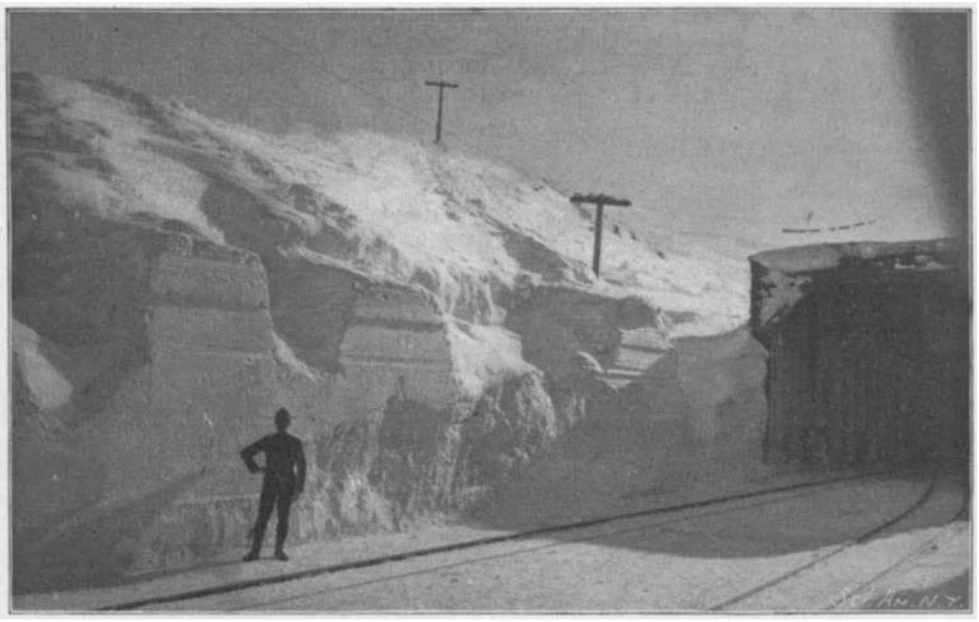
WINTER RAILROADING IN ALASKA.

BY ENOS BROWN.

The labor in maintaining an open track on the single Alaskan railroad can be understood from an inspection of the illustrations which accompany this article, which were taken expressly for the SCIENTIFIC AMERICAN. In the warmer months it is necessary to guard against obstruction of the line by avalanches of rock and gravel, which are constantly falling from the sides of the deep cuts through which the track passes. In the season of frost the work of keeping the track clear is trebly increased. From Skagway the ever-open port on the Pacific, to the summit of White Pass, 21 miles distant, the road ascends 2,400 feet, over a track that winds around the precipitous sides of the mountains, through tunnels, and a long series of deep cuts, at last emerging at the summit of the divide and continuing to the terminus at the head of navigation on the Yukon River. The same enterprise that surmounted the financial and physical difficulties in building the White Pass and Yukon route has to be employed in keeping it open. Traffic continues throughout the year. There is not a day upon which a train does not run on schedule time. Supplies for the mining communities at Dawson and elsewhere are brought down the river, during the season of navigation, from White Horse Rapids. Stocks are thus accumulated during the closed season and this requires that the route over the pass be kept open at all times. Snow begins to fall on White Pass about October 15, and continues with rare intervals until the 1st of May. The average accumulation on the level is 20 feet. Winds are violent and incessant during the winter, and the utmost effort is required to keep the deep cuts free from snow. Two large snow plows continually move back and forth on the track. Rarely a train starts out during the winter that is not preceded by one of these snow plows. In January the thermometer sinks to 60 deg. below, and then is the time when the snowfall is greatest and the wind fiercest. Cuts are filled up and the track obliterated. With two engines pushing the centrifugal plow, the attack is made upon the huge drifts, and with the help of all available shovelers, the track is soon cleared. The most dangerous season on an Alaskan mountain railroad is not when snows are deepest, or the frost most intense, but in early spring when thaws begin, and snows on the mountain sides form avalanches, which, without warning, slide down over the track and engulf it. The utmost vigilance is then required, for a whistle of the locomotive has been known to bring down thousands of tons of closely-packed snow.



SUMMIT OF THE PASS SHOWING THE DEPTH OF THE SNOW.

ROTARY SNOW PLOW AND CREW.

Purdue University will soon inaugurate a new department of instruction in telephonic engineering. This step is taken in response to the increasing demand by telephone interests for men trained in the particular branch of electrical engineering pertaining to telephony. Investigations have disclosed the fact that students completing the course in electrical engineering must devote upward of two years additional work to acquiring special details of telephone practice before they are sufficiently equipped with a knowledge which is valuable to merchants and consumers of telephone material.

Garbage-Consuming Plant.

At Darwen, England, has been established a plant for consuming household waste, and the resulting energy is utilized to operate the electric tramway system of the town. The plant, although not one of the largest, is interesting in many respects. The waste is consumed in two furnaces of the Meldrum type, with an automatic feeding apparatus. The furnaces and boilers are established in a building alongside of the electric station. The latter contains 3 engine and dynamo sets, including 2 Siemens 150-kilowatt generators driven by 250 horse power engines, and one Mather & Platt 300-kilowatt generator with a 450 horse power engine. The boilers are of the Lancashire type and measure about 8 by 27 feet. The average combustion of household waste is sufficient to furnish steam for supplying 3,500 incandescent lamps of 8 candle power, or equivalent. The quantity of waste consumed varies from 32 to 38 tons a day, although the plant has a capacity of 70 tons. The calorific power of the waste is estimated at about one-fifth that of ordinary coal. The plant has been in operation for some time and has proved quite successful, as the garbage of a city of 40,000 inhabitants is destroyed inoffensively and at the same time there is produced energy equivalent to 400 horse power for 12 hours per day. By using accumulators this may be increased to 260 horse power during the 18 hours service of the electric tramway. The annual production of energy is estimated at 900,000 kilowatts.

Dr. Hrdlicka has started on his fourth expedition into the country of the cliff-dwellers and Pueblos in the southwestern part of the United States and northern Mexico. These trips are made under the auspices of the American Museum of Natural History, the money being supplied by F. E. Hyde, Jr., of New York.

Experiments of M. Moissan With Hydride of Potassium.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

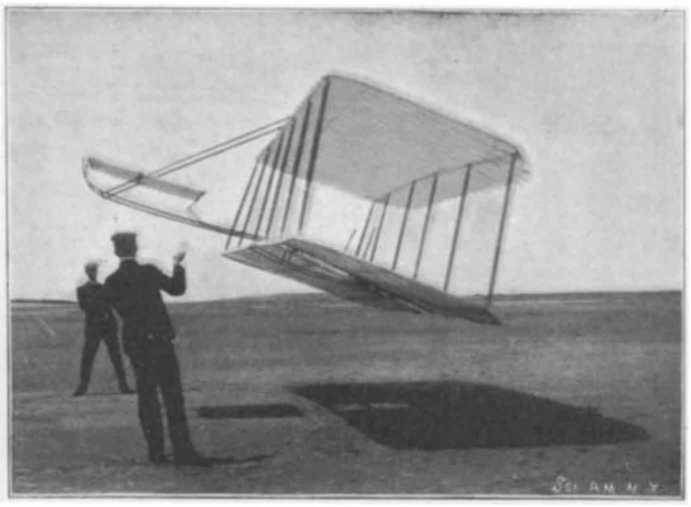
The hydride of potassium is a compound about which little has been known up to the present, and accordingly M. Henri Moissan has undertaken the study and preparation of this body, and has been quite successful in his experiments. If potassium is kept for several hours in an atmosphere of hydrogen, at a temperature of 350 deg. C., it soon becomes covered with a transparent and crystalline layer of hydride, through which the brilliant surface of the unattacked metal is visible. In his present experiments, Mr. Moissan uses potassium in the form of metallic wires, which are placed in a small iron vessel. The latter is disposed in a horizontal tube of Bohemian glass and a current of pure and dry hydrogen is passed through. Using a Deville hydrogen generator he could pass a current whose tension exceeded the atmospheric pressure by 10 centimeters of mercury. When the experiment was carried out at 350 deg. C. (the temperature of boiling mercury) the formation of hydride was very slow, but after 8 or 10 hours' heating there was seen to form at the end of the vessel opposite the hydrogen entry a small bunch of white and intermeshed crystals which had the appearance of cotton filaments. If the experiment is repeated at 440 degrees, (the temperature of boiling sulphur), metallic potassium comes off and is condensed in the cold parts of the tube, and on each side of the vessel there is formed a ring of metal and a white ring of the hydride. The best method was found to be to heat the lower part of the tube and the vessel to 360 deg., when the hydride condensed in the upper and cooler portion. It was thus obtained in a felt-like layer of fine white crystals which do not contain free potassium. M. Moissan has studied the properties of this compound, and finds it to be one of the most easily decomposable bodies known. It takes up the moisture of the air with great rapidity and decomposes at once, giving off hydrogen and leaving potassa. It decomposes cold water, producing at the contact a noise like that of a red-hot iron, with a violent disengagement of hydrogen gas. This body is insoluble in turpentine, benzine, ether and bisulphide of carbon, but dissolves in fused potassium. Its density is found to be 0.80. When heated *in vacuo* below redness it separates into potassium and hydrogen. This property enables its composition to be determined. Upon contact with fluorine, cold, it takes fire at once, and the heat disengaged at first is so great that the rest of the hydride is violently decomposed. The hydrogen then combines with the fluorine and the potassium burns more slowly in the excess of fluorine. When the hydride is projected into chlorine gas it becomes incandescent and gives hydrochloric acid and potassium chloride. It takes fire in dry oxygen with great heat, forming potassium hydrate and water. This body is difficult to handle in the air, as it takes fire when removed from the tube in which it is formed. With melted sulphur, decomposition takes place with incandescence, forming sulphide of potassium and hydrogen sulphide. When slightly heated in carbonic acid gas the hydride reacts with incandescence, and the same phenomenon is shown with hydrogen sulphide; here potassium sulphide is formed and hydrogen given off. It acts as a reducing agent when mixed with copper or lead oxides, and the metal is set free. M. Moissan has made a number of analyses of this body and finds that it has the formula KH.

SOME AERONAUTICAL EXPERIMENTS.

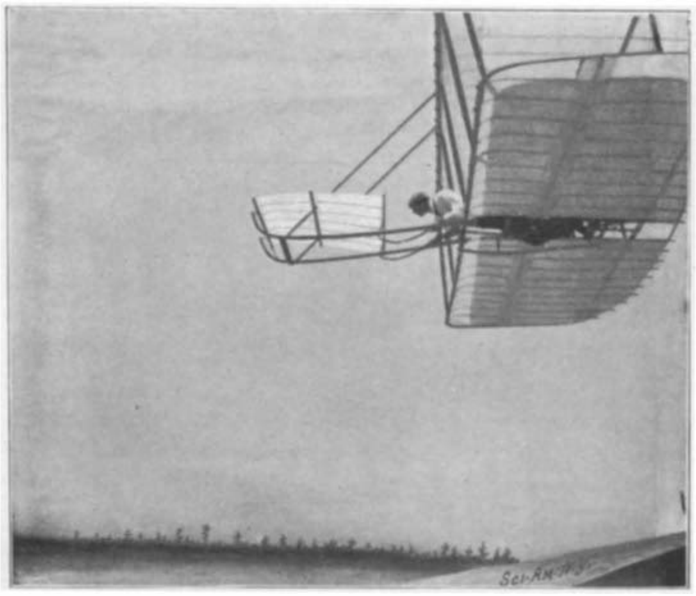
Mr. Wilbur Wright, of Dayton, Ohio, recently read a most interesting paper before the Western Society of Engineers, entitled "Some Aeronautical Experiments," and this paper was afterward published in the Journal of the Society. Through the courtesy of the Society we are enabled to present a series of engravings illustrating the article. Mr. Wright's attention was drawn to the study of aeronautical problems a number of years ago, and his active interest dates back to the death of Lilienthal in 1896. The experiments of Pilcher and Chanute also stimulated Mr. Wilbur Wright and Mr. Orville Wright to try some experiments in 1900, which were conducted on the seashore of North Carolina. These gentlemen have been bold enough to attempt some things which neither Lilienthal, Pilcher nor Chanute dared to do. They have used surfaces very much greater in extent than those which hitherto have been deemed safe, and have accomplished very remarkable results. It was the plan of Messrs. Wright to glide from the tops of sandhills. It seemed reasonable that if the body of the operator could be placed in a horizontal position, instead of the upright, as in the machines of Lilienthal, Pilcher and Chanute, the wind resistance could be very materially reduced, since only one square foot, instead of five, would be exposed. As a full half-horse power could be saved by this change, they arranged to try the horizontal position. The first machine had an area of only 165 square feet. It was first tested as a kite, and valuable data as to the angles were obtained. They then turned their attention to making a series of actual measurements of the lift and drift of the machine under various loads. The results obtained were most astonishing, for it appeared that the total horizontal pull of the machine, while sustaining a weight of 52 pounds, was only 8½ pounds, which was less than had previously been estimated for head resistance of the framing alone. On the other hand, it appeared sadly deficient in lifting power as compared with the calculated lift of the curved surface of its size.

Their attention was next turned to gliding, and a small hill which rose from flat sand to a height of more than 100 feet was selected, the slope having an inclination of ten degrees. A dozen glides were made with the wind blowing at 14 miles an hour. The operator placed himself in a horizontal position, and two assistants started the machine. Neither machine nor operator suffered any injury. The control of the apparatus proved even better than they had dared to expect, responding to the slightest motion of the rudder. With these glides the experiments for the year 1900 closed. The new machine for 1901 was exactly like the previous machine in theory and method of operation, but its lifting power was increased from 165 square feet to 308 square feet, although so large a machine had never before been deemed controllable. A special building was erected to house the apparatus. Quite a party went south to view the experiments, which were begun with the wind blowing 13 miles an hour. Various glides were made in order to find the center of gravity of the operator. The machine sailed off and made an undulating flight of a little more than 300 feet. To the onlookers this flight seemed very successful, but to the operator it was known that the full power of the rudder had been required to keep the machine from either running into the ground or rising so high as to lose all headway. The experiments also showed that one of the greatest dangers in machines with horizontal tails had been overcome by the use of a front rudder, and the operators escaped from positions which had proved very dangerous to preceding experimenters. In subsequent experiments the machine, with its new curvature, never failed to respond promptly to even small movements of the rudder. Many glides were made whenever the conditions were favorable.

A most interesting series of photographs were taken, some of which we reproduce. Our readers are referred to Mr. Wright's original paper for an elabor-

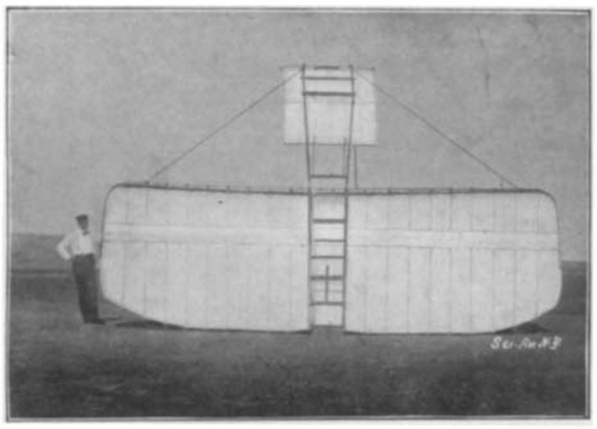


In Midair.

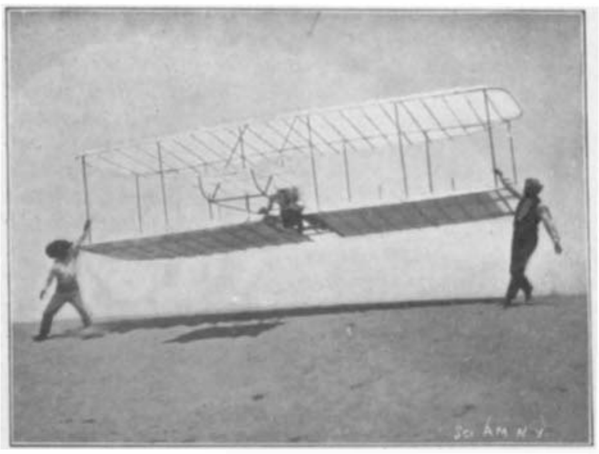


Soaring.

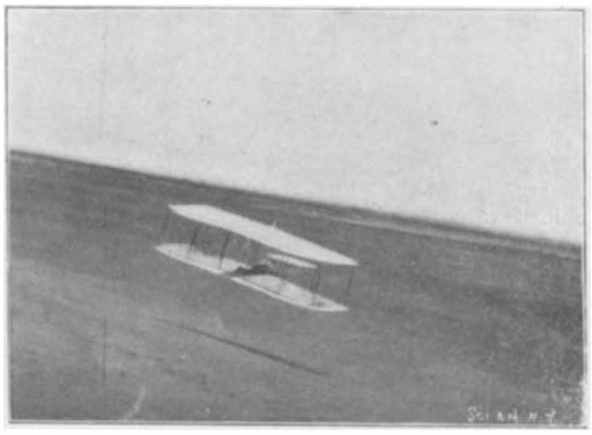
ate technical description of the principles involved in the experiments.



A Bottom View.



Beginning of a Flight.



A Low Glide.

SOME RECENT AERONAUTICAL EXPERIMENTS.

Alloys for Brass and Bronze.

Manufacturers of door trimmings, locks and hinges, etc., may find some valuable hints in the subjoined matter from a recent article by Percy Longmuir, condensed by us from The Foundry.

The author says: The term gun metal was given to various alloys of copper and tin for the purpose of making ordnance in days bygone, but, although no longer used for that work, the same alloys are exceedingly valuable for art work generally. Triple alloys, that is to say, copper, tin and zinc, have replaced the old double ones—copper and tin only—and in some alloys four or five different metals can be found. Zinc, lead, aluminium and manganese are all employed for specific purposes, and are therefore considered in this discussion. The properties of alloys have distinct qualities, and range from very hard and rigid to soft and to some extent elastic, and a general grouping includes the subjoined properties: They should be more or less elastic when cast, and have good torsional strength, together with a low melting point and fill the molds sharply. The range in alloys of the kind mentioned is very wide, and most founders have their own formulæ, which differ but slightly from those in use by others, but these very differences, minute though they be, have a great effect in some directions upon the character of the work turned out. A low percentage in the use of a deleterious element in the metal for a brass bearing may cause the same to heat badly, and similar alloys for high pressure boiler work may be dangerous. This last should have a composition somewhat as follows: Copper 86 to 88 per cent, tin 8 to 10, and zinc 2 to 6 per cent. The tensile strength is 12 to 16 tons per square inch of section, with 8 to 14 per cent elasticity in a length of two inches. This composition is an expensive one, and where the tin is high and the zinc relatively low does not machine well. A composition for a good average quality of metal is made with copper 80 per cent, zinc 10, lead 6, and tin 6 per cent, or a change in quality can be made by using the same proportion of copper and only 5 per cent of lead and 5 per cent of tin.

These cast sharp and machine well. Ordinary brass castings usually contain a greater or less proportion of scrap brass; it is usually obtained from dealers and is by no means uniform in quality, and must be sorted and graded carefully. The common proportions of scrap brass are copper 70 per cent, lead 4, tin 4, and scrap 18 per cent; but according to the grade of the scrap almost any grade of alloy can be produced. The addition of lead, up to a certain point, gives a good color, renders the metal easy to machine, and very much reduces the cost, so it is an inducement to use it as much as possible.

Bearing brasses should have a special composition, much harder than common brass; the following proportions are found to serve the purpose well: Copper 80 to 82 per cent, tin 10 to 14, zinc 2 to 4. Some use this formula: Copper 84, tin 12, and zinc 4. A cheaper bearing brass is made from copper 51 per cent, tin 8, hard scrap 41 per cent. To some extent the mixtures just described are being displaced in favor of certain proprietary bronzes and by anti-friction white metals, but there is always occasion for the use of the formulas mentioned previously on standard work.

In preparing alloys of any kind experience and skill are indispensable; in some cases the several metals are melted and cast into ingots, to be subsequently remelted when ready to pour into castings. In the latter operation the copper is melted first and the more volatile metals, tin and zinc, added afterward. For ordinary castings alloys may be used direct or in conjunction with scrap. A charge for a 150-pound crucible would be 100 pounds of new metal and 50 pounds of scrap. During melting there is always more or less loss by volatilization, oxidation and absorption of gases; these losses should be allowed for in weighing out the charges, but the loss varies in different furnaces, so that it is necessary to standardize the working of the furnace, after which no difficulty will be found in charging for given weights.

The rate of melting is a matter of some importance, the ideal condition being, whether in a reverberatory furnace or crucible, to bring the alloy to a red heat and then quickly reduce the composition to the melting point. Dull, pasty metal, so called, is very liable to absorb gases like a sponge, which is liable to spoil the casting, while the reverse is the fact with metal more quickly melted. Alloys high in tin and copper and relatively low in zinc are very sensitive to the conditions above mentioned, and every-day experience in brass founding enforces the importance of the question of temperatures. It will be found that castings melted at low heats show in the fracture that the several metals of which they are composed have separated and crystallized in masses by themselves.