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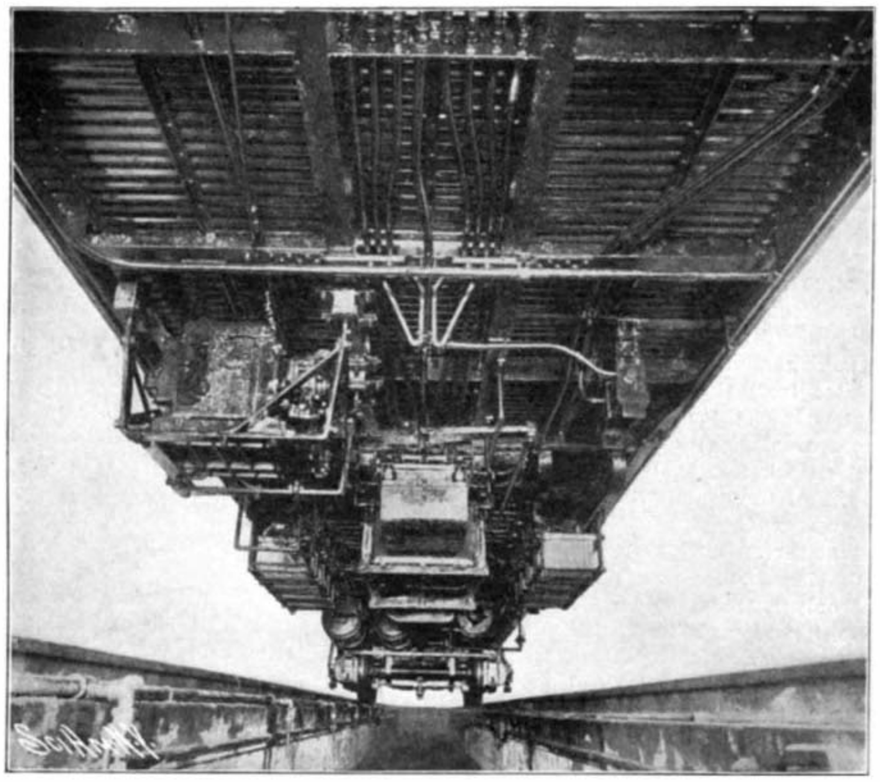
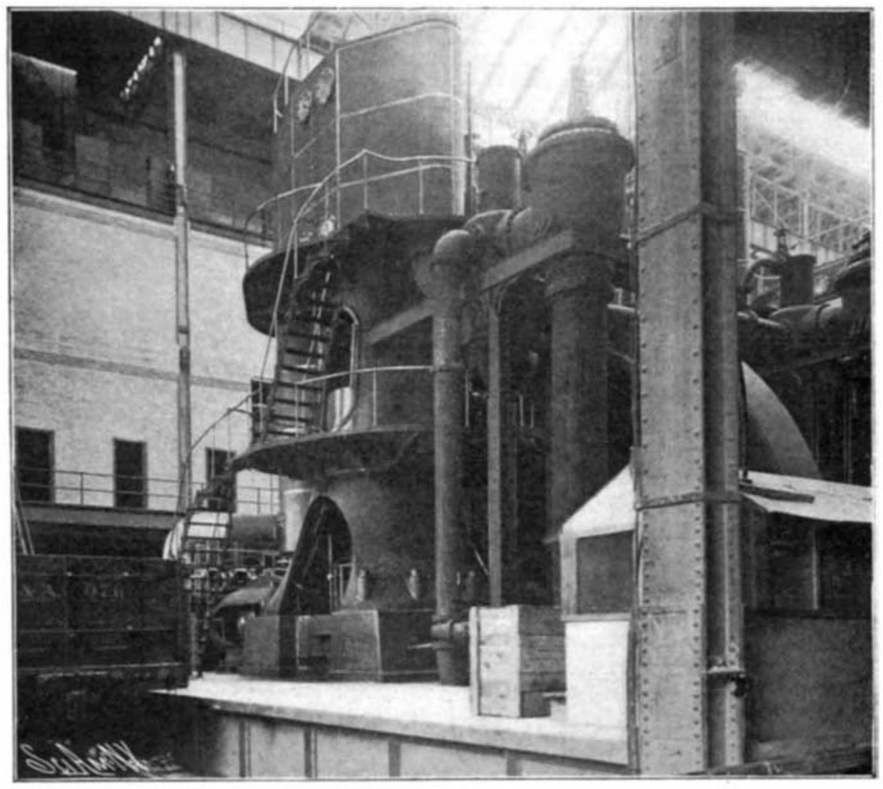
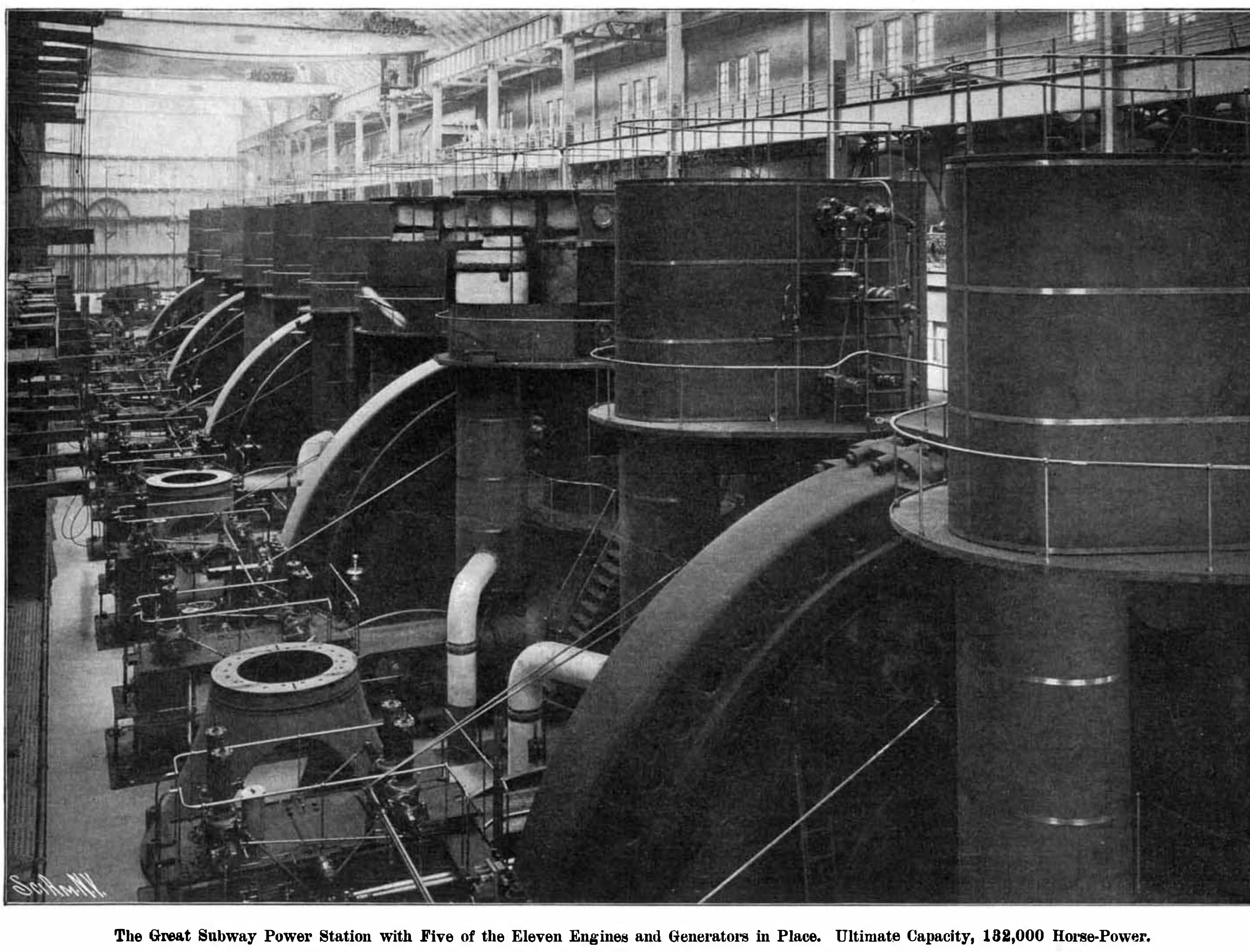


Bottom View of One of the New All-Steel Cars.



One of the Engines, Showing the Barometric Condensers.



The Great Subway Power Station with Five of the Eleven Engines and Generators in Place. Ultimate Capacity, 132,000 Horse-Power.

OPENING OF THE NEW YORK RAPID TRANSIT SUBWAY.—[See page 297.]

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NEW YORK, SATURDAY, OCTOBER 29, 1904.

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.

INAUGURATION OF THE RAPID TRANSIT SUBWAY.

With the opening of the Rapid Transit Subway, New York city is placed in possession of what is undoubtedly the most complete and up-to-date system of rapid transit to be found in any part of the world. This is due to the fact that it was planned on an ambitious scale, that the engineers were not hampered by any exacting considerations of economy, and that being the latest of the great subway systems to be opened, it has the advantage of the experience that has been gained in London, Budapest, Paris, and Berlin.

To the Scientific American the auspicious inauguration of this great work is peculiarly gratifying; for from the time that the present plans took practical shape, this journal has been a most earnest advocate of the construction of just such a road as has now been opened. There is also a sentimental interest attaching to the event, in the fact that the very first attempt at the construction of an underground system, and the plans therefor, were due to the initiative of one of the Editors and proprietors of this journal. Indeed, several hundred feet of subway was constructed and still exists below Broadway at City Hall Park. That early effort, made in the year 1870, was doomed to failure, mainly because the electric motor had not yet made its appearance, and the public was not educated up to the advantages of subway travel.

On an occasion like the present, with the road actually completed and in successful operation, we are apt to accept the result with but little consideration of the vast amount of patience, technical skill, far-sighted prescience, and unbounded faith, that were necessary on the part of the sponsors of this great engineering and financial undertaking. Acknowledgments are certainly due to the members of the Rapid Transit Commission, with Alexander E. Orr at their head, for the large amount of time that they have given, entirely without compensation, to serving the best interests of the city; to William Barclay Parsons, the Chief Engineer of the Commission, and his staff of assistants, for having shown such good judgment in the planning and carrying out of this great piece of engineering work under conditions that were extremely trying, and in many cases entirely without precedent in their profession; to John B. Macdonald, who provided the plant and vast organization for the execution of the work, and has redeemed his pledge to complete this $35,000,000 contract practically within the contract time; and finally, to August Belmont and his associates, who, at a time when the Rapid Transit Commissioners were very doubtful as to whether they could secure a bidder with the courage and the resources necessary for such a great and comparatively untried piece of work, stepped into the breach, and provided the vast sums of money that were called for.

It is gratifying to know that at the very time when these twenty-one miles of additional transit facilities are being opened to the public, the Rapid Transit Commissioners have elaborate plans made for further extensions of the system. The growth of New York city, and the increasing percentage of its inhabitants that use the various systems of transportation, render necessary further extensions of the Subway, in order to cope with the steadily increasing volume of travel. First in order of importance comes the projected line below Lexington Avenue, which will give to the east side of New York facilities similar to those enjoyed by the west side. With this should be named the line beneath Broadway from Forty-second Street to the Post Office; or if that is not deemed advisable, the line down Seventh Avenue, intersecting the new Pennsylvania station at Thirty-third Street. Within two years' time the extension from the City Hall to the Battery, and under the East River to Flatbush Avenue, Brooklyn, will be completed; and in anticipation of this, work will be begun at an early date upon the extension of this road by way of Flatbush Avenue to the Ocean Parkway. With these three extensions under way, Greater New York should be in a fair way to keep pace with the increasing traffic of the city for several years to come.

COST OF ELECTRIC WATER POWER PLANTS.

The cost of water-driven electric plants per kilowatt capacity varies much with the nature of the fall, the type of the hydraulic development, and the amount of head.

For a given head of water the natural, vertical fall costs least to develop per unit of power. Next in economy of construction is a plant whose head of water is derived from a short series of steep rapids. For either of these cases the only dam necessary is a low one at the head of the falls or rapids, to gather the water into penstocks that drop to the generating station.

If the fall is vertical, the length of penstock need be little more than the height, and the generating station may be close to the foot. Even in the case of steep rapids the length of penstock from their head to the power house at the foot may be only a few rods.

As the rapids or low falls are scattered from several thousand feet to several miles along a stream, the necessary penstock, to bring water from their head and deliver it to a power house at their foot, lengthens into a pipe line. In such a case a canal may be used instead of a pipe line, and the penstock may still be a short pipe, that connects the end of the canal with the power house. Whether the canal or the pipe line is used, the cost of the development per unit of power will increase materially with the length.

If the bed of the stream has only a moderate descent of five or ten feet per mile, it will probably be cheaper to build a comparatively high dam and set the water back a few miles, than to dig a canal or lay a pipe line to carry the discharge of the stream over the same distance. Near the foot of such a dam at one end, a power house may be located and supplied with water through short penstocks much as in the case of a natural, vertical fall.

For a given head of water, the erection of a dam to create that head, or the construction of a long pipe line or canal for the purpose of maintaining a head, are the most costly types of development. If, however, the pipe line, though several miles in length, supplies water to the wheels at a very high head, the cost of the development may be very moderate per horse-power. This fact is illustrated in many of the California plants, at one of which a head of more than 1,900 feet on the wheels is maintained by a pipe line several miles long.

Perhaps the most important single factor bearing on the cost of water power development is the available head. As a rule, the cost of the development per unit of power will increase as the head decreases, other factors remaining the same. The lower the head, the greater must usually be the mass of the dam, the larger must be the canal, penstocks, and power house, and the heavier must be the water wheels and electric generators, per horse-power developed. For wheels and generators the weight per unit of output decreases as the speed of revolution increases, and this speed goes up with the head of water. The mass of the dam, and the sizes of the canal and penstocks, increase with the volume of water to be handled, and this volume grows larger as the head decreases per horse-power of capacity.

With heads that range from as low as 10 up to nearly 2,000 feet, created in some cases by natural falls, in others by canals or pipe lines miles in length, and in still others entirely by dams, the cost of hydro-electric plants is subject to wide variations. In a very general way it may be said that a complete water power development with its electric generating station will cost anywhere from $50 to more than $300 per kilowatt of capacity. Somewhere about midway between these extremes the cost of the majority of hydro-electric plants will be found. The figures just named have nothing to do with the cost of transmission or distribution lines, which depends on factors that are but little influenced by the type of water power development. While these very general statements of cost for water power plants have a limited value, a knowledge of costs under definite conditions of development is much more useful. Several examples are therefore given of the costs of plants that have been constructed and are in operation, but the names of these plants are withheld for obvious reasons.

In one case a head of 14 feet was created almost entirely by the erection of a stone masonry dam across a small river. From one end of this dam a short canal several hundred feet long conveys the water to the electric generating station on the river bank below. The station building is constructed of stone, concrete, brick, and steel, with a floor area sufficient for two direct-connected generators of 800 kilowatts total capacity, and with a traveling crane overhead. For the real estate, the construction of the dam, canal, and power house, and the complete equipment of the latter to develop 800 kilowatts, the approximate cost was $190 per kilowatt of generator capacity. On another small river a head of 23 feet was created in part by a natural fall in the bed rock of the stream, and in part by a masonry dam. From one end of this dam a steel penstock was carried to a brick power house nearby. This power house was equipped with direct-connected water wheels and generators, and with transformers for an output of 1,500 kilowatts. For this complete hydraulic and electric plant the approximate cost was $160 per kilowatt of generator capacity.

For a hydro-electric plant of 800 kilowatts capacity, with a water head of 30 feet, the total cost will be about $175 per kilowatt, as it now appears when nearly completed. In this case a concrete dam creates the smaller part of the head, and the greater part is due to a natural fall and rapids in the river bed. To connect the water behind the dam with the power house below these rapids, a canal more than 1,000 feet long is employed. The power house is of masonry construction, the wheels and generators are direct connected, and there are no step-up transformers. In contrast with the above figures, a certain plant with a head of about 450 feet is reported to have cost about $30 per kilowatt capacity, exclusive of the electrical equipment.

TO STIMULATE CHEMICAL DISCOVERY.

The California Grape Acid Association offers $25,000 to any person who will devise a process to utilize grapes for grape acid, and in evidence of good faith has deposited this amount in the hands of a San Francisco banker, to be paid to the successful discoverer of the process.

On the Pacific coast, especially in California, are unlimited tracts adapted to the profitable cultivation of grapes, only a small proportion being employed at this time, owing to the limited demand in the United States for products of the vineyard. It is estimated that California alone could easily, were all the land available planted to grapes, supply twenty times the present demand for fruit, wine, brandy, or raisins. Compared with Europe, the consumption of wine in the United States is infinitesimally small. California, for instance, produces 30,000,000 gallons of wine yearly, which would supply only two-thirds of the annual consumption of the 450,000 inhabitants living in Rome, the capital of Italy.

In all vineyard products the normal market conditions of the country indicate an over-supply; but could the list of products of the vine be increased in numbers, the advantage both to the country and to agriculture would be great. The United States is now practically dependent upon European chemists and wine countries for its supplies of cream of tartar and tartaric acid, both derived from argol, which is the lees of wine, and imported in great quantities. Cream of tartar is an essential element in the manufacture of the best qualities of baking powder. No substitute has yet been discovered that does not deteriorate the quality of baking powder made from it. If, therefore, cream of tartar could be manufactured direct from grape juice, instead of from wine lees, this country would at once become independent of Europe, and in time an exporter. The vineyardists would find an outlet for all the grapes they could raise, and lands now unproductive could be made to yield profitable crops. To stimulate this important discovery, the association offers the large reward, to the end that California grapes, now worth ten dollars a ton, and containing 20 per cent of saccharine, may be utilized to produce grape acid. The association realizes also that if a cheap method of producing grape acid is discovered, other latent products, now unknown or unsuspected, may be evolved that will be of benefit to the agriculturist.

Prof. Hilgard, director of the Agricultural Experiment Station at the University of California, writes that "the possible production of tartaric acid from grape juice by means of the action of a special ferment I regard as one of the most hopeful methods for the attainment of the end in view, even though no such ferment has as yet been discovered. A close investigation of the manner in which tartaric acid is formed in the grape itself would be an important step toward the desired result."

As the consumption of wine and raisins in the United States is now below the normal production of these articles, the discovery of processes in which a wider diversity of products of the vineyard might result would extend vine planting to a much greater number of acres and encourage the development of regions now practically unproductive. The offer of the association has excited the attention of a large number of European scientists, who have submitted papers descriptive of the methods they advocate. All such will be carefully demonstrated by the committee to which they have been referred. A conclusion will be announced before the close of the year 1904

A NEW PROCESS OF MAKING TRICHROMATIC LANTERN SLIDES.

Mr. Fred E. Ives, president of the Camera Club in this city, recently explained his new method of making tricolored slides in a simple way, which would cause the picture on the screen to appear in the colors of nature. He stated that it was an improvement over the process he employed in 1891, in which gelatine-coated celluloid films were used, each colored and then combined to form one slide.

The new way was styled a compromise process, because it combined certain features of the half-tone process with pure photography.

In order to show that the same coloring as was obtained on celluloid could be obtained with prints made directly on glass by printing from half-tone process negatives, he threw on the screen a photomicrographic enlargement of a portion of a half-tone trichromatic print, and blended the colors into smooth tints by throwing it out of focus on the screen, stating that it would only be necessary to make the line and dot structure sufficiently fine, in order to obtain the optical effect of such continuous shading without throwing the image out of focus.

In the new process, the peacock blue print is made with smooth shading, in the manner originally proposed by him in 1889, described as "A New Principle in Heliochromy;" but the crimson and yellow prints are made from half-tone process negatives, in bichromated fish glue, by a very quick and simple process. Commencing with a trichromatic negative obtained by the use of his one-plate one-exposure cameras, he makes, by contact with the negative image produced through the red screen, a positive on a bichromated gelatine lantern slide plate, and tints it a peacock blue by immersion in a blue aniline dye solution.

From the negative images made through the green and blue screens are made half-tone process negatives, 200 lines to the inch, and from these are made prints in bichromated fish glue, by exposing a few seconds in sunlight and then washing in cold water, after which they are colored respectively by immersion in crimson and yellow dye solutions.

The yellow print is made directly upon the surface of the blue print, after the latter is dried and protected by a waterproof varnish, by coating it with a sensitized bichromated gelatine film and printing in the usual way, but the crimson print is made on the inner side of what forms the cover glass of the finished lantern slide, only the image is reversed as to position, in order to have it blend or register when placed in contact with the other two images.

The coating of bichromated fish glue is spread and dried in a "whirler," making a very thin and even film, and as the prints are developed from the face (unlike carbon prints), the development is completed in from ten to thirty seconds, so that the process is a very quick and reliable one.

As the films are all attached to glass, there is no danger of injury by the heat of the lantern, which is one of the objections to the celluloid film process. It is also not necessary to seal the films with balsam, as was formerly required.

Considering the effect of the half-tone screen structure on the quality of the slide, it was explained that it is much less in evidence than it would be if the blue image were made in that way, and that it was not likely to be noticed unless a person was very close to the lantern screen. Several slides made by the improved process were projected upon the screen, and their clearness and transparency were quite noticeable.

Since the process required the making of duplicate half-tone negatives, Mr. Ives thought it was not adapted for the amateur, but it would be useful in a commercial sense. The method was less expensive than hand coloring now in vogue.

He exhibited one colored slide of a farm scene, having much green foliage, brilliantly sunlit, the negative of which he said was made in one second with a new camera. The colors were very well rendered, and it was an interesting example of the improved sensitiveness to colors of the later trichromatic dry plates.

THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

One of the most interesting astronomical items of the last month has been the first bulletin of results from the Lick Observatory expedition to Chili. This enterprise owes its existence to the generosity of Mr. Mills, who, not contented with presenting to the observatory the spectrograph with which so many valuable observations of the northern stars have been made, has duplicated his gift, so that the work could be carried on simultaneously in both hemispheres. An observatory has been built on a hill near Santiago, and work has been going on for about a year, directed principally to measurement of the motions of stars in the line of sight.

The recent communication announces the discovery of a number of spectroscopic binaries, among which two are specially interesting, as they are also variable stars. But the observations of greatest immediate interest deal with a star whose name is familiar to all—Alpha Centauri—and advance our knowledge of its system to a point hardly reached in any other case.

Alpha Centauri is a remarkable object in many ways. It is one of the very brightest stars in the sky—coming next after Sirius and Canopus—and has a larger proper motion than any other bright star. It is also a fine double, whose components are at a greater apparent distance than those of any other known binary system; and, as is well known, it is nearer the sun than any other star yet investigated.

Summarizing what is known from observations of this system, we may say: The system of Alpha Centauri consists of two stars, of the first and second magnitudes, which revolve about one another or, strictly speaking, about their common center of gravity, in a decidedly elliptical orbit, highly inclined to the line of sight, with a period of 81 years, and at a mean distance of 17.7 seconds of arc, while the whole system has a rectilinear proper motion of 3.68 sec. per year.

From the relative distances of the two components from the center of gravity, it is found that they are very nearly equal in mass, though one is twice as bright as the other.

The careful determinations of this star's parallax made at the Cape Observatory enable us to translate these dimensions into miles, and compare them with corresponding ones in our own system.

Using the value 0.75 sec. for the parallax, resulting from all the Cape observations, we find that the distance of Alpha Centauri from the sun is 275,000 astronomical units (that is, 275,000 times the distance of the earth from the sun), a distance which it takes light four and one-third years to travel.

The mean distance of the two components is 23.6 astronomical units, so that their orbit is a little larger than that of Uranus. As it is highly eccentric, the distance of the two stars varies from 11 to 36 astronomical units, so that sometimes they are almost as near together as Saturn and the sun, and again a good deal farther apart than the sun and Neptune. The mass of the system comes out from these data as a little less than twice that of the sun. As the two stars are almost equally massive, either one of them singly is very nearly the sun's equal in mass. When it comes to brightness, we find that the brighter one gives just about as much light as the sun, and the fainter one less than half as much. As the spectrum of the brighter component is exactly like the sun's, it is not unreasonable to suppose that it is really almost a duplicate of our luminary. The fainter one shows differences which indicate either that it is cooler or that its atmosphere absorbs more of its light. Finally, from the observed proper motion, we know that the velocity of the system at right angles to the line of sight is 4.6 astronomical units a year, or about 13½ miles a second.

How fast the motion is *in* the line of sight was not known until the recent Lick observations were made. They show that both stars are approaching us, one at 11½ miles a second, and the other at 15.

It might seem at first sight that if they were moving at different rates, they must ultimately become widely separated; but the observed difference is due to their orbital motion about one another. In fact, it enables us to get a new determination of the star's distance; for we know how fast the stars are moving (relatively to one another) and how long they take to go round. Consequently, we can find the size of the orbit and, since we know how big it looks, how far off the system is.

This calculation has been made by one of the Lick astronomers, with the result 0.76 sec. for the parallax of the system. The agreement with the value 0.75 sec., found at the Cape in a wholly different way, is extremely satisfactory, and satisfies us that the distance of this system is now known within one or two per cent, and that the numbers given are approximately correct.

These observations also enable us to predict the future motion of the star. The system as a whole is approaching us at about 13½ miles a second, and also moving sidewise at nearly the same rate.

It follows that its actual motion relative to the sun takes place along a line making an angle of 45 deg. with the line at present joining the sun and star, at the rate of 19 miles a second, or 6¼ astronomical units a year. Calculation shows that the effects of the sun's attraction are small enough to neglect, so that we can assume as a good approximation that the star will keep on moving uniformly in this line indefinitely.

Now the nearest point in this line to the sun is about 200,000 astronomical units ahead of the present position of Alpha Centauri. Therefore the star will approach the sun for about 30,000 years more, when it will be at its least distance (about 200,000 astronomical units). If its brightness has not changed in the interval, it will then appear about twice as bright as it does now.

Following it back in the same way, we find that 100,000 years ago it was three times as far off as it is now, and only one-tenth as bright as at present.

The present pre-eminence of Alpha Centauri is therefore only a short-lived affair, if we count time by the lives of stars, and not of men. An average star probably keeps shining for many millions of years, and long before this time has passed. Alpha Centauri will have disappeared so far into the depths of space, that thousands of stars will then be nearer the solar system, and appear brighter, than it will.

Encke's comet—remarkable for its very short period of 3 1-3 years—is due to return this winter, and was "picked up" telescopically last month. It is now rapidly approaching the earth and sun, and will be brightest early in December, when it may be visible to the naked eye. On October 20 it was not far from Alpha Andromedæ, while early in December it will be near Altair. We hope to be able to give a more accurate account of its motion next month.

THE HEAVENS.

The familiar winter constellations are now returning to our evening skies. At 9 P. M. on November 15 Orion has just risen, and is almost due east. About it is Taurus, with the bright red star Aldebaran, and the Pleiades higher up. Gemini lies low on the horizon north of Orion, and Auriga is above it.

Following the Milky Way from this, we reach Perseus, then Cassiopeia, and, passing over the inconspicuous Cepheus, come to Cygnus, in the northwest. Aquila is below this on the left, and Lyra on the right.

The southern skies are less brilliant, except for Jupiter and Saturn. The former is in Pisces, almost due south and pretty high up, and the latter in Capricornus, low in the southwest.

Andromeda is directly overhead, and Pegasus southwest of it. The bright star low down in the S.S.W. is Fomalhaut. The southern and southeastern skies are occupied by Cetus and Eridanus, two of the dullest of the constellations. Ursa Major is low on the northern horizon, and Draco and Ursa Minor are below and to the left of the pole.

THE PLANETS.

Mercury is evening star in Libra and Scorpio. He can only be seen in the latter part of the month, when he sets about an hour after the sun. Even then he is so far south that he will be hard to see.

Venus is evening star in Scorpio and Sagittarius, and is visible in the southwest after dark. By the end of the month she sets more than two hours after sunset, and is a conspicuous object, though not nearly as much so as she will be in the spring.

Mars is morning star in Virgo, crossing the meridian at 4:15 A. M. on the 15th. On the 26th he passes very near the fourth-magnitude star η Virginis, the distance of the two objects being about one-fourth of the moon's apparent diameter.

Jupiter is in Pisces, and is conspicuous all the evening. He is due south about 10:45 P. M. on the 1st, and 8:40 on the 30th. His satellites are visible with the smallest telescope; in fact, a good field-glass will show them all when they are not too near the planet.

Saturn is evening star in Capricornus. On the 7th he is in quadrature with the sun, and is due south at 6 P. M.

Uranus is in Sagittarius, too near the sun to be seen. Neptune is in Gemini, and will be in opposition next month.

THE MOON.

New moon occurs at 10:28 A. M. on the 7th, first quarter at 7:27 P. M. on the 14th, full moon at 10:04 P. M. on the 22d, and last quarter at 2:30 A. M. on the 30th. The moon is nearest us on the 5th, and farthest away on the 17th. She is in conjunction with Mars on the 3d, Mercury on the 7th, Venus on the 9th, Uranus on the 10th, Saturn on the 14th, Jupiter on the 19th, and Neptune on the 25th, none of the conjunctions being notably close.

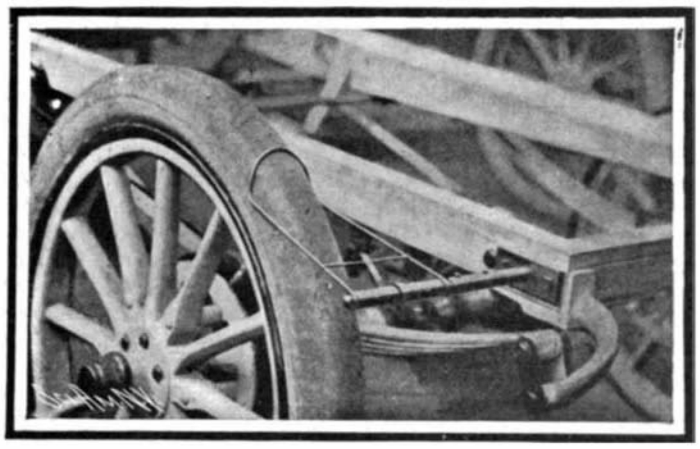
ROMANCE OF A SCIENTIFIC AGE.

Mr. Robert Bridges, in an article on "Is Poetry to Have a Chance?" in Collier's, says:

"To sail under the sea or through the air, to talk through space, to see through flesh and bone, to make light out of darkness, to harness Niagaras, to make wax speak and pictures move—these have been the deeds of the poets of our generation. The things that were dreamed of in the 'Arabian Nights' have become realities—and yet they say this is a prosaic age! It is seething with romance; young men talk the impossible on street corners and across little tables—and then make it come true. The spirit of achievement is the spirit of imagination and hope. These men delight to live, delight to plan, and dream, and hammer out results. Nothing staggers them—and failure or success is greeted with a smiling face."

DEVICE FOR PULLING TACKS AND NAILS FROM PNEUMATIC TIRES.

The accompanying illustration shows a useful little device for aiding in protecting automobile and carriage tires from puncture. The idea underlying the construction of the device is to withdraw a tack or nail immediately after it is picked up by the tire, and



NAIL-PULLING DEVICE FOR PNEUMATIC TIRES.

before it has had time, during several revolutions of the wheel, to become deeply imbedded. A wire frame, bent to conform to the contour of the tire, is supported upon a suitable bracket mounted on the chassis. A small, flat spring presses the wire frame lightly but firmly against the tire, with the result that when a nail or tack sticking in the tire strikes it, such nail or tack is likely to be quickly pulled out before it has done serious damage. The device is very useful to automobilists for protecting their tires from puncture.

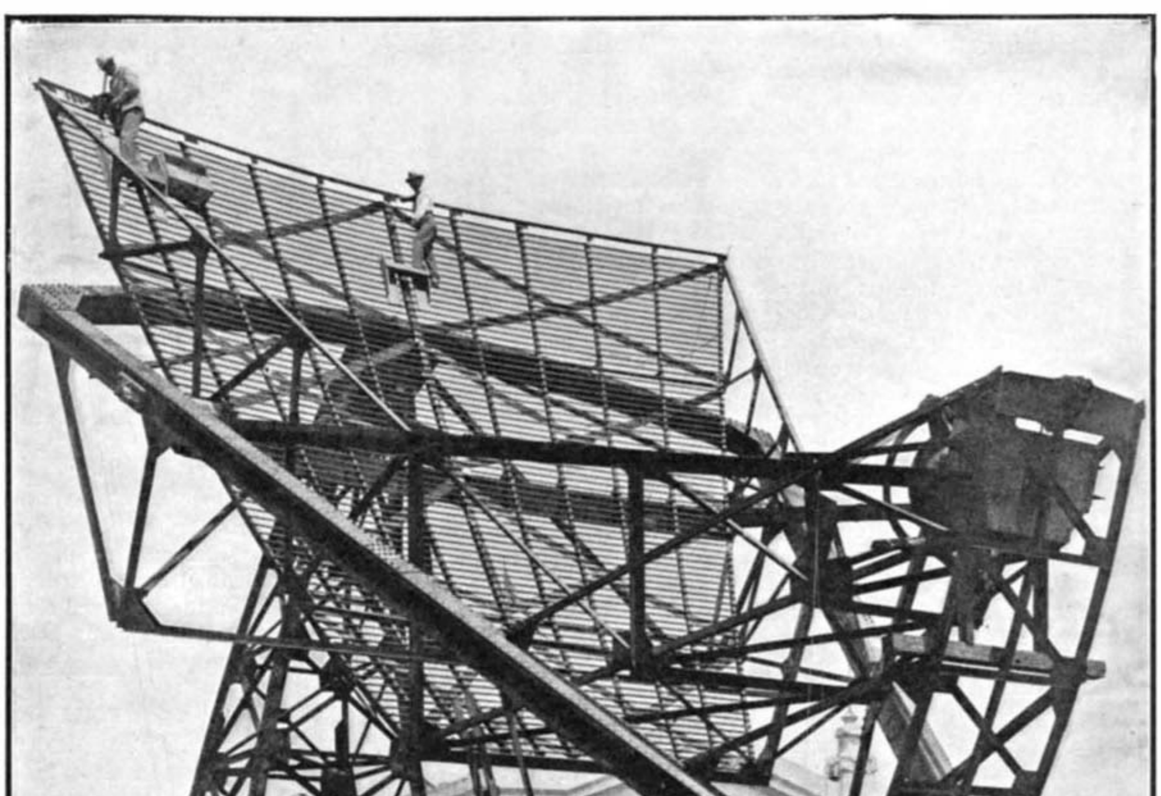
A SOLAR REDUCING FURNACE.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Not far from the Horticultural Building there stands a massive framed steel structure, which, during its erection, was the subject of much speculative comment among visitors to the fair. It was designed and erected by Prof. M. A. Gomes Himalaya, and its object is to obtain extraordinarily high temperatures by utilizing the reflected heat of the sun. Its object, indeed, is the direct opposite to that of the low-temperature exhibit of the British Royal Commission, which is to be found at the opposite end of the grounds. The inventor hopes to secure temperatures far beyond any that have yet been recorded; these temperatures to be utilized inside of a reducing furnace for experimental purposes. It is expected that temperatures even higher than those obtained in the electrical furnace will be secured. According to Prof. Himalaya 3,500 deg. C. is the highest recorded temperature, this having been actually measured by Prof. Violle. This is the normal temperature of the ebullition of carbon, just as 100 deg. C. is the normal temperature of the ebullition of water.

The structure consists of a massive A-frame, the apex of the frame being supported axially near the ground level, and the base supported axially at its center on a stiff latticed column. Within this frame and capable of adjustment at right angles to its axis is a second latticed frame, at one end of which is a large reflector, and at the other end, in the focus of the reflector, a steel crucible or box in which the substance to be reduced is placed. The top of the reflector is 42 feet above the ground. The width along the top edge is about 35 feet, the depth along each side is 35 feet, and the width across the base is 18 feet.

The reflector is built up of 6,170 elementary reflectors, each of which measures 122 millimeters by 100 millimeters. These reflectors are arranged side by side in parallel rows, being attached by threaded standards to a series of parallel angle irons, which run horizontally across the frame from side to side. The rays from these reflectors all converge to the one steel crucible furnace set in their common focus, and Prof. Himalaya is perfectly satisfied that he will secure temperatures higher than 3,500 deg. C. This is the fourth apparatus of the kind that he has built, although none of the predecessors have been so ambitious. The first was erected at Paris in 1900, the second at Lisbon in 1902. With the Lisbon apparatus, which was much smaller than the one at St. Louis, a temperature of 2,000 deg. C. was obtained.



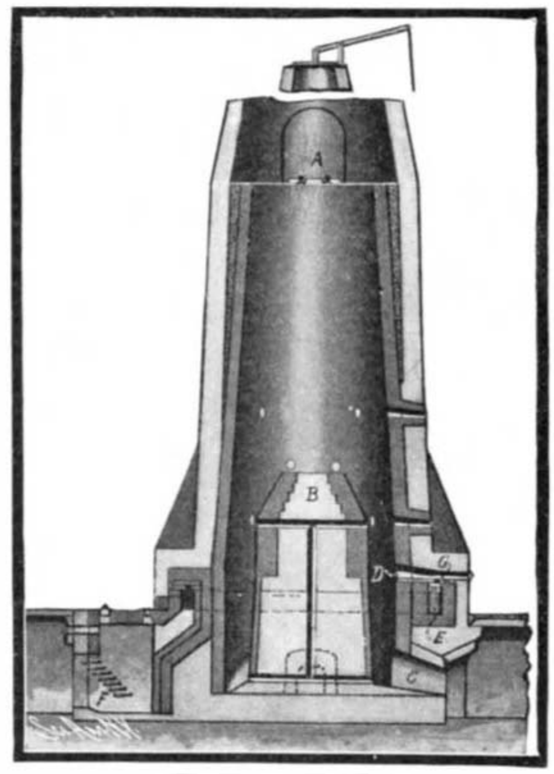
CHEMICAL FURNACE FOR OBTAINING HIGH TEMPERATURES BY CONCENTRATING THE REFLECTED RAYS OF THE SUN.

A New Alloy.

Details have now been published of the new metal alloy which has been discovered by two Tuscan engineers named Travaglian and Fabiani, and been duly patented. The new metal is called by the discoverers "radium argentiferum," and is composed of copper, iron, and infinitesimal portions of silver, radium, and phosphorus, though the fundamental secret of the invention lies in the phosphorus. The principal advantages of this alloy are claimed to be greater strength than steel, freedom from oxidation, while it is a better conductor than copper, and can be manufactured in large quantities at one-tenth of the cost of bronze. The discovery was mainly the result of an accident. The inventors had made ceaseless experiments at a cost of $20,000, and were practically impoverished, when Travaglian, exasperated by the delay in the fusing of the metal after hours of boiling, threw a two-franc piece into the crucible. His impetuosity solved the problem, for the addition of the silver in the coin brought about the desired fusion.

IMPROVED LIME KILN.

An improved lime kiln has recently been invented, which allows of continuous working, and also is so arranged that the burning of the limestone may be shut off for a time without requiring that the fires be drawn in the furnaces. The stack of the lime kiln is lined with firebrick, and in the upper portion is provided with charging doors for the introduction of the limestone. In the accompanying engraving, which shows a section of the kiln, one of these doors is indicated at *A*, and the top of the stack is closed by a cover. The cover may be raised to discharge the gases by drawing the cord shown, which extends to the ground. In the lower portion of the stack is a central distributer, *B*, which forms with the wall of the kiln an annular passage. The upper portion of the passage is the burning chamber, and the lower portion constitutes the cooling chamber. Air passages extend through the distributer, as shown, for regulating the heat in the stack. The cooling chamber is provided with a number of outlets, *C*, through which the burnt lime may be discharged. The burning chamber is connected by means of a number of gas entrances, *D*, with an annular gas conduit, *E*, formed in the wall of the kiln. This conduit communicates with a number of gas-generating furnaces, *F*. In operation the gas generated passes into the burning chamber, to burn therein and thus reduce the limestone to produce lime. The lime gradually settles downward into the cooling chamber, from which it may be removed through the openings, *C*. In the meantime lime can be continually fed into the upper end of the stack. In case it is desired to stop the burning of the lime in any portion of the kiln, the gas is cut off from the corresponding gas entrance by means of a valve, preferably a fire-



IMPROVED LIME KILN.

brick, *G*, which closes communication between the gas entrance and the conduit, *E*. If it is desired to stop the burning completely for a day, or a few days, without drawing the fires on the grates, it is only necessary to close all the valves, thus preventing the draft from passing up through the grates and causing the fuel thereon to burn slowly without generating much gas. A number of peepholes are provided in the sides of the kiln, to permit inspecting progress of the burning, and to allow of introducing stirring rods in case the material becomes choked in the stack. Mr. D. H. Gibson, of Seattle, Wash., Box 1516, is the inventor of this improved lime kiln.

Wire-Wound Wooden Pipe.

Last April the Canadian Pipe Company installed a new plant for the manufacture of wire-wound wooden pipe, since which time between thirty and forty carloads of pipe have been shipped to the Northwest Territories, Manitoba, and Vancouver Island, and other orders are on hand which will be filled within a very short time. It is claimed that this pipe is superior, for water-supply purposes, to iron pipe and can be furnished at less than half the price. Besides this, it is much lighter to handle and is not so liable to burst upon freezing as pipe made of iron. Large quantities of this pipe are being put into use by mill owners and mining engineers in lieu of flumes, as its use results in the saving of water and repair. This new industry seems to have a good future before it.

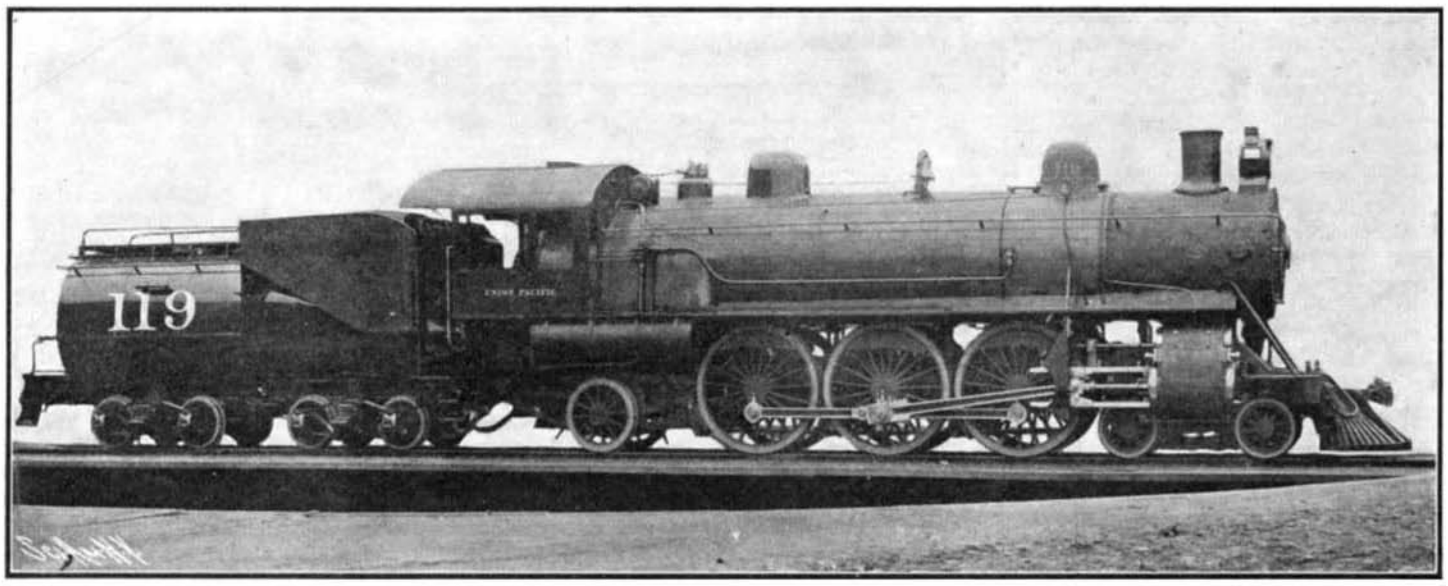
Although iron pyrites and copper pyrites are difficult to distinguish underground by candle light they are separated visually by the use of the bluish-white flame of magnesium wire or the acetylene light.

PASSENGER LOCOMOTIVE WITH VANDERBILT TENDER.

One of the novel features that arrested immediate attention in the Transportation Building at the World's Fair, was the new type of locomotive tender, designed by Cornelius Vanderbilt, which was shown on several fine locomotives of modern design. The one herewith selected for illustration was built by the Baldwin Locomotive Company for the Union Pacific Railroad Company, and is known as the Pacific type. The locomotive has cylinders 22 inches in diameter by 28 inches stroke, connected to the middle pair of the six-coupled driving wheels, 77 inches in diameter. The total weight of the engine is 222,520 pounds. It is carried as follows: 141,290 pounds on the driving wheels, 37,330 pounds on the front truck, and 43,900 pounds on the trailers. The boiler is of the straight type, with a diameter of 70 inches and a working pressure of 200 pounds to the square inch. The total heating surface is 3,053 square feet, and the grate area 49.5 square feet.

It will be seen from this description that the engine is of a standard type. The tender, however, departs very broadly from the old lines with which we are familiar. The water tank, instead of being of the rectangular pattern, is cylindrical. It is built of ¼-inch steel, and measures 8 feet in diameter by 23 feet in length. It is carried on a narrow frame, which for reasons given below is much lighter than that of the ordinary type of tender. The length over bumpers is 26 feet 3¾ inches. At about the mid-length of the tank there is a plate-steel saddle, which serves to support the rear end of the coal hopper. The latter occupies the space above the forward half of the tender, and it is of a general rectangular form, with a sloping bottom arranged at the proper pitch to give a free delivery of the coal to the foot-plate. The trucks are of the arch-bar, simplex bolster type, with cast-iron, steel-tired wheels, 33½ inches in diameter, the journals measuring 5½ inches by 10 inches. In a light condition the tender weighs 46,740 pounds. Fully loaded with coal and water, its weight is 136,450 pounds, or 68 tons, which, by the way, was the weight of a good-sized locomotive not so very many years ago. The water capacity is 7,000 gallons, and the coal capacity 14 tons.

The advantages of the Vanderbilt tender are many. For its capacity and weight the cylindrical form is the strongest that can be used. Its transverse strength is so great that, in spite of its length of over 26 feet, the tank is quite capable of carrying its load of 29 tons of water without any center support, and, consequently, the underframe can be made very much lighter than would be necessary in a tender of the same capacity but of the rectangular shape. The frame need only be made strong enough to withstand the pulling and pushing stresses of the engine, and, as compared with the standard type of frame, it is remarkably narrow and light. In a comparison of two tenders, one rectangular and the other cylindrical, and each carrying 7,000 gallons of water and 14 tons of coal, there is a saving of about 7½ tons of weight in favor of the Vanderbilt type. A further advantage is that the fuel is located at the forward end of the tank, immediately at the back of the foot-plate, and, therefore, in the most convenient position for the firemen.



For the same capacity there is a saving of 7½ tons on a Standard 73-ton tender.

PASSENGER LOCOMOTIVE WITH THE VANDERBILT CYLINDRICAL TENDER.

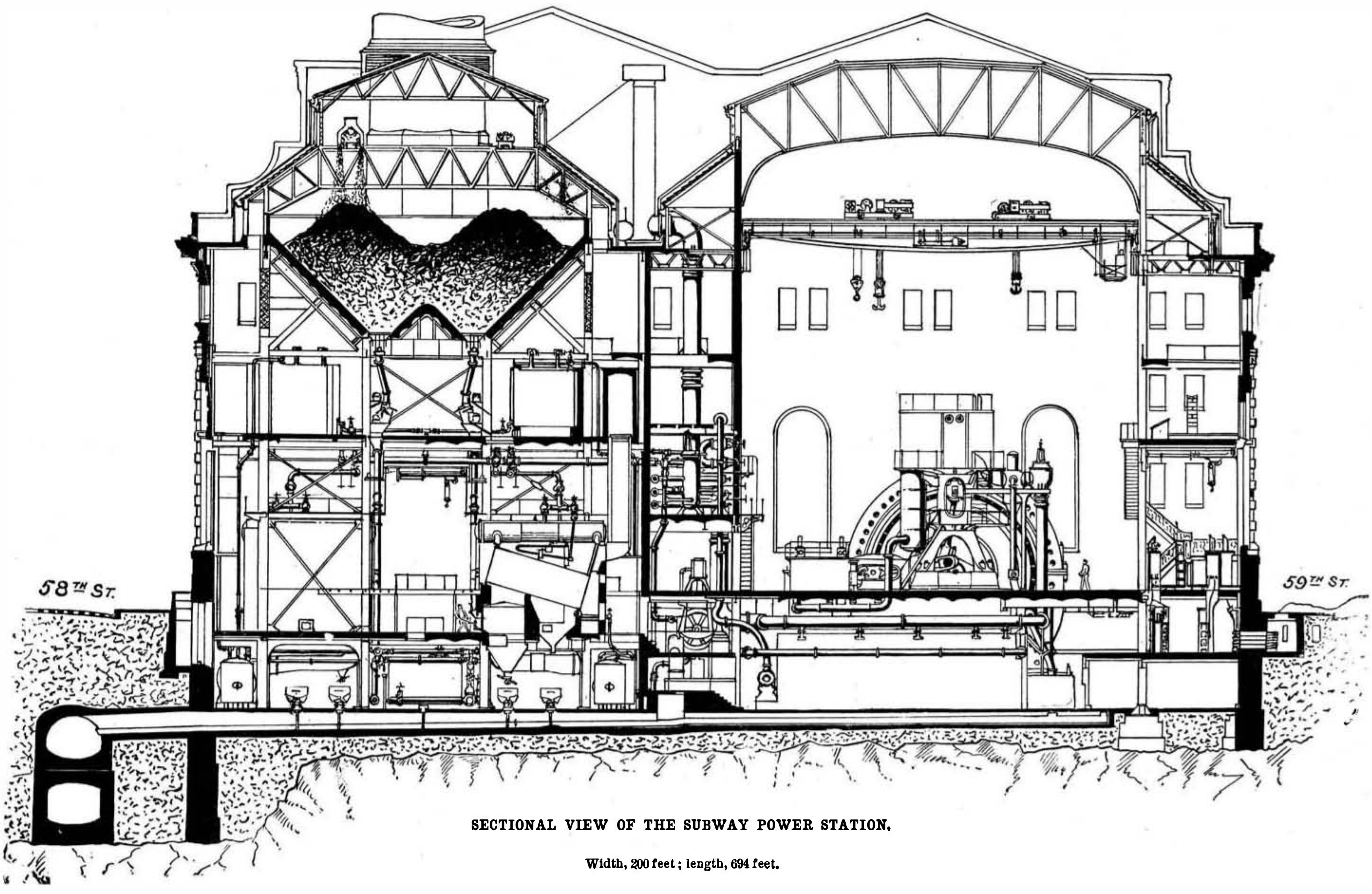
The British consul at Bahia states that ropes made from the fiber of the caroá plant will soon rival the best manila.

OPENING OF THE NEW YORK RAPID TRANSIT SUBWAY.

On October 27 the Rapid Transit Subway of this city was formally opened with simple but dignified ceremonies that took place in the City Hall. Mr. Alexander E. Orr, representing the Rapid Transit Commission, formally handed over the road to the Mayor, and after a party of invited guests had made a trip over the system, the sale of tickets commenced at seven o'clock in the evening, and the citizens of New York were thus placed in possession of this splendid addition to its traveling facilities. In our issue of September 10 we gave an illustrated description, dealing with the general features of the road, its route, construction, equipment, and method of operation, and to that article reference is now made for the fuller details which it is not necessary to elaborate here.

In no city of the world is there an underground railroad that can compare in size, capacity, and speed with this. The total length of the line is 24.7 miles, of which 19 miles is underground and 5.7 miles is carried on an elevated structure. It includes 6.7 miles of four-track, 7.4 miles of three-track, and 10.6 miles of two-track road. If we include 5 miles of switches and sidings, there is a total track mileage of 70 miles. The contract was let four years ago for $35,000,000, this being the amount necessary for the construction of the road. The equipment, power station, etc., cost $12,000,000 more, making the total cost $47,000,000.

There are two classes of service, express and local; the former using the two inside tracks, and the latter the two outside tracks of the four-track road. Express trains, which will run at a speed of about 25 miles an hour including stops, are made up of eight cars, of which five are motor cars. The local trains, which will have a speed of about 16 miles an hour, including stops, are made up of six cars, four of which



SECTIONAL VIEW OF THE SUBWAY POWER STATION.

Width, 200 feet; length, 694 feet.

are motor cars. The motor cars carry two 200-horse-power motors each, or 400 to the car, or 2,000 for the express trains. On tangents the expresses will attain a maximum speed of about 50 miles an hour. Special precaution has been taken to safeguard the passengers. The wooden cars have steel underbodies, and these will gradually be replaced by all-steel cars, built with a view to rendering them both fireproof and collision proof, the cars being of a modified vestibuled type, with special construction at the ends to prevent telescoping. A block signal system, which includes the latest refinements in the way of automatic stops at the signals, absolutely preventing a train running into a block when the signals are against it, has been installed, and it is likely that the enviable record of the elevated roads in respect of the small number of accidents, will be surpassed on the Subway system.

The present article is devoted more particularly to the great power station, which has been built at Fifty-ninth Street and the North River, the spot being chosen for its central location with regard to the distribution of the current, and because of the facilities afforded for water transportation, and transportation by rail on the New York Central Railroad tracks, which run past the power house. The building occupies an entire block, and measures 200 feet in width by 694 feet in length. It is divided longitudinally by a central wall into two portions. The northern half, 117 feet in width, is known as the operating room, while the southerly half, 83 feet in width, is the boiler house. As will be seen from our accompanying sectional drawing, the operating room or engine house is built with galleries extending the whole length on each side, those on the northerly side containing the electrical apparatus, those on the southerly side being occupied chiefly by the steam-pipe equipment. When the plant is entirely completed, it will contain six sections. Each section, with the exception of the turbine section, consists of twelve boilers, two engines, each connected to a 5,000-kilowatt alternator, together with the necessary condensing and boiler feed equipment, and a chimney, there being six chimneys in all. A novelty in respect of the last named is that they are carried on the steel structure of the building, upon a platform at an elevation of 76 feet above the basement floor. The supporting columns for carrying the chimneys form part of the regular system of columns of the boiler house. The top of each chimney is 225 feet above the gratebars, or 162 feet above the top of the supporting platform, and each weighs 1,200 tons. The obvious advantage of this arrangement is that the brick portion of the chimney extends only from about the level of the roof upward, the interior of the boiler house being thus entirely free from brickwork, and the space thus saved is available for boilers. This enables the line of boilers to extend continuously through the whole length of the house, and preserves the general symmetry of the installation. Above the boiler house, extending the full length thereof, is a coal bunker capable of holding 18,000 tons of coal. Immediately below the bunkers, and all on the same floor, are the boiler economizers, and below these again are the boilers, which are arranged in two long lines confronting each other, with a central platform between them, from which they are fired. The ashes are dumped by gravity into hoppers, which deliver them to small ash dump cars running on tracks in the basement. The cars are drawn out by a small electric locomotive to the water front, where they are dumped into a 1,000-ton bin, to be subsequently disposed of by barge or otherwise.

The coal is brought in barges or vessels to a pier on the water front, where it is unloaded by coal-unloading towers, crushed, weighed, and carried by belt-conveyors to a system of 30-inch elevating belt-conveyors, by which it is elevated to the top of the boiler house and delivered to a system of 20-inch, horizontal belt-conveyors, for even distribution throughout the bunkers.

The boiler room will ultimately contain seventy-two Babcock & Wilcox boilers, with an aggregate heating surface of 432,576 square feet. They will operate at a working steam pressure of 225 pounds to the square inch. It is ultimately intended to apply superheaters to the whole boiler plant, but before doing so a trial is being made of two well-known makes of superheaters built in this country. Special attention has been paid to the design of the steam piping, and all fittings are made somewhat heavier than is customary in ordinary practice, and they are all of special design. The line and bent pipe is of wrought iron, with loose flanges made of wrought steel rolled at the Krupp works. The engine equipment when all is completed will consist of eleven 7,500-horse-power Allis-Chalmers engines of the same general type as those installed in the 76th Street power station of the elevated road of this city, which have already been described in this journal. As these are capable of working at overload up to 11,000 or 12,000 horse-power, the total horse-power of the plant for traction purposes alone will aggregate say 121,000 horse-power. To this must be added four steam turbines used for electric lighting and two exciter engines, which would bring up the total horse-power for this station to a maximum capacity, when pushed to the utmost, of 132,000.

The main engines are each made up of two component compound engines, driving a common shaft, upon which is carried the 5,000-kilowatt generator. The high-pressure cylinders are placed horizontally and the low pressure vertically, each pair connecting to a common crankpin. The high-pressure cylinders are 42 inches in diameter, the low-pressure 86 inches in diameter, and the common stroke is 60 inches. This is for each cylinder, as compared with the Manhattan engines, a reduction in diameter of 2 inches, the stroke being the same and the revolutions per minute, 75, being also similar. The steam pressure of the Rapid Transit Subway engines is 175 pounds, as against 150 pounds for the earlier engines. The low-pressure and the high-pressure piston rods are both 10 inches in diameter, and the crankpin is 20 inches in diameter, an increase of 2 inches over the dimensions of the Manhattan engines. The low-pressure valves are single-ported Corliss, and the high-pressure valves are of the poppet type. At the journals the shaft is 34 inches in diameter, and the length of the journals is 60 inches.

The guarantees of the engines specify that they must be capable of operating continuously, when indicating 11,000 horse-power, without producing abnormal wear, jar, noise, or other objectionable results. They are to be so proportioned that if desired they can be operated with a steam pressure at the throttle of 200 pounds above atmospheric pressure. They must also operate successfully under 175 pounds pressure, should the temperature of the steam be maintained at the throttle at from 450 to 500 degrees. Finally, the engine must not require more than 12¼ pounds of dry steam per indicated horse-power per hour when indicating 7,500 horse-power at 75 revolutions per minute, with a vacuum of 26 inches at the low-pressure cylinders, with a steam pressure at the throttle of 175 pounds, and with saturated steam at the normal temperature due to its pressure.

The turbo-generators for electric lighting consist of four Westinghouse-Parsons multiple-expansion, parallel-flow turbines, each consisting of two turbines arranged in tandem-compound. The alternators will run at a speed of 1,200 revolutions per minute, and produce current at a pressure of 11,000 volts. Each unit will have a normal output of 1,700 horse-power, and it is guaranteed to operate under 450 degrees of superheat. The guarantee under a full load of 1,250 kilowatts is 13.8 pounds per electrical horse-power hour, which, it will be seen, is considerably lower than the guarantee for the reciprocating engines. There are also two exciter engines of the compound type, direct-connected to 250 kilowatt generators.

In view of the fact that the efficiency of the engines depends so largely on the vacuum, particular care was given to the design of the condensing plant. Each engine is supplied with two Alberger barometric condensing chambers, each attached as closely as possible to its respective low-pressure cylinder. The circulating pumps are vertical, cross-compound, Corliss engines. Their foundations are on the basement floor; but their steam cylinders are above the engine floor and are, therefore, under the eye of the engineer. The normal capacity of each pump is 10,000,000 gallons per day; therefore, the total pumping capacity of the station is 120,000,000 gallons per day.

The 5,000-kilowatt alternators, like the engines, closely resemble those of the Manhattan Railway Company. They deliver 25-cycle alternating three-phase current at a pressure of 11,000 volts. The revolving part is 32 feet in diameter, and it weighs 332,000 pounds. The machines stand 42 feet in height, and the total weight of each is 889,000 pounds. The revolving parts have been constructed with a view to securing ample ability to resist the centrifugal forces which would be set up should the engines, through some accident, run away. The hub of the revolving field is of cast steel, and the rim is connected to the hub by two huge disks of rolled steel. The alternators have forty field poles, and they operate at 75 revolutions per minute. Field magnets form the periphery of the revolving field, the poles and rim of which are built up of steel plates, dovetailed to the driving spider. The armature is carried outside of the field and is stationary.

Current is delivered at 11,000 volts to eight substations, where it is transformed and converted to direct current at a potential of 625 volts, at which it is delivered to the third or contact rails. As explained in our article of September 10, the third rail is protected by a lateral and overhead shield, which should prove fully effective in safeguarding the workmen or passengers from injury.

We take this opportunity to express our indebtedness to Mr. George S. Rice, the Chief Assistant Engineer of the Rapid Transit Commission, for his invariable courtesy and assistance in the preparation of the many articles that we have published during the construction of the Subway.

Automobile Notes.

One of the automobile novelties at the St. Louis fair is a self-moving lunch wagon. Besides the usual cooking paraphernalia of a lunch wagon, this one is fitted with a 25-horse-power gasoline motor and transmission, and is mounted on rubber-tired artillery wheels, on which it rolls about at from four to ten miles an hour. The wagon is illuminated at night by thirty electric lights.

An interesting motor-boat race is scheduled to take place on Saturday, October 29, on the Hudson River, when Mr. Frank Croker's new boat, which was built by the Herreshoffs and has been fitted with a 90-horse-power Mercedes engine, will race the "Challenger"—the boat which went to England to race for the Harmsworth cup. The race is to be run from New York to Poughkeepsie and back, a total distance of 140 miles. As it is the first long-distance event of this character to be held in America, it will no doubt be watched with great interest by many.

Two handbooks that will be found very useful to the intending purchaser of an automobile and the confirmed user respectively are the "Handbook of Gasoline Automobiles" and the "Automobile Laws of All the States." In the former book no less than seventy-six of the latest types of leading American and foreign gasoline motors are illustrated, and their main specifications given, thus making it possible to readily compare them and determine which one suits a person the best. The pamphlet of State laws regulating automobiles has been compiled by the Automobile Club of America. It contains the laws of all those States which have passed legislation on this subject, and it will consequently be found very useful to tourists, as it will aid them in determining in advance whether it is necessary to procure a license and number before traveling through a given State. The necessity of having a separate number for each State (which is the law in several of our principal States) has become such a nuisance to tourists that the National Association of Automobile Manufacturers is about to take steps to stop it and to make one number with the initial letter of the home State serve for all States through which a car may pass. It is to be hoped that the Association will succeed in bringing about such a result.

The New York Juvenile Asylum, which now is located in the Borough of Manhattan, will soon move to a site on the Hudson River near Dobb's Ferry, when a change will be made in the manner of housing the children in its care. They will be placed in "homes" where a group of about twenty children will constitute a "family," and as the inmates of the asylum are very numerous, there will necessarily be several of these houses. The cooking will be done in one kitchen, and it has been decided by the management that in order that the delivery of food to the different homes shall be done with as little delay and as economically as possible, an automobile shall be made use of. Before coming to a final conclusion in this matter the opinions of a number of builders of automobiles were sought, and all regarded the scheme as not only feasible but desirable for the purpose. A vehicle will be built for the special work and will be heated in some manner so that the food will be delivered hot. While the general plan has been decided upon the details remain to be worked out, and several designers and builders of automobiles have promised to consider the matter and submit plans for this novel vehicle.

Automobile affairs are not far behindhand in India, if we are to judge by the 833-mile reliability run which is to be held between Delhi and Bombay. It is organized by the Motor Union of Western India. The trip is to be made in eight days, comprising stages between the large towns varying from 147 to 71 miles. The run begins on the 26th of December, starting from Delhi, and ends at Bombay on January 2. This is the first contest of the kind which has been held in India. It should be remarked that that country offers a wide field for the automobile industry, both for transportation of freight and voyagers, as well as for postal service and agricultural work. The present test is not a speed trial, as the minimum is fixed at 12 miles an hour and the maximum at 30 miles, which is not to be exceeded. The object is to determine the best type of car, the one which will be in the best condition after the run and which has the least number of stops and accidents. The prize consists of a cup of high artistic value, which is offered by the Kaikwar of Baroda. Different Indian princes have offered prizes for other tests which are to be held at the same time. These will bear upon the type of car which is best adapted for road use in agricultural districts that have no railroad facilities; for carrying passengers, freight, and mail matter, besides motor bicycles and quadricycles. For the Delhi-Bombay contest the cars must be presented by amateurs. Entries are received up to the 15th of December, and information can be obtained from the secretary of the Motor Union of Western India, Bombay.

Correspondence.

Vestibuled Day Coaches.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with much interest your article in a recent issue on "The Menace of the Pullman Car," and also the letter of Mr. Clark on the Southern Railroad accident. There is something to be said in favor of the railroads in this matter, for there is a disposition on their part to use a type of day coach on through trains which does not easily admit of being crushed or telescoped. There are three solid Pullman trains running in each direction between Boston and New York, and several others that include day coaches of heavy vestibuled type. The New York Central western trains are practically all vestibuled coaches, and the Lake Shore Limited and Twentieth Century are, of course, all Pullman. The same thing applies on the Pennsylvania, and their standard day coach gives every appearance of solidity and of standing up under a heavy strain. All the evening trains from Chicago to St. Paul are of the solid vestibule variety, likewise the different roads to California, with their Overland and Sunset Limited. I am aware of the fact that a few trains are composed of a mixture of combination smokers, ordinary day coaches of the older type, and a Pullman or two at the rear end. This is a dangerous combination; but such trains as a rule run on much slower schedule, and do not average much more than thirty or thirty-five miles an hour. In the districts around Boston the railroads are gradually withdrawing the light day coaches and placing them in the suburban service, they being supplanted on the through expresses by the heavy, wide-vestibuled type. Of course such a change cannot be made in a month or a year, but it does seem as if the railroads are showing a progressive spirit. W. M. SNELL.

Melrose, Mass., October 14, 1904.

The Romance of Light.

To the Editor of the SCIENTIFIC AMERICAN:

I have just been reading in your issue of August 27 a most interesting article entitled "The Romance of Light," by Fred Hovey Allen. He shows that man commenced with the pine torch, and says: "The expression that mankind was plunged in darkness during the early ages is true in every sense." It seems to me that exception must be taken to this sweeping remark in the case of the ancient Egyptians. So far as I am aware, no lamps have ever been found there which could be proved to be older than the period of the Roman conquest; and yet if one grants that they had the common smoky little clay hand lamps for use above ground, how did they manage underground?

In the Valley of the Tombs at Luxor there are numerous tunneled tombs, that run for hundreds of feet into the side of the mountain. They are anywhere from eight to say fifteen feet in average diameter, square in cross section, and vary to the right and left and up or down during their length, so that to reflect light from the mouth by means of mirrors would have been quite impossible, especially with workmen continually passing in and out.

Now the walls of these tombs are literally covered with the finest hieroglyphics, either incised or stenciled in red and black, and in a new tomb these are as fresh and clean as the pages of your paper. In old tombs they are more or less smoked by the torches of the guides.

I have thought of phosphorus lamps; but they would hardly give general illumination enough to follow out a large design. Possibly bottled fireflies, as in southern India, or beetles, as in South America, might be utilized; but both methods seem too primitive.

Could they have had electricity? I saw it stated some time ago that some English electrician was going to deliver a lecture at St. Louis on "Electricity Among the Ancient Egyptians;" but I have seen no reference to it since.

I am very much interested in all that pertains to the mechanical or rather the physical triumphs of the ancient Egyptians, and have done some little work in that direction. If Mr. Allen or any of your other readers have any information or ideas on this particular application of the light problem, I would much like to hear them. L. W. BARBER,
Commander U. S. N., retired.

14 Rue Cimarosa, Paris.

Proposed Motor Boat Race Across the Mediterranean.

The proposition which has been made by Le Matin, one of the leading Paris journals, to hold an auto-boat race from Algiers to Toulon across the Mediterranean, has awakened considerable enthusiasm among sportsmen. The idea seems to be a very practical one, as it affords an intermediate distance between Calais-Dover and Paris-Trouville and the passage from Havre to New York, for which M. Charley offered his $10,000 prize. The intermediate course will afford a more gradual transition to the Atlantic trip and will give many valuable points which can be turned to account in making the longer sea voyage. The course from Algiers to Toulon is not of an unreasonable length, in view of the present capabilities of the racers, but is long enough to give the pilots an idea of how to navigate during the night. Besides, the region which will be traversed has the advantage of offering different places of refuge in case of a mishap, namely, the Balearic Islands on the west, Corsica and Sardinia on the east. The boats could reach any of these different points by using a sail. Most of the different sportsmen who have already entered for the Atlantic race think the idea is an excellent one, and some of them have already engaged for the event. Among these are M. Charley with two Mercedes racers and one cruiser, Fournier with a Hotchkiss racer, and Dalifol with an Abeille 80-horse-power motor. M. Charley proposes to found a Mediterranean Cup valued at $2,000. M. Gaston Menier, the well-known sportsman, also favors the idea and will help it along. In a recent interview M. Daymard, who is one of the leading naval authorities and designed many of the transatlantic liners, among others the "Lorraine" and the "Savoie," gave his opinion upon the subject of the long-distance races. He is convinced of the utility of these events. As to the length of the racer, experience alone will tell whether a short boat 40 feet in length, or a longer one of 75 or 80 feet should be used. Before making the run from Algiers to Toulon it might be preferable to begin with a shorter distance, Nice-Bastia, for instance, which could be made in 10 hours. But this is not a *sine qua non*, and he thinks the 24 hours' trip from Algiers to France will be an excellent preparation for the Atlantic trip. As to speed, he favors a moderate speed of 20 miles an hour. It would no doubt be better to have the racers accompanied during the passage. However, the boats should be obliged to make the trip without taking on supplies of gasoline *en route*.

As to the Atlantic trip, many additional entries have been received up to the present. Baron Henri de Rothschild announces that he expects to make the trip with a boat which will be built according to some new ideas he has. Among the other entries are Dalifol (Abeille 80-horse-power motor); Tourand & Co. (Vantour 80-horse-power); Leon Bollée I. (Bollée 120-horse-power); Leon Bollée II. (80-horse-power); Henri de Rothschild, and "Satan," belonging to M. de la Heulière. It may be added that the rules for the event will be drawn up so as to exclude any rash attempts which are not well planned and whose failure would bring discredit upon the enterprise.

The Current Supplement.

A splendidly-illustrated description of the new fast protected Turkish cruiser "Abdul Hamid" opens the current SUPPLEMENT, No. 1504. The Hon. Charles A. Parsons, of steam-turbine fame, contributes a paper on Invention that will doubtless be read with interest by inventors as well as by engineers. Mr. Joseph Horner's practical and thorough discussion of "Modern Methods of Steel Casting" is concluded. The amount of valuable information contained in this one instalment of his series will be appreciated at its true worth by practical foundrymen. Prof. Simon Newcomb opened the St. Louis International Congress of Arts and Sciences with a scholarly address on the Evolution of the Scientific Investigator." The address is published in full. In accordance with our promise to publish in each issue of the SUPPLEMENT an article on the World's Fair at St. Louis, there appear two admirably illustrated descriptions of the Italian and Belgian exhibits, from the pen of our St. Louis correspondent. Mr. Charles Ray contributes a thoughtful article on "The Education of Blind Deaf Mutes, with the Case of Helen Keller." M. Emile Guarini, a frequent contributor to these pages, writes on the "Siemens-Schuckert Continuous Current Wattmeter." Mr. Day Allen Willey discusses the proposed canal to connect Montreal with the head of Lake Huron, both from the engineering and commercial standpoints. The "Origin and Manufacture of Lakes" is a subject ably handled by Dr. Robert Ruebenkamp from the chemical-industrial point of view. Dr. Max Einhorn, in an excellent paper, makes some contributions to the method of radium treatment in medicine, its physiology, its diagnostic value, and its therapeutic results in carcinoma of the esophagus.

The Scientific American Building Monthly for November.

The Scientific American Building Monthly for November is a superbly illustrated number. The beautiful house of Herman B. Duryea, Esq., at Old Westbury, New York, forms the subject of the series on "Notable American Houses," by Barr Ferree, and is shown for the first time, the many illustrations including exteriors, interiors, and gardens, the latter embracing some unique and especially interesting features. "Old-Time Gardens" is the subject of an appreciative article, accompanied with illustrations of old gardens in New Bedford, Mass. Mr. George McCullough Miller's fine house at Morristown, N. J., is illustrated and described, and other important houses are those of E. R. North at Montclair, N. J., Albert B. Davies, Netherwood, N. J., Thomas H. Wales, Chestnut Hill, Mass., Robert C. Walsh, Morristown, N. J., a cottage at Springfield, Mass., and a stable at Rosemont, Pa. "Sun Parlors" is the subject chosen for topical illustrations. The departments treat of "The Country House," "The Household," "The Garden," "New Books," "The Chimney," etc. An article on "Nathaniel Hawthorne on Architecture" is timely in view of the Hawthorne centennial.

Engineering Notes.

With a view of ascertaining the advantages of electricity over gas in lighting railway carriages, a number of the dining and sleeping cars on the East Coast companies have been fitted at the Doncaster works of the Great Northern Railway Company with an electric lighting and ventilating apparatus.

The Norwegian government has decided to put into execution the project of establishing an important naval base on the northern coast. The site will be strongly fortified. Melbie has been suggested as the most suitable site for the new base, and fortifications will be constructed all along the coast line.

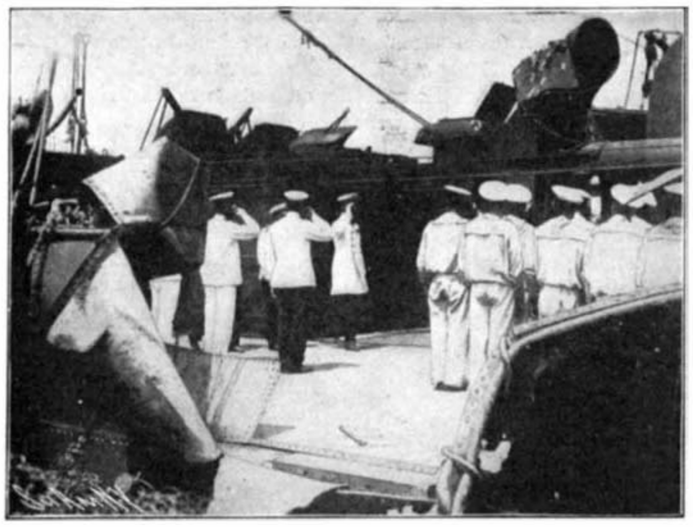
Two new bridges are now being erected across the Seine for the Paris Metropolitan, which crosses the river twice, once in the eastern and again in the western part of the city. Both these bridges will be of considerable size. Wagon tracks and footway will occupy the first platform, and upon this the railroad tracks will be upheld by iron columns. In both cases the Metropolitan line runs for a considerable distance upon an overhead structure before coming to the bridge. After crossing the bridge it enters a tunnel and connects with the existing subway. A third bridge is to be constructed shortly to provide for the north-south line, which runs directly across the center of the city. The line will lie mostly in subway, but will come out at a point near the river. The construction of the new bridge in the central part of the city is a matter of some importance, and the council has recently opened a concourse for the best design, as well as for the execution of the project. This concourse closes November 8.

A new system of manufacturing peat fuel in the form of briquettes by a chemical process has been devised. The raw peat is intimately mixed with lime, nitrate of potash, soot, and saccharine matter, by which means the water set free from the cellular tissues of the peat fiber by the action of the lime and nitrate of potash is absorbed by the lime, while the soot absorbs the oil of the peat. The saccharine matter, while strengthening the action of the lime by rendering it more soluble in the moisture, also causes the blocks of treated peat to dry thoroughly from the center throughout. The chemicals required cost 18 to 25 cents per ton of dried peat, and only a slight mechanical pressure is required, while the result is a fuel of density and calorific value equal to the best coal, free from sulphur, and suitable for domestic use, for gas making, steam raising, or conversion into charcoal for the iron smelters. By erecting the necessary machinery at the side of the bog, the cost of production is estimated to amount to $1.25 a ton. The machinery devised is simple and completely automatic, so that there is no handling from the time the raw peat is fed into the hopper at one end until the briquettes emerge from the cutter at the other side of the machine.

A cruising gasoline motor propelled boat is being constructed by the S. F. Edge Company, of London, to the order of a wealthy American, which, when completed, will be the largest of this type of craft that has yet been constructed. The boat is essentially intended for cruising purposes, and therefore it will be built upon substantial lines. It is to measure 65 feet in length, and to have a carrying capacity of six passengers and a crew of two men. The appointments of the boat will be carried out upon a luxurious scale. It will be propelled by gasoline motors aggregating 340 horse-power. There will be two sets of engines each of 150 horse-power, placed on either side, and a smaller one of 40 horse-power placed centrally. This latter engine is specially intended for cruising at a low speed, starting the boat, and bringing it alongside the anchorage, where the higher-powered engines could not be easily or economically handled. At the same time it will be possible to employ it for augmenting the 150 horse-power engines at high speed, though it is not anticipated that it will afford much assistance in this direction. The boat will have an average speed of 20 miles per hour, and will carry sufficient fuel for ten days' continuous running at full speed. One of the terms of the contract is that the boat must cross the Atlantic under her own power, and be delivered at New York upon her own keel. It is expected that the journey will occupy from six to seven days.

EFFECT OF SHELL FIRE ON THE RUSSIAN CRUISER "ASKOLD."

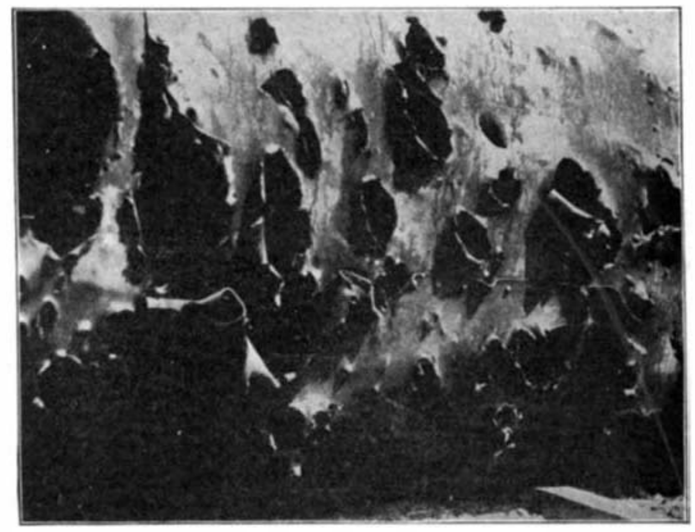
To many of our readers the accompanying series of views, taken by our correspondent at Shanghai, of the badly-battered Russian cruiser "Askold," will strongly call to mind the photographs which we published in 1898 showing the effect of shell fire on the Spanish cruisers. The sortie of the Port Arthur fleet was made in response to orders sent from St. Petersburg, in accordance with which the Russian admiral was to endeavor to break through the Japanese line of blockade and, if successful, steam to the northward, making all possible speed for Vladivostock. The fleet was to be assisted in this by the armed cruisers of the Vladivostock squadron, which were to steam south and effect a junction, presumably in or near the Straits of Corea. If the Port Arthur fleet failed to break through, or if it was worsted in the engagement, it was to make for the German port of Kiauchau, and avail itself of the temporary refuge thus offered. There is little doubt that this matter had been arranged beforehand with the German government, which throughout the whole of this war has stretched to its uttermost limits the meaning of the term "benevolent neutrality." If the Port Arthur fleet suffered a reverse, it was well understood that such ships as gained this German port could at least be saved from destruction by following the course that was ultimately pursued, and disarming. It is a matter of history how the majority of the fleet was driven back in confusion into Port Arthur, and the rest of it scattered, some of the ships taking refuge at Kiauchau, and others making for the Chinese port of Shanghai. Among the latter was the fast 23-knot protected cruiser "Askold."



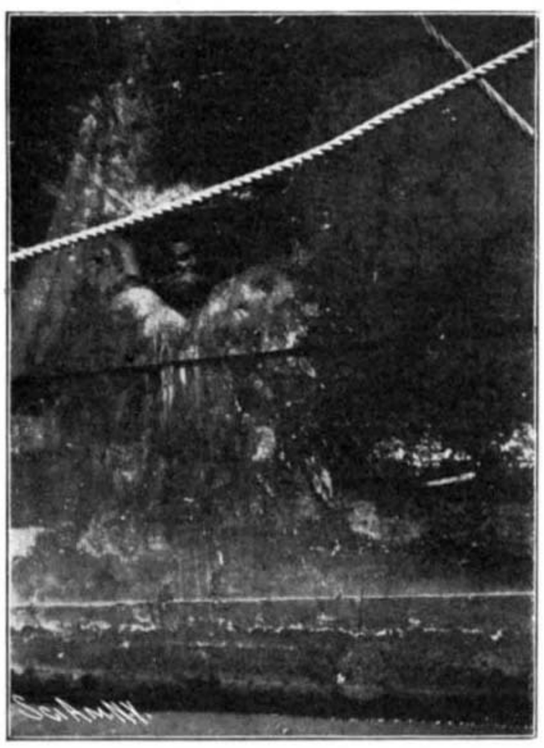
Admiral Metzenstein Complimenting Crew on Their Bravery, and Announcing Birth of the Heir to the Throne.

On reaching Shanghai, the "Askold" was docked at once, and immediate repairs were commenced. The stay of the vessel was prolonged considerably beyond the period allowed by international law, and the Chinese government ordered her to vacate her moorings by August 23, when she was to leave the port or disarm. To this order she paid no attention, and as she had overstayed the time limit, it was feared that serious international complications would be precipitated by the Japanese violating Chinese neutrality, and entering the harbor to capture or destroy the vessel. Finally, on August 26, the Russian authorities ordered the disarmament of the vessel.

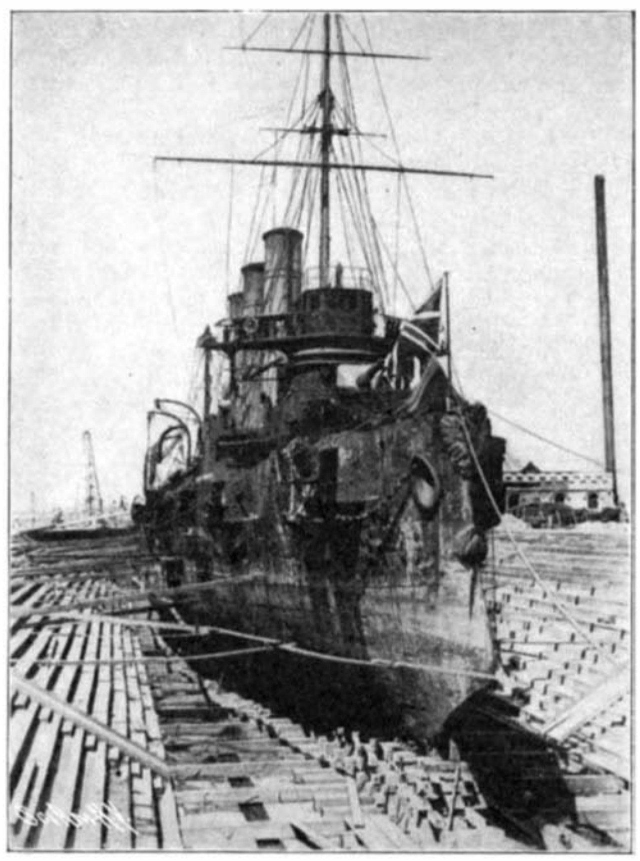
The "Askold" was under hot fire from the Japanese fleet during the time she was within range, and she received many hits from shells, big and little. Our illustrations show very graphically the destructive effect of the fire, and none more so than the near view of a portion of one of the smokestacks. This stack was hit near the base, and the lower portion of it was practically blown to pieces, being so completely shattered that the smokestack sank in upon itself, so that when the vessel entered the harbor it looked as though she had four smokestacks of even height, and a fifth stack that was only about three-quarters as tall as the others. When the shell struck the nearer side of the smokestack, it burst, and the fragments, big and little, passed out through the opposite side, tearing several large, gaping holes and hundreds of smaller



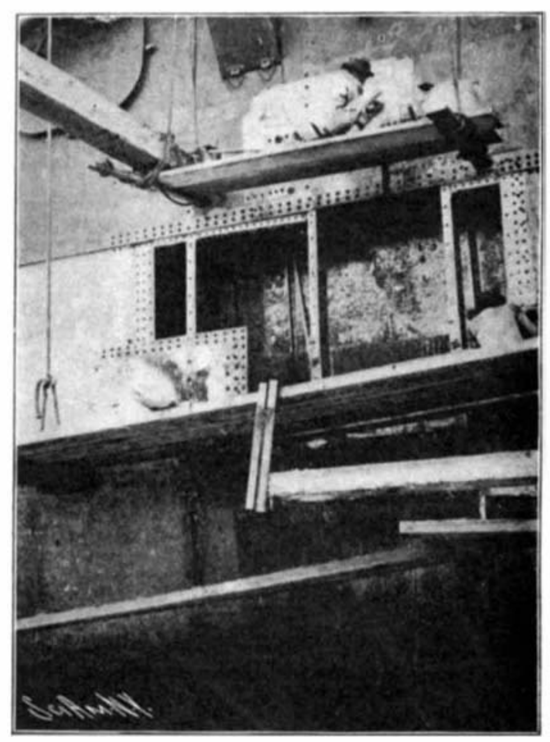
Smokestack Wrecked by Shell Fire. Effect of Fragments as They Passed Out of the Stack.



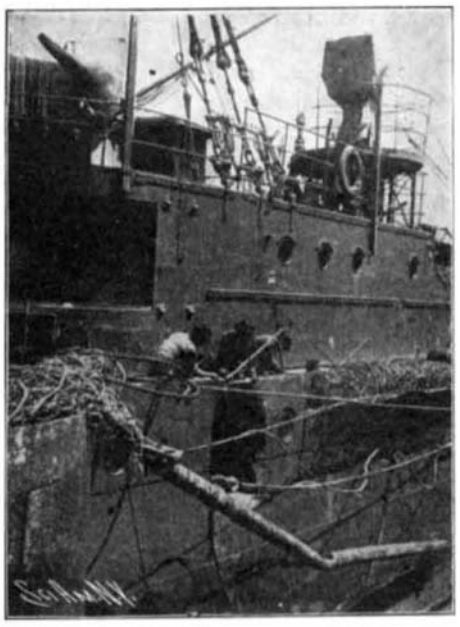
Hole at Waterline Made by Shell that Lodged in the Coal Bunkers.



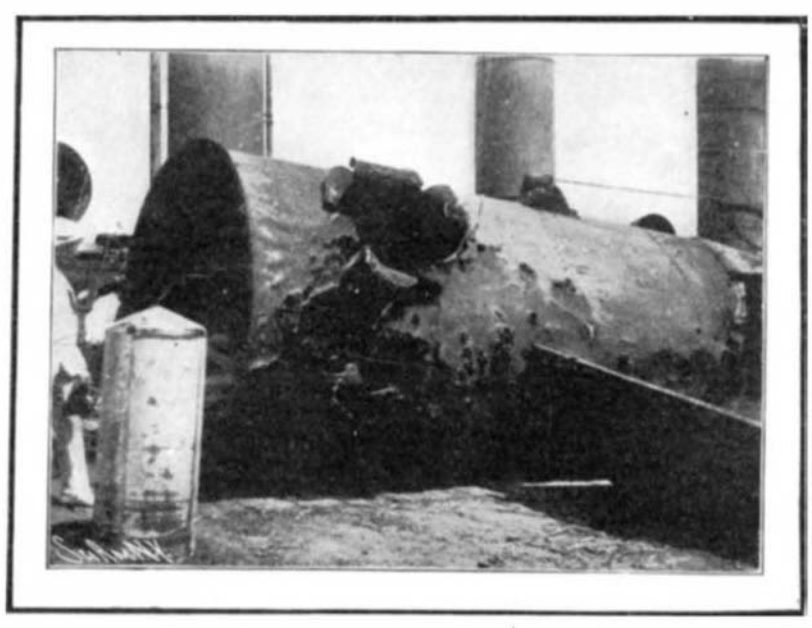
The Russian Cruiser "Askold" in Drydock for Repairs.



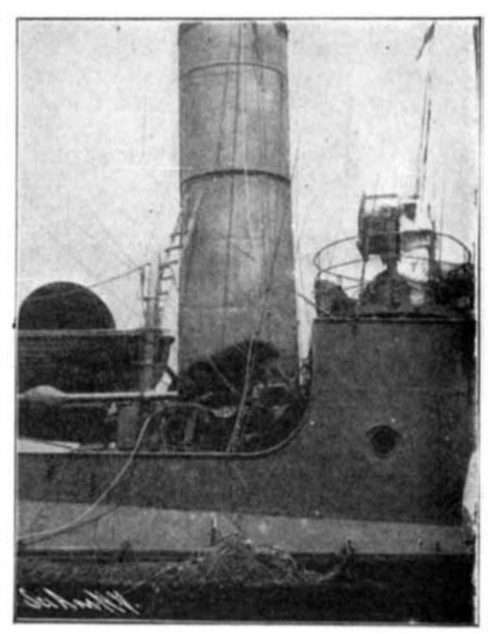
Damaged Plating Removed Preparatory to Replating.



Hole Made by Large Shell Just Below Main Deck.



Portion of Wrecked Smokestack Lying on the Dock.



Base of Smokestack Blown to Pieces by 12-Inch Shell.

"ASKOLD," WRECKED BY JAPANESE SHELLS, AT SHANGHAI FOR REPAIRS.

Trader and Mail Bicycle Equipped with Mexican Saddle Drawn by Eskimo Dogs 700 Miles Through Alaska.

A Group of Eskimo, Showing the Skillful Manner in Which Their Sealskin Garments are Cut and Decorated.

rents. As will be seen from the illustrations, some of these were large enough to admit a man's body, while others were an inch or less in diameter. We have never seen a photograph of the destructive effect of a bursting shell that was so eloquent as this one, and it is easy to picture the terrific slaughter that must take

"Mac," the Wise Bear from the Yukon, and an Eskimo Boy.

place in a crowded battery when a shell of this kind bursts, and the thousand flying fragments sweep across the inclosed space. The funnel that was so badly crippled that it fell in upon itself was the fifth and last. The fourth funnel was also so much shattered that it had to be taken out and repaired. The big shell that passed through the fifth funnel, after wrecking it, blew out a large portion of the opposite bulwark, leaving the great rent shown in one of our illustrations, the view being taken from the opposite side of the ship from which the shell entered. Another big shell passed through the vessel between the main and gun decks, badly wrecking the interior of the vessel. Another shell struck the "Askold" at the waterline and lodged in the coal bunkers. The repairs to the ship consisted in replacing the funnels, cutting out the damaged portions of the shell of the vessel, and building in new plating in its place. An interesting photograph is the one showing Admiral Metzenstein complimenting the crew of the "Askold." The sailors and officers seen in this cut are the survivors that passed unharmed through the fight.

The "Askold," which was built at Krupp's in 1900, is a protected cruiser of 6,500 tons displacement and 23 knots speed. She carries twelve 6-inch, 45-caliber rapid-fire guns, twelve 3-inch rapid-fire guns, and ten smaller rapid-fire pieces, besides two submerged torpedo tubes and four above-water tubes. She is one of a half-dozen vessels of similar speed and type, among which was the ill-fated "Variag," which was sunk by gun fire in the harbor of Chemulpo at the commencement of the war.

A New Form of Pleasure Boat.

Capt. Louis Larsen, of Muskegon, Mich., a well-known sailor of the Great Lakes and formerly master of the steamer "Charles B. Hackley," has recently received patent papers on a new form of pleasure boat which will have many attractive features for tourists and excursionists. In this craft there are not only means for constantly surveying the floor of the stream immediately under the boat, but also for making pictures of the same. The latter will open a new field for the amateur photographer, if the captain's scheme proves entirely practicable. The boat as designed by Larsen is supplied with a glass bottom, and under the bottom of the craft is an electric light which will illuminate the water and the bed of the stream for some distance around. A hooded reflector makes it possible to sit comfortably in the boat and witness the curious things in the water below with great ease, and pictures may be taken also through means of the mirror. The captain has in his possession a number of photographs which were taken by this means, and these are said to be quite satisfactory, although they were made in the early spring, when the water was clouded with dirt washed down into it. These boats will be used on Lakes Mona and Muskegon during the

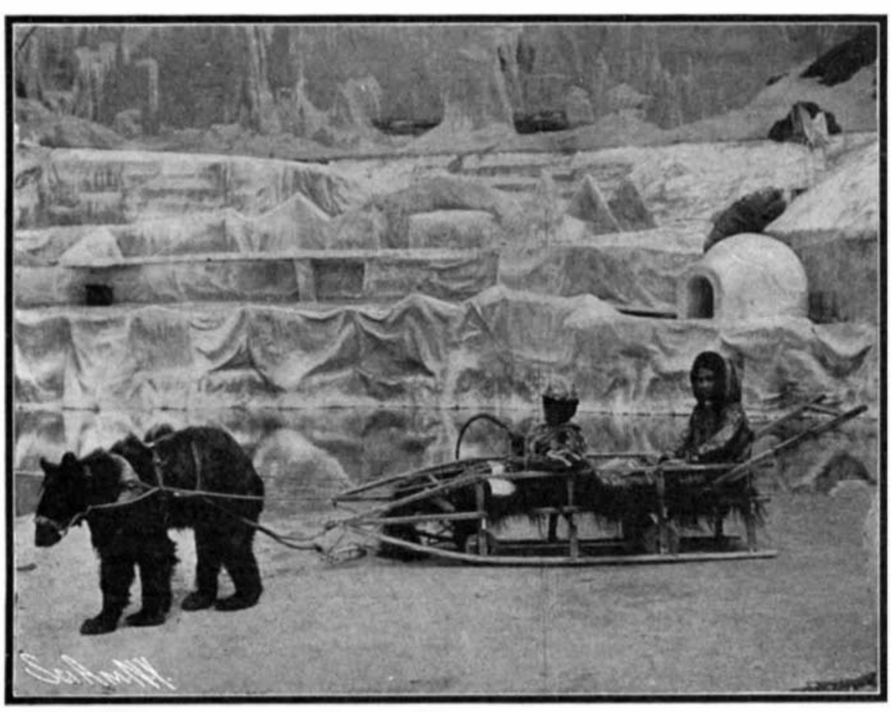
Half-Breed Eskimo Girl.

summer season. Boats of this type have long been used in Florida and California waters.

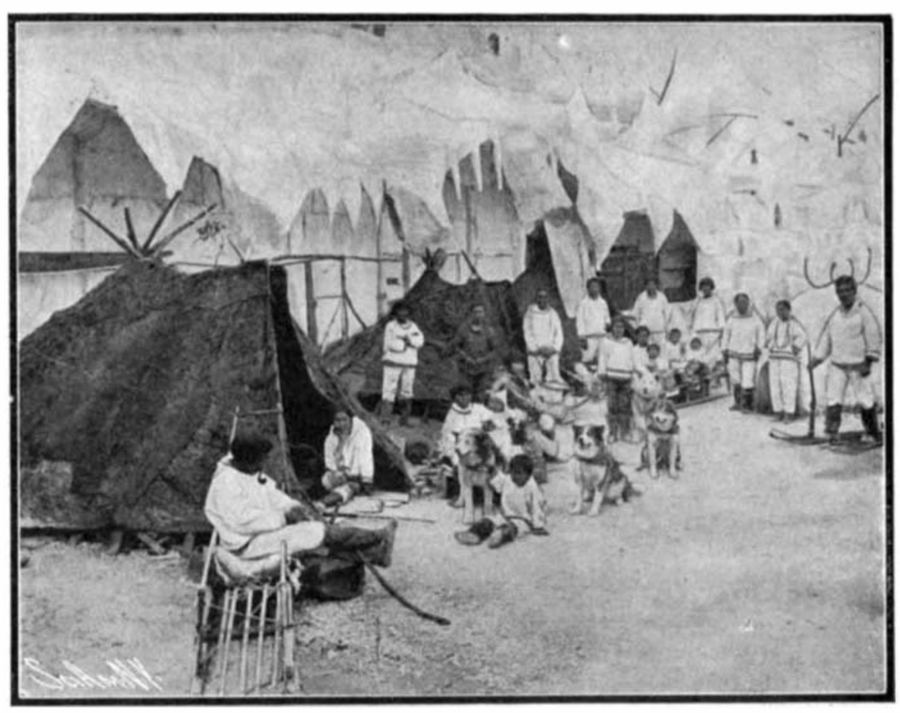
ESKIMO VILLAGE AT THE WORLD'S FAIR.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The St. Louis Fair is particularly rich in subjects of ethnological interest, and tribes from almost every corner of the earth are gathered within its inclosure.



"Mac," the Wise Bear, Driven by Eskimo Children.



Eskimo Village and Natives with Dogs, Showing the Topeks or Huts Made of Sealskin.

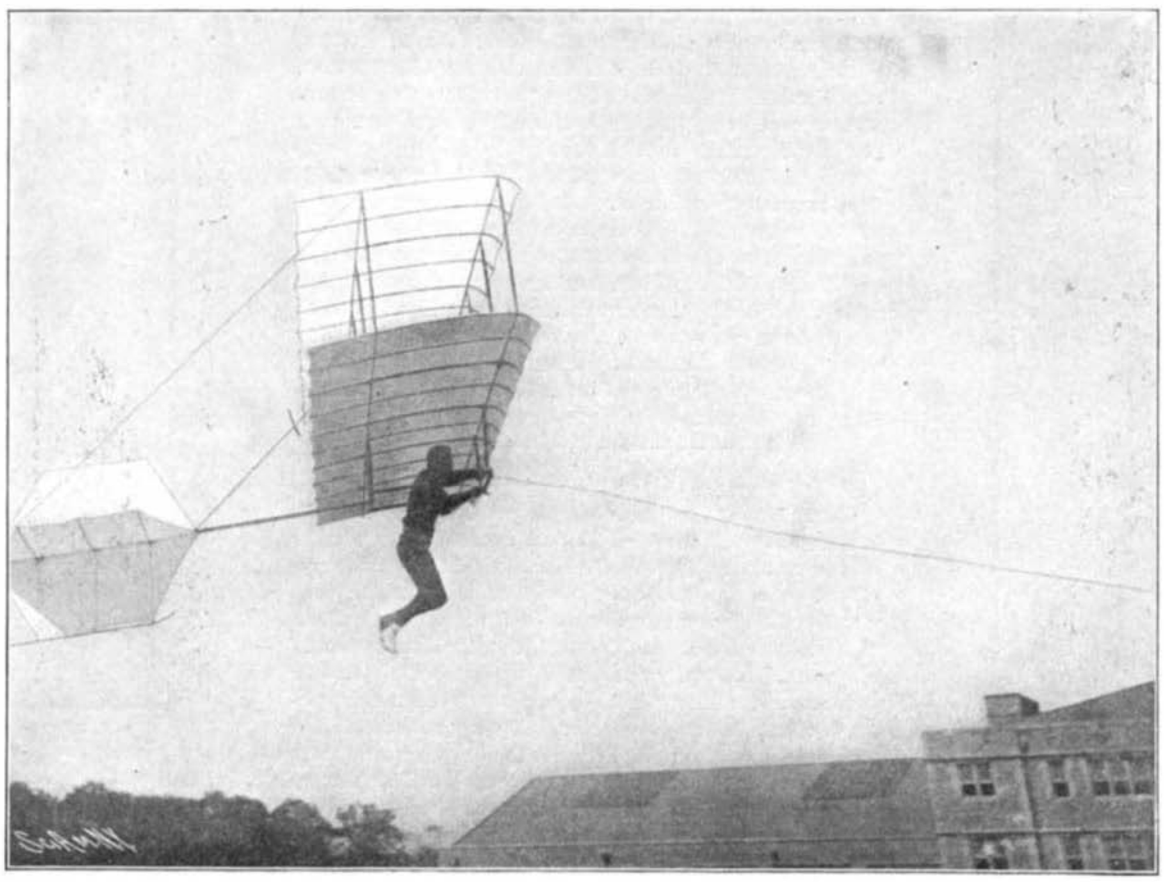
ESKIMO VILLAGE AT THE WORLD'S FAIR.

One of the best exhibits of this kind is the Eskimo Village, the inhabitants of which, representing two tribes, one from Labrador and the other from Alaska, localities that are 2,700 miles apart, have been brought to the fair by "Dick" Crane, a pioneer Alaskan explorer and trader, whose picturesque history is well known throughout the new gold fields. After many years' residence among these people, he had so far won their confidence that he was able to persuade several families, nine in all, to come to St. Louis. With them he brought twenty-six Eskimo dogs, a large number of sleds, native implements of the chase and of domestic use, and a museum of articles illustrative of Eskimo life. The whole exhibit is one of the most genuine of its kind, and the American citizen may see these strange people from the North housed in their summer tents of sealskin or their winter "igloos" or snow houses, and engaged, the women in their domestic duties of sewing, cooking, etc., and the men in their various feats of skill, whether in the hunt or in their pastimes, of which they are unusually fond. Mr. Crane has made a careful study of the Eskimo, and has formed a high opinion of his kindly disposition and sturdy qualities. He is satisfied that it is a mistake to suppose that because of certain facial similarities, these people are of Japanese or other Asiatic origin; rather he is disposed to think that they are a branch of the North American Indian, whose peculiarities of physical and facial make-up are due to climatic and other formative influences. They are a people that use the upper part of the body far more than they do their lower limbs, consequently they are enormously strong in the arms, shoulders, and back, a fact which is proved by various feats of lifting and carrying that they perform in their native village. The cold climate and the complete isolation of the people have combined to produce that exceedingly kindly and friendly disposition which shows in the genial countenance of the Eskimo, and is evidenced by the winning smile and outstretched hands with which they come out of their tents and greet the visitor. They live four or five together during the winter, in their igloos, which they can build in from twenty minutes to half an hour. For a window they use a block of transparent ice. Four or five will crowd into one of these warm abodes, with a whale or seal oil lamp, consisting of a hollow dish with a little moss for a wick, which serves to give them both light and heat. The temperature, when the lamp is lighted, will soon run up to ninety degrees.

The sociability of the Eskimos has won them many friends among fair-goers; their abodes are sweet and wholesome, and they may be seen continually washing their clothes, while in spite of their close quarters there is no offensive odor noticeable.

One of the most interesting of our photographs shows what is neither more nor less than a "dogmobile." It seems that a few years ago, when Crane was carrying mail and other matter over a 22-mile route on the Dawson trail, a "tenderfoot" came into the country bringing with him, of all things in the world, a bicycle, which he quickly discarded. It occurred to the trader that in the summer months this might make an excellent substitute for his dog sled; accordingly solid tires were put on, a huge Mexican saddle took the place of the bicycle saddle, a whiffletree of bone was constructed, and with a team of four Eskimo dogs this novel conveyance served for journeyings over the trail, which aggregated between 700 and 800 miles in a single summer.

It is stated that the French colonial party have instructed M. Leroux to submit a proposal to the Emperor Menelik to bring about internationalization of all royal lines for which concessions had been or might be granted in Abyssinia. The Negus approved the proposal on the condition that a preliminary agreement should be concluded between the three powers interested in the question. Negotiations have consequently been opened between the British, French, and Italian governments. As soon as agreement is reached work on the construction of the railways will be resumed.



SAILING 50 FEET FROM THE GROUND SUSPENDED FROM AN AEROPLANE AT THE WORLD'S FAIR.

PREPARATIONS FOR THE AIRSHIP CONTEST AT ST. LOUIS.

The first attempt in the history of aeroplanes to operate a flying machine of that type carrying a man through the air was made on Thursday, the 6th instant, in the Stadium at the World's Fair by experts in aeronautics, and was considered by all of them a remarkably successful venture. Among those who witnessed Mr. Avery's trial performances were Major Baden-Powell, Mr. Chanute, Mr. Baldwin of San Francisco, Prof. Carl Myers and wife, M. Hippolite François and party, Mr. J. E. Sullivan of the Washington University, Lieutenant-Colonel Capper of the British Army Balloon Corps and Mrs. Capper, Mr. W. F. Reed of London, England, and Captain Von Tschudi of the German Army Balloon Corps. Encouraged by the plaudits of the scientists who witnessed his initial venture, Mr. Avery awaits the time of the great aeronautic contest for which the Exposition Company has offered the $100,000 prize. Mr. Avery's machine, which was built by himself, assisted by his brother Frank, in the Aerodrome at the Fair, is made upon plans furnished by Mr. Chanute, the man who built the first bridge over the Mississippi River. Mr. Chanute furnishes original plans free of all cost to any *bona-fide* aspirant for aeronautical achievements. The Avery machine is especially interesting because of its lightness, being perhaps the lightest structure of equal surface area ever built for actual man flight, as it weighs but 18 pounds all told. It consists of a light framework supporting two aerocurves, each 18 feet wide by 5 feet deep, one placed 4 feet above the other. Behind this is a cross-bladed rudder for balance and safety of evolution. The machine is propelled by the force of gravity acting upon it, the weight including that of the operator and the machine, which falls or glides from a height downward and forward through the air to a landing on the ground. This height is attained by rapidly pulling the vessel forward by means of a copper wire attached to a small motor, until the machine rises gracefully in the air like a kite, carrying the man in its flight. The latter rests along two horizontal bars under his armpits and forearms, permitting a free movement of the body backward or forward, and a swinging of the lower limbs in any direction to counterpoise the machine or balance any irregularities of the wind currents. It is interesting to note in this connection that before taking up the study of aeronautics, Mr. Avery was for many years a sailor. While at sea he made a close study of the effect of wind currents upon sails, and is thus enabled to meet or resist the action of the current as he glides through the air. Before making the start, the kite-like glider rests upon a small platform, which is mounted upon four wheels on a small rail track, and it is upon this platform that the glider is drawn forward until sufficient speed is attained to lift the whole thing aloft and send it scudding through the air. The operator releases the copper cable at any desired point, allowing the machine to glide forward and downward to the ground. The entire operation is based upon exactly the same principle as the flying of a kite.

There are four other airships in the Exposition Aerodrome which will be entered in the forthcoming contests. The first of these to arrive here was the T. C. Benbow airship, which was built and assembled at the Carl Myers balloon farm at Frankfort, N. Y., and operated there until its evolution qualities were proven satisfactory. This is all ready for the contest, being kept inflated with hydrogen gas, which it holds for any length of time by means of a special machine varnish invented and used by Prof. Myers.

Mr. Benbow's airship is driven by a 4-cycle gasoline motor of 10 horse-power and weighs 110 pounds, actuating four side-wheel propellers, with four blades each, which open and close at any point desired, so as to impel the gas spindle up, down, forward, backward, to the right or the left at the option of the operator. This gas spindle is 74 feet long and 21 feet in diameter, contains 14,000 cubic feet of hydrogen, and will support a weight of 900 pounds. The vessel made a very successful flight of several hundred feet two weeks ago, and now awaits participation in the contests.

The second airship to arrive here was that of Marcellus McGary, of Memphis, Mo., which has not yet been assembled or supplied with gas, and consequently has as yet made no trial performances here.

A third ship to arrive here was that of Mr. T. S. Baldwin, of San Francisco, Cal. This ship has just been assembled in the workshops of the Exposition Aerodrome, but has not yet been inflated. It has a 5-horse-power engine, and is of the same type as the Benbow ship, consequently many who have been favorably impressed with the preliminary flights of the former are expecting great things of Mr. Baldwin's vessel. This ship will be propelled by a two-bladed screw in the bow and guided by a rudder, a feature which the Benbow airship has had added to its facilities for steering since its experimental flight two weeks ago. Another vessel which awaits assembling in the workshops of the Aerodrome is that of M. Hippolite François, from Paris, France, which consists of a framework built somewhat like a farmer's hay rack, which supports machinery operating two pairs of screw propellers upon each side, making four in all. A 30-horse-power automobile motor swiftly revolves these screws by pulley and belt connection, provided with loose pulley and clutch for starting and stopping. This vessel has no rudder, and is dependent upon the variable action of the screws on each side to direct its course as well as to regulate its speed. As the time for the final contests between these five vessels approaches, interest on the part of the general public increases perceptibly, and already crowds fill the Stadium to watch the trial flights of the different ships.

Recent large conflagrations in the business sections of several large cities have been the means of booming metal office furniture. Some desks and racks of metal, which underwent a severe experience at the Baltimore fire, were found to be practically uninjured after the fiery visitation but also to have preserved their contents. All of the troubles with the wooden furniture are said to arise from the warping and twisting of the wood entering into its composition. It is this and nothing more that puts a wooden desk out of service, the joints parting and the drawers becoming all awry. This cannot happen to the metal furniture and therefore its life of usefulness is said to be without end. Desks and cabinets of metal are claimed to take the place of the safe to a very great degree. It is not necessary for the bookkeeper to put his books all in the safe every night but simply to stow them away in his desk. This is not only a convenience but a saving in the matter of safes. The simple lines of these pieces are very pleasing and are approved from the sanitary standpoint. The articles are now made up in all the desirable shapes for general office use, including the desks of different shapes for various purposes and also cabinets of different shapes for filing drawers.

Luciano Butti, an Italian inventor, has designed a photographic apparatus by means of which it is possible to record 2,000 photographic impressions per second. This discovery will prove of inestimable value for the minute observation of insects and other creatures in rapid motion. The cost of the films approximates $10 per 2,000 impressions, so that the apparatus will be somewhat costly in operation.

THE MOUNTING OF BUTTERFLIES FOR NATURE STUDY.

The collecting of insects and butterflies has had its devotees since ancient times, but few people have any conception of the magnitude of the industry called forth by it. In recent years, moreover, the addition of nature study to the courses of the public educational system in the United States has largely augmented the trade in collecting, preparing, and distributing insect specimens. These are gathered all over the world by collectors—sometimes exclusively and sometimes incidentally insect gatherers—and shipped for preparation and export to distributing centers, which are found in nearly every large city here and abroad. For the information herein in regard to this trade we are indebted to Mr. O. Fulda, of New York.

Mounted Specimens for Educational and Decorative Purposes.

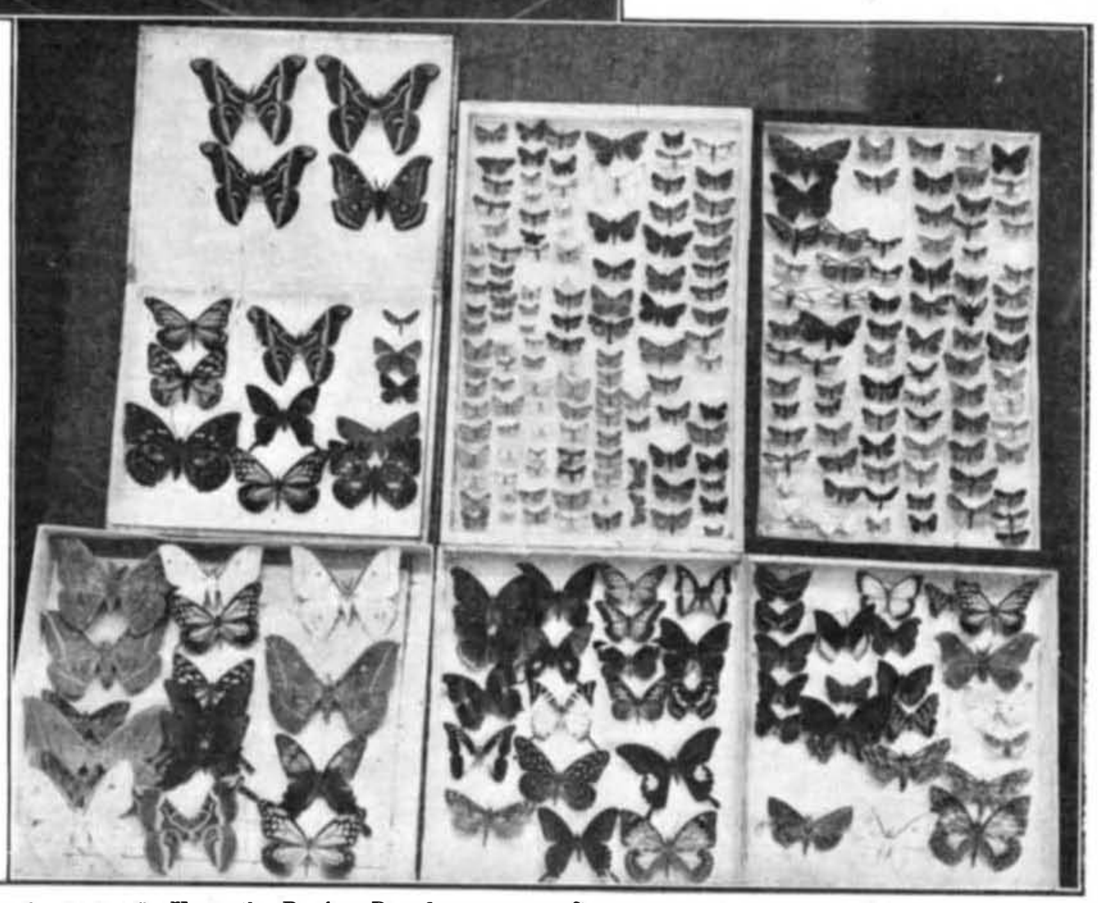
The prepared butterflies are sold for educational and decorative purposes, and to private and professional collectors. The last two deal almost entirely in the single specimens shown in the photograph, and for their convenience a list is kept of the constantly changing stock. For educational purposes the specimens are prepared and mounted in such a manner that they will present not only the butterfly itself, but also its entire life, egg, caterpillar, cocoon, butterfly, its food and method of procuring it, the plants on which it exists, and frequently its parasites. For decorative purposes the butterflies and plants or flowers are chosen for the artistic effect and color scheme, and are handsomely framed. The results as shown in two of the photographs are frequently of great beauty.

The introduction of plants into the mounting of these specimens has brought into being an industry of some size in itself in collecting and preparing them. That the plants may retain their natural colors, they must be pressed almost immediately after they are gathered; and to accomplish this, Mr. Fulda uses a special press of light weight and easily carried, in which the plants are placed between sheets of cotton, these between pieces of cardboard, and these again between sheets of corrugated cardboard, and the pressure then applied. If it is necessary to dry the flowers or foliage quickly, the hot air from a lamp placed under the press is allowed to pass between the corrugations, and in a few hours the plant is ready to be mounted.

The butterflies themselves are merely dried with great care, pinned upon a special drying board. In this board there is a channel in which the body of the butterfly is placed, so that the wings may be pinned absolutely flat. This method leaves the specimen rather brittle, but with care it may be preserved indefinitely. The cocoons and small insects like the parasite shown in the photograph are prepared in a similar manner, but the method of preserving the caterpillars is different. The interior portion of the caterpillar is removed by carefully pressing it out, and the empty skin then inflated with hot air and allowed to dry. This preserves the true form and color and prevents decay. The specimens are mounted in an excellent manner by being placed in shallow cardboard boxes, filled with cotton and covered with glass lids.

The butterflies are sent by the gatherers to the distributing centers in squares of paper folded to form a triangle, as shown in the illustration. The specimen dries out fairly well in this way, and may be kept for years before being mounted. It is only necessary to place it in wet sawdust for a few hours to soften it, and it may be pinned in the regular manner upon the mounting or drying board. While the rarer butterflies or those existing in wild countries are taken in their natural state, the commoner varieties are to-day raised by the thousand upon farms especially devoted to their culture.

Father Joseph Murgas, of the Sacred Heart Church of Wilkesbarre, Pa., is the inventor of a wireless system of communication on which he has been working for seven years. He was recently granted the seventh patent covering the different features of the system. He says he has conducted communication with a station located two miles from his workshop. The latter is in the rear of the rectory, and he says that any money he derives from his work will be turned over to the church. Father Murgas took degrees in electrical science in Vienna eighteen years ago, and has kept abreast of all developments in electricity ever since.



Educational Group, Showing Complete Life of Butterfly, Its Mode of Living, and Its Parasite.

Mounting the Butterfly Upon the Drying Board.

Single Specimens Sold Cheaply to Collectors.

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