



REVIEW OF DR. F. A. FAHRENWALD'S METALLURGICAL STUDIES.

Cleveland, O., June 6, 1916.

Dr. W. A. Price, President Research Institute, 8805 Euclid Ave., City.

Dear Sir: It is my desire to give at this time, in addition to an outline of recent researches, a brief resume of what has been accomplished during the time of my connection with the National Dental Association.

My discoveries and inventions of major importance have finally been covered by various patent applications made thru Mr. Smith of the firm of Hull, Smith, Brock and West. This includes six separate specifications covering all positive results that either the Research Institute or its attorneys considered of sufficient value to warrant patent application.

It may be well to emphasize at this point, that at the time of the development of each of the materials and processes herein-after described, it was urged by himself and by others in my presence, that they be immediately protected by law. It is not known at this date

what results have been obtained from belated action in this matter.*

The applications may be described as covering the following:

1. Palladium Alloys.

This includes the alloys of palladium with gold or silver which have been described in previous reports. I regard these alloys of very great values and for many purposes the equal of platinum.

They serve as an efficient substitute for platinum in its softer forms, and under conditions involving temperatures from 1100 deg. C. to 1500 deg. C. My observations of their behavior during various tests indicate that they will also find wide application in fields other than dental.

These alloys were developed during the latter part of 1913 and the first few months of 1914.

2. Coated Tungsten and Molybdenum.

This material has been described in

*Managing Director's Note—These patent applications are assigned by Dr. Fahrenwald to the Research Institute of the National Dental Association, which in turn is dedicating them to the free use of humanity. Until the organization of the Research Institute there was no corporation competent to receive and dedicate patents.

detail in former reports. The proper rights to the manufacture and use of this material have been lost to the dental profession by neglect in securing the proper protection.

Work on this material was begun in November, 1913, and the process of coating was proved on a laboratory scale before January 1st, 1914.

3. Solder and Flux for Tungsten and Molybdenum.

This has been completely described in a preliminary report to the Research Institute. This earlier communication outlined the theoretical considerations upon which its composition is based, and contains detailed instructions for its manufacture and use.

With this material, tungsten or molybdenum, or any substance of a similar nature, may be readily soldered, brazed, or otherwise joined during constructional operations.

This material and dependent processes were developed during 1914-15 while in the laboratories of the University of Michigan.

4. Coating Tungsten and Molybdenum with Precious Metals by means of the above described Flux.

This process is fully described in patent specifications. It was developed after learning that the previous processes for coating tungsten had been appropriated by a commercial organization.

5. Tungsten and Molybdenum Alloys and

6. Process of Manufacture.

Results of work under this head have been fully described in a recently published report, and are covered by patent applications.

The patent applications covering the above materials and processes have been dedicated to the free use of the public. There remains to be considered the results of investigations which have not as yet been formally reported. This work

may be briefly described under the following heads:

1. Ternary and Quaternary alloys of Palladium with silver or gold. This list includes:

Palladium-Gold-Nickel

" " Copper

" " Copper-nickel

" " Cobalt

" " Chromium

Palladium-Silver-Nickel

" " Copper

" " Copper-nickel

" " Cobalt

The above systems were worked thru in varying percentages but not one offered advantages for dental uses over the binary system.

Platinum substitutes for dental purposes should be either very soft and flexible, or very hard and elastic. The addition of a third or fourth metal of a base-metal nature, destroys the desired softness and does not impart sufficient stiffness to enable the more complex alloy to serve as a platinum-iridium substitute.

The combination of these binary series with noble metals of high melting point appears more promising, but the high cost incidental to research in these fields, together with insufficient appropriation, prevented a continuation with noble metals; work being taken up in other fields as follows:

2. Nickel-Tungsten.

The investigation of this series yielded results of negative value. The following system also offered nothing of value in the nature of alloys applicable to dentistry.

3. Nickel-Molybdenum.

4. Nickel-Tungsten-Copper.

5. Nickel Molybdenum.

6. Copper-Aluminum.

This system, in the range between 8% and 12% of Aluminum, yields a series of gold-colored, steel-like bronzes, which

were considered of possible value as practical dental alloys. The ease of their oxidation and corrosion, however, caused them to be discarded.

7. The Elimination of a vast number of uncertain fields as described in earlier reports.

The methods of investigation, and the principles governing the choice of fields for investigation, have been detailed in previous reports, so that it is considered unnecessary to give more than a statement of the fields covered and of the nature of the results obtained.

Positive results have already been described, and negative details are of no value except in the elimination of unprofitable fields in future researches.

For future consideration I would recommend the following general outline:

1. The introduction of palladium alloys (especially those with gold) into general dental practice.

2. The investigation of causes for failures in the use and application of dental alloys and metals.

3. Researches in the field of refractory metals.

4. The Adaptation of tungsten and molybdenum alloys as material for pins in commercial porcelain teeth.

5. The determination of physical and chemical properties of commercial and the newly developed dental products.

6. The development of a low melting-point cast filling material, that will not corrode or tarnish.

7. The development of an amalgam that will not blacken in use.

The researches of this laboratory during the past two and a half years have served to concentrate considerations for the future to fields of rather narrow limits, so that work of a more intensive nature will now be possible. The solution of the problem of platinum and other substitutes, and that of the development of new and valuable materials, is no more than begun, and the unhampered application of scientific knowledge and methods will be found to unearth many new materials and processes that will find wide application in curing and preventing the ills of mankind.

Yours very sincerely,

F. A. FAHRENWALD.
