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NEW YORK, SATURDAY, JULY 15, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A POOR START.

The most ardent advocates of the Panama Canal must admit that, admirably as the government has handled the matter of the purchase of the Panama Canal property, it has made something approaching to a very pitiful fiasco in its attempt to commence actual construction of the canal.

The SCIENTIFIC AMERICAN for many years past has favored the prosecution of this great work. It was our conviction that if the United States, with its vast experience in great engineering works, once took hold of the Panama enterprise, it would push it through to completion with economy and dispatch. We still believe that the United States can accomplish this great work with economy and dispatch; but we are just as fully satisfied that it will never so accomplish it, unless the halting policy that has thus far marked our efforts at construction be abandoned.

We have spoken above of this country's "vast experience in great engineering works." If this experience is to be applied with practical results at Panama, it must be applied along the same lines on which it has produced such splendid results in the upbuilding, let us say, of the great railroad system of the United States, a system which in its rapidity and economy of construction, is without a parallel in the world. In building that system, and particularly in the later years in which the greater part of the work has been done, the organization of the working forces has been noticeable for its simplicity and directness. The combination of a president, a treasurer, an auditor, and a chief engineer, the last-named absolutely untrammeled when once the main outlines of his work have been passed upon, has enabled this country to construct the various lines of a great railway system over 200,000 miles in length with a smoothness, rapidity, and a dispatch that have won the admiration of the world.

There is absolutely nothing in the Panama situation to prevent the application of the railroad methods of organization in carrying the work through. As far as the constructive features are concerned, it must be a one-man job; and we do not hesitate to say that there are not merely half a dozen but fully a score of civil engineers in America to-day, any one of whom is capable, *if left absolutely untrammeled by unnecessary red tape*, of taking hold of the Panama Canal, enormous undertaking though it be, and pushing it through to completion within a specified time and for a specified cost, and with just as much absence of friction, delay, graft, bickerings, political interferences, and all other petty and pure childishness of that kind, as similar works have been and are being carried through by these same men for the various railroads of this country to-day.

A cubic yard of earth, hard-pan, or rock is about the same thing at Panama as it is in the Rocky Mountains or on the plains of Dakota. In Panama so many million tons of it can be dug up, blasted out, and carted away, with as much certainty as to cost as it can in the mountains or on the plains of the West. A single chief engineer of the Panama Canal, if given an absolutely free hand, can gather around him a staff of engineers just as efficient for their work as any he may have handled when building railroads in a more northern clime. The contractors are ready with their plant and appliances to do just as expeditious work at Panama as in Maine, Missouri, or California, and the work they do will be measured up, appraised, and vouched for by the chief engineer and his subordinates with just as little "lost motion" and with as great dispatch as in the construction or rebuilding of railroads.

If the unfortunate experience of the government in its initial work on the construction of the canal has no other effect than to teach the above lesson, it will not have been for naught. The course of events suggests that the scheme of administration, as at present adopted, is greatly over-elaborated and is so cumbersome that it will ever be in danger of breaking down of its own weight.

We are free to admit that the circumstances of the precipitate withdrawal of the late chief engineer from the work would seem to augur ill for the one-man control of the work above suggested—that is, if we are to believe that, in the motives that prompted Mr. Wallace in his resignation, he represents the ethics of the body of professional men to which he belongs. We candidly believe that he does not. Caustic as were the words of Secretary Taft in commenting upon his withdrawal "for lucre" from a post of such high honor, they were none too severe. On the other hand, it may well be that there were many exasperating hindrances to the work of Mr. Wallace, due to the complicated nature of the administration of the canal, which have influenced his withdrawal. Be that as it may, we are satisfied that if the prerogatives of the present chief engineer of the canal were enlarged to the full scope with which he has been familiar in railroad work; and if the work could be organized on the well-tried lines of directness and simplicity that characterize railroad construction, there would be an end of the present confusion, and the digging of the canal would be pushed through steadily to completion.

PEARY AND THE NORTH POLE.

The start of the ninth journey of Commander Peary to the Far North is marked by the quiet determination that is characteristic of explorers who attempt the perilous quest of the North Pole. And yet it is well understood among those who are familiar with the problem of Arctic exploration, that no expedition for the discovery of the North Pole has started under conditions that were, with a single exception, so favorable to success. That exception, however, is a serious one, and were it imposed upon a less experienced and indomitable leader, it might well mean the wrecking of the whole expedition. We refer to the fact that Peary is short some $30,000 of the sum necessary to thoroughly equip his expedition and provide that margin for contingencies which, in a venture of this kind, should always be a broad one. The explorer starts within a few days. That is certain. The alternative of his setting out amply supplied with every material resource, or of his starting handicapped and burdened with the thought that he is running at all times perilously near to the limit of his resources, depends upon the immediate liberality of those who may feel themselves able to furnish the sum needed for a full equipment. We mention, in passing, that contributions may be forwarded to Herbert L. Bridgman, the treasurer of the Peary Arctic Club, at 52 Wall Street, this city.

If, as we sincerely hope, the necessary funds are immediately forthcoming, Peary will set out for the North Pole under conditions that should command success, that is, as far as success is dependent upon human and not natural conditions. Success is largely a question of the man, of the ship, and the company. Of the man it is scarcely necessary to speak; for in his previous journeys he has exhibited in a high degree the requisite judgment, resolution, and endurance that go to make up a successful Arctic explorer. He is perfectly familiar with the conditions, and in his previous dash for the Pole he went far enough north on the final sledge journey to be able to form a reasonable presumption as to the character of travel that lies between his farthest north and the Pole itself. Elsewhere in this issue we give a description of the ship "Roosevelt." She represents the combined experience of her commander and of many explorers who have preceded him; and the $100,000 that was spent upon her has been devoted entirely to giving her great structural strength both in the hull and the engines, and not a penny of it has been wasted on merely decorative or luxurious features. In fact, the "Roosevelt" is decidedly Spartan-like in the extreme severity of her appointments. The ship's company that goes to the Far North will join at Cape Breton, and it will be composed of men who are familiar with Arctic navigation. It is not upon them, however, that the ultimate success of the expedition will depend, so much as upon the twenty-five selected Eskimos who will make the final dash with Peary for the North Pole. Many of these have been living, for some time past, in the neighborhood of the point on Grant Land from which the sledge journey will be commenced. To these natives the trip, except for its ruggedness and the cutting loose from the outside world, will not involve the novel and untried experiences which the public might naturally suppose. In other words, these hardy, faithful, and courageous people will form an ideal company for the last supreme effort.

In the course of an interview of the writer with Commander Peary on board the "Roosevelt," the explorer outlined the plan of campaign by which he hopes to reach the North Pole in the spring of 1906. He will start early this month from New York and sail to Cape Breton, where the present ship's complement will leave her and the crew which will take her into the Arctic regions will be shipped. Here he will take on the remainder of his stores and five hundred tons of coal. From Cape Breton he will steam at a reduced speed, in order to economize coal, direct for the northern coast of Greenland, the scene of his former explorations. The large amount of ice which has been coming down from the North this year encourages the belief that more than usually open water will be found. When the "Roosevelt" encounters the ice the real battle with the difficulties of the frozen North will commence. It is now that the powerful compound engine and the broad-bladed propellers of the ship will be called on for their supreme effort. Normally the engine horse-power is from 1,000 to 1,100, but as soon as the ice pack is encountered, live steam will be turned into the low-pressure cylinder, and the available thrust on the propeller will represent about 1,500 horse-power. The peculiar form of the bow, and of the underwater sections forward, will now begin to tell, and the good ship will be able to smash her way through ice which would have been impassable to any of Commander Peary's earlier ships.

He expects to reach latitude 83 north, off the most northerly point of Grant Land, before he is frozen in, or by September 15. The winter will be spent in preparing the outfit, and Commander Peary states that this work alone will furnish abundant occupation and interest during the long winter's night. The articles to be made include fur clothing, sledges for the final dash to the Pole, harness for the dogs, whips, tents, stoves, and the preparing and packing of rations. The sun begins to show its rim above the horizon on February 28; but, of course, there is twilight for many days preceding that. Hence, the start on the great sledge journey will be made early in February. The ship will be the base from which the expedition will work, and the complement of fifteen men who constitute its crew will remain on her. The North Pole party will be made up of twenty-five sleds with one Eskimo and six to eight dogs to each sled. They will be heavily loaded down at the start with provisions, outside of which very little will be carried beyond the necessary instruments in the way of sextant, theodolite, aneroid barometer, etc.

Regarding the character of the travel which he would be likely to meet with on the 420-mile journey from the ship to the Pole, Commander Peary frankly admitted that he expected it to be of the very roughest, consisting probably, unless land should be found, of a mass of broken and up-ended ice, presenting a scene of confusion that it would be difficult to describe. He estimates that he will make about ten miles a day on the outward trip, and fifteen miles a day, because of his lighter load, on the return journey. Should the difficulties prove even greater than this rate of speed would indicate, and provisions runs short, it would become necessary to kill off the dogs for food—a contingency which happened on one of his excursions, when the party returned with but one dog left out of the many with which the expedition started. It should be mentioned in closing, that if the necessary funds are forthcoming the explorer will establish wireless communication between the various stations of the expedition—an installation which would contribute not a little to the ultimate success of the venture.

TIME FOR ANOTHER PRINCIPIA.

A general restatement of physical science is now due. The extensive researches in the higher phases and states of matter, beginning with Crookes, and extending to the present, have so enormously expanded all conceptions of nature, that a vast work like Newton's Principia is urgently needed. The new book would be basic, fundamental, and epoch-making. For when gravitation was discovered and its phenomena reduced to rigid law, all men at once saw that it was part of the base of the existing order of things. But Crookes's first vacuum tube made us aware of the existence of phenomena equally important. Radiation is as basic as attraction. And it may easily be imagined to be actually of greater use in the sidereal structure, if one mode of activity can be more potent than another.

There exist without doubt many other phases of radiance besides the Alpha, Beta, and Gamma; as many possibly as there are letters in the alphabet. Every nook and corner of the universe must be, and in the very nature of things is, saturated with radiations, and of many kinds or phases. The researches of J. J. Thomson on corpuscular states of radiance ought to be incorporated into the new Principia without change—word for word, as well as the marvelous papers read by Arrhenius at the International Congress of Science in St. Louis also. And his great paper written in the Lick Observatory in July, 1904, and now published as Bulletin No. 58, should be transferred without change, bodily. This is one of the most remarkable scientific productions of any age. The work of the Curies would make several chapters of the new book. The writer has been in Mount Lowe Observatory for five years, and it does seem that science has received more remarkable and splendid additions than at any time since Newton. For is it not as great to find that there is a flux everywhere within the universe as to detect the laws of gravitation? It may prove to be greater. The sun may not be required to shrink in diameter nine inches daily to maintain its present rate of radiation. The process of receiving and sending out corpuscles is competent to supply all its radio-activity. And it can issue many kinds of radiance, so long as the interchange with other suns is maintained. The problem here now is so much larger than any ever presented to man before, that all others appear to be childlike in comparison. It is to discover, rescue from space, and use these obscure radiations from our own and other suns. All other employments that can be engaged in by human hands are as straws beside this chief of all work and research. Arrhenius shows that many particles, balanced by radiance and attraction, "swim in space" in regions adjacent to suns; but vast quantities not in the clutch of critical forces escape and dart into space. These are surely the corpuscles of electricity exploited by Thomson. For three years the floods of mail received here, letters, essays, pamphlets, books, everything, have one inevitable trend and tendency, and that is: The universe rests on an electrical base. In other words, nothing exists but electricity. This doctrine comes here from all directions. This universe is now maintained by "action at a distance"; that is, radio-activity is its sole support. There is not a trace of a new idea in this. It is exceeding familiar. All have heard of it thus: "Action and reaction are equal." This is flux and flow of radiance in a nutshell.

Then the universe is alive, is a living organism. This is familiar also; it was said in India many thousands of years ago, and has teemed on the pages of all Aryan literature since. None gave it attention, thinking it to be a vagary of some poet. The reception and emission of electrical corpuscles by every sun in existence are the causes of every conceivable phase of radiance. These two combined constitute the life of Nature. All work like that of Roentgen, Lenard and a hundred like them must be put into the great Principia.

It is a wonderful thing to be upon a mountain and watch the scientific literature change. And the most astonishing of all is to behold two things: the rapidity and worldwide unanimity of wheeling into the grand procession or march on the "electrical way." There are electrical "pushes and pulls" everywhere, universal and cosmical. They are so delicate that early physicists in many cases could not detect them. But now they are being explored with comparative ease. Thus every form, phase, condition, state, or type of radiation is corpuscular. Circulation throughout the universe is a rigid proof of conservation. Radiance is manufactured on the surfaces of suns. Radium is all right, and does not conflict with conservation. It receives and pays out like suns. So does everything else. The radiations of most phases of matter are too feeble to be detected by present means. For the words action and reaction are equal. They ought to go into the new Principia thus: Activity and return are equal. Great is the demand from all sides for the Principia.

BURKE'S OWN ACCOUNT OF THE SPONTANEOUS ACTION OF RADIUM ON GELATIN MEDIA.

The following is an abstract of the communication which was made to Nature by Mr. J. Butler Burke, of the Cavendish Laboratory, Cambridge, and which has given rise to so much sensational newspaper discussion:

"In the course of some experiments on the formation of unstable molecular aggregates, notably in phosphorescent bodies, I was led to try whether such dynamically unstable groupings could be produced by the action of radium upon certain organic substances. It will scarcely be necessary to enter here into an account of the many speculative experiments which I have at one time or another tried, but it will suffice if I describe, as briefly as possible, the experiment which, among others, has led to a very curious result, and that is the effect of radium chloride and radium bromide upon gelatin media, such as those generally used for bacterial cultures.

"An extract of meat of 1 pound of beef to 1 liter of water, together with 1 per cent of Witter peptone, 1 per cent of sodium chloride, and 10 per cent of gold-labeled gelatin, was slowly heated in the usual way, sterilized, and then cooled. The gelatin culture medium thus prepared, and commonly known as bouillon, is acted upon by radium salts and some other slightly radio-active bodies in a most remarkable manner. In one experiment the salt was placed in a small hermetically-sealed tube, one end of which was drawn out to a fine point, so that it could be easily broken. This was inserted in a test-tube containing the gelatin medium. The latter was stopped up with cotton wool in the usual way with such experiments, and then sterilized at a temperature of about 130 deg. C. under pressure for about 30 minutes. Cultures without radium were also at various times thus similarly sterilized. When the gelatin had stood for some time and become settled, the fine end of the tube containing the radium salt was broken, from outside, without opening the test-tube, by means of a wire hook in a side tube. The salt, which in this particular experiment consisted of 2½ milligrammes of radium bromide, was thus allowed to drop upon the surface of the gelatin.

"After 24 hours or so in the case of the bromide, and about three or four days in that of the chloride, a peculiar culture-like growth appeared on the surface, and gradually made its way downward, until after a fortnight, in some cases, it had grown fully a centimeter beneath the surface. If the medium was sterilized several times before the radium was dropped on it, so that its color was altered, probably by the inversion of the sugar, the growth was greatly retarded, and was confined chiefly to the surface. It was found that plane polarized light, when transmitted through the tube at right angles to its axis, was rotated left-handedly in that part of the gelatin containing the growth, and in that part alone.

"The controls showed no contamination whatever and no rotation. The test tubes were opened and microscopic slides examined under a twelfth power. Objects were observed which at first sight seemed to be microbes, but as they did not give sub-cultures when inoculated in fresh media they could scarcely be bacteria. The progress of any of the sub-cultures after a month was extremely small, and certainly too small for a bacterial growth. It was not at all obvious how bacteria could have remained in one set of tubes and not in the other, unless the radium salt itself acted as a shield, so to speak, for any spores which may originally have become mixed with the salt, perhaps during its manufacture, and when imbedded in it could resist even the severe process of sterilization to which it was submitted. On heating the culture and re-sterilizing the medium, the bacterial-like forms completely disappeared; but only temporarily, for after some days they were again visible when examined in a microscopic slide. Nay, more, they disappeared in the slides when these were exposed to diffused daylight for some hours, but re-appeared again after a few days when kept in the dark. Thus it seems quite conclusive that whatever they may be, their presence is at any rate due to the spontaneous action of the radium salt upon the culture medium, and not alone to the influence of anything which previously existed therein. When washed they are found to be soluble in warm water, and however much they may resemble microbes, they cannot for this reason be identified with them, as also for the fact that they do not give sub-cultures as bacteria should.

"Prof. Sims Woodhead has very kindly opened some of the test-tubes and examined them from the bacteriological point of view. His observations fully confirm my own. He assures me that they are not bacteria, and suggests that they might possibly be crystals. They are, at any rate, not contaminations. I have tried to identify them with many crystalline bodies, and the nearest approximation to this form appears to be that of the crystals of calcium carbonate, but these are many times larger, and, in fact, of a different order of magnitude altogether, being visible under comparatively low powers; and are, moreover, insoluble in water. A careful and prolonged examination of their structure, behavior, and development leaves little doubt in my mind that they are highly organized bodies, although not bacteria. Unfortunately, the quantity is so very minute that a chemical analysis of their composition is extremely difficult. The amount of salt in the first instance is so small, and the number of aggregates, or whatever they may be, thus produced perhaps still smaller.

"Photographs, together with the numerous results of eye observations, indicate that a continuous growth and development take place, followed by segregation. The stoppage of growth at a particular stage of development is a clear indication of a continuous adjustment of internal to external relations, and thus suggests vitality. They are clearly something more than mere aggregates in so far as they are not merely capable of growth, but also of sub-division, possibly of reproduction, and certainly of decay.

"I have ventured, for convenience, in order to distinguish them from either crystals or microbes, to give them a new name, *radiobes*, which might, on the whole, be more appropriate as indicating their resemblance to microbes, as well as their distinct nature and origin. Some slightly radio-active bodies appear also to produce these effects after many weeks. A more detailed account of these experiments will be published shortly. This note merely contains some of the principal points so far observed."

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1541, opens with a well-illustrated and well-written article by Herbert I. Bennett on the building of the Santa Fé Railroad into San Francisco. Carl Lautenschlaeger, who has become well known to Americans by his connection with the New York Metropolitan Opera House, writes on "Theatrical Engineering, Past and Present." It is a well known fact that steamers will perform vibrations of a magnitude that depends upon the design and location of the engine. The well-known German marine engineer, Otto Schlick, has formulated some valuable rules for the construction and arrangement of the marine engine, calculated to minimize these vibrations. It is mainly due to his investigations that modern transatlantic liners may sail at speeds of twenty-four knots. Schlick's investigations have been carried out by means of an instrument of his invention called the Pallograph, described in the current SUPPLEMENT by Dr. Alfred Gradenwitz. The "Dey" Time Register is described by Emile Guarini. Sir William White continues his discussion of submarines. In an entertaining article by T. C. Hepworth, the incongruities and anachronisms of artists are treated. Charpentier finds that odorous substances are definitely acted upon by the N-rays. The results of his researches are summarized in a brief note. Prof. August Smithells writes on the Temperature of Flames. Recent progress in photography is reviewed by Dr. Ludwig Guenther. A history of the telephone is presented by W. H. Sharp, in which the claims of Reis are revived.

OPENING OF EXTENSIONS OF THE NEW YORK CITY SUBWAY.

On Monday, July 10, the Broadway section of the Rapid Transit Subway, comprising two tracks, extending from Wall Street to Battery Place, through which it passes in the form of a loop, as at City Hall Park, and the Lenox Avenue East Side extension from 135th Street under the Harlem River to the elevated section at 149th Street, and thence *via* Westchester Avenue and Boston Road to West Farms, was opened to the public for the first time, trains being run on five minutes headway. This marks approximately the completion of the Manhattan system, except the Washington Heights extension, which is to be in operation before the expiration of the summer.

The tunnel under the Harlem River is composed of two separate tubes, having a space below the roadbed of five feet, to collect seepage that may accidentally leak through. Pumps are provided in the center and at each end to draw this water out in emergencies.

The tunnel is dry at all times, and resembles in appearance the stretch between 33d Street and 42d Street on Fourth Avenue. The bottom of the tunnel is thirty feet below the river surface. The successful termination of this great work is a triumph of American engineering skill, and the facilities afforded will be of lasting benefit to the city and its population.

OFFICIAL METEOROLOGICAL SUMMARY, NEW YORK, N. Y., JUNE, 1905.

Atmospheric pressure: Highest, 30.15; lowest, 29.61; mean, 29.96. Temperature: Highest, 90, date, 18th; lowest, 51, date 8th; mean of max., 77.6; mean of min., 60.1; absolute mean, 68.8; normal, 68.9; deficiency under the mean of 35 years, —0.1. Warmest mean temperature for June, 72, in 1888, 1892, 1899. Coldest mean, 64, 1903. Absolute maximum and minimum for this month for 35 years, 97 and 47. Average daily deficiency since January 1, —0.7. Wind: Prevailing direction, west; total movement, 7.275 miles; average hourly velocity, 10.1 miles; max. velocity, 46 miles per hour. Precipitation, 4.18; greatest, 1.19, date 12th; average for 35 years, 3.29. Excess, +0.89; deficiency since January 1, —3.21. Greatest precipitation, 7.70, 1887; least, 0.86, 1894. Thunderstorms, 2d, 6th, 7th, 19th, 22d, 23d, 26th. Clear days, 7; partly cloudy, 12; cloudy, 11.

Near the end of the 60's, when most of the early bridge companies had been formed, there were, besides the engineers interested in bridge-building firms, only a few experienced bridge engineers in this country. The engineers who were at that time connected with bridge companies were mostly men who had gained their experience in the employ of some railroad company, had worked out their own type of construction, and had experience, not only in designing, but also in superintending the construction and erection of bridge work. Their theoretical knowledge, measured with the present standard, was limited to elementary methods, but their thorough practical training enabled them to combine theory and practice to the best advantage. They understood how to make their designs conform to the methods of the workshop, as well as to facilitate erection. This was really the beginning of the development of American bridge building and of the distinctly American types of construction which at that time differed so materially from those of other countries. The most distinguishing feature of the methods then prevailing in this country, as compared with those of other countries, the influence of which is felt to the present day, is that at that time in America the bridges were designed by experienced specialists, and the work was constructed in shops built and equipped for that special purpose by experienced mechanics trained in that class of work. At first these companies controlled the work in certain territories, or the contracts were awarded to them on account of the reputation of their engineer. However, as competition became keener, railroads desired to purchase their bridges for the lowest price, and invited several firms or companies to submit tenders on the bidders' own designs, which started the competitive system of designing and bidding on bridge work.