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BLASTING AT FISHGUARD, WALES, FOR THE NEW ROUTE FROM ENGLAND TO IRELAND.—[See page 262.]

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NEW YORK, SATURDAY, OCTOBER 13, 1906.

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.

A FORECAST AND ITS FULFILLMENT.

In an article published several years ago in the columns of this journal, we dealt with the question of the rapid increase in size and speed of transatlantic steamships, and showed to what extremes the dimensions of a ship would have to be carried to enable her to steam across the Atlantic at an average speed of 30 knots an hour. It was shown that the great demands made upon the displacement by the weight of the motive power and coal, rendered it necessary to increase the length to 930 feet, and we pointed out that this great length, coupled with the high speed at which the ship was to be driven in all weathers, would call for special construction in the hull, particularly to withstand the excessive longitudinal bending stresses to which the vessel would be subjected when she was being driven into a head sea. To meet these stresses and provide suitable longitudinal girder strength to the hull, it was proposed to double the skin plating at the sheer strakes (the topmost line of plating), and also to double the plating at the turn of the bilges, thereby transforming the sides of the ship into two huge plate girders, having the customary massing of material at the top and bottom chords. Further to strengthen the vessel, we suggested the advisability of running a continuous longitudinal plate-steel bulkhead through the vessel, extending from the keel to the main deck and similarly doubling the strakes of plating at this deck and at the keel, the bulkhead to extend from the after end of the engine room to the forward transverse bulkhead of the boiler space.

With considerable interest we now note in the descriptions of the construction of the new 785-foot Cunarders, that in view of the heavy hogging and sagging stresses due to their length, to which they will be subjected, this very method of stiffening has been adopted. Thus, although the shell plating of these ships is unusually heavy, the plates being not less than 34 feet long and from 2½ to 3 tons in weight, at the sheer strakes and at the turn of the bilges the plates are doubled and are made 40 feet in length and from 4 to 5 tons in weight; moreover they are made of high tensile steel with a strength of from 36 to 40 tons per square inch.

Although the fact that ships of great length are subjected to enormous bending stresses in a seaway has been long known to naval architects, the general public has little idea how severe these stresses can be. When the ends of a ship are wave-supported the vessel sags at the center; when the wave is at the center and the ends are comparatively unsupported it is the ends which sag; but it was only when the transatlantic liner had reached a length of over 600 feet that the effects of this longitudinal bending began to be seriously manifest. It revealed itself in the topmost decks, where rivets would be sheared, steam or other pipes broken, and plates buckled. To provide for the alternate lengthening and compressing of the decks they are now cut in two or more places and sliding joints are provided. Several years ago the writer was on one of the fastest of the German boats when she was being driven, head-on, into a westerly gale, under her full horse-power of 37,000, "just to see what she could do." For a while, until the green seas began to smash things up rather badly forward, she did 21 knots an hour. During this trial the sliding joints in the topmost deck showed a total movement of from five-eighths to three-quarters of an inch, the joints closing up as the ship buried her head in an oncoming sea, and opening out as the wave moved to amidships; while on the deck below, the plating showed signs of buckling, and the oakum was squeezed entirely out of the butt joints in the deck planking.

As to the future, it is certain that ships will continue to grow in length, until our suppositional ship of 930 feet length will be equaled and exceeded. By that time it will become necessary, we think, to introduce the central longitudinal bulkhead, with top and bottom stiffening, as suggested in the article referred to. The cutting of the necessary openings in this bulkhead for dining rooms and passages, could be done without in any way affecting the girder strength of the bulkhead. As to whether a liner will ever be built to cross the Atlantic at an average speed of thirty knots it is difficult to foretell. Apart from the question of channel and dock accommodation, the difficulty will lie with the motive power. The new Cunarders are bound by contract to make a trial speed of 25¼ knots. They will probably reach 26 knots; but it is a far, far cry from 26 knots to 30. The solution of the problem is "up to" the steam turbine, and the steam turbine as installed in the larger ships has not shown sufficient economy in weights and steam consumption over the reciprocating engine, to warrant us in believing that it will be equal to the task. The steam turbine of 20,000 horse-power and over is, however, at present, in its infancy, and will no doubt, in these larger sizes, show better results in the future. Perhaps the solution of the 30-knot four-day liner lies after all with the propeller; for if we could prevent the present loss back of the thrust block, a 30-knot boat would easily become an accomplished fact.

NEW METHOD OF RIVER TUNNELING.

The system of tunneling through the beds of rivers, estuaries, or other waterways, by digging a trench and constructing the tunnels therein, is to be utilized on a large scale in the important double-tube tunnel for carrying the tracks of the Michigan Central Railroad beneath the Detroit River, contracts for which have recently been let. We are indebted for the broad principle of tunneling by the trench method to Contractor McBean, who made use of it in building the double-tube tunnel of the New York Subway beneath the Harlem River. In the system to be used at the Detroit River the trench is retained, but the tunnel is formed by sinking two lines of steel tubes and inclosing them in a single monolithic mass of concrete. The design is a modification of that proposed by Vice-President Wilgus of the New York Central Railroad, the preliminary plans for which were described in a recent issue of this journal. The Detroit River tunnel will be built in a trench which will be excavated by floating dredges, and will be wide enough to accommodate two full-sized railway tunnel tubes lying side by side. Piles will be driven in the bottom of the trench, cut off at the proper height, and capped with transverse steel beams, upon which will rest the tubes. A layer of sand and gravel, with the addition of cement, if necessary, will be laid on the bottom of the trench, filling the spaces between the tops of the piles and also the transverse beams, and being finished off flush with the tops of the beams. Upon the steel beams and bed of gravel and concrete will be sunk two lines of tubing, built of ⅜-inch steel plate. The tubes will be built generally in lengths of 263 feet. At every 12 feet of their length they will be reinforced by plate-steel diaphragms, and they will be sunk to their places from scows or temporary platforms. The spacing of the lines of piles and of the exterior diaphragms of the tubes will be such that the diaphragms will rest upon the beams when the tubes are in place. The end of each tube will be provided with a sleeve which, as the tube is sunk, can slip over the end of the adjoining tube. By means of rubber gaskets the tubes can be bolted up, forming air-tight annular joints; and into these joints cement grout will be flowed from the scows or platforms at the surface of the water. The trench will then be filled in with concrete until the tubes are completely buried, the surface of the concrete being finished off at the low-water depth required by the War Department. After the concreting is completed, the water will be pumped out of the tubes, leaving two complete tunnels permanently buried in the bed of the river. The system, as thus described, has many features to recommend it, one of which is that it obviates the necessity for the use of the troublesome and risky pneumatic process as employed under the North and East rivers of this city. Furthermore, it becomes possible to build a tunnel nearer to the bed of the river, thereby decreasing the grades on the approaches and reducing the cost of subsequent operation.

GROWING PROSPERITY IN AGRICULTURE.

Apropos of the recent advice of James J. Hill to the people of the United States, that they should cultivate scientific farming, reference to which was made in our issue of September 29, we note that the last Bulletin of the Department of Agriculture contains much timely and encouraging information. It is announced by the department, and abundant figures are given in proof of the statement, that the farmers of the United States are enjoying unwonted prosperity, the farm lands of the country being held in such high value that it is now difficult to secure cheap land, or free, for cultivation. The Bulletin, which bears the title "Changes in Farm Values," contains a table showing the difference in the average value of farms, by the acre, throughout the country in the five years that have elapsed since 1900, from which we learn that in the State of New York farms of medium equipment have jumped in value from $43.58 an acre in 1900 to $51.54 in 1905.

The farming interests, especially in the past few years, have assumed an importance in the world of finance, transportation, and manufacture which is growing steadily the passing years. The causes underlying this prosperity are many, and chief among them should be mentioned the fact that the free or cheap lands of the Federal government, or of the States and railroads, have become practically exhausted, if we except the arid lands which must become the subject of irrigation to render them fruitful. The exhaustion of these lands has come so unexpectedly as to produce something of a mild crisis in the broad field of agriculture. Another element which has contributed to raise the price of farm lands has been the steady gain of city upon country population, whose effect has been to show in the government statistics a continual gain of demand upon supply; and this, in spite of the fact that both the amount and the value of agricultural exports have remained at a high figure. It would look as though our farmers have to-day reached a period of reasonable, if not high, prices, which they may confidently rely upon as being permanent. The beneficent result of these influences upon the condition of the farmers has been marked, and promises to be permanent. "Farming," says the report, "has assumed a new and higher dignity. Farmers have extinguished their old debts; they have accumulated surpluses, and have become depositors in banks and the owners of bank stocks; they have bought more land, not only agricultural land, but real estate in the towns, and they have sent their savings to distant States for investment in agricultural land. At the same time, the town investor has had his attention excited by the new situation, and has thrown upon the country real estate market vast sums for investment."

Although this Bulletin has a highly optimistic flavor, which it has indeed every right to carry, there is nothing in it to contradict the grave truths outlined in the recent address of Mr. Hill at Minneapolis, in which he emphasized the necessity for scientific farming as a means of increasing the output of the farms, and providing for the future enormous increase of the population of the United States. Although the Bulletin admits that there has been "a gradual and steadfast improvement in the practice of farming," it is nowhere so well understood as in the Department of Agriculture that the natural productivity of the soil is only half developed, and that the land simply awaits more intelligent and careful farming to double its output.

WHAT IS THE INTERIOR CONDITION OF THE EARTH?

Few papers read before the British Association for the Advancement of Science have attracted such wide attention or aroused such warm discussion among physicists as the address delivered by Mr. R. J. Strutt on "Radio-Activity and the Internal Structure of the Earth." Lord Kelvin, the Nestor of British scientists, in a letter published in the London Times protested against "the hypothesis that the heat of the sun or earth or other bodies in the universe is due to radium," and reasserted his conviction that planetary and solar heat is due to gravitation. When one recalls his brilliant amplification of Helmholtz's theory that a contraction of the sun amounting to about ten inches a day would be sufficient to account for its present heat, one can readily understand his position. On the other hand we have no more reason to suppose that gravitational energy is responsible for terrestrial and solar heat than we have for attributing to radium the temperature observed. The question whether or not the sun is actually shrinking can hardly be definitely answered for a century or more.

Strutt's calculations are certainly plausible, even though we may not be ready to accept his radium theories entirely. The poorest igneous rock which he examined, namely, Greenland basalt, contains more than ten times the proportionate quantity necessary to uphold the assumption that the earth's heat is due to radium alone. Because there is too much radium in the earth, Strutt has been forced to the conclusion that the interior of the globe does not contain radium. His data for the quantity of radium in rock point to a thickness of at most forty-five miles for the earth's crust, and that the internal temperature at the bottom of the crust is about 1,500 deg. C. To these views it may be objected that the diffusion of radium may have some effect on its property of radiating heat. Indeed, Sir William Crookes has tentatively shown that a molecule of radium locked up in a mass of rock and compressed in the interior of the earth would not throw off the heat-generating alpha particles, but would remain in a state of suspended animation, his data having been obtained in experimenting with powdered compressed pitchblende.

To involve the problem still more, we must take into consideration the existence of thorium, uranium, and other radio-active substances discovered and undiscovered.

Curiously enough, Strutt's theory necessitates an assumption of the internal structure of the earth, that is quite in harmony with the prevailing views of geologists. Strutt finds that the inside nucleus, heated by the crust of radium-containing material, must be at a uniform temperature of 1,500 deg. C. throughout, just as a loaf of bread, which has been in an oven long enough, acquires a steady temperature equal to that of the walls of the oven. Strutt's crust would contain about one thirtieth of the earth's volume, and if throughout it the radium heat energy were of the average of that exhibited by many samples examined by him, the temperature of the earth could be maintained until our stores of uranium suffered sensible depletion. Such an assumption would lead to the conclusion that the whole of the central portion of the earth consists of non-radioactive substances at an approximate uniform temperature somewhat below the melting-point of platinum. Prof. Griffiths has examined the proofs of this supposition at our disposal, and we here present a summary of his findings.

Prof. George Darwin has stated that the rigidity of the earth is at least as great as that of steel. Hough arrived at substantially the same conclusion by a different method. To Oldham's mind the evidence pointed to a central metallic core and to the existence of marked differences in the physical constants of the core and the surrounding crust. Prof. Milne's recent investigations have led him to the conclusion (based on the difference in the rate of propagation of earthquake waves) that the material below a depth approximating to thirty miles is of a uniform nature, and that the change in physical constitution is abrupt. Geodetical observations conducted by means of plumblines and pendulums have convinced Col. Burrard that we are not justified in asserting the non-existence of deep-seated variations in density, but that we are justified in believing that the variations in density which have been discovered are apparently superficial.

The agreement of results drawn from such dissimilar sources is certainly striking. It is possible that the evidence from each source, considered independently, might be regarded as inadequate, but the cumulative effect is sufficiently strong to justify the belief that some marked physical change in the constitution occurs at a depth of some thirty to fifty miles. At all events, we have indications that, with the exception of a comparatively thin crust, the earth consists of a non-radio-active substance with a rigidity approaching that of steel, with an average temperature in the neighborhood of 1,500 deg. C.

RESULTS OF THE FIRST INTERNATIONAL BALLOON RACE.

The Aeronautic Cup contest for spherical balloons has proved to be one of the leading events of the season. It was organized under the direction of the Aero Club of France for September 30, with the large space of the Tuileries Gardens, in the heart of Paris, as the starting point. The cup offered by Mr. James Gordon Bennett for the longest distance covered by a balloon is a handsome work of art in massive silver having a value of $2,500. It is to be held by that club whose representative is the winner. The other prizes are as follows: For the first prize, the sum of $2,500, also one-half of the engagements, or for this year $400, making a total of $2,900. The second prize includes one-third the engagements for 1906, or $246; and the third prize the remainder, or $133. Among the other prizes are a silver medal offered by the Aero Club of the Southeast, the medal of the journal L'Auto, the prizes for meteorological work offered by the scientific commission of the Aero Club, and the Meteorological Association of France, etc., also a series of medals from the Aero Club. At the same time a balloon can compete for the Santos Dumont prize of $800 for the first trip of 48 hours in the air.

Of the sixteen contestants, three each were English, French, German, and Spanish, while the remaining four consisted of two Americans, one Italian, and one Belgian. Seven of the contestants succeeded in crossing the English Channel and landing at various points in Great Britain, while the remaining nine were content with landing in France without attempting the trans-channel journey. The race was won by Lieut. Frank P. Lahm, of the Sixth United States Cavalry. Lieut. Lahm and M. Santos Dumont represented America, and the former, who was accompanied by Major Hersey, of the United States Weather Bureau, covered 485 miles in about 23 hours, and finally landed 7 miles south of Whitby, on the east coast of England, at 3 P. M., October 1. This distance in a straight line from Paris was about 415 miles, although the course actually traversed was some 70 miles longer. Although both Lieut. Lahm and his companion were amateurs at ballooning, they were able to take advantage of the latter's knowledge of meteorology and, by a careful study of the weather maps, to know what course to pursue when they were once in the air. The balloon trip was fairly rapid, as an average speed of 21 miles an hour was maintained. The balloon rose at first to an altitude of 3,000 feet, and was carried by a fair breeze in the direction of Havre. After a while the air current lessened, and the aeronauts dropped to about 1,500 feet in order to obtain a better current. Upon nearing the English Channel, they descended still lower, and crossed the latter with the trail rope dragging in the water, and at an elevation of not over 300 feet. The crossing of the Channel occupied four hours, from 11 P. M. until 3 A. M. the following morning. France was left at Caen, and England was reached near Chichester. The average speed while crossing was 25 miles an hour. Not until noon of the following day did their balloon, the "United States," ascend to any very great height. At this time the aeronauts threw out ballast, and allowed it to ascend to an elevation of nearly 10,000 feet. The wind carried them in a northwesterly direction, and finally brought them to the east coast, near which the landing was effected. This was Lieut. Lahm's fifteenth ascent, and it was a most successful trip. His balloon was of French manufacture. It had a capacity of 22,500 cubic feet, and was constructed of varnished cotton cloth. The other American balloon, "Les Deux-Amériques," manned by Santos Dumont, met with an accident and got no farther than Broglie, some 80 miles northwest of Paris. The noted experimenter had his balloon equipped with a 6-horse-power gasoline motor arranged to drive two horizontal propellers mounted in a frame on the side of the basket. The propellers were intended to serve the purpose of the usual ballast, and to raise or lower the balloon as the aeronaut wished.

While starting the motor in order to send his balloon to a higher altitude, M. Dumont caught his coat sleeve in the machinery, ripping it and slightly lacerating his arm. Consequently, he landed and returned to Paris.

The balloon which went the second greatest distance was the Italian aerostat manned by Alfredo Vonwiller. This balloon, the "Elfe," covered about 370 miles and landed in England near New Holland, a small town on the river Humber opposite Hull.

The balloon which covered the third greatest distance was the "Walhalla," the large aerostat of that experienced amateur aeronaut, the Count de la Vaulx. This balloon landed at 1:30 P. M. October 1 in Walsingham, near Norfolk, England. The distance it covered in a straight line was about 285 miles, but the actual distance traversed was about 435 miles, and the highest altitude reached about 7,500 feet.

One of the English balloons, the Hon. C. S. Rolls's "Britannia," of 78,000 cubic feet capacity, remained in the air the longest of any of the air craft, its record afloat being 26¼ hours. The landing was made at Sandringham at 6:30 P. M., October 1. The "Britannia" was fourth in the contest. Another English balloon, the "Zephyr," of Prof. Huntington, was 8 hours in crossing the Channel, but it finally landed safely at Sittingbourne, Kent, and obtained sixth place.

The third English balloon, piloted by Frank H. Butler, went only as far as Blonville on the north coast of France. This balloon, the "City of London," like its two English mates, was of 78,000 cubic feet capacity. It obtained twelfth place in the contest.

M. Jaques Balsan's French balloon crossed the Channel and landed at Singleton, Isle of Wight, at 4 A. M., October 1, thus obtaining fifth place.

Capt. Kindelan in a Spanish balloon was seventh, he having landed at Chichester, England. Eighth place was obtained by Herr Scherle, representing Germany, who landed at 11:30 P. M., September 30, at Dieppe. Another Spaniard, Emilio Herrera, was ninth. He landed half a mile from the coast between Cabourg and Dives-sur-Mer at 10:38 P. M., September 30. Tenth place was secured by Capt. Von Abercorn, of Germany, who landed at Villers-sur-Mer at 11:15 P. M., September 30. Signor Salamanca, of Spain, was eleventh. His balloon came to earth at Blouville-sur-Mer at 11 P. M. Count de Castillon de St. Victor was thirteenth. He also landed at Blouville-sur-Mer at 11:30 P. M. He stated that the wind was too uncertain for him to attempt to cross the Channel. Fourteenth, fifteenth, and sixteenth places were gained respectively by Baron von Hewald, of Germany (who landed at Conde-sur-Lisle, near Point Audemer, at 11 P. M.), by Santos Dumont, and by Van den Dresche, representing Belgium, who landed in Brittany.

The contest is remarkable from the fact that no serious accident occurred to any of the balloons. Santos Dumont's aerostat was the only one which was at all out of the ordinary as regards its equipment, and it was due to the slight accident mentioned above that this daring aeronaut found it necessary to give up the contest. The Italian balloon of Alfredo Vonwiller had some difficulty in alighting, as a gust of wind drove the balloon at a high rate of speed over a number of fields before the anchor caught. Finally, however, the anchor caught in the garden gate of a country house, bringing the balloon up suddenly against the side of the house and damaging the chimney and roof slightly. Fortunately, no one was hurt.

That sixteen balloons, carrying twice that number of aeronauts, could make such successful flights seems to show the safety of ballooning as a sport, provided the aeronauts are sufficiently experienced. The chief result of the race, however, and the one for which Americans should congratulate themselves, is that the race was won by an American and that, consequently, the next race will be held in this country. It has been officially stated at the Aero Club of America that the race of 1907 will be open not only to balloons proper, but also to dirigible balloons, aeroplanes, and other types of flying machines. Thus there will be presented a grand opportunity for American inventors to perfect their apparatus in time for the next race which, in view of what has already been accomplished in this country, will doubtless be won again by America.

LEVAVASSEUR'S GLIDING BOAT.

A new form of gliding boat has been constructed at Paris by Messrs. Levavasseur, the well-known motor manufacturer, and Lein. In its main points the new apparatus consists of a front boat of light and pointed construction which contains the motor and its accessories. Connected with the rear of the boat by a short, light wood frame about two feet long is a large flat construction in the form of a tail, which extends for some thirty feet back in the water. The rear end of the tail is almost submerged, while the front end, and also the boat, appears to float on the surface and is almost lifted out of the water under the action of the propeller. The latter is placed in the tail portion and a shaft runs back from it to the motor in the front boat. The motor is the new 50-horse-power 8-cylinder "Antoinette" motor, of the Levavasseur construction. The present system is claimed to have the advantages of a sliding boat as well as those of an ordinary boat, that is, it is able to run in rough water, at moderate speed. In calm water it glides very rapidly on the surface.

SCIENCE NOTES.

There is no more important group of questions demanding attention from the chemist at the present time than those connected with the production of India-rubber or caoutchouc. An enormous increase in the demand for India-rubber has taken place in the last few years, and last year the production was not less than 60,000 tons. Until recently the supply of rubber came chiefly from two sources—the forests of Brazil, which contain the tree known as *Hevea brasiliensis*, furnishing the Para rubber of commerce which commands the highest price, and the forests of Africa, where climbing plants, generally of the Landolphia class, also furnish rubber. The increased demand for caoutchouc has led to the extensive planting of the Para rubber tree, especially in Ceylon and in the Federated Malay States. Systematic cultivation and improved methods of preparation are responsible for the fact that the product of the cultivated tree, which begins to furnish satisfactory rubber when six or seven years old, is now commanding a higher price than the product of the wild tree in Brazil. It is estimated that within the next seven years the exports of cultivated India-rubber from Ceylon and the Federated Malay States will reach between ten and fifteen million pounds annually, and that after fifteen years they may exceed the exports of the so-called wild rubber from Brazil.

Some valuable natural history acquisitions have recently been secured by various zoological institutions in Great Britain. An extensive collection of chimpanzees, two of which were brought from Africa, are of more than passing interest. One belongs to a hitherto unknown species, the face being cream-colored, while the other, which is of a rare species, is known as a "koolokamba." It has a shaggy coat jet black in color, with the hair hanging over the hands like mittens. The head is quite bald, and its size is somewhat abnormal for this race. It receives its curious name from the peculiar guttural sound it makes and which signifies "the animal that speaks." The London Zoological Gardens have received twelve specimens of the "leaf insect," so called on account of its curious and striking likeness to a leaf, which it resembles in every respect—shape, color, veining, and texture being identical. This strange insect comes from a damp climate, and in order to keep the specimens moist, they have to be continually sprayed with water. These gardens have also been presented with two specimens of the white ibis, which is rapidly becoming extinct. These were secured by Lord Crawford during his recent seven months' cruise round South Africa and the Mozambique Channel, by permission of the Hon. Walter Rothschild, from Aldabra, who some time ago secured a lease of the island from the government, in order to preserve these rare birds. During the same voyage Lord Crawford collected about five hundred specimens of rare birds, which have been presented to the British Museum, to be mounted for the national collection.

MASKS OF CLASSIC AND MODERN TIMES.—II.

BY RANDOLPH I. GEARE.

(*Concluded from page 248.*)

The use of masks in religious ceremonies was not confined to Greece and Rome, but was and still is widely spread in all countries where the form of religion is polytheistic. Beast masks and human masks, monsters and complicated head-dresses, all find a use in religious performances. They occur in China, Tibet, India, Ceylon, Siam, and among the old Mexicans and Peruvians, as also among the Indians, Eskimos, Melanesians, and African negroes. The Aleutians put masks along with the bodies in the graves, with such comically different features that one is inclined to take them for dancing masks, which at one time served a profane end, and now are connected with serious conceptions of life and return after death.

In Melanesia, carved wooden masks, often trimmed around the lips with red beans, fitted with wigs of real hair, and dressed in feather clothing, are carried at dances. Such carvings are executed with firm, strong cuts in palm-wood. Lines in relief are colored black, the general level red, and depressed parts white. In New Ireland occur masks made by sawing off the face of a skull, as also in Peru, and with these are connected the rudely-painted skulls of New Britain. Formerly in southeastern New Guinea and in the Torres Islands, flexible tortoise-shell was the favorite material for masks, with wild arabesques and appendages like trunks and combs. Now they use masks of tin in New Guinea, where formerly a rigorous style of mask used to prevail, corresponding with that of the carved woodwork generally.

In Japan masks serve a serious and higher purpose than in many other countries. They were used freely as types of mythological characters in the religious-historical procession called "Nô." The dances on that occasion were always performed by the upper classes, and they may still be revived on occasion, although they are entirely distinct from theatrical entertainments proper, which are of comparatively recent date in Japan. Describing these processions, one writer states: "Generally, the procession was led by a winged demon called a Tengu, whose chief characteristic is a very long nose, about which the broadest witticisms are in order among the people. As he passes, he performs clownish tricks, and his office is to put in good humor the bystanders, or else the audience, if the procession is adapted to a theater."

Samba is the name given to the dancer who ushers in Japanese dramatic entertainments. His mask has puffs on the forehead, and often on the cheeks also. In the forehead may be carved deep concentric lines, to simulate the wrinkles of laughter, or as a reminder of the tattoo marks of the Polynesians and New Zealanders. His office, like that of the Tengu, is also to create a good impression on the audience, and make them favorable to the actors.

There is almost no end to the wearing of masks in Japan. The Karas-Tengu, or Crow Demon, has a beak like a bird. The fox mask is a great favorite; so are demons with horns, and a third eye in the middle of the forehead, as well as satyrs with horns and the muzzle of a goat. Then there are masks worn at weddings and on other special occasions.

In the Papuan Archipelago large masks are used in religious ceremonies, and small ones on festive occasions. In the latter the mouth is usually very much distorted.

In the New Hebrides masks are used in dances which the women are not allowed to see. They are built upon a foundation of cocoanut shell, colored with red, black, and white. The mouth and nose are large, and a boar-tusk perforates the flesh on each side of the mouth, the points being turned up to the forehead. These masks are called "Na Bee."

The Peruvians seem to have used masks from much the same motives as prompted their use in Mexico and in the northern coast of America. In their festive rites and processions some are clothed in lions' skins, their heads inclosed in those of the beasts, because they believe that the lion was the founder of their stock. Others assume monstrous shapes with visors or masks.

In Central America and Mexico masks inlaid with obsidian and turquoise occur, as well as wooden masks inlaid with similar materials as well as red and white shell.

The masked figure of a god described in the Zuni creation myth of the Indians of New Mexico, is an excellent illustration of the belief that as soon as the priest dons this sacred costume, he actually is transformed into a living representation of the god himself.

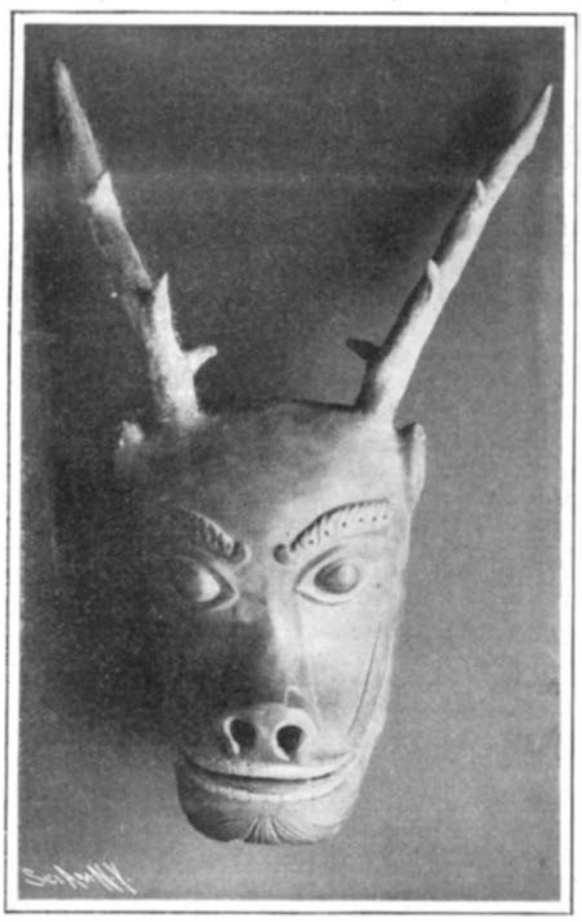
Among the North American Indians the origin of the use of masks lay, as I am personally informed by the chief and political representative of the Delaware Indians in Washington, in the desire to conceal the emotions. Thus should two warriors meet in combat, the mask conceals any expression, whether of sympathy, fear, or other emotion. For instance, the knowledge that fear was depicted on one's face, and that his antagonist knew it, would very possibly insure the defeat of the one whose feelings were betrayed to the other. So in religious ceremonies, the orator wears a mask, that he may speak his inspired words without interference or embarrassment, either of which might arise, were his personality not thus veiled. He must not be overawed by anything—a condition which might ensue if he were recognized by friends, relatives, or enemies, who might scoff at him. When masked, the orator's duty is merely to listen to the inspirations which come without effort through the medium of the spirit. And since this inspiration might seize any of the tribe at such times, all come masked.

The Indians of the coast and islands of northwestern America and of British Columbia indulge in a rich assortment of artistically carved masks, which are fastened in front of the face or are worn on the head. Some of them have human faces, with hair, head, and eyebrows; others represent the heads of eagles or sea-birds, wolves, stags, and dolphins. They are usually exaggerated in size, and are often painted

Alaskan Indian Mask.

Feudal Japanese Masks for Terrifying an Enemy.

Ladak Mask—Tibet.



Ladak Mask from Tibet.

This Costume Conceals an Indian Priest Who on Donning It Becomes a God Described in the Zuni Creation.

Tiger-God Mask of the Siamese, Which Is Worn During Theatrical Performances.

MASKS OF CLASSIC AND MODERN TIMES.

or covered with leaves of tinsel. Even great pieces of carved work are often worn on the head, such as the forepart of a canoe. The northwest American masks, carved from soft wood, often show great sharpness of carving and certainty of touch, and are nicely polished, showing clearly the tendency of the race to accurate imitation of nature. Animal masks and figures made of plaited bast, strong reminders of Melanesian types, are found frequently in the Northwest and in South America. The great explorer Cook records the fact that when at Nootka he saw the presiding official in a leathern cloak trimmed in straight lines with deer's feet, each hanging by a thong sewn all over with quills, with a mask over his face, and brandishing a rattle.

Among the Haida and Tlinkit tribes the style of ornamentation is artistic, though lately their masks have deteriorated in this respect. The late James G. Swan in his monograph of the Indians of Cape Flattery, published by the Smithsonian Institution in 1869, gave an interesting account of their religious ceremonies, revealing the use and character of the masks employed in their dances, which were mostly carved by the Indians on Vancouver Island, and sold to the Makahs, who painted them to suit themselves. These Indians have three mythical performances, called Dukwalli, T'siark, and the Do-h'tlub. The idea of represent the features of the Innuit of that region.

Masks of special kinds are also used by the Innuits of Prince William Sound, Kadiak Island, Kuskokwim River, Norton Sound, the Yukon Delta, and Bering Strait. A few used in the last-mentioned region are here shown. They were collected by E. W. Nelson, and published by the Bureau of Ethnology in connection with his paper entitled "The Eskimo about Bering Strait."

A New British 5-Inch Field Gun.

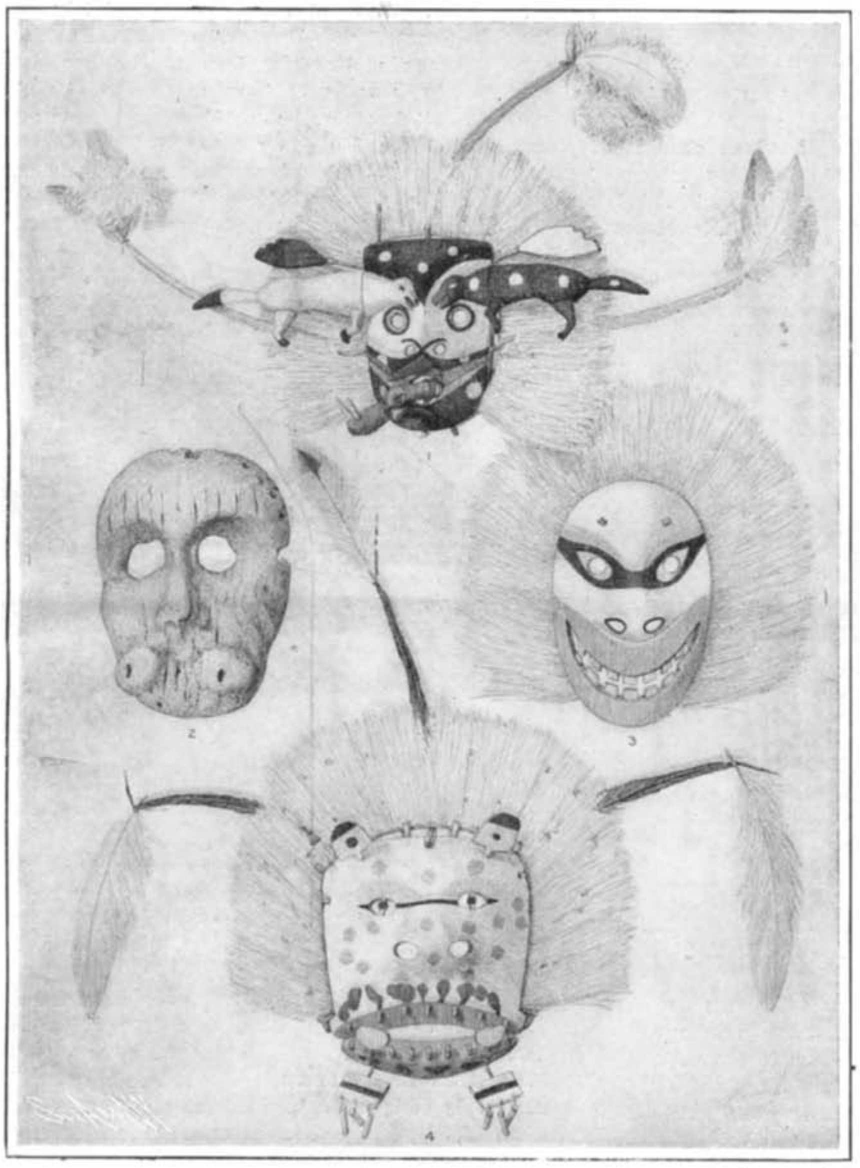
During the recent British military maneuvers, experiments have been carried out with a new type of mobile field gun. The caliber of this new weapon is 5 inches, and it is intended to supersede the 4.7-inch arm at present extensively employed in the British army. This new gun, which has been evolved by the military ordnance department, possesses several distinctive features, which render it a formidable field weapon, though it is more essentially a gun of "position" rather than what is generally understood as a "field" gun. It is sighted up to 8½ miles, which is a greater range than has hitherto been the practice in military operations, and it discharges a 60-pound shell as compared with the 45-pound shell fired by the 4.7-inch weapon. Furthermore, it has a greater rapidity of fire, and is so constructed as to be extremely mobile, over any other controller now on the market, one adjustment a year being sufficient.

It is claimed that the apparatus would require no attention except winding once a fortnight, and that once set it would not have to be reset for a year. The gas can be turned on and off in the ordinary way, quite independently of the gas controller. This is important, as it might be necessary to turn off the gas for the renewing of the incandescent mantles.

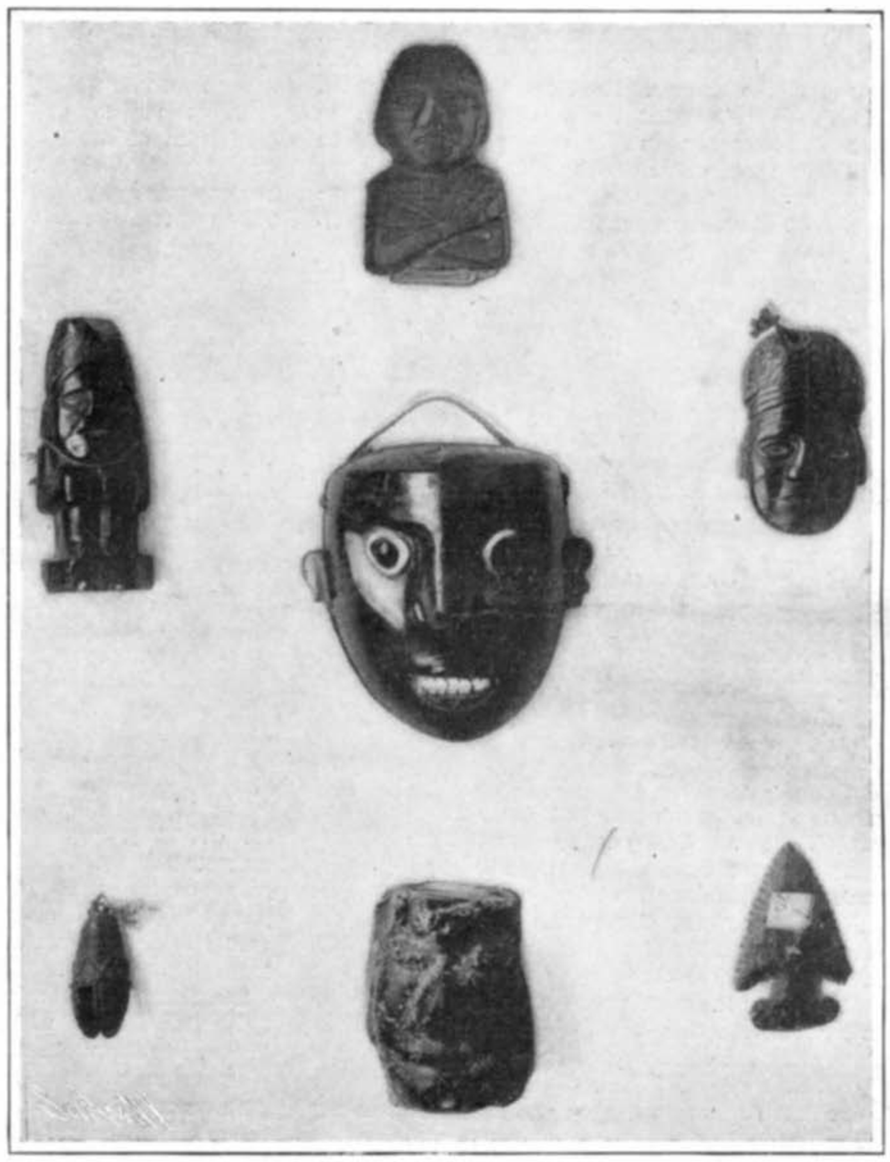
These controllers are now on trial at Bath, and the engineer of the gas company there informs the municipal gas department in Birmingham that so far as their experience goes it gives satisfactory results. In the city of Birmingham proper there are 13,860 street lights, and in the district outside which is supplied by the municipal gas department of Birmingham there are 7,108 street lights, their caretaking costing $102,488 per annum. To equip these street lights with this gas controller would involve an expenditure of $153,061. The cost of operating, it is claimed, would be just one-half. The price of a controller is now $7.29.

Modern Threshing.

Thirty years ago threshing time was one of the most strenuous occasions that came to the farmer's annual experience and was something that was dreaded as much by the women of the house as by the



Masks are used in connection with dances. In one of these described in Mr. W. W. Rockhill's work on the Ethnology of Tibet, there were about thirty dancers, half of them men and half women. The second part of the dance was performed by four or five men, with winged rainbow-colored caps, who jumped and twisted about to the clashing of cymbals and the beating of drums.



Obsidian Masks and Masked Figures Used in Mexico, Before the Conquest, as Fetishes for the Purpose of Bestowing Power on the Wearer.

MASKS OF CLASSIC AND MODERN TIMES.

the first is to propitiate the "Thunder-bird," who with the Makahs apparently takes precedence over all other mythological beings. The performance is given at the expense of some wealthy member of the tribe. The masks are made of alder, maple, poplar, etc. Many of them have the eyes, lower jaw, etc., movable by means of a cord. They present a frightful appearance, and resemble owls, wolves, bears, etc. The T'siark is a medical or curative ceremony, while the Do-h'tlub is of the same general character as the Dukwalli. These ceremonial masks are called "hu-kaú-itl-ik," and the details of the ceremonies are fully described in Dr. Dall's paper on Masks and Labrets.

Masks are used by the Eskimos in their ceremonies, particularly in pantomimes, and are essentially similar to those worn by the Tlinkit, Haida, and Makah tribes of Indians. Among the ludicrous masks there are some which show either human faces or whole human figures, either concealed by flaps or carved in depression on the surface of an animal mask. Some rudely represent the head of a saw-billed duck. In others the head of a fox, wolf, or seal is represented. The Point Barrow masks are distinguished by an artistic finish, and also by the very faithful manner in which they and easy to operate in the field. The weapon has been subjected to severe tests under conditions as near as possible to those experienced in actual warfare, and owing to its complete success and formidable nature, it has been decided to arm the service with it.

Street Lighting by Clockwork.

Consul Albert Halstead, of Birmingham, reports that an automatic gas controller has been patented and is now on sale in England which may materially lessen the cost of public lighting in the municipalities of the United States if in practical operation it fulfills the claims of its owners.

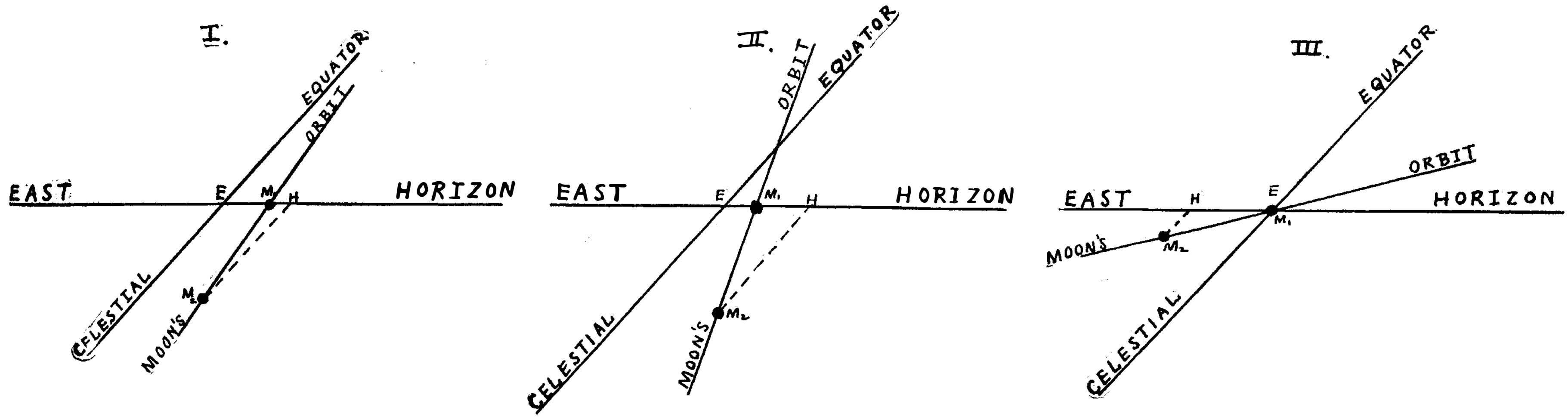
The controller is said to be adaptable to any type of incandescent burner, to fit any lamp, and to be instantaneous in its lighting and extinguishing. The mechanism consists of a clock which can be so set as to light the gas each night and extinguish it each morning, so as to make an automatic variation of the time of lighting and extinguishing according to the calendar. In short, by means of a chart, the street lights are turned on and off, lighted and extinguished, at a different moment each day throughout the year, according to the season. This is an advantage, it is claimed, farmer himself, as it required two or three days to thresh the average crop, with fifteen and twenty men and as many teams to be fed and housed. The stacks of fried chicken and apple pie that disappeared during those troublous days was something wonderful to behold. This is now all changed. The threshing crew come down the road with their whole outfit *en train*, pull in alongside of the stacks and in ten minutes are at work, and no one is surprised if they are threshing ten bushels a minute. The sheaves being fed automatically the threshed grain runs directly into the farmer's wagons, the straw being stacked automatically, taking away most of the laborious and dirty part of the work of the old times. For the average farmer one day cleans up the whole job, and the thresher moves on to the next setting.—Implement Age.

The manufacture of tantalum, one of the hardest metals known, into sheets and bars is now, it is said, being practised in Germany by the squirting process, the material in its original powdered form being mixed with water and gum tragacanth, and then successfully forced into rods and shapes as desired.

THE HARVEST MOON.

BY ARTHUR B. TURNER, PH.D.

If we imagine a plane passed through the earth's equator and produced to cut the celestial sphere, we obtain a circle called the celestial equator. Again, suppose another plane, which touches the earth at your point of observation, to be produced to cut the celestial sphere. We thus obtain a second circle called the horizon. The accompanying diagrams represent to the observer facing the east these two circles cut by the orbit of the moon, and they show how the inclination of her path varies during the month. The fact that the moon does travel in an eastward direction around the earth is shown by the earth having to turn, on the average, 51 minutes more than a day between one moonrise and the following one. The high and low tides are also delayed by about the same amount, and indicate an eastward motion of the moon. This extra turning of the earth to catch up with the moon is called the retardation of her rising and it is when this retardation is smallest and the moon is full, that we have the phenomena of the harvest moon and the hunter's moon. In the diagrams E represents the east point, M_1 the position of the moon on the horizon, M_2 the position of the moon a day later; M_1 M_2 being the arc through which she has moved eastward in that time. M_2H then represents the arc through which the earth must turn to bring the moon on the horizon on the next day. The time it takes the earth to turn through this arc is the daily retardation. It is evident that M_2H is smallest when the moon's orbit is least inclined to the horizon. Now, for the harvest moon it is also essential that the moon shall be full; as the horizon, equator, and the moon's orbit should be situated approximately as in Fig. III. These conditions are satisfied in the autumn about the time of the equinox. Then we have the full moon rising for several successive evenings about the same time and nearly in the same place. The result is that these nights have the moon shining for a longer time than usual, and consequently we say the nights are more brilliant. From the diagrams it can easily be seen that the lengthening of the nights also increases with the latitude of the observer, so that in Norway and Sweden the moon's orbit may actually coincide with the horizon. In this case the moon will rise at absolutely the same time for a considerable number of successive evenings. When the harvest moon occurs in the first part of September, the farmers, especially in England, utilize these beautiful evenings to complete their labors in the field. In the latitude of New York city the daily retardation can be as small as 23 minutes and as great as 1 hour and 17 minutes. For the last full moon of October 2 the least retardation was 29 minutes.



THE HARVEST MOON.

THE NEW ROUTE TO IRELAND.

BY L. H. YATES.

There is all the romance of daring enterprise about the new route which the Great Western Railway Company of England have recently opened. For many years it has been felt that the rocky point of Fishguard on Pembroke coast, and Rosslare on the Wexford coast of Ireland, were the natural extremities of the most direct line of communication between the sister isles. Brunel, the great engineer of the Great Western system, saw this as far back as 1845, but the difficulties that faced him, besides want of funds, brought his plans to a standstill, and Milford Haven, a natural harbor, was chosen instead. Ten years ago, however, the project was revived, and in 1898 the Great Western of England and the Great Southern and Western of Ireland entered into an agreement, in which the English company engaged to take over all undertakings regarding the building of a new harbor at Fishguard, to build and own the steamships, and to link up their railway system on the English side, while the Irish company were to convert Rosslare into a suitable harbor and to construct a direct railway thence to Waterford. From Waterford the connections with Cork, Killarney, the West, and Dublin were to be made direct, in order that the whole of Ireland might benefit from the increased traffic that should result. What the construction has involved on the English side can be realized only by looking back over the eight intervening years, to what Fishguard was then—a face of rock, sheer down to the sea, and a rough, scattered hamlet.

The bay is in the form of a crescent, the coast-line being one of irregular projections, but without natural harborage or shelter. It is exposed to gales from the north and northeast, but protected from the more frequent southwesterly winds which trouble the southern ports. The extent of the bay from west to east is about three miles, and the general depth of water is from 30 to 70 feet, according to the distance from shore. There is sufficient depth of water all over the harbor to accommodate in safety vessels of the largest draft at all states of the tide, with excellent anchorage, the bottom being sand mixed with mud. Because of exceptional climatic conditions, this side of the coast is especially free from fog. Unfortunately, as much cannot be said for the Irish coast.

The construction of the new harbor has necessitated the making of a quay space, half a mile in length, of an average width of 250 feet, and in the beginning, since there was no foothold for them, the men had to be slung in cradles to commence boring. Drills, cranes, and tools had to be lowered in pieces as a space for them was cleared, before blasting operations could begin. When a small terrace had been cleared by hand steam drills were brought into use, and finally a complete installation of 8-horse-power pneumatic drills was put down. Blasting was effected by boring deep holes of small diameter into which charges of explosive were placed, and by detonating mines of black powder in a T-shaped tunnel, which, being built up, was discharged by electricity. One of these mines brought down 113,000 tons of rock in huge blocks. The total amount of rock excavated has been estimated at something like two and one-half million tons, the larger blocks being picked up and transported to form the quay wall, the smaller ones being used for the construction of the breakwater and for ballasting purposes.

The foundations for the quay wall were excavated by suction dredges, with a Priestman grab-hopper following to remove the shingle down to the rock. The rock surface was then leveled by divers, and filled up with concrete. On this the wall was built, the blocks being laid by means of a "Titan" crane. The block work of the wall reaches up to within 3 feet of high-water mark, the upper part being made of mass concrete. In this a cattle gallery has been formed by a cantilever of reinforced concrete. This gallery is 10 feet high by 6 feet in width, and on the seaward side is inclosed by gates hung between fender piles of karri wood. The gallery is connected by subways and ramps with a line of 68 pens on the inside of the quay-space, so that dealing with cattle may be effected without interference with other traffic. Along the quay-wall are nine electric cranes for lifting cargo, mails, etc., directly from the steamer to the quay or train, and *vice versa*. There is also a 21-ton electric crane, capable of lifting a loaded coal car and tipping it into a steamer or lighter. The immediate proximity of the South Wales coal fields makes Fishguard a most favorable port for bunkering purposes, and it is intended to quote special low rates for carriage of coal from the pits.

The throwing out of a breakwater to protect the harbor from northeasterly gales has been one of the most difficult parts of the whole undertaking, as this required to be some 20 feet in height at high tide. Its total length is 2,000 feet, the breadth at base 300 feet, and at top 70 feet. In its construction about one and a quarter million tons of material, chiefly stones in blocks, have been used. The extent of deep water protected by this breakwater is 76 acres.

Every convenience designed to facilitate the transference of passengers and goods from steamer to train has been provided at Fishguard, as far as space permitted. The passenger platform is 800 feet long by 32 feet broad, and has five blocks of station buildings upon it, which when finished will offer every accommodation that can be desired. At low tide, passengers reach the steamer or quay by means of subways. There is only a short distance of about 12 feet which is not under cover. The electrical generating station, which provides power for working the cranes as well as for the admirable lighting, is situated in the angle formed by the termination of the quay wall and commencement of the breakwater. The works have all been designed and carried out departmentally under the able management of Mr. James C. Inglis, the general manager and consulting engineer of the Great Western Company, under whose care this line is making rapid advances.

A building estate is being laid out at the top of the cliffs, where housing for the large number of men employed by the company will be found. Fishguard is picturesquely placed, and the altitude of 300 feet above the sea makes it a bracing spot. A new branch line of railway has been laid down to avoid the steep gradients of the existing one *via* Rosebush, and by this "South Wales Direct Line" the distance from the Great Western Railway terminus, London, is brought down to 261 miles. Further improvements will take place later on.

Three new express turbine steamers have been built for the cross-Channel service, appropriately named the "St. George," "St. Patrick," and "St. David," and each is propelled by three Parsons turbines, driving separate shafts and propellers, capable of attaining a speed of 22½ knots an hour. Sleeping accommodation is provided for 250 first-class and 100 second-class passengers, with saloons and every convenience for comfort. The voyage between Fishguard and Rosslare is performed in two and three-quarter hours in reasonable weather, and there are no rocks to impede navigation.

Official Meteorological Summary, New York, N. Y., September, 1906.

Atmospheric pressure: Highest, 30.48; date, 25th; lowest, 29.65; date, 3d; mean, 30.09. Temperature: Highest, 90; date, 10th; lowest, 54; date, 16th and 25th; mean of warmest day, 80.5; date, 10th; coldest day, 60; date, 25th; mean of maximum for the month, 76.7; mean of minimum, 63.6; absolute mean, 70.2; normal is 66.4; average daily excess compared with mean of 36 years, +3.8. Warmest mean temperature for September, 72 in 1881; coldest mean, 61 in 1871. Absolute maximum and minimum for this month for 36 years, 100 and 40. Precipitation: 2.54; greatest in 24 hours, 1.04; date, 12th and 13th; average for this month for 36 years, 3.57; deficiency, —1.03; greatest precipitation, 14.51, in 1882; least, 0.15, in 1884. Wind: Prevailing direction, N.E.; total movement, 7,551 miles; average hourly velocity, 10.5 miles; maximum velocity, 35 miles per hour. Weather: Clear days, 13; partly cloudy, 8; cloudy, 9. Thunderstorms: Date, 3d, 12th, 13th, 22d.

The effect of electrical oscillations on iron in a magnetic field formed the subject of a paper recently read before the Physical Society by Dr. W. H. Eccles. In attempting to make precise measurements of the effect of high-frequency oscillations on iron held magnetized by a magnetic field, two main difficulties are met. The one is that arising from the fact that the oscillatory currents induced on the surface of the iron investigated shield the inner layers, and thus make the mass of iron affected a variable quantity. The other difficulty arises in the matter of producing oscillations of determinate and invariable character. The author has endeavored to meet the first difficulty by using oscillations so feeble that they affected only the outermost layers of the iron wires employed, and these even only slightly. The second difficulty has been met by using the oscillations produced in an open insulated solenoid by a single small measurable spark passed to one end of the solenoid.

Correspondence.

The Gila Monster and Its Prey.

To the Editor of the SCIENTIFIC AMERICAN:

I read in the issue of your paper for September 15 an interesting account of the Gila monster, by D. A. Willey, in which he says: "The breath is very fetid, and its odor can be detected at some little distance from the lizard. It is supposed that this is one way in which the monster catches the insects and small animals which form a part of the food supply—the foul gas overcoming them."

Now, although I do not know much about the Gila monster, it seems to me that a more plausible explanation of the use of this "foul gas" is that it attracts insects to the lizard, by its resemblance to the odor of putrid meat. SYDNEY A. WRIGHT.

Bangor, Me., September 16, 1906.

Relation of Speed to Automobile Dangers.

To the Editor of the SCIENTIFIC AMERICAN:

Many, if not most, of the automobile accidents are due to the fact that the drivers do not know or do not realize the relation which speed bears to danger. The danger in all cases increases as the square of the speed. Take three machines of the same make, one going five miles an hour, one twenty miles an hour, and one forty miles an hour. The second has stored up in it, due to its rapidity of motion, sixteen times as much energy as the first, and if it leaves the road and runs into an obstacle, such as a tree, a stone wall, or a ditch, it will strike with sixteen times as great force. In going around a curve or turning a corner, it is sixteen times as likely to upset, skid into the ditch, or strip a tire; when the power is shut off and the brakes applied, it will go sixteen times as far before it can be brought to a stop; if it comes upon a pedestrian suddenly, the latter will have to exert sixteen times as much energy to get out of the way in time, and if struck will be struck with sixteen times the force. The third machine will be sixty-four times as likely to get into trouble in going around a curve as the first; if it strikes an object, it will do so with sixty-four times the force; when the brakes are applied, it will go sixty-four times as far before stopping; and if it comes suddenly upon anyone on foot or driving, the latter will have sixty-four times as much difficulty in getting out of the way in time.

An object going five miles an hour is moving with the same speed as it would have attained in falling ten inches; in moving ten miles an hour it is going as fast as though it had fallen three and a half feet. As the first is the average, and the second generally the extreme speed of horses and carriages, it follows that drivers of the latter seldom need to take speed into account in this connection. With automobiles it is different. Twenty miles an hour is generally considered a very conservative speed. Now, twenty miles an hour is the same speed that would be obtained were the machine to fall thirteen feet through the air; thirty miles an hour is equivalent to a fall of thirty feet; forty miles an hour to a fall of fifty-two feet; sixty miles an hour to a fall of one hundred and twenty feet; and one hundred and twenty miles an hour, the speed developed by one or two machines in the Florida contest last winter, to a fall of four hundred and eighty feet. A person struck by an automobile going twenty-five miles an hour receives the same jar as though he himself had fallen from a height of twenty-one feet, or say from a second-story window; by one going forty miles an hour, as though he had fallen fifty-two feet, or say from the top of a lofty tree; by one going a hundred and twenty miles an hour, as though he himself had fallen from the top of the Washington monument.

A consideration of these facts should help both legislators and automobile drivers in placing limits on speed. CHARLES S. ADAMS.

Are Sun Spots Caused by Tidal Action?

To the Editor of the SCIENTIFIC AMERICAN:

Many theories have been advanced as to the cause of sun spots. I suggest one here that I have never seen published before; that is, that the bodies revolving around the sun are directly responsible for the periodic roiling up of his surface. It has, indeed, been suggested that Jupiter and Saturn might produce the stress necessary, but they having been found inadequate in themselves, this tentative theory has been abandoned. I began to look for the nearest fixed star as the probable cause, but gave that up for the time being, as I now think that there are doubtless other large bodies in the solar system besides Jupiter and Saturn. To be brief, I think there is a companion sun. Against the theory that the sun spots are caused by forces from within the sun, I suggest the following:

No celestial body has an inward mechanism, like a clock, for instance, to produce periodically outward manifestations like spots on the sun.

All periodic changes that we see are produced by a disturbance from without, by some other body.

The most regular and periodic agency in the universe that we know of is an orbit, or a body moving in an orbit. Its regularity is absolute.

The spots on the sun appear at regular intervals.

The phenomena of the sun spots are tidal phenomena produced by bodies revolving around the sun in orbits.

A large body, about one-third the diameter of the sun, situated at the outskirts of the solar system, acting in conjunction with Jupiter and Saturn, which are comparatively near, would produce the required tidal action to make spots. The large outer body, or companion sun, has such a slow motion in its orbit, that for the question we are now discussing, it is practically still. Once in about eleven years Jupiter comes round on the same side of the solar system as this large body, which we will call Olympia, and both pull on the sun. Saturn can be either with these two, or directly opposite, like the sun and a full moon, making the same tide on the earth.

I am led to believe that there are perhaps three large bodies belonging to the solar system, outside the orbit of Neptune. The two next outside of Neptune are planets, and the third one out is a companion sun, some 200,000 or 300,000 miles in diameter, and distant some 33 hours in light waves. Though it may be self-luminous, it is probably only of the 18th magnitude.

On the earth the tide consists simply of a wave of water, which quickly subsides, but on the sun the tidal stress breaks open an envelope, liberates enormous quantities of gas or even molten material, and leaves a scar or spot that takes weeks to heal up. The thrown-out matter does not fall back again vertically, but distributes itself around, and the scar has to heal as best it can, with whatever matter it can collect.

The visible result of the tidal stress on the sun is somewhat different from that on the earth. Here we have the wave of water going around the globe. On the sun the tidal influence of Olympia is so evenly balanced with the strength of the sun's crust, or overcoming power, that no apparent tide is produced, but when Jupiter or Saturn comes in line, the balance is disturbed, the crust breaks, and an eruption takes place producing a spot. Imagine the Atlantic and Pacific oceans covered with ice to such a depth that no visible tide takes place twice daily as at present, but only twice a month, when the moon is new or full. On those two occasions the ice cracks, and the water spurts up into the air for hundreds of feet, and falling, makes a great frozen mound of ice. Two observers on Mars, let us imagine, see the phenomenon. One lays it to a powerful volcanic force, the other to tidal action. There may be no actual crust on the sun, but the hot gases, being held down by gravitation, are relieved and allowed to rise on account of the tidal stress at periodic intervals.

WILLIAM D. MCPHERSON.

South Framingham, Mass., September 15, 1906.

[Our correspondent's ingenious theory has been submitted to Prof. Henry Norris Russell, of Princeton University, who gives his views as follows:

"The theory outlined fails to stand the test of simple mathematical analysis.

"Such a body as the hypothetical Olympia may perfectly well exist. With a diameter one-third that of the sun, and a distance of 33 light-hours, or 240 times the earth's distance from the sun, it would be of about the twelfth magnitude, if shining by reflected light, and might easily remain undiscovered. But such a body would not produce sensible tides on the sun. The tide-raising force varies inversely as the *cube* of the distance. Olympia being by hypothesis of about 30 times Jupiter's mass, and 45 times its distance from the sun, would have a tide-raising force of $30/45^3$, or 1/3,000 as much as Jupiter, which is less than that of any one of the principal planets of the solar system except Neptune.

"It has often been suggested that the periodicity of sun spots is caused by planetary tidal action, but this is rendered improbable by the fact that they are *roughly*, not accurately, periodic, the successive maxima being different in intensity and unequally spaced.

"The correspondent is wrong in assuming that no celestial body has an inward mechanism . . . to produce manifestations like spots. Certain variable stars are almost certainly of this character. For a terrestrial example take the "Old Faithful" geyser in the Yellowstone, which is almost as regular as the sun spots, though the periodicity is certainly due to internal forces."]

The Current Supplement.

"The Tortosa Astronomical Observatory" is the title of the opening article of the current SUPPLEMENT, No. 1606. Good illustrations accompany the text. Hector Macpherson writes on the construction of the Heavens. Prof. Sir James Dewar contributes a most instructive article on some new low-temperature phenomena which he has observed. The fourth installment of the article on Tinning is published. This installment deals with the tinning of copper and brass, blanching, stannic chloride, tinning of lead and zinc, extraction of tin from scrap tin, and tinning with tin amalgam. Some very old Greek jewelry which has been acquired by the Metropolitan Museum of Art is described and illustrated. Prof. Max Standfuss has for years been propagating butterflies and moths under artificial temperature conditions. He has taken the eggs of middle European moths, for example, and bred them at very low temperatures, and obtained varieties of that same middle European moth found only in Arctic regions. Similarly, eggs of the middle European moths, hatched at very high temperatures, produce varieties that are to be found only in tropical countries. Furthermore, by changing the temperatures he has obtained varieties which have existed but are now extinct, and varieties that will exist thousands of years hence. These experiments have a most important bearing on the old problem of the origin of species. Dr. Standfuss writes exhaustively of his experiments in the current SUPPLEMENT. Prof. Crocker, of Columbia University, writes on some tests made with a new primary battery, which he considers a marked improvement in the making of batteries.

New Method of Photographing Colors.

Mons. Lippmann, to whom we owe all the progress made up to the present time in the difficult problem of the direct photography of colors, has just proposed a new solution. The principle of it is based upon the decomposition of white light by the prism. The colored object chosen as a model is placed before a glass plate bearing longitudinal striæ or flutings to the number of five to the millimeter. These flutings act like very small prisms which decompose the luminous sheaves proceeding from the image at their passage into the camera obscura. After the proof is obtained, developed and dried, it is placed in its position behind the fluted plate. If then it be illumined with the white light, it is seen through this plate to appear with the colors of the object photographed. The dispersive system of the fluted plate has decomposed the light into its elementary rays, and the colored radiations have been distributed upon the sensitive plate.—From L'Illustration.

THE WINNING FOREIGN MACHINES IN THE THIRD INTERNATIONAL RACE FOR THE VANDERBILT CUP.

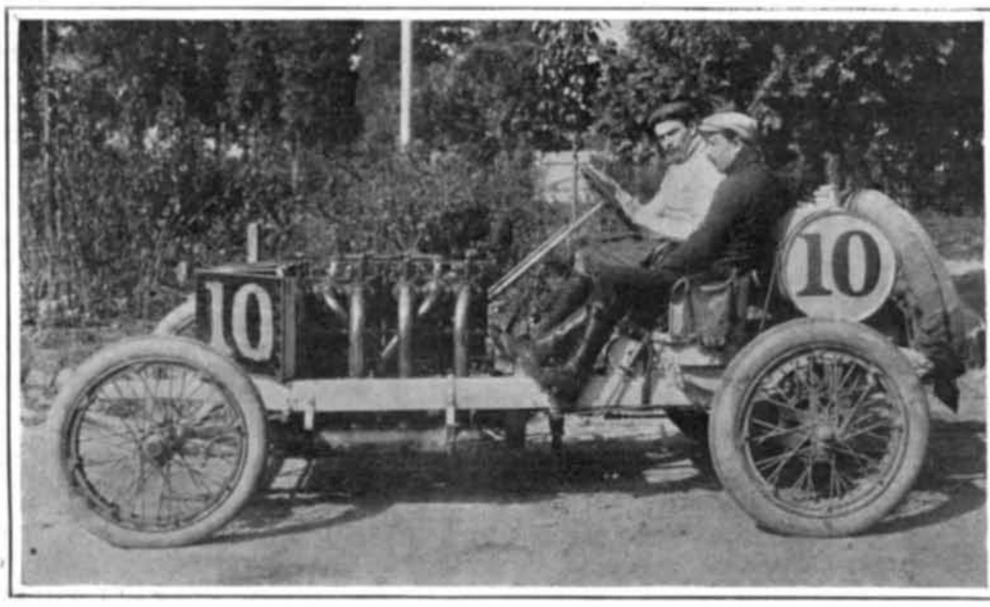
The photographs which we reproduce on the following pages show seven of the eight foreign makes which ran in the third Vanderbilt cup race last Saturday, and one of the most novel American cars—the Christie. The other car of distinctively American design—the 110-horse-power air-cooled Frayer-Miller racer—we have already illustrated in the issue of September 29.

The Vanderbilt race last year was won by a four-cylinder Darracq light-weight racer of 80 horse-power. A car of similar type, but of 100 horse-power, was one of the representatives of France this year. Our illustration shows this machine mounted by its driver, Wagner, who recently won with it the 100-kilometer (62-mile) Ardennes race in France at an average speed of 72 miles an hour. This car differs from the other racers chiefly in two respects, viz., its short wheel base of but 96 inches, and its tangent, wire-spoked, suspension wheels. Much ingenuity has been used in fitting these wheels with detachable rims, so that the tires can be changed as readily and quickly as can those on any of the wood-wheeled racers, all of which are likewise provided with practically the same form of detachable rim, whereby, by removing eight or ten nuts, rim and tire can be quickly removed and replaced. The Darracq engine, as heretofore, is an extremely neat, clean-cut affair. The inlet and exhaust valves are placed in the cylinder heads, and are operated by light tappets on top. All the valve mechanism is worked from a single camshaft. The make-and-break igniters, and the low-tension magneto which supplies them, are on the opposite side of the engine to that shown. The peculiar plow-shaped radiator shown keeps the cooling water for the engine jackets below the boiling point without any fan to increase the draft. The water is circulated by a centrifugal pump. By pushing a button on the dash the driver can relieve the water-circulating system of any steam or air pockets that might form. The 1905 Darracq racer had no differential, and the transmission was suspended from the frame in the usual manner. The new racer, however, has the transmission combined with the differential on the rear axle—a most unusual place for it on a racing car. This transmission furnishes three speeds and reverse, as usual. The second speed is as high as 65 miles an hour. A propeller shaft with universal joints connects the leather-faced cone clutch in the motor flywheel with the transmission on the rear axle. The brake pedal operates a hinged band brake on the transmission shaft, while the emergency brake lever operates expanding-ring brakes in the rear wheels. The round tank behind the seats has a fuel capacity of 30 gallons, and supplies the carbureter by gravity. The water tank is built around the seats, and holds 6 gallons of water. The 3-gallon oil tank is placed on the floor directly in front of the driver's seat, and is fitted with a hand pump for forcing oil into the engine crankcase. The frame of the racer is of pressed steel, stamped from a single piece. The car, while extremely speedy and powerful, is in no sense a freak, as it is built along the same lines as most Darracq touring cars, albeit it contains several new features that will doubtless be incorporated in them in the near future. The bore and stroke of the engine of this car are 180 and 140 millimeters (7.086 and 5.511 inches) respectively. The wheels are equipped with 880 x 120 millimeter (34.64 x 4.72-inch) tires. The tread is narrow, being but 52 inches. The car weighs 2,213 pounds, which shows it to be heavy despite the appearance of lightness.

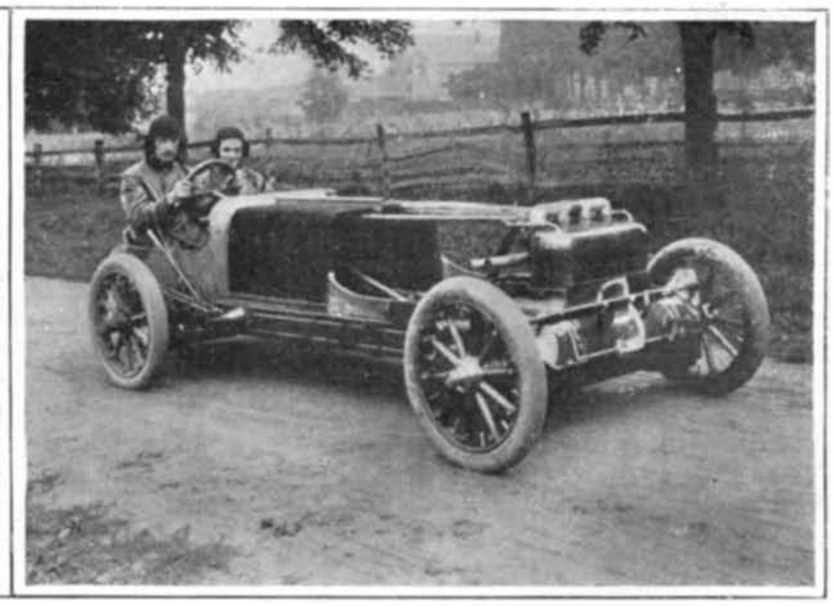
The only really light car of the entire seventeen is the Christie direct-drive racer. This machine weighs only 1,780 pounds and is provided with a 50-horse-power, 5⅜ x 7-inch, 4-cylinder engine, the crankcase of which forms the front axle, as shown in the photograph. The drive is direct to the front wheels through cone clutches in the flywheels of the engine. A low speed, which is thrown in by means of a small multiple-disk clutch, is also provided. The Christie and the Frayer-Miller cars are each provided with a two-circulated by a gear pump, gear-driven. The hub and spokes of each wheel of Christie's car are a single manganese-bronze casting. The rims are attached to the spokes by bolts. A special brace is used to remove the nuts, and it is possible to change a rim and tire in less than two minutes. The wheel base of the car is 101 inches. The tread is slightly wider than usual.

The Panhard car, as usual, was driven by Mr. George Heath. This car had no particular innovations. The 120-horse-power engine consists of four individual steel cylinders of 180 x 185 millimeters (7.086 x 7.283 inches) bore and stroke. The cylinders are fitted with corrugated copper water jackets and integrally-cast heads having inlet and exhaust valve chambers placed symmetrically, one on each side. The spark plugs, fed from a gear-driven high-tension magneto, are located in the side of the inlet-valve chambers. The water is circulated through a honeycomb radiator by means of a centrifugal pump. No fan is used. An hydraulically-regulated Krebs automatic carbureter is employed. A steel multiple-disk clutch is placed between the engine and transmission, which is of the selective type giving four speeds ahead. The fuel tank has a capacity of 30 gallons. The car has a racer has separately cast cylinders with inlet and exhaust valve chambers located symmetrically on each side. The bore and stroke are about 6½ x 6½ inches. The cylinders are fitted with copper water jackets. A multiple-disk clutch, consisting of 56 steel rings having an 8-inch hole in the center and an outside diameter of 9 inches, is used. A 4-speed selective-type transmission is used. Ball bearings are employed throughout, except in the engine. A 40-gallon gasoline tank is fitted. The wheel base is 114 inches, and the tread 52. Like all the other foreign machines, this car has detachable rims.

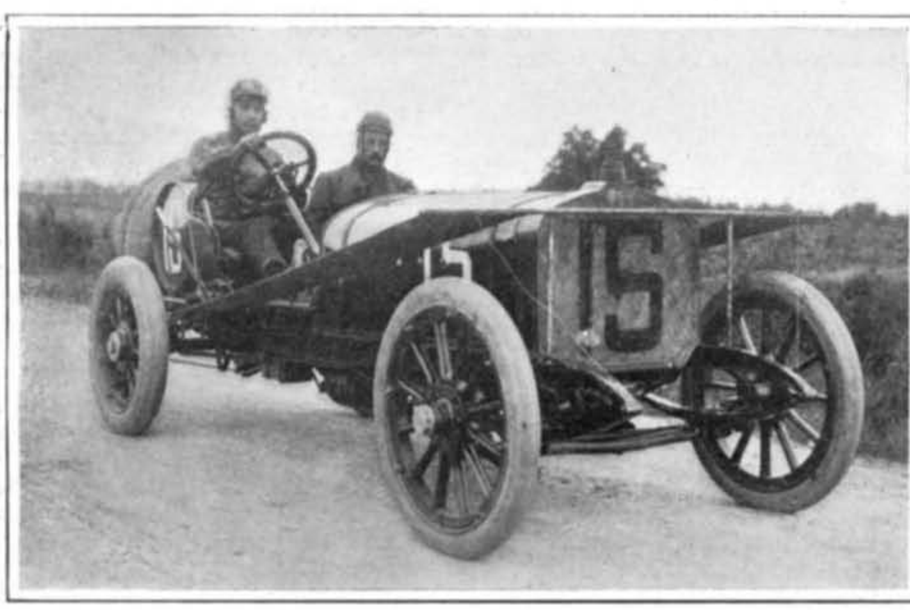
The 130-horse-power Hotchkiss racer is one of the most refined French machines. Ball bearings are used throughout, even in the engine crankshaft. The cylinders of 160 x 180 millimeters (6.299 x 7.086 inches) bore and stroke, are cast integrally in pairs. They are fed from a double-spray carbureter with perpendicular air currents, the carbureter being supplied with fuel by gravity from a 33-gallon tank. A centrifugal pump circulates the cooling water through a tubular radiator. No fan is provided. A pressure-feed oiler is employed. An Eisemann high-tension magneto supplies the ignition current to the spark plugs. The spark



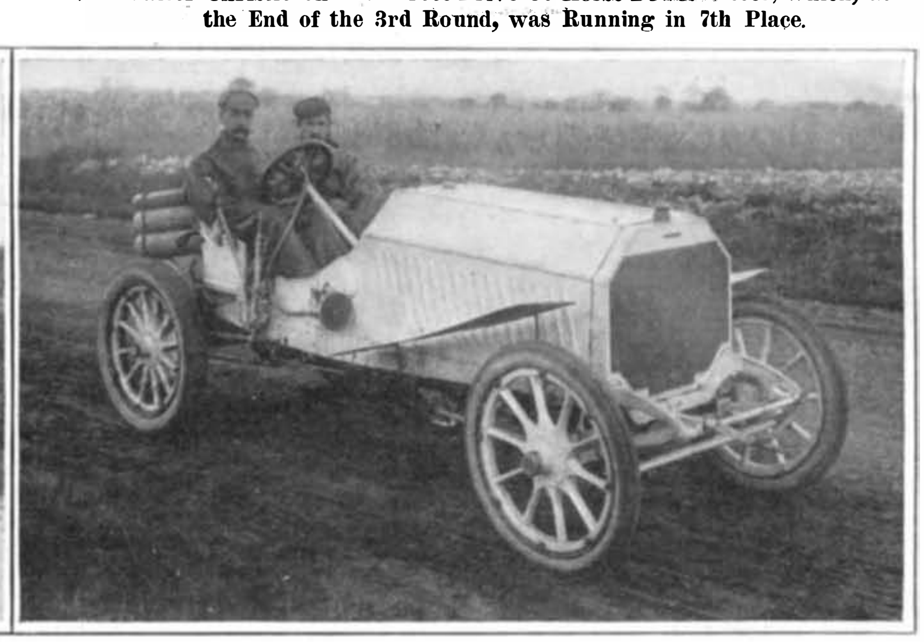
Wagner on His 100-Horse-Power Darracq Racer, Which Won in 4 Hours, 50 Minutes, 10⅖ Seconds—an Average Speed of 61.48 Miles an Hour.



Walter Christie on His Direct-Drive 50-Horse-Power Racer, Which, at the End of the 3rd Round, was Running in 7th Place.



Clement on His 100-Horse-Power Racer, Who Finished Fourth in 5 Hours, 1 Minute, 59⅘ Seconds.



Heath on His 120-Horse-Power Panhard, Which Was in 9th Place at the End of the 8th Round.

THE WINNING FOREIGN MACHINES IN THE THIRD INTERNATIONAL RACE FOR THE VANDERBILT CUP.

speed transmission merely, instead of one giving three or four speeds. Owing to the demolishment of his 120-horse-power racer from a collision with a telegraph pole when practising, Mr. Christie was obliged to fall back upon his first touring car, which had just been completed but never run. He transformed it into a racer in time to enter the elimination race, in which he was running in fifth place at the finish, and thus was placed on the American team. His "touring-car racer" is of the same horse-power as the Haynes machine, which was the only other low-powered car on the American team; but on account of its light weight and extremely efficient drive, it was able to make much faster time than the latter, and consequently to stand a chance of winning. At 1,000 R. P. M. of the engine and wheels (which are shod with 28 x 3½-inch Diamond tires) Christie's car makes 83 miles an hour. The novel features of this machine are the engine, which has copper water jackets, with a large exhaust valve in the center of each cylinder head surrounded by four small, flat-seated, automatic inlet valves; and the radiator, which, as can be seen in the photograph, is made up of a large number of finned tubes placed lengthwise in front of the dashboard. The water is wheel base of 2.4 meters (94.48 inches) and a tread of 1.2 meters (47.24 inches). It is fitted with 870 x 90-millimeter (34¼ x 3½-inch) tires on the front wheels and 935 x 135-millimeter (36.8 x 5.3-inch) tires on the rear. It weighs complete 1,000 kilogrammes (2,204 pounds) plus the 15 pounds extra allowed for the magneto, which makes a total weight of 2,219 pounds. It was one of the smallest and highest-powered cars that competed.

The 120-horse-power De Dietrich racer, driven by Duray, was one of the most formidable-appearing of the foreign cars. It has a 4-cylinder, 7.28 x 6.28-inch engine having the cylinders cast in pairs. Unlike its mate the Panhard, this car has the older form of double side-chain drive to the rear wheels instead of a shaft drive. The engine has a cone clutch, centrifugal water pump, make-and-break magneto ignition, and a special form of carbureter designed for perpendicular air currents. The wheel base and tread of this car are 116 and 55 inches respectively. Its weight is 2,204 pounds. This car is fitted with a 4-speed transmission, and it is geared to make extremely high speed.

The engine of the Clement-Bayard 125-horse-power is set at 90 millimeters (3½ inches) advance (measured on the flywheel), and the entire control of the engine is had by throttling it. This car is fitted with shaft drive. No shock absorbers are required, on account of the suppleness of the springs. A leather-covered cone clutch is fitted in the motor flywheel. The transmission gives four speeds. Detachable rims fitted with 870 x 90-millimeter and 935 x 135-millimeter tires front and rear are employed. The wheel base and tread of this car are 104 and 57 inches respectively.

The German team consisted of but two 120-horse-power Mercedes racers, as Mr. Foxhall Keene's machine, which otherwise would have run, was disabled by cracking a cylinder during practice. These two cars are similar in most respects to the 1905 Mercedes racers. A new form of spiral clutch known as the Lindsay is employed, however. The cylinders, of 7-inch bore by 6-inch stroke (approximately), are cast in pairs. The well-known honeycomb radiator and centrifugal water pump, together with the low-tension magneto ignition, are retained. The wheel base of these cars is 115 inches, and the tread 53½.

The Italian team consisted of three 120-horse-power Fiat racers and two 120-horse-power Italas. Both of these makes have integral cylinders cast in pairs, the cylinder dimensions of the former being 7¼ x 6½, and those of the latter 7¼ x 5¾ inches. Both makes have a final drive by chains to the rear wheels. Both are provided with multiple-disk clutches, four-speed transmissions, etc. The wheel bases and treads are respectively 112 x 52 and 116 x 55 inches.

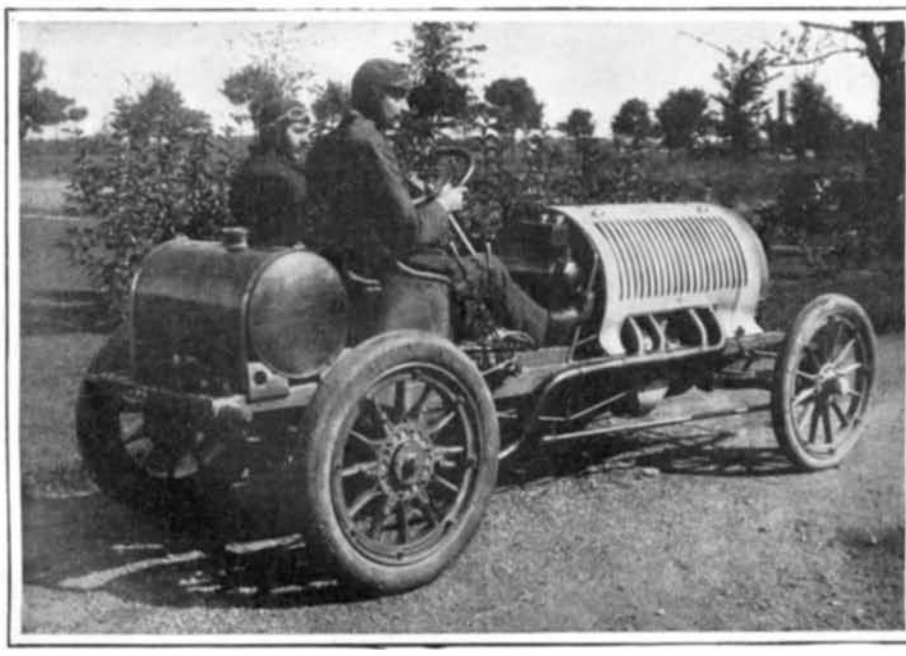
The third Vanderbilt race was run on Saturday, October 6, under threatening weather conditions. There was a delay of fifteen minutes in starting the cars, the first car to get away being the 115-horse-power Thomas racer, driven by Le Blon. This car represented America, it having finished second in the elimination trial. Car No. 2, Mr. George Heath's Panhard, started one minute later. The third car was the German Mercedes, driven by Jenatzy. Lancia's Italian Fiat was fourth, and was followed by the remaining machines in the following order: Fifth, the Frayer-Miller racer, representing America; sixth, the French Hotchkiss machine, driven by Shepard; seventh, the second Mercedes, driven by Luttgen; eighth, Nazzaro's Fiat; ninth, Tracy's Locomobile; tenth, Wagner's Darracq; eleventh, car No. 12, the Italian Itala, driven by Cagno; twelfth, No. 14, the Haynes; thirteenth, No. 15, the French Clement-Bayard, driven by A. Clement; fourteenth, No. 16, Dr. Weilschott's Fiat; fifteenth, No. 17, Walter Christie's 50-horse-power Christie; sixteenth, No. 18, Duray's 120-horse-power De Dietrich; seventeenth, No. 19, Fabry's 120-horse-power Itala.

The fastest car in the first round appeared to be Wagner's Darracq, which covered the 29.71 mile circuit in 28 minutes and 26 seconds. Jenatzy's Mercedes was second in 30 minutes and 2 seconds; Duray, on the De Dietrich, being third in 30:18, and Lancia fourth in 30:27. The second round saw Duray pass both Lancia and Jenatzy and move into second place, while Lancia was 17 seconds ahead of Jenatzy at the end of this round. The Locomobile, America's chief hope, held twelfth place. The third round found the Darracq still in the lead with Duray, Lancia, and Jenatzy a close second, third, and fourth. The Clement-Bayard moved up from sixth to fifth place at the end of this round, while Christie, who stood seventh some 8 minutes behind the sixth machine (the Hotchkiss) was the foremost American car. The fourth round witnessed the passing of Duray by Lancia, who now held second place, with Jenatzy third and Duray fourth. When the race was half over the same order prevailed save that Duray was third, Jenatzy fourth, and Clement fifth. The Locomobile held tenth place, and the Thomas twelfth. The Haynes held fourteenth place and the Christie fifteenth. Clement, who had been running in fifth place since the second round, still held this position. In the eighth round Jenatzy changed places with Duray once more, taking third place instead of fourth. In the ninth round he crept up to fourth place, while Duray obtained third, and Jenatzy fell back to fifth. This order was maintained throughout the tenth round. This round was completed by Wagner in 4 hours, 50 minutes, 10 2-5 seconds, or at an average speed of 61.43 miles an hour, as against 61.49 made by the winning 80-horse-power Darracq machine last year. Lancia, with his 120-horse-power Fiat, was second in 4 hours, 53 minutes, 28 4-5 seconds, which corresponds to an average speed of 60.74 miles an hour, while Duray was third in 4 hours, 53 minutes, 44 2-5 seconds, or 16 2-5 seconds later. Clement was fourth in 5 hours, 1 minute, 59 4-5 seconds. Jenatzy, on his 120-horse-power Mercedes, was fifth in 5 hours, 4 minutes, 38 seconds, corresponding to an average speed of 58.51 miles an hour.

The race was witnessed by some 200,000 people, and the drivers experienced great difficulty in making fast speed on account of the crowds of people which flocked upon the course. At some of the turns in the straight-away stretches the crowd was so dense that the road was completely obscured, and the drivers were obliged to shut off power and slacken speed while the people moved slowly aside. This detracted considerably from the speed that would otherwise have been made. Tracy, the American driver, protested to Mr. Vanderbilt about this crowding of the course, and at one time the Referee threatened to call off the race on account of it. Although Tracy made very slow time on his first round because of the crowds, he subsequently, on his fifth round, made a record of 26 minutes 21 seconds, which was an average speed of 67.65 miles an hour—a remarkable performance in view of the ten dangerous turns.

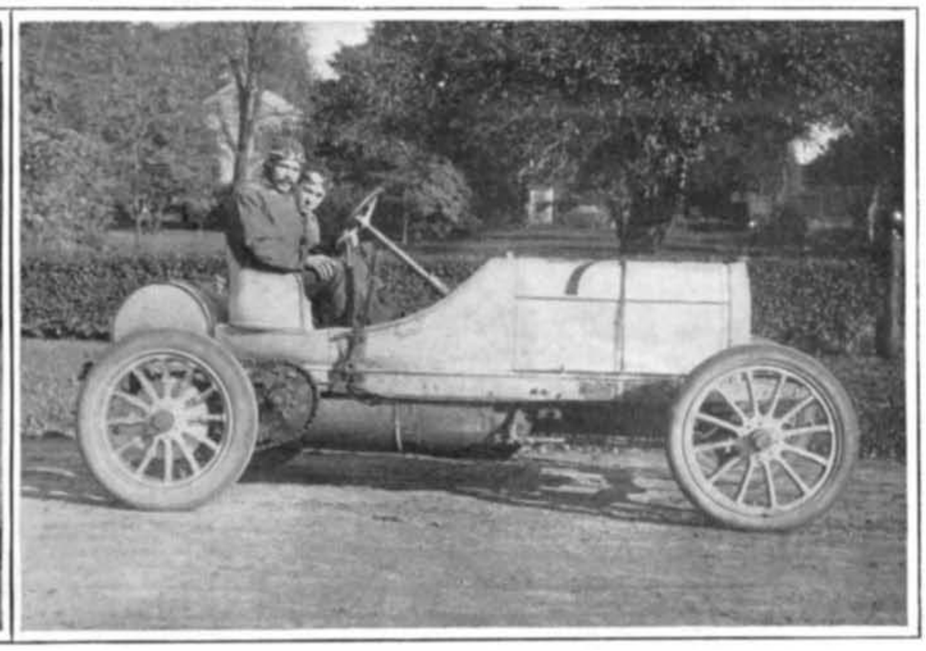
The race was a close one among the leaders from start to finish, but at no time during it did the American cars appear to have any chance of winning. Tire and other troubles were given as the cause of their falling behind. Not all of the American cars were fitted with detachable rims, so that tire trouble, no doubt, figured largely in the performances of some of them. Although the Locomobile showed the fastest speed, it did not make as even speed on the various rounds as it did last year. The Christie machine had the honor of being the American car to win a place nearest the front. At the end of the third round it had moved forward from the ninth to the seventh place. The showing of the two Mercedes machines was a good one, and was quite different from that made by these cars in previous years. Two of the Italian Fiat racers also made a fine performance; the third one, driven by Dr. Weilschott, broke its steering gear at the turn and hill near Manhasset, and ran through the wire fence into the crowd. A boy was killed, and two bicyclists had a very narrow escape. The driver and mechanic were thrown out and injured, although not seriously. Shepard's Hotchkiss also struck and killed a man shortly after making the turn at Mineola. These were the only fatalities so far as can be learned at the time we go to press. The wonder is that there are not many more on account of the crowding of spectators on the course. If the race is run another year in this country, the course should be thoroughly protected by a large number of soldiers, as is done in France.

The result of this race seems to show that France, Italy, and Germany are still a considerable distance ahead of America in the building of racing cars. When it comes to a touring car for pleasure purposes, however, there is but little to choose between a foreign machine and one built at home. As far as the perfecting of the touring car is concerned, the hard endurance tests which some makers give their cars are far preferable to a 300-mile speed contest like that held last Saturday. If these races must be held in the interest of sport, by all means let those conducting them protect the thousands of spectators who flock to see them, and who appear to be utterly unaware of the great dangers they are running in standing near to the racers as they flash by.



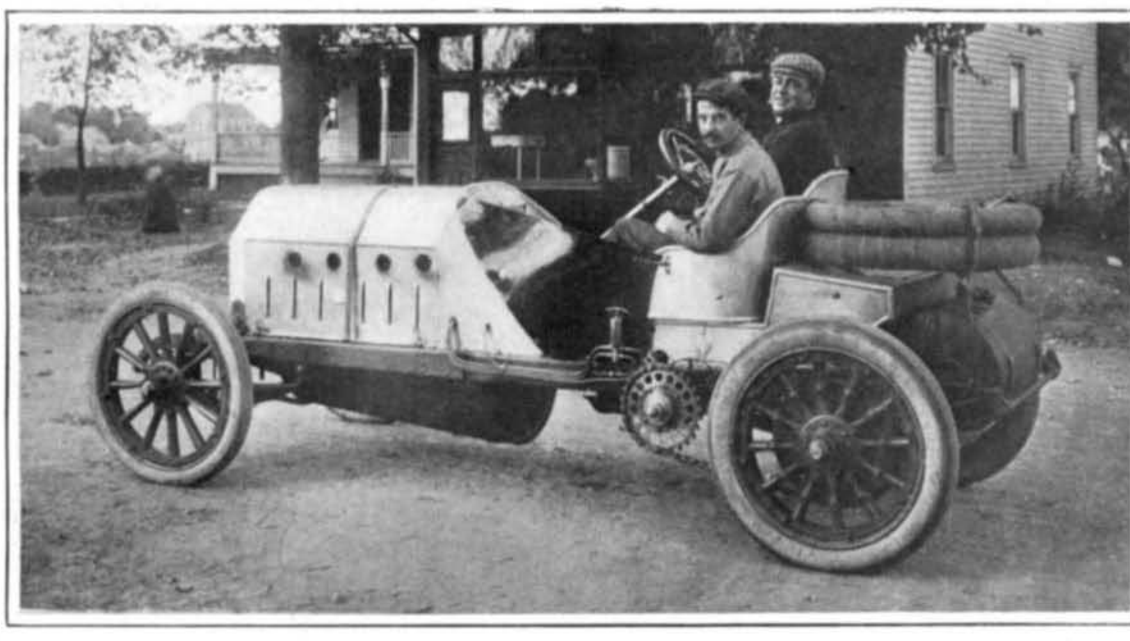
Shepard on His 130-Horse-Power Hotchkiss Racer.

This car struck and killed a man during the race. It was running 6th at the end of the 6th round, but in the following round it broke its crankshaft.



Luttgen on His 120-Horse-Power Mercedes Racer.

A duplicate Mercedes, driven by Jenatzy, was 4th in 5 hours, 4 minutes, 38 seconds—an average speed of 58.51 miles an hour. Luttgen was 12th at the end of the 7th round.



Lancia at the Wheel of His 120-Horse-Power Fiat Racer, Which Finished Second in 4 Hours, 53 Minutes, $28\frac{4}{5}$ Seconds—an Average Speed of 60.74 Miles an Hour.

Duray on the 120-Horse-Power De Dietrich. He Finished $16\frac{2}{5}$ Seconds Behind Lancia and Obtained 3rd Place.

THE WINNING FOREIGN MACHINES IN THE THIRD INTERNATIONAL RACE FOR THE VANDERBILT CUP.

THE TELTOW CANAL.

BY OUR BERLIN CORRESPONDENT.

The Teltow Canal, which has just been completed and is one of the largest artificial waterways ever constructed, is mainly intended to avoid the passage through Berlin in connection with the lively traffic going on between the rivers Oder and Elbe; and while shortening the way from the River Elbe to the Upper Oder by 15 kilometers (9.3 miles) and the journey Elbe-Upper Spree by 13 kilometers (8 miles) eliminates the difficulties encountered in draining such Berlin suburban communities as are situated to the south and west of the metropolis. Starting at the Glienicker Lake, it traverses the Lake of Griebnitz, from the upper end of which it follows the Beke Valley, and after cutting two roads and three double-track railways, passes through a large sluice situated at Machnow. After next traversing the villages of Lichterfelde and Steglitz and crossing the High Teltow, it continues its course through the western plains of the River Spree and the numerous Berlin suburbs situated there.

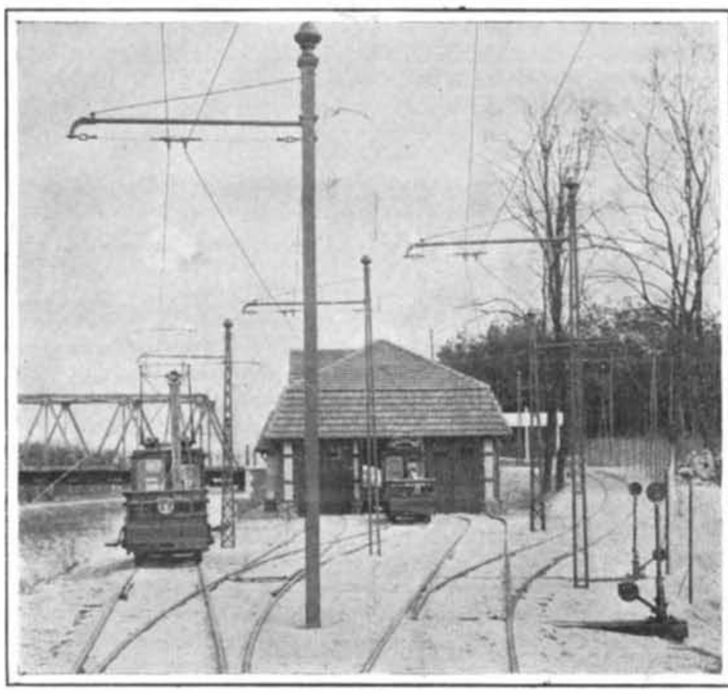
The cross section of the canal was designed in accordance with that of "standard" boats, that is, barges of 600 tons capacity, 65 meters (213.2 feet) in length, 8.6 meters (28.2 feet) in breadth, and 1.7 meters (5.57 feet) in draft. The useful breadth of the bottom was accordingly chosen as 20 meters (65.6 feet) with a depth of 2.5 meters (8.1 feet) beneath low water in the middle and 2.1 meters (6.6 feet) at the sides. The slopes have a gradient of 1:3 below water and 1:5 or 1:2 above water, according to the strength of the soil. On both banks runs a towing path 2 meters (6.56 feet) in breadth, the crest of which lies at 1.5 meters (4.9 feet) above high water. Beyond this path there is a protected strip 1 meter (3.28 feet) in breadth. An aggregate of nine railway bridges and forty-six viaducts has been constructed in connection with the main canal and its branches.

The sluice situated at Machnow is a most remarkable plant, chiefly because of the electric operation provided throughout, both for the syphons serving to fill and to empty the chambers, the lifting gates, and the special crabs facilitating the entering and issuing of vessels. Between the two chambers, each of which is connected to the upper and lower ponds by channels 2.46 square meters (26.5 square feet) in cross section, there is an outlet channel 25 cubic meters (883 cubic feet) per second in capacity, serving to discharge the Upper Spree in the case of high water.

The chambers are locked by huge vertical gates. A pump of one cubic meter capacity per second serves to carry the water used in the sluice back into the river Spree in the case of low water. The gates are moved in directions parallel and vertical to the axis of the sluice by two systems of rollers running in a vertical cast-iron guide. The gate elevator comprises an electrically-operated spur wheel winch with a shaft traversing the whole breadth above the gate, on which shaft the pulleys required in supporting the gate and their counterweight are placed. For the electric operation of the winch has been installed a rotary current motor for 220 volts tension (of 15-horse-power capacity with 600 R. P. M.) A switch designed like a railway controller serves to start it while the winch is cut off in the two terminal positions by terminal cut-outs actuated by the gates or counterweight tanks when at their highest position. These cut-outs at the same time serve to reverse the motor. A centrifugal cut-out has been provided to avoid any danger arising from an excessive speed of the motor.

The sluice is operated as follows:

The boats arriving at the sluice enter projecting wooden guides about 140 meters (459 feet) in length, whence they are carried into the sluice chambers by electrically-operated tractors or crabs running on the poles which project beyond the platform of the guides. The crab motor (11 horse-power) has been so designed as to insure a speed of 1 meter (3.28 feet) per second, with the largest canal barges; the crab is 1,500 kilogrammes (3,300 pounds) in weight. The current is collected in the way usual with traveling cranes, while the barges are connected to the crab by the hauling tow fixed on one side to the towing pole, and on the other to the drum arranged on the crab. A special advantage of crabs as against the capstans otherwise used is that the handling of long ropes is avoided, thus eliminating much risk to the operator. The sluice master, from a cabin situated in the middle of the platform, controls all the operations, signaling



The Switches Near the Locomotive Shed.

Shed for Electric Towing Locomotives

Towing Barges by Electric Locomotives on the Teltow Canal.

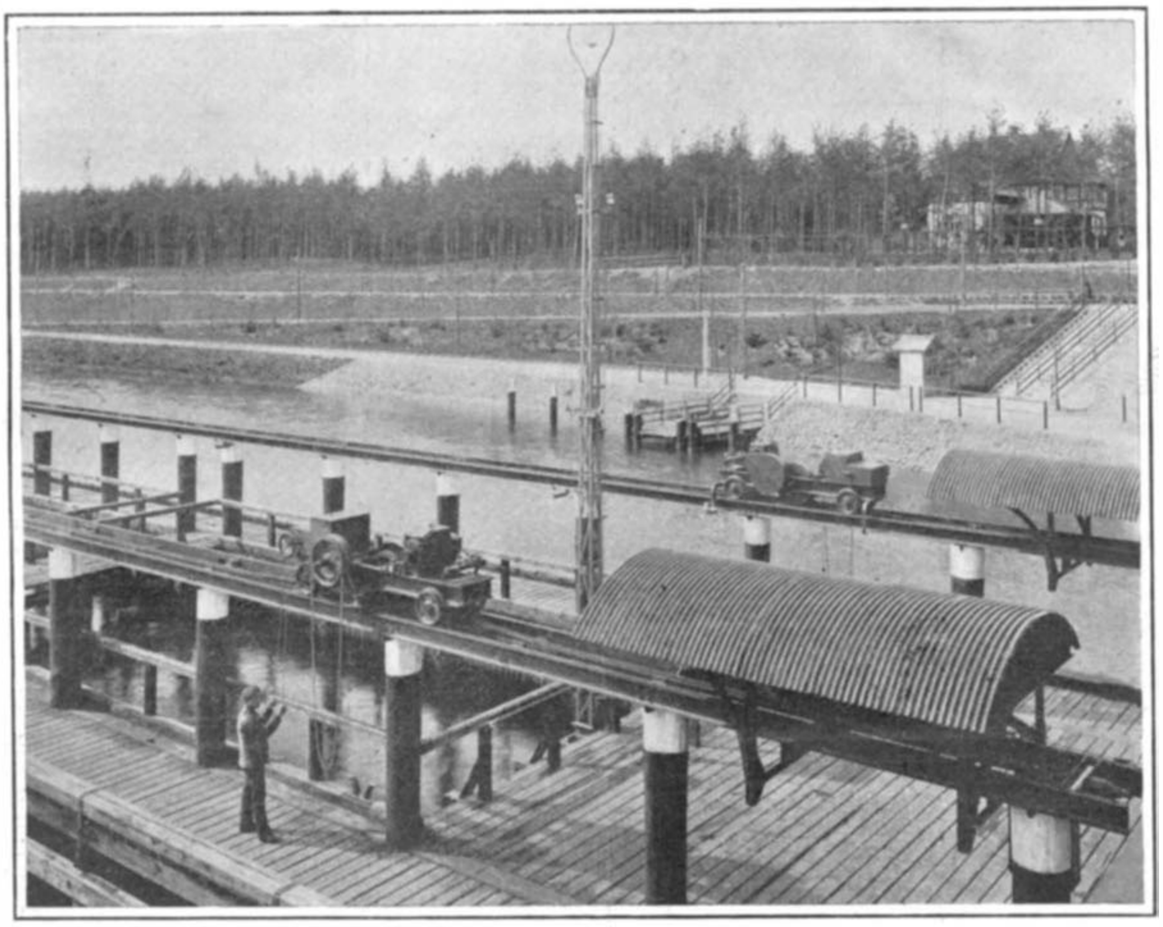
THE TELTOW CANAL.

by means of an electric bell and a green lamp signal "Gate off" to the operator in the switching room, who in order to acknowledge switches out both the bell and light. The signal "Stop" is given by means of bells and a red incandescent lamp only in case of emergency. To the south of the gates at the lower pond there is the transformer room, containing three transformers of 25 K. V. A. each for 6000/200 volts, one of which supplies the lighting current to the building close to the sluice, and the other the current for the operation of the fore-gate and for the lighting of the sluice. Three cables leading to the sluice building, switching room, and sluice master's cabin respectively start from the transformer room.

The total time taken by a barge in passing through the sluice, inclusive of its entering and issuing, is only 15 minutes. As the average load of a standard barge is 400 tons, the sluice is therefore able, allowing for a total of 270 working days in the year, to deal with an aggregate annual load of 8.64 million tons, which figure might be more than doubled by adopting a night service.

The Towing Service.—Trials made by Messrs. Siemens & Halske on the Finow Canal at the end of the nineties had shown the cost of operation of electric towing locomotives to be rather low, while the equipment of the plant entailed a most considerable outlay. In order, therefore, to secure a dense

(*Continued on page 268.*)



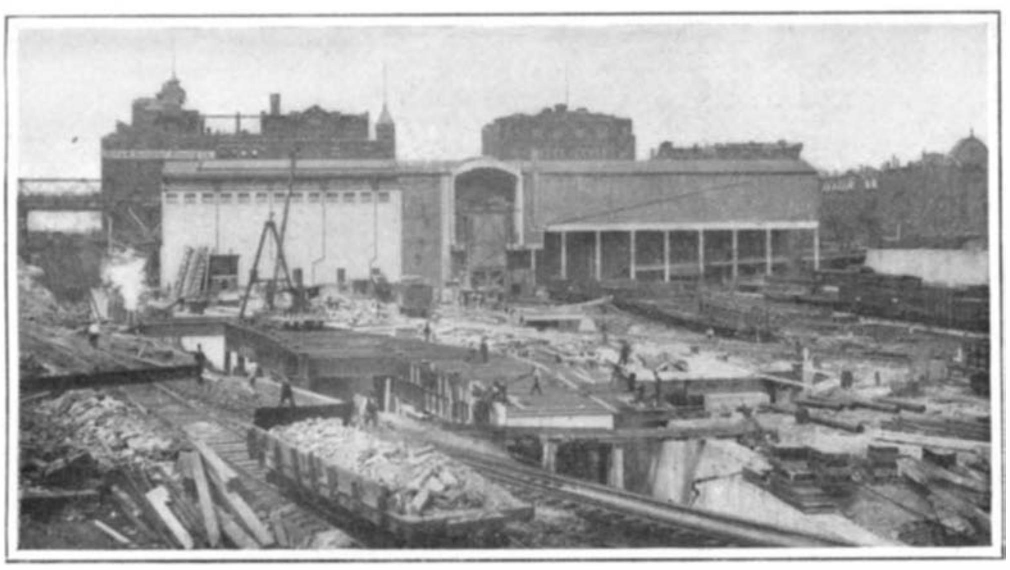
Electrically-Operated Tractors for Hauling the Barges Into a Double Lock.

THE TELTOW CANAL.

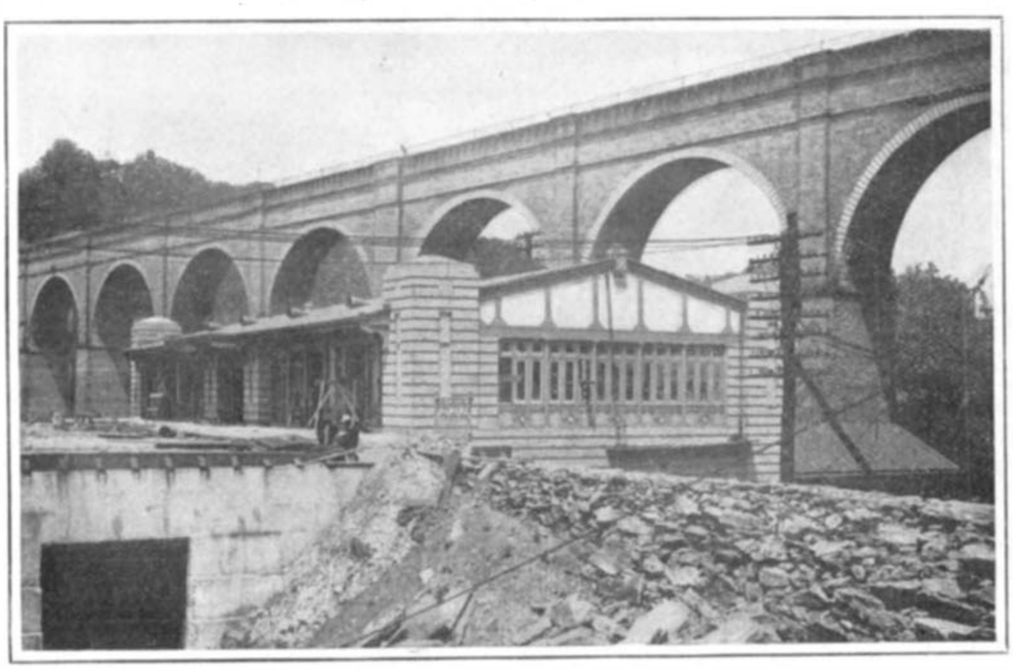
PROGRESS OF THE NEW YORK CENTRAL TERMINAL IMPROVEMENTS.

The entrance of the first electric train into the Forty-second Street station of the New York Central Railroad, which occurred on the last day of September, indicates that the first section of this great work of electrical equipment will be soon handed over to the operating department. It is true that this was merely a trial train, carrying the leading officials and guests of the New York Central Railroad, and that it ran over only what is known as the "first zone," which extends from Highbridge for a distance of 7 miles to the Grand Central station. It was of standard weight, however, being made up of eight Pullman and special cars, and weighed altogether 550 tons. The trip was made on schedule time, and served to indicate that the equipment is in running order and is capable of performing the work for which it is designed. It is the expectation of the company that the regular service will be operated electrically by about the 10th of November. The trains will be hauled by electric locomotives to and from Highbridge, where, for the present, the electric locomotives will be switched off, or on, as the case may be, and the steam locomotives take their place. Although only a portion of the whole electric zone will be operated in November, the work of equipping the system as far as Croton Landing on the main line, and White Plains on the Harlem branch, is well advanced, and it will not be long before the trains will be electrically operated between Forty-second Street and those two points. By the courtesy of W. J. Wilgus, vice-president of the company, we present a series of photographs showing the present condition of the work, and by way of making them clear we will briefly recapitulate the leading features of the whole plan of terminal improvement.

The new station yard commences at Fifty-seventh Street, where the tunnel has been excavated to the

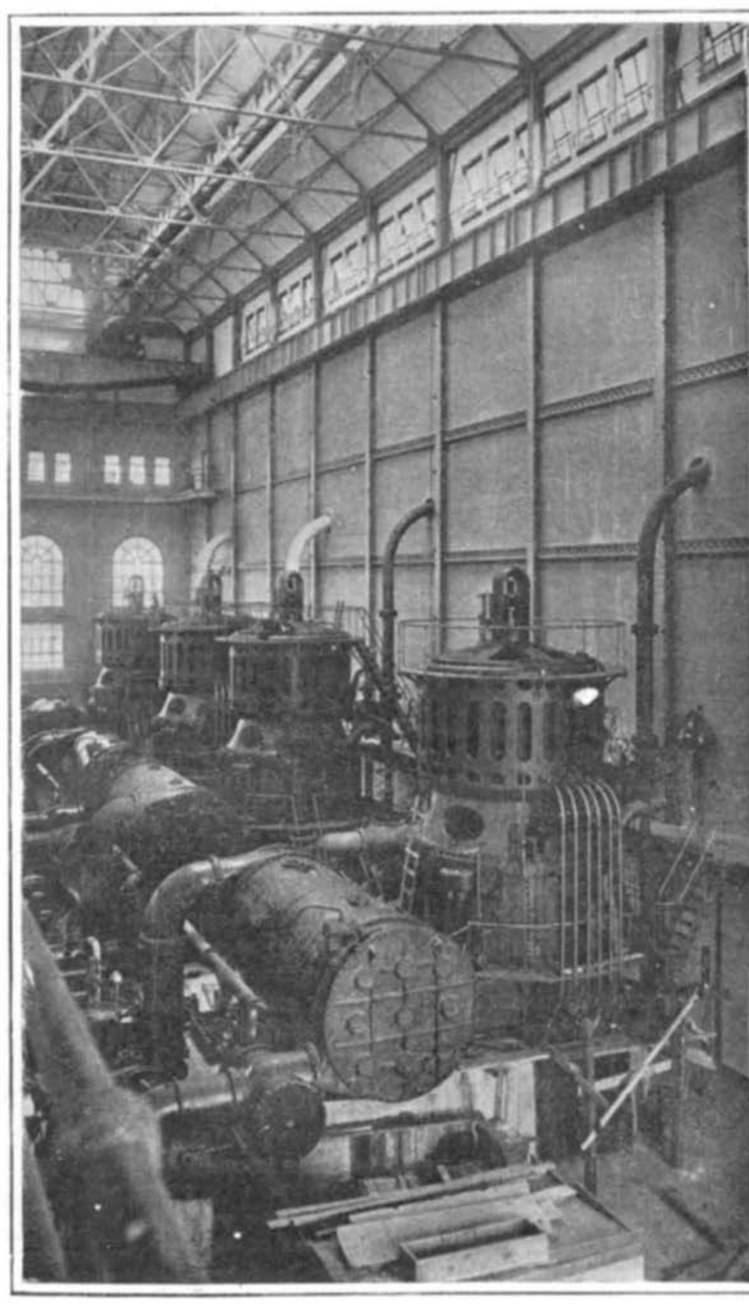


Northeasterly Portion of Grand Central Yard, Showing Sub-station, Express Level, and Steelwork Erected Above Suburban Level.



The tracks are built within the concrete structure, and the station is placed transversely above it. The sloping approach in the foreground is the unfinished street, which is to be carried over the tracks.

The New Highbridge Station.



This power house and that at Yonkers are built in duplicate; each will have sufficient capacity to operate the whole electric zone.

Interior View of Port Morris 40,000-Horse-Power Power House.

PROGRESS OF THE NEW YORK CENTRAL TERMINAL IMPROVEMENTS.

full width, 140 feet, of Park Avenue. This provides for ten parallel tracks, which will be continued down to Fiftieth Street, where they will diverge into the main yard, and occupy the space from Lexington Avenue to within 100 feet of Madison Avenue, as far down as Forty-third Street. From Forty-third Street to Forty-second Street the station ground will be bounded by Vanderbilt Avenue on the west, and by Depew Place on the east. Both the station and the yard will be built on two levels, the upper level being devoted to express tracks and covering practically the whole of the area above described, the lower level being reserved for the suburban trains. Of the four tracks in the Park Avenue tunnel, the outer two, which will be reserved for incoming and outgoing local trains, will lead to and from the suburban level by means of two inclines built on a two per cent grade.

The terminal station will be a monumental structure, with a frontage of 300 feet on Forty-second Street, and 680 feet on Vanderbilt Avenue. All of its accommodations have been planned on a vast scale, with a view to meeting the future increase of traffic. The ticket lobby will be 90 feet wide by 300 feet in length, the grand concourse 160 feet wide by 470 feet in length, with a clear height from floor to ceiling of 150 feet. To the north of the station building and over the tracks will be erected a vast office building, of the same architectural characteristics as the main station building, and with sufficient accommodation for the officials and the army of professional and clerical employees of the company.

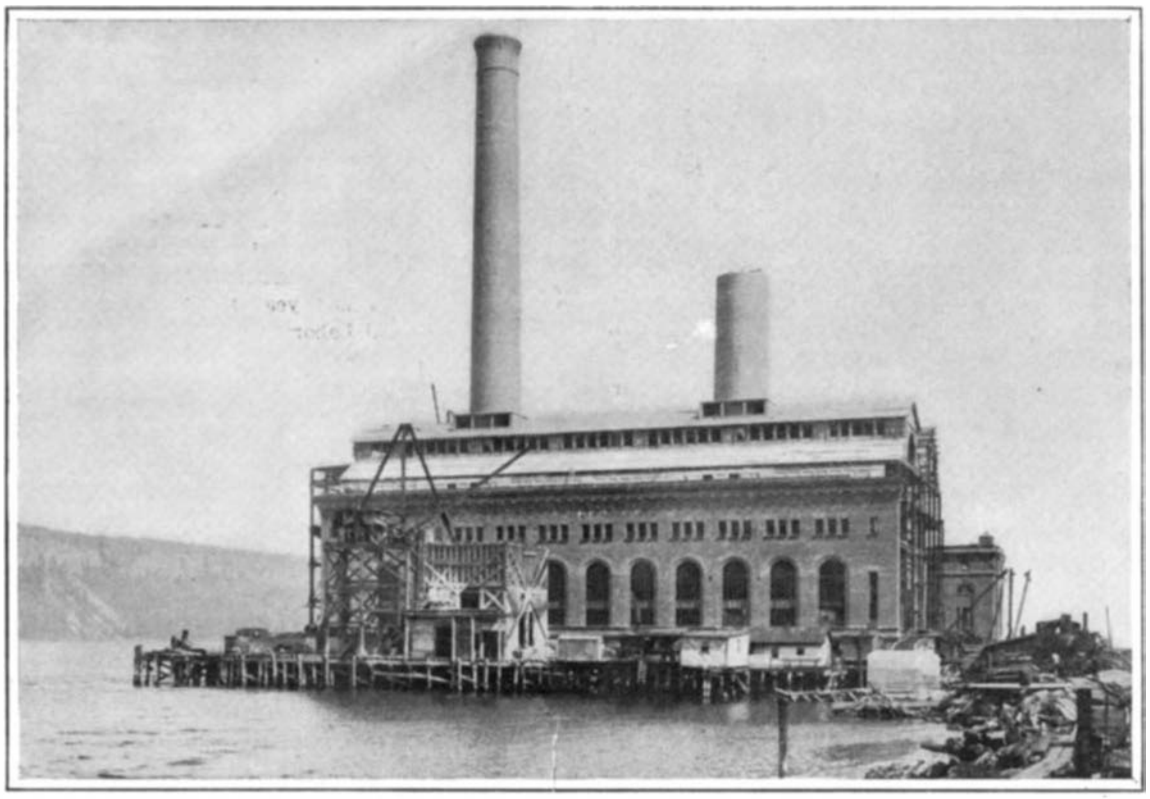
In order to meet the requirements of the city as to restoration of the streets, the whole of the upper or express level of the station and yard is being lowered 15 feet below the present track level, and the suburban tracks will be 20 feet below this, or 35 feet below the present level. This, however, does not represent the vast amount of excavation that is being done; for within the area of the new yard was included much ground that extended considerably above the average level of the old yard. The total amount of estimated excavation is 2,000,000 cubic yards, and of this over 25 per cent has been taken out.

The work which has been done to date at the terminal has consisted of the widening out of the yard entrance to the full width of Park Avenue, and the excavation of the easterly portion of the express and suburban station yard. At present, practically all of the east side of the 43-acre upper yard has been carried down to its final grade at an average depth of about 30 feet below street level, and excavation is now being done at a depth of 50 feet below the street on the 20-acre low-level yard. The company is completing this easterly portion of both upper and low-level yards first, and building a temporary station beneath the Grand Central Palace, with a view to shifting the traffic over to this portion of the yard and operating it electrically. The excavation of the central portion of the yard and the construction of the main station will then be carried on, and when this is completed the westerly section will be attacked.

The approach to the temporary station and the upper and lower yard levels is shown in two of the accompanying photographs, one of which is taken looking north, and the other south. The tracks which lead from the tunnel to the yard extend on a falling grade past a series of large buildings to the east of Park Avenue, among which are the Steinway factory and a large brewery. The excavation involved some heavy underpinning to these buildings, all of which has now been completed and faced with the heavy I-beams and concrete retaining wall, illustrations of which have been given in our previous articles on this work. The steel work which carries the upper level has, most of it, been put in. The work is being carried forward so rapidly that the whole of the open cut, shown in our view of the excavation looking south, has been roofed over since the photograph, a very recent one, was taken. The yard is bounded along its easterly side by a heavy concrete retaining wall of an average height of 21 feet, and this wall extends from the Grand Central Palace to the large sub-station known as No. 1, which forms the background of the accompanying view of the station yard looking north. The sub-station consists of two buildings in duplicate, with a 30-foot opening between them at the center. Each building is 200 feet in length by 40 in width and 100 feet high, and here will be housed the transformer and converter plant for the use of the yard and tunnel.

The most advanced portion of the work is the construction of the two power houses, each of about 40,000 horse-power capacity, one at Yonkers, and the other at Port Morris. At present each of these is being equipped with four Curtis turbine generators; and there is provision for two other units in each of the plants, making in the two stations a combined capacity of over 80,000 horse-power. The Port Morris station is complete and ready for operation. That at Yonkers is in an advanced stage of construction, and will be all ready for operation within a few weeks' time.

The rolling stock equipment for the electrical service will consist of 95-ton electric locomotives of 2,500 horse-power. This is 1,000 horse-power greater than that of the most powerful express steam locomotives of the New York Central Company. The locomotives will be used for hauling express trains between Forty-second Street and Croton Landing. The suburban service will be operated by all-steel motor cars, similar to those developed on multiple-unit, urban, rapid-transit railways. Each car will seat sixty-four persons, is equipped with two motors, lighted and heated electrically, and in the summer will be ventilated and cooled by electric fans. The belief that the new service will be marked by all those well-known advantages that come from the use of electric traction was verified during the trial trip of the special train, referred to at the opening of this article, when the freedom from jolt in starting and the rapid acceleration and general smoothness of running were very noticeable.



Yonkers 40,000-Horse-Power Power House on the Hudson River. The Engine Room Will Contain Six Curtis Turbo-Generators.

View of Excavated Easterly Portion of Grand Central Yard Looking South, Showing Suburban Level and Steelwork for Carrying Upper Express Level. The Retaining Wall to the Left Fronts on Lexington Avenue.

PROGRESS OF THE NEW YORK CENTRAL TERMINAL IMPROVEMENTS.

THE TELTOW CANAL.

(Continued from page 267.)

traffic, a monopoly was obtained from the District Council.

The type of electric towing locomotive adopted comprises a front truck, each of the axles of which is driven by a series motor of 8-horse-power permanent output, with 800 R. P. M. at 550 volts, its operation being effected through a double toothed-wheel gearing. At the back there is a freely-moving axle. The underframe carries a horizontal shaft on which the towing pole is carried vertically and operated by means of a 3-horse-power motor with spur wheel gearing and screw and nut drive. The towing rope is wound up on a drum operated by a 3-horse-power motor through worm wheel gearing, which is connected to the shafts by means of a friction clutch, the springs of which are so adjusted by hand as to have the drum turn round the shaft, the rope being gradually disengaged from the drum as soon as a pull of 1,200 kilogrammes is exceeded. As in starting a pull of about 2,000 kilogrammes (4,400 pounds) is required to deal with a fully-loaded 600-ton barge, the rope is accordingly disengaged gradually, thus avoiding any violent shock. The weight of the locomotive is 7,500 kilogrammes (16,500 pounds). Its design is entirely different from that of the experimental locomotive used in connection with the Finow Canal trials, its output being moreover considerably higher, while even the auxiliary operations are carried out by the aid of electricity.

The current operating the locomotive is branched off behind the lightning arrester and induction coil and goes on, first, to the motors serving to lift the towing pole; second, to the motors operating the rope winch; third, to the electric lighting system; and finally, through a fuse and self-acting switch-out, to the controller of the two traveling motors. The locomotive has been designed for conveying two standard barges with an aggregate useful load of 12,000 pounds at a speed of about 4 kilometers (2½ miles) per hour, or four Finow barges with about 8,000 kilogrammes (17,600 pounds) at a speed of 4.5 kilometers (2.8 miles).

As the canal traverses two extensive lakes on which the use of electric towing locomotives was out of the question, propeller operation had to be resorted to on these sections. Several solutions of this problem were tried; viz., first, an electrical three-screw towing barge deriving its energy either from an accumulator battery carried on board or from two different types of trolley wire; second, an alcohol-operated barge; third, a suction gas boat of the Körting system; and finally, a towing steamer, the boiler of which was fired by means of coal-tar oil.

The economical results of the experimental service failed to warrant the adoption of the electrical barge, in spite of the obvious advantages of electric operation. It is, however, contemplated to continue these trials, and eventually to adopt this interesting system of towing on the two lakes. For the moment, the current consumption is about three times higher than in the case of the locomotives. The alcohol barge was found to be quite impracticable, while experiments begun on the suction gas towing barge had to be temporarily discontinued in view of the inefficient design of the motor. The ordinary towing steamer was, however, found to be quite satisfactory. Its fireplace, designed on the Körting system, consists mainly of a nozzle in which the oil, having been pulverized under pressure, is thrown out in a fine veil. A smokeless combustion and most economical fuel consumption is insured by fitting a preheater, while the boilers are equipped with superheaters. The consumption of heating oil was found to be about 0.5 kilogramme per horse-power-hour.

Alcohol from Corncobs.

The Department of Agriculture is developing a new industry in the production of alcohol from corncobs, which, the Department says, promises to be of much commercial value. Investigations are being made at Hoopeston, Ill., and have proved that the large quantities of corncobs which every year go to waste can be made to produce alcohol in sufficient quantities to justify the erection of a distilling plant in connection with a corn cannery.

So far the Department has succeeded by simple methods of fermentation in getting a yield of 11 gallons of alcohol from a ton of green cobs, and, by similar methods, in getting 6 gallons of alcohol from a ton of green cornstalks. A Department official says that these tests show that there are 240 pounds of fermentable substance in a ton of green field cornstalks, which will yield about half of their weight in absolute alcohol. In round numbers, a ton of stalks will produce 100 pounds of alcohol or 200 pounds of proof spirits. As a gallon of alcohol weighs nearly 7 pounds, there should be 15 gallons of alcohol in a ton of stalks. The addition of the corn on the cob adds further to the possibilities of alcohol obtainable from a ton of cobs, and will have its influence in bringing the quantity to a greater figure.

Radio-Activity and Purity of Springs.

There are known to be springs that, while issuing from fissured and cracked soils and which hence would seem fated to contain microbes, contain scarcely any of the latter; particularly is this true of bacilli *coli communis*, which indicate a contamination by fecal matter and cause typhoid fever. The springs of Avre are to be classed with such water sources, and two chemists, Messrs. Dienert and Bouquet, accordingly investigated the springs. The result of their researches has been communicated to the Académie des Sciences. It would seem that there is some connection between the purity of a spring and its radio-activity. The springs of Avre are all radio-active; the purest of all, that of Breuil, is more radio-active than the others. It may be, therefore, that pure springs owe their poverty in microbes to their radio-activity. Is this the indication of a possible method of purification of waters? At all events, there might be a supplementary means of assuring ourselves of their harmlessness to the public health.

Official Study of Earthquakes.

A state institution for the study of earthquakes was founded last year in connection with the Hamburg Physical Laboratory. The institution has been erected at the cost of a private citizen of the town, and has recently been opened. It corresponds with 245 other institutions of a similar character in various parts of the world, and more especially with the German Imperial Central Earthquake Institution at Strasburg in Alsace.

Experiments are being made at the Auszenjade Lightship with a bell fixed beneath the surface of the water, to ascertain how far sound signals interfere with one another.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

DRAFT APPARATUS.—H. JOHNS, Troy, Pa. In this case the invention is an improvement in draft apparatus designed for immediate use for all kinds of hitching on farms, in lumber woods, or elsewhere where it is desired to readily connect the timber with the load. The construction is simple, easily applied, and can be adjusted for use in almost every location where a draft apparatus of the sort is desired.

CLEANER FOR DISK HARROWS.—A. C. GAYLORD, Galesburg, Ill. The invention refers particularly to that class of disk harrows in which the disks are arranged in gangs and are provided with individual scrapers by which the earth and trash accumulating upon the disks is removed, its object being to produce a device which shall be efficient and one in which the scrapers can be adjusted to meet varying conditions.

Of General Interest.

RECORD KEEPING SYSTEM.—M. D. POLLOCK, Decatur, Ill. The principal object of the invention is to provide a ledger or permanent record line on a suitable portion of a series of original bills or record slips, said slips serving as the permanent ledger record. A convenient system of filing the record slips is provided in such a way that the desired record which is usually posted in a ledger can be set up in ledger form without rewriting it, and so that it will appear in regular order as posted from time to time. It is, therefore, unnecessary to make any copy of the record in posting, this being done by moving the original bill or record slip from the bill pad to the desired ledger pages or files. An index guide is also provided for each page or file.

UMBRELLA-STAND.—T. L. MONAGHAN, New York, N. Y. In the present patent the object of the invention is the production of an umbrella-stand which is simple of construction and which will enable umbrellas to set conveniently therein with the tips uppermost; which facilitates the draining of the water toward the handle.

VALVE ATTACHMENT FOR FOUNTAIN-PENS.—F. O. CONILL, New York, N. Y. The principal object of the invention is to provide a device which can be applied to ordinary pens without changing any of their existing parts, and which can be removed from them to permit the pen to be put together without the valve and not necessitate the use of any additional parts or the modification of the existing parts of the pen.

DENTURE.—R. M. CRAIG, Dennison, Ohio. One purpose of the inventor is to provide a porcelain tooth or facing so shaped that the backing can be quickly and conveniently applied thereto and readily set to the tooth in such manner as to be a fixture therein and wherein the backing when in position will be hidden from sight at the front of the body.

PORTABLE GRAIN-SPOUT FOR ELEVATORS.—G. W. BAIER and C. D. BAIER, Cissna Park, Ill. In this patent the invention is an improvement in the class of grain spouts or conductors which are adapted to telescope and to be adjusted or placed at different angles or inclinations, so as to deliver grain into different bins or receptacles as conditions may require.

WALL CONSTRUCTION.—J. G. VON HOFE, New York, N. Y. This invention has reference to a wall construction especially adapted for use with concrete veneered walls. The principal object of the invention is to provide means whereby building-blocks can be readily and permanently attached to the surface of a wall formed of continuous masses of concrete or other plastic material.

SHELF.—PAUL STEEG, Danzig, Germany. An essential part of the invention consists in the means employed whereby each shelf is clamped at any desired height upon the columns by the weight of the shelves and that of the load resting on the same. The shelves are suspended from above, each one being supported by the means employed for clamping it. By this arrangement the center of gravity of the loaded shelf is situated below the place where the clamp is situated.

JEWELRY-CASE.—H. W. SMITH, Newfield, N. J. This improvement is in cases for holding and displaying necklaces or other chains, the object being to provide a device that will be neat and attractive in appearance and so constructed as to firmly hold on its outer side the portion of a chain to be displayed and having a chamber for receiving the surplus portion of the chain.

APPARATUS FOR THE PRODUCTION OF CARBURETED AIR.—A. PERRIER, 47 Place St. Michel, Marseilles, France. The apparatus is located in a cabinet and comprises a device for forcing atmospheric air into a container, the device being operated from a motor within the cabinet. An air collector relieves the air of impurities and from it the purified air is conducted to a heater within the air tank. Heated air is conducted from the latter to carbureter boxes, and means supply each box with a hydrocarbon fluid with which the air is saturated to form a gas. This fluid is supplied to a distributer, and the gas formed in the boxes is collected in a receiver, whence it is conducted to a gas-holder and thence through a conductor to any place for consumption or utilization.

BARREL-CARRIER.—J. FRAVEL, Dayton, Ohio. The invention pertains to package-carriers; and its object is to provide a carrier arranged for convenient and quick attachment to one or two barrels, to enable a workman to readily carry two empty barrels with the use of but one arm and hand, and to permit two workmen to carry a filled barrel with ease.

JUVENILE SAVINGS-BANK.—W. G. HOLMES, New York, N. Y. The invention has reference to toy money-boxes; and its object is to provide a juvenile savings-bank which is simple and durable in construction and exceedingly ornamental and arranged to stimulate saving by constantly reminding children and other persons of a home that may be owned if money is saved.

Hardware.

DOOR-LOCK.—J. H. SIMMONS, Talmo, Ga. The objects in this invention are to provide a lock that may be adjusted for either the right or left hand side of a door, that may be used as an automatic latch which may be opened by either knob, and that may be used as a lock operated from the inside knob, and locked from the inside of the door without a key, but which cannot be unlocked from the outer side excepting with a suitable key.

Household Utilities.

FLY-ESCAPE.—A. W. SALOKAR, Lewiston, Idaho. In this instance the improvement refers to a device adapted to permit flies readily to escape from a room or other inclosure and to prevent them from entering at the same point. The invention may be attached to a window-screen or applied to any opening independently of a screen.

TABLE-SYRUP.—V. M. BACA, Denver, Col. This new food compound is in the form of a table-syrup designed for use on griddle-cakes and the like; and it consists in a new product of a very palatable character and high dietetic quality and one which also has a certain therapeutic value, there being no hurtful mineral ingredients and no low-grade adulterants.

Machines and Mechanical Devices.

STAIR-ROUTING MACHINE.—S. P. WOOLF, Omaha, Neb. Supporting-frames being clamped upon a stringer, the carriage is adjusted, and the brace-chuck applied to the upper end of an inclined shaft. Pressure of the shoulder against end of the chuck tends to drive the bit forward, exerting a downward force thereon to hold it more firmly in the groove it cuts. In a five point bit, the cutters slant from the bottom upward and incline toward the shaft and the lower edge of each cutter is a point standing at approximately a right angle with the cutter. Points cut the grain of the wood in advance of cutters and when one cutter just leaves work the succeeding one is at full cut, the third just entering.

ART OF MAKING BUTTONS.—W. S. WATSON, Memphis, Tenn. A circular or other kerf is formed in the shell and simultaneously the shell bounded by the kerf is dressed to form the face of the button. The kerf is of depth equal to or greater than thickness of button. After these operations a portion of the back of the shell is ground away or otherwise removed, forming a cavity therein extending along a plane surface and extending through to the kerf first made. Thus the button is simultaneously separated from the shell and the back of the button dressed. The button is now formed excepting the thread-holes, which are drillable at any time and in any desired manner.

JOURNAL-BEARING.—F. LATULIP, Syracuse, N. Y. Rubbing surfaces of mica set edgewise to the revolving surfaces are employed. Mica has been heretofore employed but not with satisfaction on account of difficulty of retaining and holding in place the thin laminæ of mica whose smooth surfaces slip upon each other. The invention consists in the arrangement of the blocks of mica sheets and treatment of same designed to secure coherence of the sheets and unity of the blocks as a composite structure.

PACKING APPARATUS.—A. L. HOLTON, Norfolk, Va. The invention relates particularly to apparatus such as covered in Mr. Holton's former patent, and comprising a counting device and means operated from the same for delivering separating-strips to separate a pile into desired divisions; and the present invention relates to certain parts designed to secure the delivery of the strips in a purely mechanical way and without the necessity of any electrically-operated devices.

SHIFTING DEVICE FOR TYPE-WRITING MACHINES.—J. B. SKEEN and J. M. GRAFTON, San Francisco, Cal. This invention relates to a device to be applied to type-writing machines which have a single keyboard requiring the operation of one or more shifting-levers in order to provide for printing the upper and lower case characters. The device operates these levers by a simple movement of the knee, thereby leaving the left hand free for manipulating the keys and securing those advantages at small expense and little attention to the operating parts.

Pertaining to Recreation.

AMUSEMENT DEVICE.—E. H. LANIER, Memphis, Tenn. In operation the cars are pushed out of the chute and start toward the bottom of a platform and are engaged by obstructions and deflected here and there, meeting other obstructions, until they reach the bottom. The circular form of the cars and peculiar arrangement of wheels permit the cars to revolve or run in any direction without overturning. Padding prevents injury to the occupants, and the incline angle permits the cars to descend gently, so that contact with the posts will be gentle, but still sufficient to cause the car to rebound with its passengers.

AMUSEMENT APPARATUS.—F. W. THOMPSON, New York, N. Y. An object of this inventor is to provide a device in the form of an inclined chute or slideway down which a person may slide with increasing momentum from top to bottom, with pleasureable excitement without danger of injury. Another object is to construct a slideway of a material having inherent and lasting slipperiness or smoothness, thereby obviating the use of polishing substances.

GAME.—O. HENRICHSEN, New York, N. Y. The purpose of the invention is to provide a game by which many and varied situations may be brought about with respect to one or more movable objects employed in playing the game, and, furthermore, to so carry out the main features as to render the game of physical benefit, the tendency being to expand the lungs when the player is in action.

Pertaining to Vehicles.

WHIFFLETREE-HOOK.—J. G. MYERS, Mancos, Col. The snap-hook comprises a tongue having at its butt the eye for a bolt connection, at its point end a laterally-extending and transversely-curved head-plate, and in advance of its butt-eye an upwardly-projecting lug and the hook pivoted at its butt-end to the lug, extending thence forwardly over the head of the tongue and turned beneath the head with its point bearing in the hollow.

CUSHION-TIRE FOR VEHICLE-WHEELS.—L. H. BARRY, Durango, Mexico. The inventor employs a wheel rim or felly of special construction in direct association with the outer face of which he employs a set of directly-adjoining metallic springs together with means for securing the same to the rim. Connected to the springs are metallic springs of another set also of special construction and directly adjoining each other, combined with which are means for connecting them together continuously about the circumference of the rim by which to derive the direct cushioning effect as well as a uniform tread.

Designs.

DESIGN FOR RUBBER MATTING.—A. J. WHISLER, Goshen, Ind. Mr. Whisler has designed a rubber matting, involving parallel rows which are striped diagonally in reverse direction, giving the pleasing effects of contrasting shades, and having longitudinal ornamental borders at its opposite edges.

DESIGN FOR A FINGER-RING.—J. L. HERZOG, New York, N. Y. This inventor has secured a design patent for an ornamental finger-ring. In the front of the ring the heads of two animals with wide open mouths touch. On their lower teeth rests a precious stone. The band of the remaining part of the ring is plain.

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

Business and Personal Wants.

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

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8396.—Wanted, manufacturers of a newly invented rotary gas engine of 8.2 h. p., the cylinder being contained within a 12-inch fly wheel.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 8397.—Wanted, a machine for making tamales.

J. C. Sparks, B.Sc., F.C.S., Chemical Expert. See adv't.

Inquiry No. 8398.—For manufacturers of floor scrapers and smoothing devices.

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

Inquiry No. 8399.—Wanted, a machine, similar to a typewriter, for the use of the blind, for writing musical scores.

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

Inquiry No. 8400.—Wanted, manufacturers of vapor head screws.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8401.—Wanted, makers of distilling apparatus, of all kinds.

Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods, Dies and Metal Stampings our Specialty. 43-47 S. Canal Street, Chicago.

Inquiry No. 8402.—Wanted, a machine for ornamenting glassware, and having a platinum point to be heated to white heat.

The celebrated "Hornsby-Akroyd" safety oil engine. Koerting gas engine and producer. Ice machines. Built by De La Vergne Mch. Co., Ft. E. 138th St., N. Y. C.

Inquiry No. 8403.—Wanted, quotations for printed boot polish tins to hold one and two fluid ounces.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8404.—Wanted, a machine for barking logs.

Inquiry No. 8405.—Wanted, the outfit and apparatus for making and plating royal silver metal.

Inquiry No. 8406.—Wanted, the address of the manufacturers of the Munson typewriter.

Inquiry No. 8407.—Wanted, tubing butt seam or lap seam, ⅜ inch outside diameter, No. 24 gauge B & S, steel or galvanized iron; wanted in 2-inch lengths.

Inquiry No. 8408.—For manufacturers of sheet celluloid, folded or pressed into tubes or U section.

Inquiry No. 8409.—Wanted, manufacturers of flock machinery.

Inquiry No. 8410.—Wanted, a manufacturer of machinery for making confetti.

Inquiry No. 8411.—Wanted, manufacturers of machinery for making clock movements; also of those who do metal stamping of clock movement parts.

Notes and Queries.

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10174) M. W. and C. P. write: We would like to know, through the columns of, your valuable paper, how a boiler of 15 horse power, that is only in use about three months during a year, should be left. Should it be filled with water or empty, and should the smokestack be protected? A. A boiler to be laid up for a season should be thoroughly cleaned on the inside, filled with water with steam on, so as to be full of hot water that has been boiled, up to the safety valve. The flues and fire surface of the boiler should then be cleaned; ashes and soot removed from every part where such lodge. Then close fire doors, ash pit, and put a cap on the smokestack. With this treatment laid-up boilers do not rust inside or outside. It is the moist air drawn through a laid-up boiler that does damage by rust.

(10175) C. F. C. asks: 1. Are lantern slides (which are printed by contact) more sensitive to the light than carbon velox? For instance, a plate that printed a good clear picture on carbon velox in 15 seconds, being held 12 inches from a large size house lamp, would a lantern slide take longer or shorter time to print it? A. Lantern slide plates are always slow plates, much less sensitive than ordinary plates. A longer exposure is required. 2. Have you a SUPPLEMENT telling how to make lantern slides? A. We can send you "Photo-Miniature Lantern Slides," price twenty-five cents, and Elmendorf's "How to Make and Color Lantern Slides," price $1 by mail. We can send you SUPPLEMENT 483, 517, 724, 1062, 1082, on slide making, for ten cents each. 3. Also, how to make a lantern slide camera for making slides from 4 x 5 negatives? A. SUPPLEMENT 625 tells how to make a bellows for a camera to take 4 x 5 negatives, and in Elmendorf's book there is a chapter on working with a camera in slide making. 4. Is there a magic lantern made which takes standard slides and burns oil for the light? Is this done, and are the pictures clear when thrown on the screen? A. Yes. The pictures cannot be enlarged more than four feet in diameter with oil lamps since the light becomes so faint by diffusing it over so large a screen.

(10176) E. E. S. asks: 1. What is the best way to mount a map on a muslin backing, and would a window shade be suitable? A. Moisten the muslin, stretch and tack it down on a table. Then wet the map thoroughly and apply the paste evenly over the entire back of the map, being very careful to bring it to the edges of the paper. Now lay the sheet on the cloth and smooth it out and rub it down upon the cloth and smooth it out and rub it down upon the cloth so as to remove air bubbles and bring it into contact with the cloth. A roller or squeegee such as is used for mounting photographs will answer to do the job much better. 2. How can I produce on brass the bronze-like finish used on the instruments of surveyors and engineers? A. Bronzing of brass by dipping in a solution of 5 drachms of perchloride of iron to 1 pint of water, until the desired color is obtained; then wash in hot water, dry, and lacquer with a thin shellac and alcohol varnish.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending October 2, 1906.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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Alcohol

Its Manufacture
Its Denaturization
Its Industrial Use

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