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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.

VANDALISM AT NIAGARA FALLS.

That spirit of brutal utilitarianism which tries everything by the test of "the money there is in it," grows bolder with every success. We have scarcely cooled down from the bitter indignation that was aroused by the disfigurement of our new Subway by the bill-poster, before we are confronted with an attempt to sacrifice the beautiful American Falls of Niagara to the ambitions of a few men, who see visions of great profit in the energy of the falling waters.

We have made no protest against the previous use of Niagara Falls for commercial purposes, because it has not yet been attempted on a scale that would seriously interfere with the scenic beauties of the Falls; but the present attempt to secure legislative authority for developing something like half a million hydraulic horse-power, at the expense of the volume of water flowing over the American Falls, is so serious as to call for a halt in what is becoming a case of ugly vandalism. The New York State Geologist has stated that when 80,000 cubic feet of water per second has been taken away from the Niagara River above the Falls, the American Falls will cease to exist. The American Falls will run dry before the Canadian Falls, because the ledge over which they pass is at a higher elevation than the larger Falls on the Canadian side. The bills now before the Legislature, should they be passed, will give to the various companies that are behind them the power to take away an amount of water that will go far toward wiping out the greatest object of natural beauty east of the Rocky Mountains.

The Niagara Falls are the pride of America and the wonder of the world. They are a proper object of delight to millions of people, and they will naturally, unless they be destroyed, form, for all time to come, one of the most popular points of scenic interest in the world. On the other hand, "there is money" in these Falls—lots of it—for a few people. It is argued that there is much useful energy going to waste at the Falls, that could be turned to a great commercial advantage; but it is not necessary that this energy should be developed, inasmuch as equal energy can be developed in other ways, such as utilizing less important water falls, or by burning bituminous coal under steam boilers. But if this energy were produced from coal, it would be done with less profit to a few individuals than if it were developed at the Niagara Falls. In other words, there is more money in using up the Falls than in using up an equivalent amount of bituminous coal. Now, the object of the bills at Albany is to enable these few individuals to make that extra amount of money, represented by the difference in cost between generating a certain amount of energy from the Falls and generating the same amount of energy from anthracite coal.

That is exactly the long and short of it.

And the spirit which is back of this attempted vandalism is the same spirit that is becoming rampant throughout the whole of our commercial life—a spirit of cold, hard, ugly utilitarianism which, if not curbed in this and many other similar cases that confront us at every turn, will work irreparable injury to the ideals and the character of this, the youngest, and as many of us believe, the greatest among the nations of the earth.

THE TRUE POINT OF VIEW.

In the debate following a paper that was read at a recent meeting of the New York Railroad Club on the subject of heavy electric traction, there was the inevitable discussion of the relative economy of alternating current and direct-current traction. A new point of view was taken, however, when Mr. Wilgus stated that the question of adopting electric traction on steam roads was one rather of an increase in earnings than of a decrease in expenses. This, surely, is the lesson taught by the great success that attended the electrical equipment of the elevated roads in this city. It

is true the change was accompanied by a decrease in expenses; but the economies secured in this way were insignificant compared with those that resulted from the great increase in passenger traffic, due to the larger trains, higher speed, and more frequent service, and the considerable increase in travel due to the greater comfort and cleanliness of electric traction. The success achieved on the elevated roads was due, not to the extension of the system, but to the development of the existing roads to the full measure of their carrying capacity. In the case of steam railroads, however, the increase in earnings should be, if anything, relatively larger than that on the elevated roads, for the quickening of the service, and the more frequent headway of trains, will enable the steam railroads to extend their suburban service to remoter districts, which at present, owing to the limitations of steam service, are too far removed to be reached by suburban travel. In the future, the question of the electrifying of steam railroads will not be determined by an academic discussion of the relative costs of operation of existing stretches of line, but it will be determined by a consideration of the increased earnings that would result from the wider distribution of population over a larger area of territory.

THE FASTEST 40-FOOT MOTOR BOAT.

It is well understood among designers of fast boats that we must have length for speed. Hence, in judging a high-speed performance, we must know the length of the craft that broke this or that record, before we can determine its merit. Quite a sensation has been created at the recent performance of "Napier II," the motor boat that was constructed last year to represent Great Britain in the International Motor Boat contest. During the winter this vessel has been in the hands of her builders, Yarrow & Co., who have made considerable changes in the form of her hull, and have so far improved the boat that, during a recent trial, she covered the one-knot course used by the British Admiralty, in a strong wind and rough water, at a mean speed of 29.925 miles per hour. The changes in the model of the boat have consisted mainly in the sharpening of the entrance lines, while the twin engines have been lightened by taking metal out of the reciprocating and other moving parts. That a speed of just under 30 miles should be made by a boat only 40 feet long, is a really remarkable fact; and the "Napier II." must be reckoned as the fastest vessel of her length in the world.

In commenting on this performance, Mr. Yarrow stated that the high speed of the boat is largely due to the wonderful efficiency of the motors. If he were asked what speed he would be prepared to guarantee in a boat of the size of "Napier II," if it were equipped with the type of boilers and engines which he places in the torpedo destroyers of which the firm turns out so many, he stated that he would not be prepared to guarantee more than 16 knots an hour. As showing the great increase of speed due to increase of length in these craft, Mr. Yarrow mentioned that a 60-foot torpedo boat with modern steam machinery is good for about 20 knots an hour, while a 200-foot boat with similar, but of course larger machinery, would make 30 knots an hour. Hence, it is inferred that since 26 knots an hour has been secured in the 40-foot "Napier" boat, 45 knots an hour could be secured in a 220-foot motor boat of the same general type.

COMPLETE THE PRESENT SUBWAY PLAN.

With a considerable show of reason, it is claimed by Mr. Belmont, of the Interborough Company, that his company should be given a fair chance to complete the original rapid transit system as laid out by the Rapid Transit Commission, of which the subways recently opened constitute but an incomplete portion. It will be remembered that the original plan contemplated, in addition to the roads that are now completed, an upper east side branch through Lexington Avenue and a lower west side branch from 42d Street to the Battery. These two branches were not included in the contract of the Interborough Company, for the reason that the city's debt limit was such as to place insufficient funds at the disposal of the Rapid Transit Commission for carrying out the whole scheme. It is claimed by Mr. Belmont that the first contract was undertaken in the full expectation that, when the city was prepared to build the two branches, thereby completing the system, his company would have the first option on doing this work. It is urged that when the Interborough Company put in a bid of only \$2,000,000 for building the lower Broadway, East River tunnel, and Brooklyn extension, they bid \$8,000,000 less than the actual cost of the work; and that they were willing to do this in order to maintain the Brooklyn and Manhattan system of lines intact in their own hands, with a view to being able to operate them under a single five-cent fare over the whole system.

Although there is no legal obligation binding the Rapid Transit Commission to allow the present com-

pany to complete the system as originally designed, it certainly does seem as though there was a certain measure of moral obligation. At the time that Mr. Belmont and those associated with him stepped into the breach and put up the vast sums of money necessary for the inception and carrying on of this great work, the Rapid Transit Commission was at its wits' end to know where to find a bidder. It should not be forgotten that the Metropolitan Street Railway Company, which, as newly incorporated, and under a new name, is now burning with zeal to build subways, would have nothing whatever to do with rapid transit four or five years ago. It is only when the present Subway Company has proved that subways are a valuable property, that the Metropolitan interests become anxious to take up the very work at which they looked askance only a few years ago. Both the company and the city are the gainers by this change of heart; for it is probable that the Metropolitan interests will figure largely in the building of future subways. Nevertheless, it would seem desirable that, for the reasons stated above, the original subway should be completed and operated by one and the same concern, provided, of course, that their bid is put in at the prevailing prices for such work.

THE CHEMISTRY OF PAINTING AND THE PRESERVATION OF CANVASES.

BY GEHEIMER HOPFAT PROF. DR. W. OSTWALD, OF LEIPZIG.

Little improvement has been made in the technique of oil painting since Pettenkofer, forty years ago, explained its scientific principles and exposed the antiquated character of current knowledge and practice. The temperature and humidity of picture galleries is now regulated in accordance with Pettenkofer's recommendations, and his method of renovating paintings has been adopted and developed, but the important question, how to produce durable paintings, is still neglected, even by the best technicians, as is shown by the proportion of obviously short-lived works in every collection. What is still more remarkable, picture buyers, both governmental and private, pay no attention to the expectation of life of their dearly-bought treasures. I know a very costly Makart which, though little more than twenty years old, is already a senile wreck. Its brilliant colors have become muddy, all detail is gone from the shadows, and the whole picture is flaked, cracked, and wrinkled. A celebrated Knaus in the Leipzig Museum has become so covered with cracks that it has been taken down, and some of Menzel's early works are in little better condition.

So our art treasures are perishing before our eyes. Has the same condition always existed, and must it continue to exist? Neither the one nor the other. When we look at the splendid Van Eycks in the Berlin Museum, which have retained their brilliant hues almost unchanged for nearly five centuries, we infer that the swift decay of modern works is not an organic necessity. It may be objected that the method by which these durable old paintings were produced is irretrievably lost. True; but it is surely as possible to make permanent pictures now as it was then.

The first requisite is a certain amount of scientific research; the second and more important is that artists and purchasers should pay the same conscientious regard to permanence that was paid in Albrecht Dürer's time.

We require of the architect, as a matter of course, that his artistic creations shall not crumble in a few years; but the genius of the painter, it is assumed, must not be fettered by chemical laws or petty technical considerations. Yet so great an artist as Boecklin devoted his life to technical experiments, and he might have carried them further and given freer scope to his genius if he had also known a little chemistry. For example, he used pure vermilion with startling and unpleasant effect, because he fancied that vermilion is permanent when used alone but is affected by other pigments. The truth is that some varieties of vermilion withstand the action of light very well, while others turn gray or brown, whether used alone or with other colors. If one speaks to a painter of these things, he retorts that chemistry is the root of the whole evil; the Van Eycks knew nothing of it, and made durable pictures, but the modern aniline colors fade. This is unjust, for nineteenth-century artists painted fugitive pictures before aniline colors came into use. The fault is not in the colors, but in the medium. Now, as formerly, the palette of the oil painter consists chiefly of pigments of unquestioned permanence. All the yellow and red ochers, most blacks and browns, ultramarine, cadmium yellow, chrome green, and some other colors remain unchanged for thousands of years; indigo, madder, and Prussian blue endure for centuries. The former are the pigments of thirteenth-century and fourteenth-century frescoes; the latter are found well preserved in still older miniatures.

But these are not oil paintings. The medium is carbonate of lime in the frescoes, gelatine or albumen

in the miniatures. Nor are the Van Eycks above mentioned oil paintings in the modern sense. The method employed in their production is not recorded, but it could be ascertained by micro-chemical examination. Many technical questions might be solved by such examination of minute fragments, which could be taken from the edges of pictures without material injury.

Still, some genuine oil paintings are very permanent; for example, Raphael's "Sistine Madonna" in the Dresden gallery. Now, a comparative study of old oil paintings shows that those which are best preserved are *very thinly painted*. This is not a mere coincidence. The evils of oil increase with the thickness of the layer of paint, and are further intensified by applying one color over another. Hence the works of Rubens, painted thinly and rapidly, are so much better preserved than Rembrandt's; and, for the same reason, Knaus's pictures, painted apparently on an asphaltum ground, have decayed so soon. In short, though it is possible to make permanent oil paintings, conditions fatal to permanence are very apt to occur. One such condition is the use of thick masses of color, or impasting.

In spite of these obvious disadvantages, oil has practically displaced all other media, because it permits the artist to judge the effect of his work at once, as oil colors do not change appreciably in drying. Water colors alter perceptibly, and *gouache* still more, and the painter must make allowance for the alteration. But though the oil painting does not change in drying, or in weeks or months, it changes inevitably in decades and centuries, and always in the same way, by assuming a general yellowish brown cast, called the "gallery tone."

Is there no remedy? I know none for the yellowing of oil with age, but we may take a broader view, and seek a method which shall retain the chief advantage of oil painting and yet avoid its defects. Such a method is pastel.

Pastels show no trace of "gallery tone," but remain bright and fresh for centuries. They are executed with dry colored crayons, which adhere loosely to the ground, and must therefore be protected with glass. Pastel allows the greatest freedom of treatment, and unsatisfactory parts can be wiped off and done over as often as necessary. When I recommend this method to painters, they say: "Very true! If one could only fix the pastel." Even this is possible. In my "Notes on Painting" I have given the formula of a fixative which enables a pastel picture to be rolled, dusted, and cleaned with bread crumbs without injury. This brings us back to a medium, but one which is used in very small quantity and does not darken with age, but, at the worst only disappears, when it may be re-applied. When I add that pastel is suitable for pictures of every size and character, that it is the cheapest of all methods, and that it enables the artist once more to prepare his own colors and assure himself of their purity, it will be understood why I regard it as the method of the future.

[NOTE.—Malerbriefe. Beiträge zur Theorie und Praxis der Malerei. Von W. Ostwald. Leipzig, Hirzel, 1904. 165 S. In this book the eminent chemist, who is also an artist of talent, ascribes the permanence of the Van Eyck pictures in part to the fact that they are on wood, strongly recommends the use of wood, cardboard, or metal instead of porous canvas, and also advises that oil paintings be protected from the air by glass.—Ed.]—Condensed from Die Woche.

NIAGARA POWER AT GOAT ISLAND.

BY ALTON D. ADAMS.

If Niagara Falls is abolished, Goat Island will become the greatest power site in the world. Canada and New York State have already made a long start toward destruction of the American Falls, and, as soon as this result is accomplished, Goat Island will be available for power purposes.

Money is the motive that is leading Canada to dry up the American Falls, but New York is granting away great water rights without compensation.

Under natural conditions, power development on the New York side of the Niagara River can be more easily and cheaply carried out than it can on the Canadian side, but this advantage is offset by the exclusion of power plants from the New York State Reservation, and by the high value of real estate in the city of Niagara Falls. As soon as the American Fall disappears, the policy of New York in excluding power plants from Goat Island can no doubt be reversed. The tendency toward this result will be increased by the knowledge that Canada is deriving a large revenue from the water which its power plants suck up. With Goat Island open for power development, the balance of advantage in the cheap production of energy will turn strongly to the American side of Niagara River.

The precarious situation of the American Falls, in view of the present and prospective diversion of Niagara water, and the great superiority of Goat Island as a power site, are both evident on inspection of a map of the river above and below the Falls. Just

upstream from Goat Island the Niagara River is 4,200 feet wide, but that part of the water which goes to the American Falls shrinks to a width of only 400 feet near the upper end of the island. Even this narrow bed does not carry a deep unbroken current, but the uneven bottom breaks the shallow water into scores of minor cascades. It is estimated that as little as 10 per cent of the total discharge of the river goes down the channel to the American Fall; and within the memory of men a strong east wind has so lowered the river, by piling up the water at the west end of Lake Erie, as to leave the brink of this cataract bare. When canals, pipe lines, and tunnels suck down a large part of the discharge of the river, the narrow line of cascades above the American Falls will be laid bare, while the far wider and deeper channel between Goat Island and the Canadian bank will be comparatively unaffected. Thus will the American Fall disappear. With the passing of this cataract, Goat Island and the adjoining part of the Reservation on the New York bank will become united by the dry bed, and present a most favorable site for power development. From that corner of the New York Reservation which is close to the new suspension bridge over the Niagara River to the junction of Goat Island with the Horseshoe Fall, there is a shore line 3,200 feet long at the base of the perpendicular cliffs. With the channel to the American Fall dried up, the shore line on the upper river from the lower end of Goat Island to a point opposite its upstream end, on the New York bank, would measure nearly 4,000 feet. Between these upper and lower water fronts, that differ in elevation by 160 to 200 feet, only a narrow peninsula of rock would intervene. Over, through, and beneath this peninsula enough canals, pipe lines, and tunnels might be constructed, at a minimum of expense, to swallow any desired part of the Niagara waters. The deepest part of the channel between Goat Island and the New York bank might, with some excavation, be made to carry a large volume of water for power houses located either at the crest or the foot of the present American Fall. Near the lower end of Goat Island, close to the Horseshoe Fall, either canals, pipes, or tunnels, each several hundred feet long, would suffice to convey the water at trifling cost to wheels at the level of the lower river. With such possibilities for the development of cheap and practically unlimited power, it is little wonder that promoters are looking with longing eyes at Goat Island.

But it may be questioned whether New York or Ontario will ever allow enough water to be diverted from the Niagara River to dry up the channel that leads to the American Fall. Just here comes in the influence of competition in grants of water rights by the two governments; and it should be held in mind that while New York has full power to make such grants, it has no power, as one of the American States, to enter into any treaty with Canada for the limitation of such rights. At the rate charters have been granted to divert water from the Niagara River during the past decade, less than another ten years would see New York corporations with power to divert enough water to dry up the American Falls. But suppose that New York, to save its falls, discontinues the granting of water rights. Canada will still be free to lease power sites, and the Horseshoe Falls will still present a grand spectacle when the site of the American Fall is as dry as the sands of Sahara. Is it probable that Canada, out of pure kindness to New York, and merely to save the American Fall, will forego the larger revenue it may derive from the sale of further water rights? Ontario already receives a minimum yearly rental of \$60,000 from the three great power companies whose works are under construction in Queen Victoria Niagara Falls Park. When these works are in full operation, an additional revenue of nearly \$250,000 per year will be received by the government as a royalty on every horse-power developed. This great revenue, amounting in all to more than \$300,000 annually, is to be received as compensation for the right to divert about 32,000 cubic feet of water per second from the Niagara River just above the Horseshoe Falls, or more than twice the volume that is diverted on the New York side. Large as is the sum just named, Ontario wants more, for its government has purchased or acquired the entire river front of the Canadian frontier between Lake Erie and Lake Ontario, a distance of more than thirty miles, and large amounts must be obtained to meet the interest on the purchase price of these lands, pay off the principal, and develop them. With an eye to all this, the Ontario government is considering the sale of further power privileges at the Falls, and has obtained a report from a hydraulic engineer to the effect that at least another 30,000 cubic feet of water per second can be conveniently diverted from the upper river. This would raise the total volume of water to be diverted on the Canadian side of Niagara River just above the Falls to about 62,000 cubic feet per second. For purposes of navigation, and for the several power plants that it feeds, the Welland

Canal draws an unknown quantity of water from Lake Erie, but it is known that a single one of these power plants, the largest, has wheels with a capacity of 1,400 cubic feet of water per second. It is perhaps not an overestimate to say that the Welland Canal draws as much as 3,000 cubic feet of water per second from Lake Erie; and this with the above figures would raise the total proposed draft from the lake, in Canada, to 65,000 cubic feet of water per second. On the New York side of Niagara River, the power plants about the Falls, or under construction there, have an authorized capacity of about 32,000 cubic feet of water per second, and to this should be added the 1,200 cubic feet estimated for the New York barge canal between Buffalo and Savannah, and not less than 6,000 cubic feet per second for the Chicago drainage canal. These figures for the actual and proposed diversion of water from the Great Lakes and Niagara River, in the United States, form a total of fully 39,000 cubic feet per second. Adding this last-named quantity to the volume of water that may be diverted on the Canadian side at no distant day, brings the total volume that is to be sucked away from the lakes and river above the Falls up to 104,000 cubic feet per second. In 1899, the United States engineers found that while the discharge of Niagara River is 222,000 cubic feet per second for mean Lake Erie level, this discharge sinks at times to as little as 165,340 cubic feet per second. The proposed diversion of almost one-half of the normal discharge of Niagara River would probably dry up the American Fall, save at times of high water, and this result must certainly follow when the water is low. With the Fall reduced to an intermittent spectacle, there can be little further motive to exclude power plants from Goat Island.

SCIENCE NOTES.

Particulars of a new and painless anæsthetic are published by the *Petit Journal*. This drug, which is obtained from a plant found in Japan, has been named "scopolamine." It is administered by hypodermic injection, and has the effect of inducing deep sleep for eight or nine hours. Scopolamine, it is claimed, is far superior as an anæsthetic to any of the drugs at present in use for the purpose of operation, and has absolutely no after effects.

Explaining the four types of radio-active substances at the Royal Institution, Prof. J. J. Thomson showed how the beta substance attracted and repelled an object much in the style of a pendulum. Unless the object were removed, he said, it would be made to swing so long as the radium lasted—say, a million years—so that with some clockwork attached to the pendulum we should have a clock that would require winding up only once in a million years.

Dr. Karl Pearson, of University College, London, states that a man of mediocre ability can observe and collect facts, but that it takes the exceptional man of great logical power and control of method to draw legitimate conclusions from them. He thinks that at least fifty per cent of the observations made and the data collected are worthless, and that no man, however able, could deduce any result at all from them; that, in the language of engineers, we need to "scrap" about fifty per cent of the products of nineteenth-century science; that the scientific journals teem with papers that are of no real value at all, recording observations that cannot be of service to any one, because they have not been undertaken with a due regard to the safeguards which a man takes who makes observations with a view of testing a theory of his own; that in other cases the collector or observer is hopelessly ignorant of the conditions under which alone accurate work can be done; that such a man piles up observations and data because he sees other men doing it, and because that is supposed to be scientific research. Prof. Pearson feels that sociological observations are of the lowest grade of value in too many cases; that even where the observers have begun to realize that exact science is creeping into the sociological field, they have not understood that a thorough training in the new methods is an essential preliminary for effective work, even for the collection of material; that these observers have rushed to measure or count any living form they could hit on without having planned *ab initio* the conceptions and ideas that their observations were intended to illustrate. Dr. Pearson is skeptical about the right men or the right man, and he thinks the securing of these men is the chief difficulty in organizing any force for the scientific interpretation of the great mass of data now existing; but he says that when the right man is found he must have been rightly trained; that he is to be occupied in drawing logical conclusions from other persons' observation and data; that therefore he must, in the first place, be an adept in scientific method, a first-class mathematician and statistician, and a trained calculator and computer. Such a man will be the man who has the courage to "scrap," and do it relentlessly. Science wants immensely the courageous pruner, but Dr. Pearson feels that such a task is not an enviable one.