PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCE.

We continue our abstracts of the papers read before the National Academy of Science at its recent session in Washington. Dr. E. Bessels gave some further scientific

RESULTS OF THE POLARIS EXPEDITION.

It is probable, he thinks, that Smith's Sound must be regarded as the best of the three gateways to the pole. A channel, of almost 300 nautical miles in length and in some places scarcely twenty-five miles in width, separates Greenland from Grinnell Land and the archipelago south of it. This separation, as the nature of the land between 81° and 82° latitude demonstrates, took place in a south-north direction. The speaker then proceeded to explain various phenomena which tend to confirm this view, and pointed out the truth that the southern end of the strait is the older as is apparent from the fact that the southern portion of it is evidently broader than the northern; and also the fiords on the south-west coast of Greenland are by far more numerous and deeper than further north. According to the theory, a warm current must have moved along the east coast of America, and must have entered Baffin's Bay, having the full strength of an unweakened current in washing the end of that bay. Thereby considerable atmospheric precipitation as rain was occasioned, accelerating the growth of the glaciers, which moved on toward the valleys, and then formed spurs. The fiords we must consider as the former beds of these spurs.

What was the agency which caused the separation, we can only surmise. There are two probabilities: either the channel is a fissure which gradually widened because of the influence of the current, or it has been eroded by the action of a glacier, the south end of which gradually melted down. The latter hypothesis seems the more probable of the two, and we may regard the channel itself as formerly an immense fiord. But we know that the soundings of fiords are usually shallower at the mouth than at the head, while with Davis's Strait and its continuation exactly the reverse is true: the greatest depths are found at its entrance.

In reality, nothing else could be expected. We know that the bottom of the North Atlantic is slowly but continually sinking, and has been ever since the miocene period. Among other evidences is the fact that the Bermudas rest on a coral foundation. This motion reaches far north and includes a part of Greenland.

Professor Wm. Ferrel of the United States Coast Survey spoke upon

THE TIDES OF TAHITI,

the peculiarity of which is that the solar tide is for the most part greater than the lunar tide, although the force producing the latter is more than double that producing the former. There is only one other case of the sort in the world—at Courtown, Ireland. It is not, however, due to any exception in the general theory of the tides. Certain constants in the tidal expressions, which have to be determined by observations, are unusually large in this case. It is yet impossible to specify, however, what are the irregularities of ocean bottom and of coast outline which occasion the phenomena in this particular instance.

In a paper on

METAMERISM IN ORGANIC CHEMISTRY,

Professor Wolcott Gibbs, of Harvard, presented a novel and valuable discovery regarding metamerism, which has never before been observed in organic substances. Bodies are said to be metameric when they are of the same composition and atomic weight, but differ entirely in their properties in consequence of different molecular constitution. Professor Gibbs has discovered six such bodies, bearing such a relation to one another and to a seventh. The substance with which the series begins was discovered by Dr. Eidmann and is an exceedingly stable compound denoted by the formula: $CO_2(NH_3)_6$, $(NO_2)_6$, or two equivalents of cobalt, six of ammonia, and six of nitric oxide. In the following formula, the ammonia is represented by A and the nitric oxide by X, for the sake of abridgement:

First series—Eidmann's discovery:

$$\text{..... .....} \quad Co_2A_6X_6$$

Second series—Dr. Gibbs' discovery:

$$(Co_2A_4X_8)^{II} \quad (Co_2A_8X_4)^{II} = 2.\ Co_2A_6X_6$$

$$(Co_2A_4X_8)\ 2\ (Co_2A_{10}X_2)^{II} = 3.\ Co_2A_6X_6$$

$$(Co_2A_4X_8)\ 3\ (Co_2A_{12})^{IV} = 4.\ Co_2A_6X_6$$

Third series—Dr. Gibbs' discovery:

$$(Co_2X_{12})^{VI} \quad (Co_2A_{12})^{VI} = 2.\ Co_2A_6X_6$$

$$(Co_2X_{12})^{VI} \quad (Co_2A_8X_4)_3 = 4.\ Co_2A_6X_6$$

$$(Co_2X_{12})\ 2\ (Co_3A_{10}X_2)_3 = 5.\ Co_2A_6X_6$$

As each of the salts thus obtained is beautifully crystaline and perfectly well defined, and each salt of the second and third groups gives the reactions of each constituent with perfect distinctness, no doubt can exist as to their real chemical structure.

Professor Alexander, of Princeton, gave some brief remarks on the

COMPARATIVE VELOCITY OF LIGHT IN AIR AND IN VACUO,

relating to a small correction of the velocity of light as deduced from experiment. This, according to the undulatory theory, must be less in atmospheric air than in vacuo, in the inverse ratio of the index of refraction of atmospheric air to 1, that is, as 1 to 1·000294. The velocity then, as ascertained by experiment, under the air should be increased by just about 0·000294 of itself to be equal to that in vacuo; that is, to the extent, almost exactly of 55 miles per second, a very small quantity indeed in comparison with the whole velocity of 185,000 miles per second; and yet, small as it is—and so small as to be below the limits of error of the experiments in question,—it is yet very closely equal to three times the velocity of the earth in its orbit.

Professor Hayden presented a general account of scientific explorations in the west and gave a brief summary of the forthcoming seventh annual report of the expedition under his charge. Professor Silliman described the

TELLURIC ORES OF COLORADO.

The mineral is found on the side of a dyke some fifty feet in thickness, and was introduced by a plutonic invasion of this formation. The speaker had found that, in many instances, telluric ores were associated with gold, and the association was very unfortunate for the gold miner, as in one instance $3,000 worth of gold thus associated was thrown away (through ignorance), while the yield of the rest of the ore was only $40 or $50 to the tun. Professor Silliman asked Professor Endlich to perform an experiment, showing the presence of tellurium by using concentrated sulphuric acid. A bright purple color was rapidly obtained when the ore was thus treated with heat in a test tube. In one specimen of these telluric ores, there was $55,000 extracted from a tun.

With reference to

THE LAWS OF CYCLONES,

Professor Ferrel reviewed the theories of Espy and of Redfield, Reid and others, and re-enunciated his own views published several years since.

Concerning

THE GREAT TELESCOPE AT WASHINGTON,

Professor Newcomb gave some interesting facts. The question is frequently asked, how does the new instrument compare with other telescopes? This is difficult to answer, since there are no refracting telescopes in this country of comparable dimensions. The question as to the comparative efficiency of refracting and reflecting telescopes is frequently raised. It must be admitted that great reflecting telescopes give very variable results and are very apt to prove unsatisfactory. As an instance of this, if we examine the record of Herschel's work, we find that nearly the whole of it was done with his two foot reflector; we shall almost arrive at the conclusion that all the work accomplished with the four foot reflector might have been done with the smaller instrument. The same comparison of results leads us to a similar conclusion with regard to the four foot reflector of Lassell—probably the largest ever constructed. He had under the clear skies of Malta made many important observations; but when he took his four foot reflector there, hoping with it to verify his discoveries, it does not distinctly appear that he succeeded. Struve, after looking through the four foot telescope, wrote that it was not in any remarkable degree more powerful than his 15 inch instrument at Poltava. The only exception to this generalization is the fact that the four foot instrument of Lassell did really discover the two inner satellites of Uranus. Professor Newcomb having rediscovered these with the new instrument, and thus verified Lassell's discovery, thinks that they could never be seen with a 15 inch refractor. In the new telescope the outer satellites of Uranus look as if of about the size that *Ursæ Minoris* appears to the naked eye. The smaller satellites, strange to say, have been best seen when the moon was shining, and its light was plainly apparent in the telescope; the first of these appears about half as bright, and the second about one third as bright, as Titania.

Our friends have asked whether there is difficulty in the Washington telescope on account of spherical aberration. This proves to be a very small factor; its total amount is less than that produced in the lens by ordinary atmospheric variations of temperature—an effect which is noticed when work is first begun with the instrument of an evening, but which rapidly wears away as the glass acquires the uniform temperature of the rest of the instrument. It seems to be only the rays near the edge of the glass which are thus affected. Professor Newcomb has looked through many other refracting telescopes, by way of comparison, and after full consideration believes the new instrument to be a great success.

PLANETARY SATELLITES,

Professor Alexander said, are claimed to resemble our moon in the coincidence of their times of rotation and revolution; and that in consequence every satellite presents always nearly the same side to its primary. One occasion for this belief is found on observing the special vicissitudes which the light of the satellites exhibits, each specified change recurring when they have again arrived at the same position in their orbits around their respective primaries. Another evidence is found in the remarkable phenomena of their apparent loss of light on certain occasions.

The loss of atmosphere is one of the supposable consequences of those stringent conditions, as indeed M. Laplace has intimated, when, after stating the distance at which the attractive force of the earth is in equilibrium with that of the moon, he adds: "If at this distance the primitive atmosphere of the moon had not been deprived of all elasticity, it would be carried to the earth, which would thus draw to itself. This is perhaps the reason why the moon's atmosphere is nearly insensible." We may fairly inquire whether this has not been the case with all the satellites, and their common experience.

Professor Loomis, in a paper on the

LAWS OF STORMS,

explained the process by which he computed the relative velocities of the winds, etc., at high altitudes, such as that of the signal service stations at Mount Washington, coming to the conclusion that, at the hight of 6,000 feet in the western quadrant of a storm, the velocity of the wind is more than double that of the storm. By another series of computations he obtained the forms of the isobaric curves in at least 200 cases. In 55 per cent of the whole number of cases, the major axis of the isobar exceeded its minor axis by half its length; in 30 per cent the major was double the minor; in 3 per cent the major axis was at least four times the minor. The storms of the United States are mostly of an oval form, with the longer axis most frequently in a direction about N. 40 E. About three quarters of the great storms originate in the extreme west. In a case of which the details were particularly reviewed, it seemed probable that the first development of magnitude in a storm began with the collision of moist air from the Pacific Ocean against the peaks of mountains in Oregon, resulting in heavy rainfall. But the most remarkable fact elicited was that the storm, once originated and organized, traveled over the highest mountain ranges without indicating sensible obstruction, proceeding eastward across the whole continent of North America.

An exceedingly interesting and valuable paper on the mode of formation of the earth, its condition as to interior fluidity, and the probable limits within which it was reduced from a fluid state to its present condition, under the title of "A Criticism on the Contractional Hypothesis of the Earth's Surface Changes," was read by Captain Clarence Dutton of the Ordnance Corps, U. S. A. Mr. James D. Warner of Brooklyn read a technical paper on a new set of Bernouilli's numbers, which are a mathematical invention for shortening certain processes by their application to the coefficients of development of expanding series.

At the conclusion of this paper, Professor Henry simply remarked "The Academy is now adjourned," and thus the session ended without the passing of resolutions or any other of the usual formalities.

Correspondence.

Freight Cars.

To the Editor of the Scientific American:

I notice, in your issue of April 11, an article headed "A Chance for Inventors," which article attracted my attention. Bearing as it does upon a matter of great importance, it ought to be called to the attention of car builders generally; and while I am compelled to differ with the author very widely in many respects, I fully concur in the belief that there is a need of improvement in this direction.

But where is the inventor who is able to overcome the the numberless difficulties that stare him straight in the face at every turn? We wait for him to appear. The author of the article referred to seems to exhibit a wonderful lack of knowledge in regard to the difficulties which must be met, when he supposes that the strength for carrying of a country wagon is to be placed in comparison with the strength for carrying of a freight car, and that its paying weight should be, in proportion, equal to the former.

For the past seventeen years, I have been a practical car builder, and have tried a great many experiments in building very light cars, both for passengers and freight, and every experiment has proved a failure. Some fifteen years ago, box freight cars weighed only from 15,000 to 16,000 lbs. and would carry 10 tuns. These cars proved to be sufficiently strong and durable at that time, when the railroads were doing only a local business, running short trains and resting them at almost every station (a car requires rest as well as a man, if it is to last long). Then every railroad had its cars under the master car builder's care, who watched over them as carefully as over his children; and if they did not return when they ought, they were looked after in the same way. Our repairs were then very light. But since that time, the world has not only been revolving, but moving in other directions; and today freight cars, formerly simply local carriers, are interchanged by nearly every railroad in the United States, and are drawn (in tremendous trains) thousands of miles, with but short stops and no rest from their loads.

It has been said that the steam engine is subject to fits and starts, and, when attached to one of these long trains, must of necessity test the strength of the most workmanlike and thoroughly built car to its utmost capacity, which would not be the case if only a few cars were taken. Couple even twelve or fourteen country wagons together, and I doubt very much if they will carry the load referred to (3,000 lbs. to a wagon) for very long, successfully.

Box freight cars have and can now be built to weigh not over 12,000 lbs., and I will guarantee to build them, not to exceed that weight, so that they will carry successfully 10 tuns to the car. But they must be taken in very short trains, as they would be likely to receive injury by sudden starts and stops if taken in long trains. Consequently, as the rule and not the exception is long trains, we are placed under the necessity of building our freight cars about three times as strong as they were built fifteen years ago; but the weight has not increased in that proportion, being only one or two thousand lbs. more: we therefore have reason to be thankful for this improvement already made.

Freight cars are subjected to very rough usage; for example, an engineer couples his engine to a train of forty cars, and undertakes to start gently; he finds that this makes no impression on his train; he therefore backs up with as much force as possible, and then, putting all the force of the powerful machinery to work, starts up again, and perhaps may repeat this several times before succeeding. In view of these