For a year past the patient has been afflicted with dyspnœa much of the time, with severe palpitation of the heart, but since the operation she has had no attack of either.

Query.—Had the catheter anything to do with the tumor in the first case?

February 21st, 1866.

ALUMINUM IN DENTISTRY.

By AUGUSTUS MASON, M.D., Brighton, Mass.

[Communicated for the Boston Medical and Surgical Journal.]

THE medical profession, in its medico-legal and hygienic departments, has very intimate relations with dentistry. As custodians of the public health, physicians should be thoroughly acquainted with the metals and alloys used for dental plates, and with the safe or pernicious character of all substances used in the mouth. Dentistry, in some form, has become so indispensable and universal a requisite of our social condition, that in addition to the obvious local effects of cheap or poisonous dentistry, the physician may as wisely interrogate the mouth for an explanation of obscure constitutional affections as he has heretofore suspiciously criticized the wall-paper, the water, or the culinary implements.

I have strong reasons for believing mercurial pastes are still clandestinely used for plugging teeth, though they have long since ceased to be used openly, professional and public opinion having secured their merited condemnation.*

The use of red vulcanite as a base for artificial teeth is open and universal, and if there is any virtue in homœopathic triturations, or the cumulative effects of minute doses, the experiment of constitutional poisoning by cinnabar is being tested by this generation on a most stupendous scale.

I am aware that most physicians, even the best informed generally, were until lately (if they are not now) ignorant of the composition of the red vulcanite, though the medical journals have repeatedly called attention to the subject;† and that to arouse the profession and the public to any source of danger requires persistent effort or the panic of some startling development.

Certain qualities have introduced the vulcanite to popular favor (in ignorance of its composition), and the introduction of some desirable and equally efficient substitute will hasten its disuse.

Dr. Keep's brief paper on the use of aluminum as a base for ar-

* The day after this was written, a gentleman came to my office to consult me about an aching tooth. I found it recently plugged with an amalgam of mercury and silver. In such cases the tooth must generally be lost, owing to the difficulty of removing the filling.

† Vide London Lancet, American reprint, vol. ii., No. 1, 1861, p. 64; Boston Medical and Surgical Journal, vol. lxi., p. 164, et al.

tificial teeth, read before the Massachusetts Dental Society and printed in the last number (Feb. 15th) of your valuable JOURNAL, will probably, by the value of his reputation, recal the attention of dentists, to some extent, to new experiments with that metal.

It is to be regretted that Dr. Keep has not detailed more fully the history of the application of aluminum in Europe and this country, with the reasons, if any, leading to its utter neglect.

I shall endeavor to supply a portion of the void left by Dr. Keep, together with a concise statement of my connection with bringing the article anew into the field of notice and experiment.

In the summer of 1864, Dr. Fowler, of Yarmouthport, had proposed to make a set of permanent teeth for a member of my family, upon a rubber base. Gold was at a high premium. Learning that the red rubber was colored with a large quantity of cinnabar, or bisulphuret of mercury, he came out to my house in great excitement, with the idea that if an innocuous color could be found to replace the cinnabar, or a cheap and desirable substance for gold or red rubber, it would be worth a fortune to the discoverers.

An agreement was therefore made, at his urgent request, that I should immediately investigate the subject; that he should conduct the laboratory work and experiments, and the results, if any, should be equally shared.

It is sufficient to say, that having investigated the properties of the whole list of metals, I soon became aware that there was no known sulphuret, with the proper color, that could be used as a substitute for cinnabar, and in this opinion I was fortified by subsequently learning that the whole field had been thoroughly worked by competent chemists, with unsatisfactory results, and for the very same end, i. e., to avoid the poisonous or supposed poisonous properties of the cinnabar.

In studying the series of metals and their compounds, I found but one that had the requisite properties for use in the mouth as a substitute for the metals already employed, and this, from its chemical description, and from what I knew of its actual employment for domestic purposes, appeared every way suitable. This was aluminum.

Having, therefore, explained to Dr. Fowler the uselessness of further experiments and researches for a substitute for cinnabar, I proposed that our experiments should be tried with this metal.

We visited the Public Library of Boston, thinking that we might find there all that was known in regard to aluminum. The Librarian most courteously assisted us, but I am sorry to say that the information obtained was very limited, and led us to suppose our field entirely unexplored.

Some ingot aluminum was purchased and rolled into plate, but the aluminum would not solder.

A set of teeth was, however, made without difficulty, as the process of using vulcanite in connection with metallic plates was well

known to dentists at that time. The great resistance of aluminum to the action of sulphur and its compounds rendered it singularly adapted to combination with rubber in the vulcanizing process.

The set was inserted in the mouth for trial, and found to be remarkably clean and tasteless. The red vulcanite was used in this set, as we had no plastic material for black vulcanite.

Our attention was still directed to working up a set wholly of aluminum, and while we were discussing the possibility of soldering and filling the crevices by throwing down the aluminum from solution by galvanism, my attention was attracted to an advertisement of a patent for making a base for a set of teeth entirely by that process.* This I hunted up, and notified Dr. Fowler, and together we inspected the models, which were in the hands of J. M. Batchelder, a gentleman of inventive ability, but not the patentee of this process. This gentleman had, however, been trying some successful experiments in the use of vulcanite for telegraph insulation, and fortunately had some unvulcanized rubber in his possession. This was obtained in small quantity, tried with aluminum, and found to work handsomely.

The product was objectionable only on account of color, but was free from deleterious qualities. The main purpose of our experiments seemed to be secured. I therefore forwarded a fresh supply of aluminum to Dr. Fowler, and as soon as possible a sufficient quantity of prepared unvulcanized rubber, which I obtained after great effort and trouble, for the construction of specimens to be forwarded to the Patent Office. This patent was to be in our joint names, and the expense divided.

It would be foreign to the purpose of this paper to detail the course pursued by Dr. Fowler to obtain the patent in his own name. It suffices to say, I discovered his perfidy at the last moment. I at once procured some more aluminum, assisted with my own hands in rolling it, and employed a dentist to make up a set of teeth.

Relieved of the incubus of the secret, I could obtain information beyond the range of scientific works, to which I had been confined. I could consult persons, and soon became aware of new facts in regard to aluminum, which I will proceed to detail.

I consulted Mr. Farmer, with whose name I was familiar in connection with alloys of aluminum, and who was considered an expert on the subject. Mr. Farmer informed me that aluminum plates had been used several years previously by Dr. Fiske, of Salem. Such I found to be the fact, and also that Dr. Fiske was well informed in regard to the previous use of aluminum in dentistry. In a letter to me from Dr. Fiske, dated the 20th of January, 1865, he writes that he made a set of teeth upon an aluminum base for Col. P., of Salem, on the 28th of February, 1859. Col. P. brought his aluminum from Europe where, in 1858, its employment in dentistry was attracting

* John Johnson, Saco, Maine, patentee.

considerable attention.* The aluminum bar was rolled by Dr. Fiske, and the teeth fastened on by aluminum rivets through the body of the tooth. The set was made without difficulty. It is still in possession of Col. P., and occasionally worn.

Dr. Fiske, whose mechanical and inventive genius is very remarkable, took my aluminum plate and returned me a complete set of teeth, made with perfect ease at the first trial, the aluminum plate containing an air chamber, which is wanting in the earlier sets of Dr. Fowler. The set made for me by Dr. Fiske I have in my possession. The teeth are attached by rubber.

Any dentist who has access to an old file of the *Quarterly Journal of Dental Science*, London, January No., 1859, will find a lengthy and interesting paper from the pen of Mr. Harrington, containing most of the facts now known upon the use of aluminum. The paper was read before the College of Dentists Oct. 5, 1858. Mr. Harrington had experimented one year. The following is a summary of his conclusions:—

That cast aluminum plates stood well, were without taste or unpleasantness of any kind, and were in no ways affected by the saliva, or secretions of the mouth—in fact, everything one could desire.

That in contact with any other metal, or if wrought aluminum (rivets, for example,) were used with cast aluminum, strong galvanic action set in, with a saline taste, and gradual decomposition.

That wrought aluminum would decompose when used alone, and that the use of the hammer, roller or file would produce a decomposable surface.

His idea of using cast plates arose in the first place from the known difficulty in soldering, and the fact that by his process plates could be cast with facility.

In this country, cast plates were made by Dr. D. Van Denburgh, of Oswego, N. Y., in 1858, without the knowledge of their employment abroad. He, however, subsequently learned that there was a patent taken out in England in 1855. His experiments were perfectly satisfactory. In fit, strength, lightness and mechanical beauty his plates left nothing to be desired. Their recommendations were, extreme lightness, resistance to acids and sulphuretted compounds, and the limited extent to which aluminum could be alloyed. It was eight times lighter than gold, and yet in the same bulk of greater strength. Complete upper sets, with the teeth, might be made not weighing more than half an ounce, and the heaviest need not weigh over fifteen pennyweights.

For more full particulars of Dr. Denburgh's conclusions, see the *Dental News Letter*, published by Jones, White & McCurdy, April and July Nos., 1859.

In another periodical I found a complete summary of the processes

* Aluminum wire was successfully used for sutures in surgery in England in 1858. See Braithwaite, Part xxxviii.

for manipulating aluminum. I thus discovered that we had been ploughing an old fallow, but perhaps with an improved plough. I came to the conclusion that my proper remedy against Dr. Fowler was by a suit in equity, though probably his patents would not be valuable.

1st. Because a re-issue to Dr. Cummings made his patent to include sets where rubber was used in part.

2d. Because of various patents, especially those of the Messrs. Assay, of Philadelphia, in 1860, and Steinberg, of California, in 1861, covering the use of all metallic plates with rubber.

3d. Because of the previous use of aluminum.

I made an attempt, by writing to Dr. Van Denburgh, to ascertain his experience of the wear of aluminum, since the date of his communication to the *Dental News Letter*, but obtained no reply.

The trial set of rubber and aluminum used in my family has been in constant wear about eighteen months. There is a possible loss of substance by attrition, but unfortunately, not having been weighed, the loss is mainly conjectural.* It has recently cracked, and the fissure has extended through the rubber rim, and I fear the set is permanently ruined. The plate was undoubtedly too light. It has, however, been free from taste and remarkably clean—in these respects much superior to the gold plate previously worn.

I have no doubt that the use of aluminum as a base for teeth has fallen into undeserved neglect, and that it is eminently adapted for the purpose;

That cast sets are cheap, of facile manufacture (under pressure), and combine all the advantages pointed out by Dr. Keep in the use of rubber and aluminum;

That possibly perfect sets may be thrown down from the solution in aqua regia by the galvanic process, with equal or greater advantage;

That rolled plates with black rubber are innocuous, free from galvanic action, light and cheap, unless too many patents are paid for;

That the combination of aluminum bronze with rubber entails the risk of galvanic action and slow decomposition;

That the use of red rubber with aluminum does not obviate the objection to the use of entire rubber sets, namely, the presence of cinnabar in the mouth.

Aluminum has considerably fallen in price of late years, and, when improved processes of manipulation have freed it more from silica, will probably be more ductile and easier worked.

In modern chemical nomenclature the metal is called aluminum, and not aluminium, as Dr. Keep has it.† I called it aluminium to Dr. Fowler, as I found it so named in my old chemistry, but I find it

* Muriatic acid and vinegar have some solvent action on aluminum.

† [Both terminations—in *um* and *ium*—are used by modern chemists.—EDS.]

so called in the dental magazines. Dr. Fowler's name should be N. C. and not C. A., and I do not envy him all the honor he may obtain; when the field for a reputable credit was before him, if he had not been led astray by the illusory hope of a dishonorable profit.

Physicians and dentists, it seems to me, should encourage repeated experiments with so innocuous and desirable a substitute for red vulcanite. It often happens that the most valuable discoveries are shelved at the first trial, from the difficulty of pushing them against the obstinate prejudices and conceits of mankind, which, when re-introduced at a favorable moment, are found not only to meet a pressing need, but to lead to higher planes of progress.

February 16, 1866.

CONTAGIOUSNESS OF CHOLERA.

To the Editors of the Boston Medical and Surgical Journal.

I NOTICED in your JOURNAL of Feb. 8th, some strictures by "*A Practical Physician*" (so self-styled) on a letter of mine to Dr. Sayre, Health Commissioner of New York, in which, rather by ridicule and sneers than argument, he attempts to contradict or disparage the views therein expressed. If cholera were not too serious a subject for ridicule, I might, perhaps, reply to your humorous correspondent in a similar vein; but I think a more serious style more befitting so important a subject.

As to the matters alluded to, by way of query, I leave the relevancy of the questions to the judgment of your readers. I congratulate your city, however, on the recent change of views of Dr. Read, your excellent City Physician, and trust you will have a quarantine sufficiently stringent to leave no possibility for cholera to enter your port and city. I hold, with, I believe, a majority of our profession in this and foreign countries, *that cholera is portable in some way, and communicable*, and that it is not only the right, but the duty of all communities and governments to establish strict quarantines, and if such as they should be they will compensate for all their inconvenience and expense. The quarantine regulations and restrictions heretofore established in our ports against the introduction of cholera have been worse than useless, vacillating, inefficient, differing in different ports, and never properly enforced; and then, because they proved ineffectual, the wise conclusions were adopted that quarantines are of no use, that the whole atmosphere is pregnant with cholera-poison, the disease is not contagious, or carried by those affected with it; and if any physician holds to the latter doctrine, the case is not one for argument or facts, but only for ridicule! I certainly would agree with some of your Boston faculty and say, let all quarantines be abolished and done away with, if rational ones cannot be instituted and their observance despotically and unremittingly enforced. In the case of