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 disavantages, 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 reapplied. 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 computator. 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.