at the top of the inclined post, which in turn is supported at the trunnion pin at the top of the frame, which rotates upon the turntable, the supporting ring and rack of the latter being secured to the bottom of the craft. The length of the tilting post above the trunnion is 30 feet, and the height of the trunnion pin above the bottom of the pontoon is 17¼ feet. The weigh-house is fitted with six automatic grain scales of 250 pounds capacity each, and these can discharge into sacks or loose into lighters, as may be desired.

A noticeable feature of the machine is the celerity and facility with which it can be brought in and out of action. Once it is moored alongside, the leg can be swung round and lowered into the hold ready for working within about four minutes, and this is considerably less than is possible by any other method. A portable machine to be rigged up ready for working takes from two to three hours, according to the position of the ship's winches and the weather. Moreover, the great advantage of facility for instant adjustment of the elevator to any width of ship, or for lifting the leg instantly from one side of the ship to the other over shifting boards or propeller tunnels, is perfectly obvious. Again, not only does this machine render possible the use of a single instead of a double leg, but in the event of there being hatch-beams or other obstructions in the hold, it facilitates the placing of the leg in the position required immediately; while in a big hatchway the possibility of being able to sweep the hatchway to its full extent with the combined movements of slewing and post tilting, thereby saving a considerable amount of trimming, is a conspicuous advantage. The exact adjustment of the telescopic leg or the height of the jib also makes it possible to work different consignments of grain in the same hold which are only separated by mats or cloths, as the depth at which the leg is to work can be adjusted to a nicety. As may be seen in the illustrations, the combination of the two levers and the telescopic leg gives a great range of action.

The precise angle of the jib is controlled by means of an electric winch and wire hauling gear, acting on the back end of the jib, while the tilting of the post is performed by means of a screw and nut carried in a bracket near the trunnion pin of the post. All the controlling actions are performed by series-wound motors of 4 B. H. P., and the elevator is driven by a 20 B. H. P. motor attached to the turntable. The direct current at 110 volts is generated on board the pontoon by means of a gas engine and suction gas plant driving a dynamo by belting. The deck elevator is driven from a countershaft in the engine room and a chain belt as described.

The whole apparatus is controlled by one man, for whom a cabin is provided on the turntable. A deckhand assists in adjusting the chutes when getting the elevator to work, and afterward attends to the suction gas plant. The maneuvering requirements of the machine are signaled by a man on the grain vessel's deck, who indicates the exact desired position of the elevator, and follows its operation.

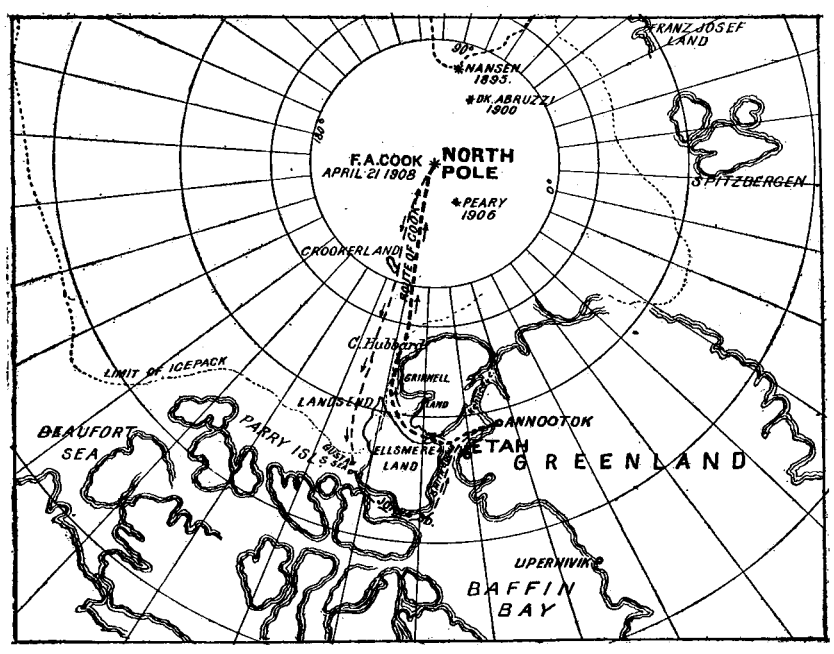
DR. COOK'S DISCOVERY OF THE NORTH POLE.

The search for the North Pole, which began in the Middle Ages for the purely commercial purpose of finding a sea passage to the wealth of the Orient, and which continued to attract adventurous and scientific spirits long after a more direct route to the Far East was discovered, seems to have culminated in the success of Dr. Frederick A. Cook, of Brooklyn, N. Y. Dr. Cook announced the remarkable result of his expedition in a telegraphic dispatch sent on August 24th from the Shetland Islands, where he stopped for two hours on his way south to Copenhagen. Although no definite scientific proof is as yet available of Dr. Cook's claim, there can be but little doubt of his great triumph. His previous experience in Arctic exploration and his acknowledged intrepidity are conceded even by those geographers who are disposed to await his arrival at Copenhagen.

Dr. Cook's polar expedition seems to have been quite unpremeditated. In 1907 he accompanied John R. Bradley, a wealthy sportsman, on an Arctic shooting trip in a small converted Gloucester fishing schooner. When they arrived at the limit of navigation in Smith Sound late in August, 1907, the conditions seemed so favorable for a successful polar dash that Cook determined to make the attempt. In that venture he was undoubtedly favored by a combination of fortunate circumstances. Many Esquimaux had gathered on the Greenland shore at Annootok for the annual bear hunt. Great quantities of meat had been brought in by the hunters. Dogs, too, were numerous. Since food and dogs were plentiful, both prime requisites in any polar expedition, Dr. Cook promptly decided to make an attempt to reach the Pole, 700 miles distant. The entire village of 250 people fell to and fitted him out, so that before the end of the long winter night he was ready to set out and to follow a route of his own choosing over Grinnell Land and northward along its west coast out on the polar sea.

The expedition started on February 19th, 1908, with 11 men and 103 dogs drawing 11 sledges. At the very outset the usual hardships of the Arctic explorer were encountered. The crossing of Ellesmere Sound was accompanied by a drop in the thermometer to 83 deg. below zero Fahrenheit. Several dogs were frozen to death. Eventually Land's End was reached. Game was plentiful. In this march to Land's End no less than 101 musk oxen, 7 bears, and 335 hares were killed; there was no lack of fresh meat.

At a point 460 miles from the Pole, Cook sent back all his Esquimaux but the two most capable, and all his dogs but 26. On March 21st the final effort began. A great stretch of open water was crossed—how, Dr. Cook does not tell us in his dispatch. Presumably he used a collapsible canvas boat, which he casually includes in the description of his outfit. On March 30th new land was discovered in latitude 84 deg. 47 min., longitude 86 deg. 36 min. No time was lost in exploring the new country. This was the last land that Cook traversed. Thereafter his course lay on the frozen polar sea.



THE COURSE FOLLOWED BY DR. COOK AND HIS IMMEDIATE PREDECESSORS.

The game which had previously been so plentiful was conspicuously absent. Even microscopic life could not be found. Curiously enough, the surface of the ice pack opposed fewer obstacles than at the outset. On the other hand, violent winds hampered him. On the night of April 1st, 1908, the sun appeared at midnight over the northern ice. The next day found Cook at latitude 86 deg. 36 min., and longitude 94 deg. 2 min. In other words, he had covered about 100 miles in nine days and was 200 miles from the Pole.

Dog after dog was killed to supply the other animals with food, as well as Cook and his companions. On April 14th latitude 88 deg. 21 min. and longitude 95 deg. 52 min. was reached. The pole was 100 miles away. The few stretches of open water were covered with young ice, so that no difficulty was encountered in crossing them.

On April 21st the first corrected altitude of the sun gave 89 deg. 59 min. 46 sec. The Pole was only a few miles distant. The remaining 14 seconds were covered by April 21st, 1908, on which day Cook planted the American flag at the North Pole, or rather on a shifting bed of ice which was then at the North Pole.

Cook remained at the Pole for two days. On the 23rd he started back. Keeping his course well to the southwest, in order to allow for the easterly drift, he covered considerable distance during the first few days. Food became so scarce that for a time it seemed questionable whether Cook and his companions would not perish by starvation. Cloudy weather, an indication of approaching summer, as well as violent gales made his journey southward difficult. Eventually he reached Crown Prince Gustav Sea, with its vast expanse of open water. Fortunately, a few bears were shot, and the diminished food supply was replenished. In July Cook crossed the Firth of Devon into Jones Sound. Eventually Cape Sparbo was reached, where game was plentiful. An underground den was dug, in which Cook and his companions lived until sunrise of 1909. February 18th a start was made for Annootok, and the Greenland shores were reached on April 15th.

Contrasting Cook's achievement with Peary's exploit of 1906, in which year Peary reached latitude 87 deg. 6 min., 200 miles from the Pole, we find that Peary started about three weeks earlier in the season. Cook's outfit was probably inferior to Peary's, hastily prepared as it was. Peary was compelled to turn back because of the great stretch of open water that confronted him. Cook was undeterred by water, possibly because he carried with him the canvas boat mentioned.

Peary's attempt is particularly interesting because Dr. Cook started out with the avowed intention of avoiding some of the drawbacks which had beset Peary. One of these drawbacks was the general set of the floe to the eastward, with which Peary had to contend. Dr. Cook, it is understood, struck off to the westward for the purpose of making allowance for this floe when he started on his direct north route.

Dr. Cook is not a novice at exploration. He was surgeon and ethnologist in the first Peary expedition in 1891-92; assistant in command of the Miranda expedition, which ended in disaster in 1894; surgeon and anthropologist of the Belgian Antarctic expedition which was gone between the years 1897 and 1899, and surgeon in the Peary expedition of 1901. This record must be amplified by the inclusion of his feat as the first conqueror of Mount McKinley in Alaska, about which there has been some controversy.

It is the prevalent view among geographers that there is no land in the neighborhood of the North Pole. This opinion is based upon the fact that no Arctic land is known to rise, except from the continental shelf, or from comparatively shallow waters. But north and northeast of Franz Josef Land the "Fram" expedition under Nansen found depths of 2,000 fathoms or more, and fifty miles to the north of Alaska the Nikkelsen-Leffingwell expedition was unable to reach bottom with its sounding line, which measured 2,060 feet. These and other ascertained facts have encouraged the belief that there is no land around the North Pole. Dr. Cook now confirms these geographical surmisings.

The mere quest for the Pole itself is not regarded even by Arctic authorities as an especially worthy undertaking. What are the conditions of the sea and its currents, the air, the ice, the life of the region, and other phenomena between the known Arctic and the Pole? The answer to such questions as these is what is expected in these days of trained explorers. No doubt Cook will be able to add much to our scant knowledge on these points.

The Norsemen probably were the first Europeans to visit the Arctic regions and Greenland. The struggles to find a short cut to the riches of the Far East were more productive of adventures and loss of life than the latter-day dashes for the Pole. Perhaps the earliest of scientific explorers was Sir Hugh Willoughby, who sailed in 1553 "for the search and discovery of northern parts of the world." He discovered Nova Zembla, but starved with most of his men in Lapland on the return voyage.

The following explorers emulated him:

	Deg.	Min.
1588—John Davis, England, ship.....	72	12
1594—William Barents, Holland, ship.....	77	20
1607—Henry Hudson, England, ship.....	80	23
1616—William Baffin, England, ship.....	77	45
1773—J. C. Phipps, England, ship.....	80	48
1806—William S. Scoresby, England, ship..	81	30
1827—W. A. Parry, English, sledge.....	82	45
1852—E. A. Inglefield, England, ship.....	78	21
1854—E. K. Kane, American, sledge.....	80	10
1868—K. Koldeway, Germany, ship.....	81	5
1870—C. F. Hall, American, ship.....	82	11
1871—C. Weyprechte, Austrian, sledge.....	82	5
1875—G. S. Nares, England, sledge.....	83	20
1879—George De Long, American, ship.....	77	36
1882—A. W. Greely, American, sledge.....	83	24
1894—C. F. Jackson, England, sledge.....	81	20
1895—F. Nansen, Norway, sledge.....	83	14
1897—W. Wellman, American, sledge.....	81	35
1897—Duke of Abruzzi, Italy, sledge.....	86	33
1901—Baldwin-Ziegler, American, sledge....	81	45
1901—R. E. Peary, American, sledge.....	84	17
1903—Ziegler-Fiala, American, sledge.....	82	..
1905—R. E. Peary, American, sledge.....	87	6
1908—Dr. Cook, American, sledge.....	The pole	

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

COAT-HANGER.—L. Trestman, New York, N. Y. This invention relates especially to the cords or chains which are attached on the inner side of the collar to enable the same to be hung upon a hook. The purpose is to provide an anchor plate which can be readily secured to the material of the garment. There are two of these anchor plates provided and they are connected by a chain.

Electrical Devices.

IGNITER.—G. W. Sage, Eureka, Cal. The improvements are in igniters for use in connection with internal combustion engines, and more particularly to that type of igniter in which two electrodes are brought into contact and then separated at the instant it is desired to produce the spark. It relates to that type disclosed in the previous patent granted to Mr. Sage.

TELEPHONE-MOUTHPIECE.—G. H. Reed, New York, N. Y. The invention refers more particularly to means for rendering the mouthpiece antiseptic and for increasing the volume of the sound transmitted. The diaphragm and pad may be readily removed or replaced, and the mouthpiece in presenting a large bell-shaped outer end increases the effect of the voice upon the diaphragm of the transmitter.

ROTARY CONVERTER.—J. L. Murdock, Boundbrook, N. J. Mr. Murdock's invention pertains to so-called "current shaping mechanism," his more particular object being to produce a converter, for selecting from three-phase alternating currents predetermined portions of said currents, in such manner as to accumulate the effect of the portions thus selected, and thus build up a virtually direct current which is practically constant.

Of Interest to Farmers.

GIN COTTON-SEED CLEANER.—H. A. Sugg, Kennett, Mo. This cleaner is a shaking screen for cleaning gin cotton-seed by removing therefrom hulls, loose cotton, dirt, and sand. It is adapted and used for securing cotton-seed discharged from the gins, and separates from the seed the cotton and hulls, which are conveyed to a storage bin, the cotton being subsequently returned to the gin to be re-ginned, whereby an important saving is effected.

THERMOMETER-HANGER FOR INCUBATORS.—G. H. Lee, Omaha, Neb. In this case the invention refers especially to thermometers when used in incubators or in similar situations where it is desirable to have the bulb supported adjustably so that the level of the bulb may be regulated and placed at any point desired.

PLOW.—S. A. Estabrook, Jr., Ponchatoula, La. In the present patent the invention is in plows, and has for its purpose to provide means to vary the sweep of the plow, whereby the soil may be thrown from furrows close to growing plants at each side, and the plow thus used for different spaced rows.

Of General Interest.

CAMERA.—A. L. Richardson, Melrose, New Mex. This invention has reference to improvements in photographic apparatus and is applicable chiefly to cameras used in photographic studios for the purpose of making portraits; also it may be used with other cameras such as those used for taking landscapes or for other outdoor photographs.

HIGH-SERVICE DAM.—R. Griswold, Denver, Colo. The purpose here is to provide novel details of construction for a high service dam that adapt the dam for erection in a gorge or canyon near the highland, so as to arrest a portion of the water drained therethrough, and produce back water for irrigation of the soil over which the arrested water is returned.

EAVES-TROUGH.—Lizzie H. Dickelman, Forest, Ohio. The aim in this instance is to provide a construction whereby to increase the strength and rigidity of the trough when the sections are coupled together and at the same time to provide a construction in which the process of manufacture is simplified and in which the sections may be more quickly and easily put together and disconnected when desired.

Hardware.

NAIL-HOLDER FOR HAMMERS OR HATCHETS.—W. E. Wieland, Durango, Col. One purpose here is to provide details of construction for the handle of a nail driving tool, such as a hammer or hatchet, which convert the handle into a magazine, wherein nails of a selected dimension may be carried, and by a shaking movement of the handle be passed through a longitudinal slot in the hollow body thereof, and hang by their heads projected from the slot, to be manually removed as desired.

Heating and Lighting.

INCANDESCENT-LAMP SOCKET AND SWITCH.—I. L. Cash, Portland, Ore. This invention relates to incandescent lamp sockets, and the intention of the invention is to improve the construction at the socket, and particularly that of the switch, for turning the lamp on or off. Means are provided for making signs visible that indicate that the current is turned on or off.

CONDENSING SYSTEM.—S. Woolf and C. W. Rafferty, Lynch, Neb. An object of the invention is to provide means for disposing of the exhaust steam by condensing the same, thereby providing means for overcoming back pressure. Means also provide for removing impurities carried along with the steam thereby leaving the feed water in a pure condition for immediate re-entrance into the boiler.

Household Utilities.

SAD-IRON.—G. P. Clements, New Milford, Pa. The iron has an adjustable extension adapted for opening and pressing seams, ruffles, tucks, etc. In retracted position the extension conforms to the outward contour of the iron. It retains heat much longer than small irons, yet is capable of ironing small and complicated work even more thoroughly than small irons, besides avoiding the necessity of having several sizes of irons.

BED ATTACHMENT.—H. L. Appleton, Shelby, Ala. In this patent the intention of the improvement is the provision of an attachment for hospital beds or the like, easily removed or replaced, for containing sponges and instruments, and so arranged as not to interfere with the use of the Kelly pad or similar drainage devices.

CURTAIN-FIXTURE.—J. Darling, Chicora, Pa. The improvement here is particularly in that class illustrated in Mr. Darling's former patent. The construction permits the convenient utilization of the ordinary curtain rollers on the market and provides for securing the same in the hook bracket in such manner as to prevent any accidental displacement of the shade when applied for use.

CLOTHES-DRYING DEVICE.—J. M. Teach, Santa Monica, Cal. The aim here is to provide a drier, erected in the open air, which affords a device that is very convenient in use and well adapted for the reception of a considerable number of pieces of clothing or other fabric that are to be exposed to the sun and air.

Machines and Mechanical Devices.

CUTTER-HEAD.—J. F. Stedman, Newburg, Ore. Mr. Stedman's invention has for its more particular purpose the provision of an improved mounting for securing the cutters upon the cutter head in such a manner that the cutters may be readily attached and detached at will, and may also be adjusted as desired, without removing them from the cutter head.

WAVE-MOTOR.—C. W. Hicks, Los Angeles, Cal. A purpose of this inventor is to construct a motor particularly automatic in action, wherein a pier is built out into the ocean or equivalent body of water, a desirable distance, in connection with which tracks are employed, having an inclination upward in direction of the shore, upon which tracks a motor carriage is adapted to travel.

WIND-MOTOR.—C. Daub, New York, N. Y. The more particular purpose of this invention is to provide a type of wind motor in which there are two sets of wind wheels turning in planes which cross each other, the combined effect of all of the wind wheels being transmitted ultimately to a shaft or other driven member common to all of the wind wheels.

FILLING DEVICE.—E. N. Gaudron, Hasbrouck Heights, N. J. The object here is to provide a device, more especially designed for filling bottles and other receptacles with liquids contained in kegs, barrels, vats, tanks and other storage vessels, and arranged to automatically stop the filling at the time the bottle is filled, to prevent the return flow into the storage vessels and thus avoid displacement of sediment.

REDUCING-VALVE.—T. P. Ford, New York, N. Y. The valve is more especially designed for high-pressure fire systems and the like, and arranged to permit variable pressures from a common supply, such as a hydrant, to allow, for instance, use of several hose of low and higher pressure for outside work. Use is made of a valve casing having a connection with the hydrant or other water supply, and provided with a plurality of outlets for connection with separate fire hose, and main piston valves arranged within the said valve casing for controlling the flow of water to said outlets.

Prime Movers and Their Accessories.

FLUE-CLEANER.—J. Wiechmann, Albany, N. Y. This cleaner thoroughly cuts the scale from the inside of the flue or tube by the use of a cutter head rotating with the turbine wheel, and provided with a cutter wheel mounted to rotate loosely on the end of a centrifugal swing arm, so that the center pin of the turbine wheel is relieved of undue strain and a proper cutting of the cutter wheel is insured, without danger of breaking the latter or causing it to stick in the scale.

Designs.

DESIGN FOR A PICTURE-FRAME.—A. Kaiserman, Rochelle, Ill. This neat ornamental design for a picture frame comprises a frame of an inverted kite shape, the frame standing by a prop support on a flat surface. A cord and tassel hangs from the top point, and a tube shaped projection extends from the center of the article.

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.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12121) O. M. T. asks: A local steam plant has been supplying steam for some time to several power plants in this city. They have two boilers of 100 horse-power each. They have been supplying about 200 horse-power steam through a 4-inch steam line, about 500 feet long. To do this took altogether too much coal. They used about eight tons per day. They dropped off 100 horse-power of this load, and it only takes three tons or less per day, using one boiler only. What is the explanation? Would the size of steam pipe make any difference in the amount of coal used? A. The size of the steam pipe might easily affect the coal consumption per horse-power generated. Without further particulars as to the distribution we cannot say exactly, but supposing that half or more of the total horse-power is consumed by engines half or more of the total distance from the boilers, a 4-inch main is certainly small enough to cause an appreciable loss of power. It is probable, however, that the boilers are overloaded, and a reduction by half of the power consumption might well cause a greater proportionate reduction in the fuel consumption.

(12122) C. H. P. asks: We have two tanks lying horizontally. One is 6 feet 6 inches in diameter and 29 feet 6 inches long, and there is 24½ inches of oil in this tank. The other is 6 feet in diameter and 25 feet 3 inches long, with 32¾ inches of oil (from bottom of tank to top of oil). How many gallons in each tank? Please give formula used if possible. A. Your question is not very clear, as you refer to the distance from the *bottom* of the tank (usually meaning the circular flat bottom) to the top of the oil; but as you refer to the tanks as lying horizontally, we presume you mean that the axis or longer dimension is horizontal, and mean by the bottom, the curved side of the cylinder lying on the ground. In this case the volume of the oil is the product of the length of the tank by the area of the segment of a circle of which the surface of the oil is the chord. The area of such a segment is calculated by the formula

$$\left(A = \frac{4h^2}{3}\sqrt{\frac{D}{h} - 0.608}\right)$$

in which A is the area, h the height of the segment (in your case the depth of the oil), and D the diameter of the circle of which the segment is part. The derivation of the formula is difficult, involving higher mathematics, which you presumably do not want, but its results are very closely approximate. In your first case $D = 6$ feet 6 inches $= 78$ inches, and $h = 24.5$ inches, so

$$\left(A = \frac{4 \times 600.25}{3}\sqrt{\frac{78}{24.5} - 0.608} = 800.33\sqrt{2.576} = 800.33 \times 1.605 = 1284.5 \text{ square inches.}\right)$$

So the volume of the oil is $1{,}284.5 \times 29$ feet $= 454{,}713$ cubic inches $= \frac{454{,}713}{231}$ gallons $= 1{,}968$ gallons nearly. With the above example you can easily calculate the second amount, substituting $h = 32.75$ and $D = 72$ inches, and multiplying the area found by 25 feet 3 inches.

(12123) P. O. B. 35 asks: Does a 22-horse-power automobile develop more horse-power in "low" than in "high"? I am sure it does not, but just to prove it to the fellow with whom I am betting, I am asking you. Do you answer by letter or in the next Scientific American following the receipt of the question? A. We make it a rule not to settle bets, but as we can only guess at the meaning of your question we do not mind stating a general principle from which you can draw your own conclusions. Supposing that your question has some reference to the change-speed gear of an automobile, no amount or kind of gearing can alter the power generated by any engine. If a man can lift 100 pounds through one foot in a second with his hands, but can raise 1,000 pounds with a fall and tackle, he must continue for ten seconds expenditure of the same amount of energy per second required to raise the smaller weight in order to raise the 1,000 pounds 1 foot, because where he gains in mechanical advantage, he loses in speed. In the same way with an engine, if a certain number of revolutions producing through gears a given torque on the wheels will drive a car 20 miles an hour along a level road, a greater torque is required to drive at even a much less speed up a steep grade. The engine speed is therefore reduced by the increased load, and, as a high speed is necessary for efficiency in gasoline engines, a change of gear is made which allows the engine to run as fast as before while the wheels turn more slowly, thus distributing the same amount of work over a longer period and overcoming a heavier load; but the power generated is the same, power being the work done divided by the time consumed in doing it. This is not to say that the output in brake horse-power of an automobile or any other engine is always the same, but merely that it cannot be affected by the gearing.

NEW BOOKS, ETC.

Modern Accounting. By Henry Rand Hatfield. New York: D. Appleton & Co., 1909. 12mo.; 367 pp. Price, $1.70.

This is a most valuable treatise, giving in lucid style the best principles of accounting. The essence of accounting from the author's viewpoint is the presentation first of a careful exhibit of a definite status of the concern at a given moment of time, and secondly a showing of the results obtained during a given period of time. The first is embodied in the balance sheet, the second in the income or profit and loss statement. The presentation of a correct view of a concern's financial status and of its past profits involves many points of theoretical interest and practical import. The present volume will do much to give those who are charged with the ultimate revision of figures most valuable information. The chapters relate to: Principles of Double Entry Bookkeeping, Balance Sheet, Assets and the Principles of Valuation, Valuation of Particular Assets, Mutual Assets, Depreciation, Capital Stock, Liabilities, Profits, Surplus and Reserve, Sinking Funds, Trading, Manufacturing, and Income Accounts, Cost Accounts, Partnership Accounts, Statement of Affairs and Deficiency Account, Technical Improvements in Accounting Practice. The subjects treated are very well arranged, and the book will certainly be of great value to the heads of business corporations as well as those who are charged with the actual accounting.

Handbuch für Heer und Flotte. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete. Herausgegeben von Georg von Alten, Generalleutnant z. D. Vollständig in 108 Lieferungen reichillustrierten Textes mit farbigen Beilagen, Karten, Plänen, Gefechtsskizzen, etc. Deutsches Verlagshaus Bong & Co. Price per part, 50 cents.

The last five installments of this admirable military and naval encyclopedia contain some excellent articles on tactics, most of them istorical in treatment, and some based upon the results of the recent Russian-Japanese war. Among these may be mentioned the articles entitled "Aufklaerung," "Aufmarsch," and "Ausdehnung der Gefechtsfront." Some excellent articles on historical battles and sieges, are to be found under the headings: "Aspern," "Austerlitz," "Bayaume," "Bar-sur-Aube," "Bautzen," "Ath," "Badajoz," and "Barcelona." European military geography is also discussed, particularly under the headings "Athen," "Baden," and "Bayern." Among the numerous articles of general military interest may be mentioned those entitled "Aufgebot," "Aufnehmen," and "Aushebung." while some special technical subjects will be found discussed under such titles as "Bajonettangriff," "Attacke," and "Batteriedeckungsbau," which last is most admirably illustrated. Among the naval articles of more than passing mention are those under the headings "Artilleristische Maschinen der Kriesgsschiffe," "Atlantischer Ozean," "Ausstossrohr," "Azimut," "Babcock und Wilcoxkessel." Military hospitals and military sanitation are ably discussed under the titles "Arznei- und Verbandmittelversorgung," "Aerztliche Fortbildung," "Atmung," "Augenkrankheiten," "Bakteriologie," and "Baracken." A very clear presentation of military and legal relations, in other words, the subject of military jurisprudence, will be found nder the titles "Ausland" and "Auswanderung." For the first time we find an exhaustive review of the historical development and the military value of expositions.

My System. Fifteen Minutes' Work a Day for Health's Sake. By J. P. Müller, ex-Lieut. of Engineers, Klampenborg, Denmark. With forty-four illustrations and a time-table. Translated from the fifth edition of the Danish original. New York: G. E. Stechert & Co. Price, in colored paper covers, 75 cents net; red cloth, gold lettering, $1 net.

Müller's book "My System" has become almost a household word in Germany. Indeed, it is referred to in more than one German comic journal with humorous approval, as well as in such literary works as Andrejev's "Geschichte von den sieben Gehengten." The system described is an excellent arrangement of gymnastic exercises intended to consume not more than fifteen minutes a day and yet to develop the physique. There can be no doubt that if the suggestions of this book are carried out, a weak body can be scientifically built up.

A New Light on Ancient Egypt. By G. Maspero. New York: D. Appleton & Co., 1909. 8vo.; 315 pp. Price, $4 net.

Prof. Maspero is one of the most noted Egyptologists in the world, and he states in his Preface that he has been fifteen years trying to bring a science, supposed to be comprehensible only to experts, within the reach of the ordinary man, and it is gratifying to find that his time

has not been wasted. He has drawn his materials from everything than can be discussed with educated people, without demanding anything more than a little attention. Excavations, religion, travels, popular customs, literature, and history have each and all furnished him with subjects. The result is a living picture of the researches made in the domain of Egyptology during a period of fifteen years. The book is a most fascinating one to all who have even a slight appreciation of what Egyptology really means. Many chapters deal with the very latest discoveries and matter that has never before appeared in book form.

THE LIFE OF MAJOR-GENERAL SIR CHARLES WILLIAM WILSON, ROYAL ENGINEERS, K.C.B., K.C.M.G., F.R.S., D.C.L., LL.D., M.E. By Colonel Sir Charles N. Watson. New York: E. P. Dutton & Co., 1909. 8vo.; 419 pp. Price, $5.

The material from which this memoir of the late Sir Charles Wilson has been compiled consists principally of his own diaries and notebooks, which he always kept in a very thorough manner; all his official reports printed in Parliamentary papers and all other public writings; and more especially, all his letters to his wife, which recorded everything which he did and saw during his travels. Sir Charles Wilson's career was a remarkably varied and interesting one. He was selected to serve on the North American Boundary Commission. For many years he served upon the Astronomical Survey, and had charge of that department in Scotland, Ireland, and afterward in the United Kingdom. He also was employed by the War Office; Foreign Office Survey under Lord Dufferin in Egypt. Sir Charles was prominent in his close connection with the Soudan question and the mission of Gen. Gordon. In the Nile Expedition of 1884 he held the important position of Chief of the Intelligence Department. Sir Charles Wilson had many interests in life outside of his military and political positions, and probably did more than any other man to increase the knowledge of the geography and archæology of Asia Minor, Palestine, and adjacent countries. The book is an entertaining one to those who care for memoirs.

STAINED GLASS WINDOWS IN ENGLAND. By Charles Hitchcock Shirrel. New York: J. Lane Company, 1909. 12mo.; 254 pp. Price, $2.50 net.

This admirable book is a rational guide to the study of stained glass in England. It is accompanied by maps which show how the cities may be visited in their proper sequence with as little fatigue and crossing of one's path as possible. Not only are many noble cathedrals visited, but smaller religious edifices and secular buildings of many types are treated. In this latter category are treated the universities of Oxford and Cambridge and one of the finest of the stately homes of England—Knole. Any cultivated person who completes the tour as outlined will have obtained a well-rounded impression not only of glass but also of history, as well as an intelligent insight of the customs of England. Unfortunately, no form of illustration can hope to reproduce the combination of light and color which makes up the beauty of stained glass. Those selected by this book are the best obtainable, but are chiefly useful in showing how the windows are set. It is not a technical book, so that scale drawings are not required. It is a beautifully printed and bound book.

HAPPY HAWKINS. By Robert Alexander Wason. Boston: Small, Maynard & Co., 1909. 16mo.; 352 pp. Price, $1.50.

"Happy Hawkins" is a quick-tempered, independent, loyal, lovable, adventurous, and philosophical cowboy of the plains. He tells his own story in his own way, and after a plan of his own. His knowledge of human nature, his simple-hearted devotion to those he loves, his ability to get into trouble and out of it, his self-possession in any society—all these qualities make him one of the most original characters in modern fiction. Mr. Wason tells a story full of red blood, with action, romance, and the interplay of hot human passions, with an intricate plot, an abundance of incident, a great variety of scene and type, shrewd philosophy, genuine pathos, and, perhaps best of all, real fun and humor on nearly every page. It covers the growth from childhood to womanhood of Happy's little playmate, Barbara, the daughter of his employer, "Cast Steel" Judson, of the Diamond Dot ranch, and swings round from Wyoming to Texas, Nevada, California, Montana, and back again. The book easily establishes the author's reputation as a great storyteller and fun-maker.

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