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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.

DAM FAILURES NOT THE ACT OF GOD.

If the proper person is intrusted with its design, and the proper materials and methods are used in its construction, a reservoir or dam can be made just as secure as any other of the important works that minister to the daily wants of the public. Nevertheless, if the normal processes of nature (well known and easily provided for at the time of construction) should wreck a poorly-built dam, and a few score of the community be wiped out of existence, we write it down as the "act of God," give the unfortunates decent burial, and proceed to build other structures which only require like conditions ("cloudbursts," as they are popularly called) to produce a like calamity.

Now, as a matter of fact, a cloudburst is simply a heavy and sudden rainfall of the kind that has been occurring intermittently for untold ages in the past, and that is liable to occur on any spring or summer's day for ages to come. This being so, when we set about building our dams, we ought to build them strong enough to withstand not merely the ordinary rainfall, but the excessive one. If the dam be thus built, the so-called cloudburst will fill the reservoir with surplus water which will flow harmlessly over its crest, or through the adjacent spillway; and cloudbursts will no longer be commemorated by anywhere from a dozen to one hundred gravestones in the neighboring churchyard.

Considering the awful possibilities of loss of human life that depend upon dam construction, it is astonishing what crude methods are adopted in building many of the reservoirs, big and little, that are scattered throughout the watersheds of the country. Indeed, the wonder is not that there are so many failures, but rather that there are so few; for the question of failure of many of them is merely a question of the occurrence of one of those unusually heavy precipitations, such as recently occurred with shocking loss of life at Oakford Park, Pa. There is no possible excuse for faulty dam construction. Of the more important engineering works it is the one above all others that demands the services of a qualified expert both for drawing up the original design and superintending the construction. It is little short of a crime to allow excessive regard for economy to determine either the form of a dam or the nature of the materials that are built into it, and where a shadow of a doubt exists as to the security of one system of construction over another, it is the bounden duty of the authorities to choose the obviously safer type, even if such choice involves a considerable increase in the cost. A commendable instance of this course of action may now be witnessed at the Croton Dam, where over half a million dollars is being spent in making a change in the structure which will render it secure beyond all peradventure of a doubt. As a rule, the weakest feature in the smaller dams (among which most of the disasters occur) is the spillway, upon which falls the important duty of carrying away the surplus waters of a heavy precipitation—cloudburst, if you will. Although these spillways are able to carry away the flood waters of one hundred ordinary rainstorms, they cannot deal with the one hundred and first; and the surplus waters, seeking an outlet, flow over the crest of the dam itself, washing away the toe of the embankment and bringing about the inevitable collapse. It was in this way that the Johnstown disaster occurred; and an investigation of existing dams throughout the country, particularly of the smaller dams that were not constructed under expert supervision, would probably show that the area of the spillways in numerous cases is insufficient.

"SHAMROCK" AND "RELIANCE."

For the first time in the history of the struggle for the "America" cup the challenging yacht will have the benefit of a series of tuning-up trials against a reliable competitor, carried out in American waters; moreover, the tuning up is taking place over the identical courses off Sandy Hook on which the international contests are sailed. To this extent the challenger is placed to better advantage than any that have preceded

her. Moreover, the seven or eight weeks spent by the captain of "Shamrock III." off Sandy Hook, prior to the races, should go far to remove that serious handicap under which previous English skippers have labored of being unfamiliar with the many tricks of the tides and weather during the summer months, such, for instance, as that combination of a southerly wind and a suddenly-falling barometer, which is a sure indication of an early shift of the wind to westward. Those who have followed closely the history of these races in the past will call to mind how frequently the attempted windward and leeward races have developed into close and broad reaches due to this westerling of the Sandy Hook breezes. By the way, just here we would suggest, that with a view of making sure of a continuous 15-mile stretch of windward work, the race committee would do well to send off the tugboat that logs off the course a couple of points to westward of the prevailing wind at the start.

But we are digressing; and to return to the question of the respective merits of "Shamrock III." and "Reliance," we have to confess that for want of a common basis of comparison it is extremely difficult to say just how the two yachts stand at the present writing. It is true that "Reliance" and "Shamrock III." have sailed a number of races against two boats, "Columbia" and "Shamrock I.," which themselves fought it out a few years ago in every kind of weather off Sandy Hook; but, unfortunately, since 1899, changes have been made in the handling or the rig of the two trial boats that entirely vitiate any comparison of "Reliance" and "Shamrock III." based upon the performance of "Shamrock I." and "Columbia." First, it must be remembered that whereas in 1899 and 1901 "Columbia" was handled by the best professional skipper in America, who had achieved a high reputation in British waters before he came to this country, this year she is being sailed by an amateur who, in spite of his high reputation as such, is not supposed to be able to get "Columbia" over a 30-mile course within several minutes of the time she would take with the present skipper of "Reliance" at the wheel. The difference might easily amount to from three to five minutes according to the conditions under which the race was sailed. On the other hand, while "Columbia" has deteriorated somewhat, it is confidently believed by the present captain of "Shamrock III." that "Shamrock I." is fully five minutes faster to-day than she was when she met "Columbia" in 1901; and he ought to know, since he was the joint skipper of "Shamrock I." when she raced here. The grounds for thinking that she is faster are, first, that in 1899 her spars were altogether too light for her big sail plan, and buckled so badly that her sails were "all out of shape" and quite unequal to the supreme test of a thrash to windward. Moreover, her designer lay sick in bed during the races; and in his absence, "Shamrock's" weights and the set of her mast were rather clumsily tampered with; indeed, it is pretty generally admitted by our yachtsmen that "Shamrock I." never had a chance to show her best work at that time. When she was used as a trial horse for "Shamrock II.," her rig had been improved, the spars that had shown weakness had been replaced by spars that were stiffer; her trim had been adjusted, and the vessel proved that she had "found herself" by beating "Shamrock II." easily during her trial races. That she was a greatly improved boat received further confirmation in the fact that the yacht she had beaten came over here two years ago and proved, in the opinion of most yachtsmen, to be practically equal to "Columbia," and if sailed as well as that boat, especially in light weather, slightly better. On the other hand, there is little doubt that "Shamrock II." was faster in American waters than she had been in the English Channel. Just how much, no one can tell, but the difference is, we take it, sufficient to vitiate any comparison of "Shamrock III." and "Reliance" on the "Shamrock I."-"Shamrock II."-"Columbia" basis. The writer is inclined to think that "Columbia" is to-day two or three minutes better than her old antagonist of 1899.

Now as to the two new boats themselves, it must be admitted that they represent a remarkable advance in yacht designing; remarkable in the considerable margins by which they have beaten their trial boats, and particularly remarkable in view of the high point of theoretical and constructional development which has been reached in the production of the 90-foot racing yacht. "Reliance" and "Columbia" have met about a dozen times, and in every case "Reliance" has shown an easy superiority to "Columbia," and under certain conditions has proved that the older boat is scarcely in her class. Exactly the same thing may be said of "Shamrock III.," which has shown the same ability to sail completely around her older namesake, beating her under any conditions of weather, and completely running away from her in the lighter breezes. "Reliance" has sailed 34 miles over a triangular 30-mile course in 2 hours, 59 minutes and 20 seconds. "Shamrock III." has sailed over a 30-mile, reaching course in 2 hours, 58 minutes and 37 seconds. The "Reliance" however, made her record time in a 20 to 25-knot

breeze, whereas the fast time of "Shamrock" was made in a breeze of between 6 to 12 knots. In the case of "Reliance," 10 miles was to windward and 20 miles of the 30 was reaching; whereas in the case of "Shamrock," owing to a shift of the wind, of the kind to which we have referred earlier in this article, the whole 30 miles consisted of reaching. So with these facts before him, the reader will be able to draw his own conclusions.

The present will be a great year in the history of the "America" cup. America is represented by the three great 90-footers, "Reliance," "Constitution" and "Columbia." Great Britain by "Shamrock I.," II., and III. There is a growing feeling among yachtsmen that after the international cup races are decided, a magnificent marine spectacle and a yachting event of supreme interest could be secured by having a race between these six magnificent boats. It is true, one of them, "Shamrock II.," is not in commission, but we have seen enough of the temper of her owner to feel assured that he would be only too willing to launch her and bend on a suit of canvas to help out an event which, we do not hesitate to say, would provoke more widespread attention and excite more enthusiasm than any event in the long history of the "America" cup. The cup races will be finished early this year, and a series of races between the six 90-footers in September would be well within the limits of the yachting season.

THE BOOK PAPER OF THE FUTURE.

Time was when the composition of a letter was a task far more arduous than we who live in a stenographic and typewriting age suspect. Before your old-time letter-writer could even begin to set down his thoughts, he was compelled to cut and fold his paper (for note-paper of the proper form could not be purchased in those days); to stir up his slimy ink, so that it would flow as readily as his thoughts; and to cut a goose-quill or two with a skill which many of us would find it probably hard to emulate. And when the letter was finally written and carefully folded and sealed, the scribe had to look about him for some trusty carrier.

These difficulties were not without their literary influence. A letter was then a work of art; for it had been long pondered before quill was ever dipped into inkwell. And because the writing of a message, however trivial, was considered no light task, the letter of a century ago has still a certain literary value.

Now in those halcyon days of long, elegant letters, the postal departments of the various governments, which in the course of time sprang up, sought to curb the epistolary ardor of ladies and gentlemen by charging postage, which varied in amount with the weight of a letter. But the old letter-writer would not be curbed, and frustrated the efforts of the postal officials by inventing a very light, thin paper, which materially reduced the postal revenues. To this very day, this fine paper is still used. In Europe it rejoices in the high-sounding name of "foreign note-paper." Although it is no longer extensively used, "foreign note-paper" may become of far more importance than we may dream.

It has been said that letters in the higher sense of the word are no longer written. Nowadays we only "correspond"; we "beg to state," or "have the honor of informing." The most weighty affairs are dismissed in a short sentence. Thus it is possible to dispose of a mass of correspondence before which the heart of the old-time letter-writer would have quailed. It still remains for our children to discard the forms of polite address which have come down to us, and thus to rob the letter of the only element of picturesqueness which it can still call its own. The letter of the future will be a colorless communication of telegraphic brevity.

Although our modern strenuous life is not conducive to the cultivation of the fine art of letter-writing, some of us still find time to think. And what we have thought finally appears in print for the benefit of posterity—since our contemporaries have even less time to read than to write. Much is printed which no one but the author and the typesetter ever reads. But although we are indifferent to books, we take infinite pains to preserve them. Libraries innumerable are built. There are national libraries, city libraries, county libraries, village libraries, university libraries, memorial libraries, and a host of others. Their name is legion.

Many a hopeful youth who looks into the future with optimistic eyes and who is filled with the laudable desire to do something for himself and for his fellow creatures, in a moment of weakness is persuaded to join a literary or scientific society, trusting that his mind will thereby be improved. Forthwith the society's monthly or weekly magazine is sent to the hopeful youth, gratis. At the end of a year, two portly volumes have appeared. When the hopeful youth has reached the age of forty, he finds himself so far buried in the printed thoughts of his colleagues that he is no longer able to think for himself. And when another decade or two has passed, a material difficulty is encountered in disposing of the

accumulated matter. Bookcase after bookcase is bought until the walls are no longer visible—all to lodge a treasure for which he longed when it was beyond his reach, and of which he wearies when he can call it his own.

There are times, however, when we appraise this treasure at its full value. And the appraisal usually assumes the form of the depressing discovery that what we have thought has been thought by a hundred men before. There are also times when the spirit moves us to set down our thoughts for the benefit of a presumably grateful posterity; and then we look proudly on the hundred volumes piled up around us. In order to lighten the task of writing what we have to tell, we take down a few of the works that have proven of most value, with the intention of seeking some spot less oppressive than the bookish atmosphere of a library. Good as the intention may be, its carrying out is difficult. Six or eight volumes of generous proportions are not carried without some physical exertion. Twenty or thirty volumes, which may be required during a journey, would not be transported free of charge if the ardent student is otherwise incumbered with luggage. An encyclopedia weighs a hundred pounds or so; and its imposing length covers a majestic yard or two of a bookshelf. In a word, the size and weight of our volumes hamper us everywhere. The greater the value placed by the publisher on a work, the statelier is its appearance. Paper almost as thick as cardboard in *éditions de luxe*; broad margins; large type; ample spacing—everything contributes to render the book more unwieldy.

Naturally the question arises: Shall we always be able to manufacture enough paper to meet the ever-growing demands of the insatiable author and publisher? Our forests are not inexhaustible; and wood pulp is the material from which most paper is made. Even now the primeval forests of sparsely populated regions are swept away to satisfy the intellectual needs of more thickly populated lands. But what will happen when all countries are civilized, when all nations alike will need trees?

Clearly we must soon adopt the expedient of our letter-writing forefathers. We must stint ourselves in some way—not perhaps by curtailing the number of books which we write, but by reducing their weight and size. By microscopic print the end is not to be reached. Some improved form of "foreign note paper" must be invented to meet the requirements of the printer—a paper thin but not transparent, and capable of receiving an impression on both sides. Such a paper has not yet been generally introduced; but it must come sooner or later.

That the making of a paper having the requisite properties is not a technical impossibility was proven by an interesting exhibit which probably escaped the notice of many who visited the Paris Exposition. The exhibit in question was made by the Oxford University Press and consisted in part of works printed on "Oxford India paper," remarkable for its extraordinary thinness, toughness, and opacity. Specimen pages of the Bible, Shakspeare, and the *Encyclopædia Britannica* printed on the new and on the ordinary paper and bound in volumes of the same form, proved that the size of a book could easily be reduced by one-half without impairing the legibility of the text. How this new paper is made cannot be learned. But whatever secret process may be employed, it is certain that the exhibit was made in a spirit that should commend itself to paper-makers and to book-makers.

PRESENT CONDITIONS IN ALASKA.

BY J. R. THOMPSON.

The month of June is the date of the opening of the summer season in Alaska, and the amount of work planned for this season devoted to developing and exploiting the resources of that vast territory far exceeds that contemplated or accomplished at any prior time. In the interior every tributary of the Yukon River has been more or less prospected and many of these stream beds and the adjacent country are being worked to a profit. The Klondike district of the Northwest Territory of Canada, just one hundred miles up the Yukon from the imaginary line which intersects the two countries, does not give promise of increasing its output of gold over that of last year, which amounted to \$12,000,000. Lack of new strikes or discoveries since the memorable find in 1896 has set a limit on the output of this famous mining camp. It was reached two years ago and is now on the decline, having at this date produced over \$80,000,000 in gold. But while the richest spots are a thing of history, the importation of modern machinery has made it possible to work to a profit low-grade propositions. Large pumping plants and heavy dredging machinery have ameliorated the condition of the mining operator and reduced expenses to a reasonable basis. One company has taken to Dawson this year 450 tons of machinery, the cost of transportation of which exceeded the original cost of the plant. Freight rates and high wages for day labor have deterred the rapid development of the Klondike district.

Now it can be safely stated that the wages for day labor will average \$4.50 and board per day. The Canadian government pays \$5 and board to all of its employes on government work.

The Nome mining district is daily increasing as a producer and is being extended over a vast expanse of territory, projecting from Golovia Bay to the Arctic Ocean and east inland from the Behring Sea as far as the difficulties of transportation will permit. As yet it has not settled to a defined limit, for prospectors are daily finding prospects in isolated districts which give evidence of substantial discoveries. The future of the northern mining camp, with its rigorous climate during all seasons of the year, is very promising. The known wealth in placer gold and the prospects of the development of the mineral veins and coal beds, of which there are ample indications, give evidence that for many years to come this section will be a great producer of valued minerals and a large consumer of produce and mercantile products.

The year just passed proved very profitable to this mining section, and as a consequence many necessary and costly works were begun. The need of water had curtailed development work heretofore, and to supply this need large ditches, tapping streams at a distance of twenty-five miles from the center of the mining section, were begun and the work vigorously pursued, until cold weather made it impracticable for further work.

One of the heavily interested corporations has now under its management one narrow-gauge railroad running out of Nome to its properties, a distance of five miles, and now has under construction a similar railroad from a point south of Nome (Golovia Bay) to Council City, the center of a mining district. This company has in operation on the bank of the Snake River, near Nome, a pumping plant costing \$75,000 at the builders' in Chicago, which delivers through a pipe line to an elevation of 800 feet, 3,000 gallons of water per minute. Another company sent 900 tons of machinery to Nome in one shipment last season and will construct a large pumping plant this year.

Day labor, as well as those employed in the trades, had a most prosperous season in the past year. The average wages paid for labor was \$5 per day and board. Some mining operators were compelled on account of lack of labor to pay as high as \$6 per day and board. It may seem strange that more laboring men do not flock to such a place; but every man who has served in this capacity will concur in the statement that every man is expected to earn the wages he is paid—that the laborer is well worth his wages.

Two new districts have recently attracted attention. They are known as the Tannan and the Copper River districts. They are deep in the very heart of the territory. Discoveries made last summer have developed so satisfactorily that this new find bids fair to gather round it a very substantial mining community. Valdez, a town on Cook's Inlet, the point from which all the miners start for this new discovery, is the gateway of a tremendous expanse of practically unexplored or unprospected country.

The need of some practical method of transportation is keenly felt. Last season the price of freighting to these new camps was \$1 per pound. This problem can be solved by the building of a railroad. A survey has been made from Valdez to Eagle City, on the Yukon, traversing the heart of this district; but as yet no steps have been taken for building the railroad. The prospects indicate that there is a vast amount of wealth in minerals and unnumbered acres of agricultural and grazing land in this district awaiting development. This season one thousand head of cattle will be driven to these grassy plateaus and slaughtered in the fall of the year. Another party contemplates bringing a similar number of sheep for the same purpose.

Along the coast of Alaska, especially in Cook's Inlet, men have prospected for oil for the past three years. During October last a gusher was struck seventy miles south of Valdez. All the adjacent land was taken up and recorded and companies formed for the further exploiting of the field. Since then large quantities of supplies and machinery have been forwarded to this point, and it is expected that further developments will reveal the existence of a considerable oil field. The surface prospects are decidedly encouraging. The gusher referred to, which is the pioneer in Alaska, was struck at a depth of three hundred feet, and the oil proved of an exceptional quality.

The annual spring stampede from the Pacific coast cities to Alaska is in progress. It is expected that at least 10,000 men will go into the new mining camps, 200 miles inland, while many others will be attracted to the new oil fields.

Since the development of the resources of the Pacific coast the value of its fish has proven to be one of its richest heritages, and to-day Alaska can claim a paramount position in that respect. Last year over \$8,000,000 worth of salmon was shipped from its ports. It might be well to state that Mr. Seward paid \$7,200,000 for these Russian possessions. Salmon canneries are now located on almost every stream of any importance from Mary's Island, the most southern point of the

territory, to the Arctic Ocean, and this year's output will far exceed that of the past year.

These canneries encroach upon the inalienable rights of the natives, sometimes depriving them of their livelihood. This is a serious matter and will soon resolve itself into a difficult problem.

SCIENCE NOTES.

In a note entitled "The Ear a Manometer," M. Pierre Bounier sets forth a new theory of hearing, to wit, that the liquid of the interior ear moves as a whole, so that audition is a hydrodynamic, not an acoustic, phenomenon. The ear is not a resonator, but a registering manometer, in which variations of pressure are alone recorded. He points out that the nerve of the labyrinth is thus brought under the common law of the apparatus of sensation.

Mdme. Curie, having obtained about a decigramme of pure radium chloride by fractional crystallization of radiferous barium chloride, has endeavored to determine the atomic weight of radium. The results of her experiments show that the atomic weight is 225 (taking Cl = 35.4 and Ag = 107.8), with a probable uncertainty of not more than one unit, radium being considered a bivalent element. The chemical properties of the element include it in the alkaline-earthly series, in which it constitutes the higher homologue of barium. In accordance with its atomic weight it should be placed below barium in Mendeleeff's table, and on the same line as thorium and uranium. Pure anhydrous radium chloride is stated to be spontaneously luminous.

The largest factory of chemicals in the world is said to be the aniline and soda establishment of Baden, in Ludwigshafen-on-the-Rhine. The works employ 148 scientific chemists, 75 technical engineers, 305 clerks, and more than 6,000 workmen. There are 421 buildings for factory purposes and 548 dwellings for laborers and 91 for officials. One hundred and two boilers furnish steam for 253 engines with 12,160 horse power. Gas is extensively used as fuel. Five large steam hoists on the banks of the river are used for loading and unloading. The works own a vessel, with a capacity of 600 metric tons, for the transportation of sulphuric acid. A network of railways, having a total length of 27 miles, connects with the state railroad system. Three hundred and eighty-seven cars are owned by the factory.

As a result of the numerous micro-chemical experiments with calcium metaphosphate, A. L. Herrera in *Memorias de la Sociedad Científica "Antonio Alzate,"* Mexico, propounds the theory that natural protoplasm is composed of this salt, impregnated with various substances absorbed or secreted under special osmotic and electrolytic conditions. Transparent vacuolated bodies of homogeneous structure, and of the consistency of natural protoplasm, have been observed, which have very striking analogies with protozoa in general, changing shape, swelling, dividing, and, on treatment with salt-solution, forming a plasmodium. Prof. Herrera shows several micro-photographs of the artificial protoplasm which he has prepared, and which consists solely of calcium metaphosphate, in actual movement in salt solution.

We have heard so much of what is poetically termed the "teeming millions" of China, that the official census recently published by the Imperial Treasury Department of China is of no little interest, since it furnishes a method of determining just how many "teeming millions" there are. It appears that the Celestial Empire contains 426,000,000 inhabitants, and that China proper—the eighteen provinces—contains 407,000,000. The table is given in the *Mouvement Géographique* of Brussels, to which readers are referred for details. The number of inhabitants per square kilometer varies from 201, in Ho-Nan, to 32, in Kan-Sou, and is, on the average, 103 in the eighteen provinces. In Mongolia, the number is 0.7; in Manchuria, 9; in Yibet, 5, and in Turkestan, 0.8. For comparison we may recall that Germany has 105 inhabitants per square kilometer; Belgium, 220; and the United Kingdom, 130.

The agricultural authorities at Barbadoes have been carrying out investigations to ascertain the effect produced by falls of volcanic dust on insect pests and other parasites of the field. The first examination was made after the fall on October 16 last to study the results. Taken on the whole, the dust appeared to have exercised but little effect, most of the insects having hidden themselves during the actual fall. Observations on the following day showed that the greater number of insects had escaped unharmed. Two-winged flies suffered severely, there being a notable absence of them after the dust. "Cow bees," "wild bees," and other hymenoptera suffered in the same way. Other groups practically escaped, so that the dust had little, if any, effect on the pests. The destruction of two-winged flies, "cow bees," etc., is not regarded as beneficial, as many of these serve to keep caterpillars and other pests in check.