STELTJE'S TYPE-PRINTING TELEGRAPH.

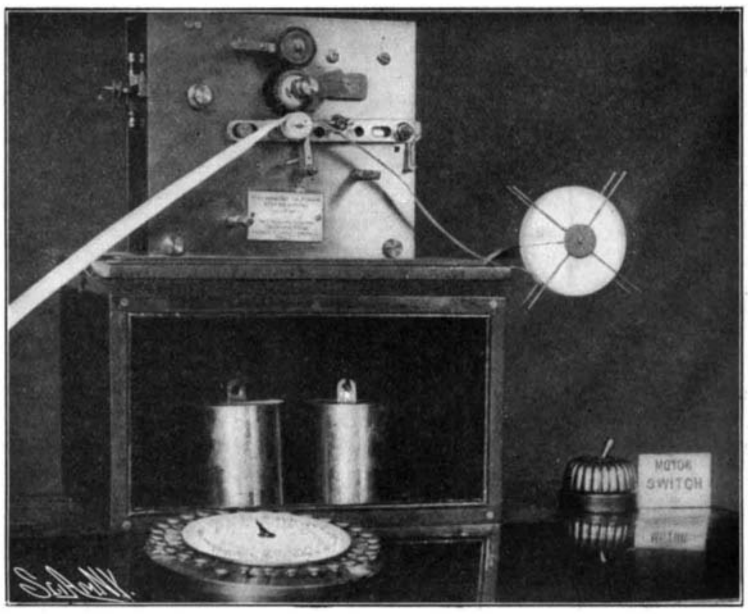
The leading features of the Steltje's type-printing telegraph, improved by the Type Printing Telegraph Corporation, are that no batteries are required, no expert telegraphists needed, and the message is printed automatically at both ends of the lines.

The sending part of the Steltje's telegraph recorder is essentially the same as the well-known Wheatstone A B C instrument, the keys being arranged round a dial on which are marked the characters to which they correspond.

The receiver, however, differs in that the letters are printed on a continuous tape instead of being merely pointed to by a moving needle, which cannot easily be followed if worked beyond a certain rate. Hence no operator is required at the receiving end. The instrument, like the ordinary tape machine, prints its message in plain characters, but will work with currents of 8 milliamperes generated by a small magneto. The keyboard permits of 58 different characters being dispatched. The apparatus can be used on an ordinary telephone line without in any way interfering with its use for speaking over.

The receiving instrument consists of a train of clock work actuating a typewheel and controlled by two magnets. One of these is called the busy magnet, and the other the lazy magnet. The current operating the instrument is a high-tension alternating current generated either by turning a handle, by working a pedal, or by a small electric motor. As long as the current is kept flowing, the receiving instrument remains at rest, but on the depression of one of the keys in the transmitter, pulsations are transmitted along the line to the busy magnet, and rotate the typewheel synchronously with the rotation of the needle of the transmitter. The pointer of the transmitter comes to rest opposite the key depressed and the current is cut off. It is this cutting off of the alternating current altogether which operates the lazy magnet, allowing its armature to fall away and thereby releasing a second train of clockwork which brings the paper into contact with the typewheel to print a letter. There is an exceedingly beautiful arrangement for changing from letters to figures. The key opposite the word "Figures" is depressed on the transmitter, whereby the typewheel at once takes up a corresponding position at the receiving end. No impression takes place because there is no letter on the typewheel at that particular spot, but the typewheel carries a small projection on its axis, which in this particular position is caught by a projection on the printing lever, or lever which lifts the paper into contact with the typewheel, and the typewheel is thereby shifted longitudinally on its axis and prints figures until it is returned to its letter-printing position in a similar way. The method of obtaining synchronism is very interesting. Of course it is necessary that the typewheel and the pointer on the transmitting dial should revolve accurately together and should start together from the zero point. This is accomplished by means of a lever at the receiving end, which slowly rises as the typewheel revolves and after three or four revolutions gets into the path of a projection on the typewheel shaft, thus stopping it in the zero position. The first movement of the printing lever returns the lever to its normal position and allows the typewheel to rotate again to get into position for the next letter.

The advantages—not merely claimed, but practically established—are simplicity of working, celerity, and accuracy. Mr. Steltje's novel and ingenious instrument possesses moreover the great advantage of providing a record of all that passes at each end of the circuit simultaneously for subsequent reference and confirmation, and thus furnishes the missing link so long desired. It appears that the instruments work admirably in series, so that a message can be transmitted from one station to six or more stations at once, at all of which a printed record will be produced; and moreover, owing to the very small current required to operate the mechanism, it appears that messages can be sent along an uninsulated wire lying on the ground. Messages can be dispatched at a very rapid rate; the instrument weighs no more than 28 pounds. Last October the invention was tried by the German military authorities with excellent results. In Vienna 50 soldiers were one afternoon instructed in the working of the instrument, and it was not found necessary for any expert engineer to interfere during the whole of the trials, which lasted a week. The fact also that Steltje's apparatus can be worked over their cavalry wire cannot be too highly appreciated. The necessary wire for purposes of telegraphic communication can be carried by men on the march. The instrument has been adopted by most of the continental armies, and has become popular in Austria, Siam, Spain, Nicaragua, etc. This apparatus is one likely to be also useful in large offices where messages have to be sent privately from one room to another which may be far away, without the disadvantage of a personal journey being necessary. The system would seem to have a good prospect of success in the commercial world, because enormous possibilities are undoubtedly open for the utilization of this invention.



STELTJE'S TYPE-PRINTING TELEGRAPH.

French Academy Prizes.

At the annual public session of the Academy on October 26, President Perrot announced a number of prizes, including $1,400 for experiments at the Sorbonne Laboratory to settle the differences between French and American scientists in connection with electrodynamics. The Academy awarded the prize of $20,000 for the most remarkable scientific work to Dr. Roux, who continues to carry out the work begun by the late Prof. Pasteur. Dr. Roux accepted the prize on condition that the amount be devoted to the scientific investigations of the Pasteur Institute.

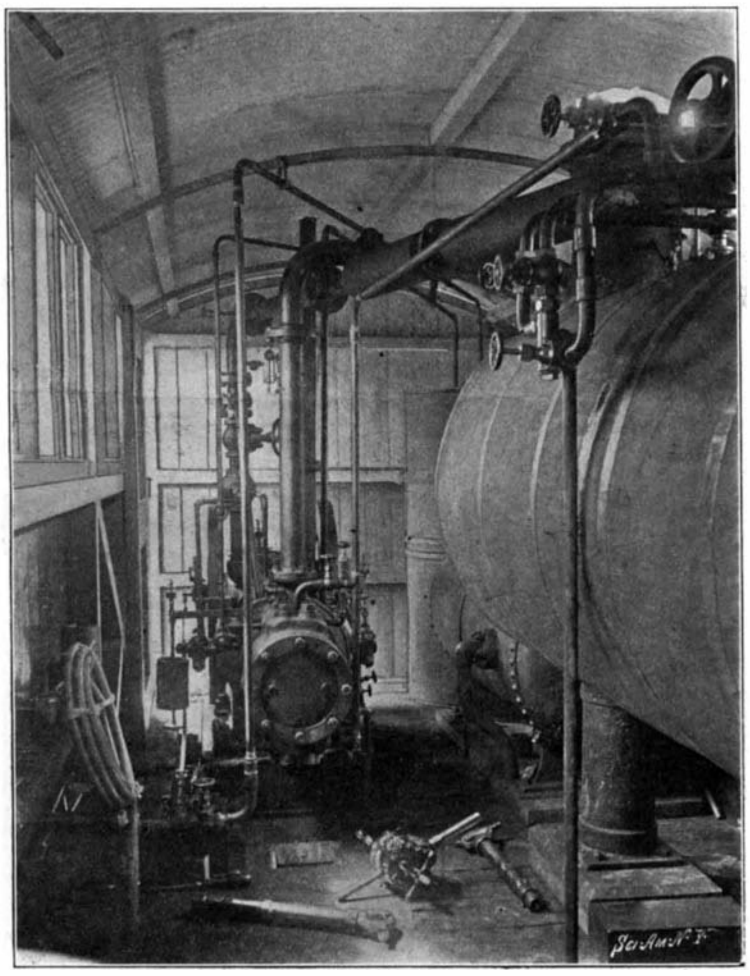
A PORTABLE PNEUMATIC TOOL OUTFIT FOR RAILROADS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

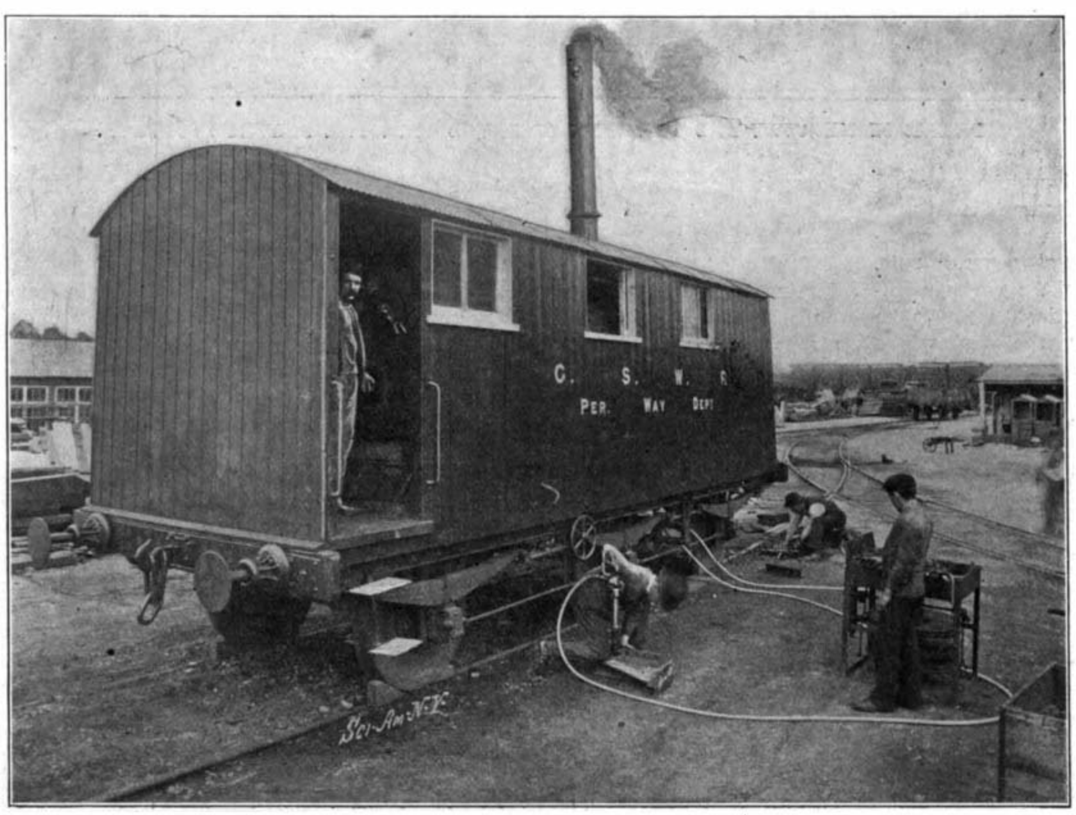
A compact and well-equipped complete portable pneumatic tool installation has recently been designed for the Great Southern & Western Railroad of Ireland by the International Pneumatic Tool Company. There are many phases of work and repairs upon a railroad for which such a pneumatic outfit is peculiarly adapted, notably the repair of bridges, relaying of the rails, and drilling operations, which can be more expeditiously and economically carried out by the aid of pneumatic tools than by the ordinary means of manual labor. The only difficulty in such work is the provision of the necessary air-compressing plant to operate the tools. The Great Southern & Western Railroad have had the car which we illustrate herewith specially constructed and fitted up with a complete installation necessary for emergency purposes.

The power for driving the air-compressing plant comprises a 12-horsepower semi-portable boiler, complete with steam injector and the other necessary fittings. The air compressor is of the horizontal straight-line, steam-driven type, with water jacket and automatic speed and pressure regulators, and it has a capacity of 134 cubic feet of free air per minute. This part of the plant is mounted on a sub-base fixed on the floor of the truck. Beneath the floor of the wagon is suspended a steel air tank. This reservoir is 6 feet in length by 2 feet 6 inches diameter, and is fitted with a flexible hose. The plant in the wagon itself also comprises a water-circulating tank, which for economy of space and weight fulfills a dual purpose—cooling the air-compressing cylinder and feed-water tank for the steam engine boiler.

The pneumatic tools provided with the plant consist of two long-stroke hammers capable of closing down rivets of one inch diameter, and two pneumatic holders for use with them; two No. 2 "Little Giant" drills for boring holes up to 1¼ inches diameter, several lengths of ½ inch metallic covered flexible hose, to enable the tools to be operated at a distance from the vehicle, air filters, air-cocks, hose-clips, etc. The plant, which has been in operation for some weeks, has proved a great benefit for general and temporary work, both in the saving of labor, the expedition of the work in hand, and cheapening of the



INTERIOR OF THE REPAIR-CAR, EQUIPPED WITH PNEUMATIC TOOLS.



A PORTABLE PNEUMATIC TOOL OUTFIT FOR USE IN RAILWAY-BRIDGE REPAIRING.

cost of repairing. In our illustration the plant is shown in use for bridge-repairing work, for which it is most eminently suited.

Such installations are useful in sparsely-populated countries like Ireland, where either labor is difficult to obtain, or the repairs have to be carried out some distance from a center of population. The wagon containing the installation can be rapidly conveyed to the spot, and the air compressor can be set in working order *en route*, so that it is possible to commence operations directly the structure in need of repair is reached.

RECENT OBSERVATIONS OF THE PLANET MERCURY.

BY EMILE GUARINI.

M. L. Rudaux, director of the private observatory of Donville, France, has devoted himself for ten years to the study of the planet Mercury, and, owing to the favorable situation of his observatory, has had an opportunity of making upon this planet a series of observations from which conclusions not lacking in interest have been drawn.

The planet Mercury was the last discovered by the ancients because, on account of the nearness to the sun, its brightness is lost in the dim light of dawn and dusk. Even with modern instruments it is difficult to observe. Its elongation of small amplitude; its location on the horizon or thereabout (always less clear than the high regions of the sky) at the most favorable instant for observations, and the great rapidity of its proper motion are all obstacles to be considered. Scientists are not even agreed as to the period of revolution of Mercury. Schiaparelli found that the planet rotates on its axis slowly in a time equal to that of its revolution around the sun and always presents the same face to the sun. Denning claims to have seen spots which have shifted in position upon it. Ever since the observations of these two astronomers a dispute has existed, certain astronomers having verified the displacement of the spots, and others not having observed it. Every contribution to the study of Mercury is therefore of importance, and from this point of view the observations of M. Rudaux, extending over a period of ten years (1892-1903), are most valuable.

In the first place, M. Rudaux has found that the phase observed is always less than the phase calculated, and in proportions which vary, but which are at times very notable. The majority of the observations have been made at the time of the eastern or evening elongations, and each time the phase has been found already in crescent, while the planet was reaching elongation and should have presented the aspect of a perfect half-disk. The apparent dichotomy therefore manifests itself before the epoch at which it ought theoretically to take place. The mean of such advance is from three to four days, but this figure appears to vary from two to five days. With the elongations of the morning the same phenomenon is observed, in inverse direction, the dichotomy manifesting itself with a retardation that appears to be of the same order as the advance for the eastern digressions.

Aside from these anomalies of the line of the phase or the terminator of the phase, M. Rudaux has noted that, very often, this terminator, instead of appearing in the geometrical form that should result from the illumination of a regular globe, presents deviations and distortions that indicate changes of level in the illuminated surface. Often also the southern horn appears truncated. As a general rule, these changes of level correspond to the various configurations of the disk. The projections seem to be caused by the illuminated regions, the depressions exhibiting themselves especially when the dark spots partially occupy the terminator.

The dark spots are very apparent, even more apparent than those of Mars. Sometimes they are almost black. It is difficult to observe them, however, because of the small size of the disk and of the rather poor quality of the images, which prevent their details from being made out and the limits of their contours from being fixed. As to general form, some appear roundish and others like wide bands connecting the first. Their color is gray, while the rest of the planet is of a yellowish or orange shade. The edge of the disk, the limb, is white and very luminous. The general luminosity of the planet decreases very rapidly from the edges toward the center, which is sometimes very dark.

M. Rudaux has, in addition, observed some light spots more or less white, and of which the accompanying figures show good specimens. They seem to be of two kinds, one of them sometimes very vague and apparently connected with certain configurations of the disk, and the other very white and often sharply defined under the form of caps and occupying pretty exactly the horns of the phase. All do not appear to have the same fixedness as the dark spots and seem to be due to phenomena of a rather temporary order.

One of our figures explains diagrammatically the anomalies of the phase. It must be taken, of course, for what it is worth, that is to say, a very plausible explanation of certain phenomena produced by Mercury. Like all diagrammatic figures, it is necessarily somewhat exaggerated in its details. But such as it is it remarkably reproduces what is required of it. In order to judge of it well, it must be looked at from a distance, say of 30 feet or more, or, better still, be observed in a camera with a slightly insufficient focusing. This will very well reproduce the aspect of the small telescopic image much influenced by atmospheric disturbances, those famous disturbances that make astronomers despair. What, now, are the conclusions that M. Rudaux draws from his observations?

Let us take up each point in succession. Let us recall in the first place the anomaly that makes the visible part of the planet appear smaller than that which ought to result from its position and from its illumination by the sun. It seems that it is necessary to seek the cause of it in the nature of the matter of the planet. M. Rudaux sees therein an analogy with the moon. But Mercury, in consequence of the difficulty of observation, cannot show the thousand luminous and dark details that we see in our satellite, and the final result is a great loss of light, which destroys the true limit of illumination, so that the eye cannot succeed in penetrating the illuminated features that should be delineated therein. In the center, the aspect is more pronounced than toward the horns at the edge, where all the details show themselves more and more contracted in perspective one before another, the low parts appearing situated in the shade. The result is that the horns have a total brilliancy greater than that of the center.

The explanation given for the horns may likewise explain the great luminosity of the limb. Nevertheless, M. Rudaux, in showing this analogy with the moon, thinks that it is very certain that it is necessary to add the atmospheric phenomena thereto in order to exaggerate these aspects. In fact, the presence of an atmospheric stratum absorbing the solar rays, especially those which, tangent to the globe, traverse it at the greatest thickness, results in the limit of illumination being reduced by such absorption. Since such influence is exerted with a greater or less intensity according to the atmospheric conditions, certain variations observed by M. Rudaux would be explained, at the same time as the illumination of the disk upon its edges, by a greater and greater superposition of the illuminated strata. Upon the whole, the observer concludes that the surface of Mercury is quite broken and presents changes of level and eminences of a mean altitude of from 9,840 to 13,000 feet, very approximately. There are also some that are higher, especially in the southern hemisphere.

As for the nature of the dark spots, it would be difficult to give an exact definition of them. It is certain, however, that they appear to have some analogy with those of the moon. What is evident is that they really belong to the matter of the planet, without apparent variations in aspect. And what of the white caps that appear to occupy the poles of the planet? Could accumulations of snow and ice occur to form these white zones? For want of a better theory, it is not unreasonable to admit this and to explain the spots by the production of atmospheric condensation in these regions of high plateaux, and also by huge banks of accumulated clouds. This would explain the sometimes vague and nebulous aspect and the variability of these zones. At all events, meteorological accidents take place upon the entire planet, as is shown by the changing and hazy appearance of certain regions.

Such are the first results to which M. Rudaux has been led. They will, without any doubt, appear of interest through the new facts that they add to our knowledge of this little world of Mercury, which presents numerous problems, for the solution of which no effort should be spared.

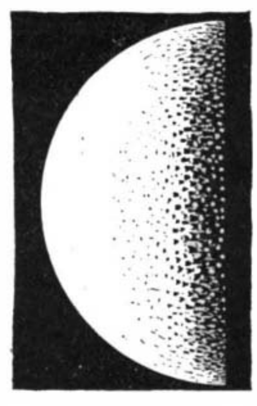
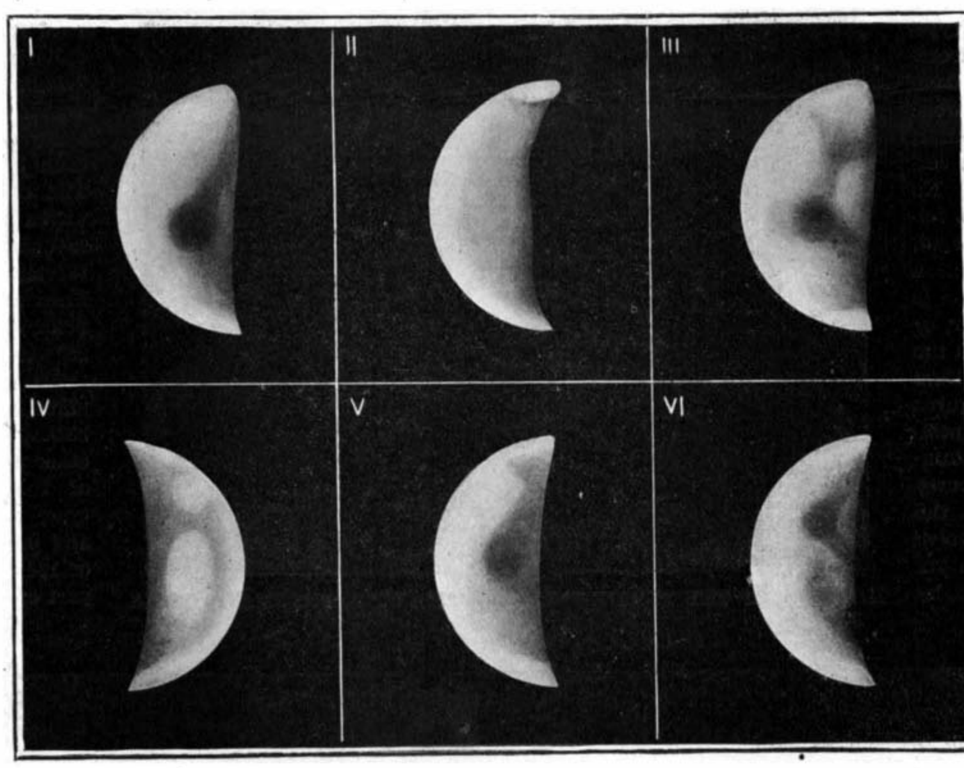


Diagram Explaining Some Anomalies in Mercury's Phases.



PHASES OF MERCURY AND THE SPOTS OBSERVED UPON THE PLANET'S SURFACE.

Dr. Cook's Return.

Dr. Frederick Cook, who unsuccessfully attempted last summer to ascend Mount McKinley, in Alaska, the highest mountain in North America, has recently returned to his home in Brooklyn.

Dr. Cook said to a representative of the New York Times that the trip had completely established the fact that it is impossible to scale Mount McKinley, 20,400 feet high, from its western side, but that three routes were noted on the eastern slope, by one of which it is possible the summit may be reached.

"Following the suggestion of Mr. Brooks of the Geological Survey," said Dr. Cook, "we determined to attack the west side of the mountain, and made our start from Cook Inlet at Tyonek. Our equipment of 2,200 pounds was carried on fifteen pack ponies from the Yackimer Indian Reservation. We followed an Indian trail to the Kuchatua River, crossing the Beluga and Skewentna rivers by boat. On the way I climbed Mount Yenlo, 4,500 feet, and obtained a good view and survey of the whole McKinley Range.

"We followed up the Kuchatua in a westerly direction, crossed the McKinley Range, through Simpson Pass, and proceeding along the northwestern slope of the McKinley Range above the timber line, we reached Mount McKinley on August 14. This left us but fourteen days in which to make our trial, the practicable season ending September 1.

"We first attacked the mountain from the southwest, but were stopped by a glacier which interrupted the route some 2,000 feet below us. In the second attempt we reached an elevation of 11,400 feet when we were stopped by a spur of the main mountain, with almost perpendicular slopes of granite rock, forming an impassable obstacle to any ascent from that side. The mountain is an almost continuous series of granite cliffs, corniced by overhanging glaciers. We were greatly hampered by the advance of winter and heavy snow, which made it necessary for 2,000 feet of the climb to dig away thirteen inches of snow before cutting the steps in the glacial ice.

"After finding the western slope entirely impracticable, we had to get out of the country quickly, and instead of returning the way we had come, we decided to cross the range and come down the east side, traveling over 100 miles of unexplored country. We found a break in the range fifty miles northeast of Mount McKinley, at an elevation of 6,000 feet, crossed it, and dropped down into the valley of the Sushitna, striking the Chulitna, the largest tributary of the Sushitna River. This flows through a remarkable cañon, which made it necessary to abandon our horses and take to rafts, on which we came down through the unexplored eastern foothills of Mount McKinley.

"We discovered two glaciers, one probably the largest in the interior of Alaska, and made a rapid survey of the east slope of the range. On September 15, two weeks later than we should have remained, we left