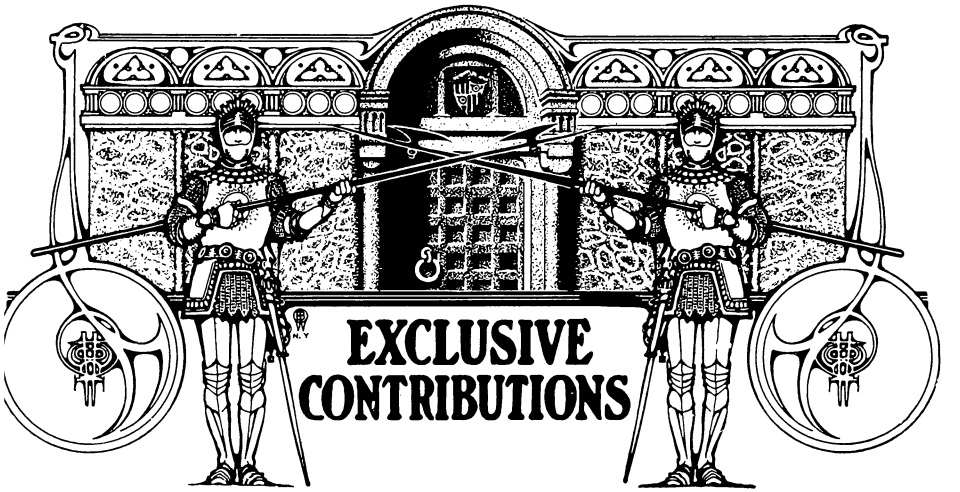

Dental Radiography.*

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CHAPTER V.

In the foregoing chapter we dealt with the general elementary principles of radiography. We shall now take up a more concrete consideration of dental radiography.

The first radiograph of the teeth was exhibited by Prof. Kaoenig to the Society of Physics at Frankfort-on-Main, Germany, in February, 1896—only a few months after the discovery of the X-ray. Five months later an article appeared in *Dental Cosmos* by Morton, entitled "X-Rays in Dentistry." Since then there have been scores of articles written on the subject and published in various dental, medical, and Roentgenographic journals.

Most dental radiographs are made on films held in the mouth during their exposure to the X-rays, the patient being seated in the dental chair. Ordinary films, as stated in Chapter IV, are not efficacious.

Special X-Ray Films.

As stated previously, but two manufacturers, the Ilford Co. and the Eastman Co., supply special X-ray films.

The Ilford film, being a foreign product, cannot be delivered with desired promptness. It is, however, the best X-ray film on the market, and may be obtained from the American agent for Ilford goods, E. B. Meyrowitz, 104 West 23d St., New York City. Ilford films of practically any size—4x5 in., 5x7 in., 8x10 in., etc.—can be purchased in packages, one dozen films to the package.

Ilford films are also supplied just ready for dental use in sizes of about 1⅜x1⅝ in., one film to the packet, wrapped in black paper and covered with a rubber-like, moisture-proof material, such as tailors use to mend clothes.

For the past several years the Eastman Kodak Mfg. Co., of Rochester, N. Y., have supplied films for radiographic work. These films are covered with the same emulsion that is used to make cinematograph (moving picture) films. There are two kinds of cinematograph films, the positive and the negative. The positive films yield very satisfactory radiographic results, but the negative films are little or no better than ordinary films for cameras. This explains why some of the films heretofore supplied by the Eastman Company have proved satisfactory, while others have not, for both the negative and positive films have been sold under the label "X-ray films." I have been in communication with the Eastman Kodak Mfg. Co., and have informed them of the failure of their negative cinematograph films to meet the requirements of a good X-ray film, but to guard against a possible mistake it would be well when ordering to state that the *positive* film is wanted. The negative film is a little faster than the positive, but sufficiently contrasty results cannot be obtained with it.

The Eastman Company will supply films in any size to order; or in little black paper packets, ready for dental use, two films about 1¼x1¾ in., to the packet, the sensitive side of the films presenting toward the black side of the packet.

The special 4x5 in. X-ray film, formerly manufactured by the Seed Dry Plate Mfg. Co., of St. Louis, is now made by the Eastman Kodak Co., of Rochester, successors of the Seed Dry Plate Co. The old Seed film was not a non-curling film. The "Seed Positive Film," now manufactured by the Eastman Co., however, has a coating of gelatin on the back of the film to keep it from curling. With the film thus coated on both sides it is impossible to tell by observation which is the sensitive side. The way to determine this is by the manner in which the films are packed in the envelopes. Of the twelve films in the package, eleven have the sensitive surface presenting away from the seam of the enclosing envelope. The twelfth film—the one farthest from the seam—has the sensitive surface presenting towards the seam.

Because it is efficacious and is furnished promptly and at a reasonable cost, the most popular dental X-ray film is the Eastman film supplied in small packets. The black paper of the packet is thick enough to protect the film against moisture when taking pictures of the upper teeth, but additional protection is needed when making radiographs of the lower teeth. This protection may be given by covering the packet with rubber dam. The rubber dam is staked out with pins to prevent curling, and

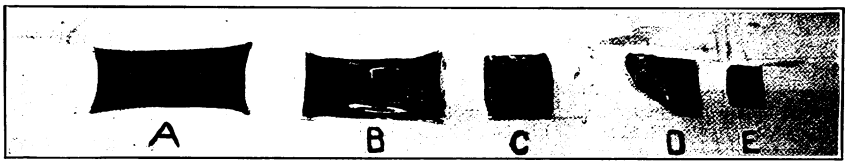


Fig. 78. A, rubber-dam stretched out and fastened to a board with pins. B, the rubber covered with cement and the film packet on it. C, pins removed from one end and the rubber lapped over packet. D, all pins removed. E, excess rubber trimmed off.

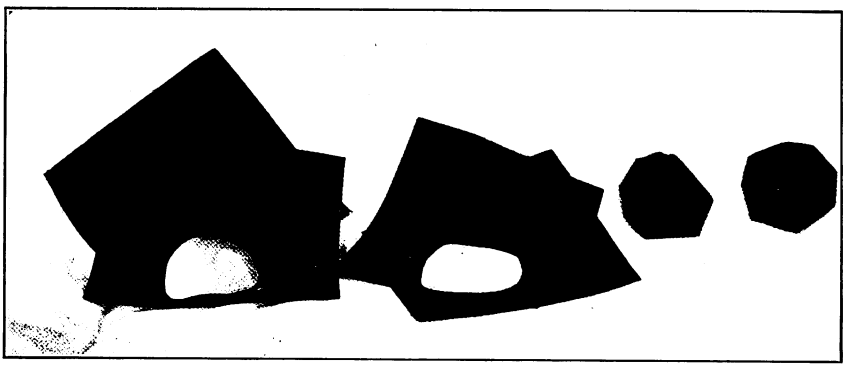


Fig. 79. Illustrating method of covering a more or less circular film with black paper.

covered with ordinary rubber cement, such as is used to repair the inner tubes of bicycles and automobile tires. Allow the cement to dry a minute or so. Place the packet on one end of the rubber, remove the pins at said end, and fold the rubber; so covering the packet. Trim off the excess rubber. (Fig. 78.)

This method of protecting the film against moisture is so much better —easier, quicker, more efficient, and less expensive—than the usual method of covering the film with unvulcanized plate rubber that a description of the latter will not be given.

If the large Ilford or Eastman films are used the operator may cut the original large film into any size or shape, and cover with two

thicknesses of black, lightproof paper. This must, of course, be done in a dark room. A pair of scissors, with long, sharp cutting blades, will be found especially suitable for this work. Cover the film so the sensitive will be the smooth side of the packet. Figure 79 illustrates a method of wrapping up more or less circular or oval films. By unwrapping an Eastman film packet one can learn how best to cover a square or rectangular film. If the films are to be used to radiograph the lower jaw or teeth the packet should be covered with rubber dam as described. Two films may be put in a packet if desired. The advantages of this are as follows: If one negative is spoiled, or spotted during development, possibly the other will not be. If the patient be referred from another dentist or physician, one negative may be given to the man referring the case and the other retained and filed away.

Instead of wrapping the film in black paper, as suggested above, one may have little black paper envelopes of the desired size made and use them. Instead of using rubber dam, one may have small oiled paper envelopes made and protect the films against moisture by enclosing the packet in them.

With the films ready for use we may now proceed as follows:

Technic for Dental Radiographs.

Be it understood that some of the steps in the technic given hereinafter are for the beginner, and may be eliminated after the operator is acquainted with his coil, tubes, films, etc.

First test the coil and see that it gives a fat, fuzzy spark, at least 6 or 7 inches long. This almost invariably necessitates cutting out all the resistance of the rheostat. I cut out all the resistance of the rheostat on my 18-in. induction coil and obtain a fat, fuzzy spark 10 inches long.

Some of the most modern induction coils are made with "multiple inductance." With this equipment, by changing a plug or switch, the induced current is made stronger or weaker in milliamperage. The higher the milliamperage sent through a tube the greater the number of X-rays produced. Thus the more rapid the work to be done the higher the inductance should be. Some of the very largest induction coils on their highest inductance, and the interrupterless coils, can force 30 or 40 milliamperes through a high vacuum X-ray tube. With such a current dental radiographs can be made instantaneously. A tube will not stand such a current without injury for longer than about fifteen seconds.

Some induction coils, not yet on the market, but under construction, will be, if we are to believe the men who are making them, able to force from 80 to 200 milliamperes through a hard tube. A tube could not stand such a current longer than a second or so, if so long.

After testing the coil, throw off the switch and hitch up the tube. Have the terminal tapes tight, so they will not come unhooked from the tube while it is in operation. When a terminal becomes disconnected from the tube while the current is passing through it a puncture of the tube sometimes results.

Set the tube-regulating arm to give a tube-regulating spark gap of 4 inches. This is not an invariable rule. Perhaps the gap should be 5 inches when a tube is new and reduced to 3 or 2 inches when the tube is old. And so with many statements following—they are subject to

Fig. 80. Position of the film in the mouth for making radiographs of the upper bicuspid and first molar region.

variation; they are calculated only to give a beginner something tangible to start with.

When the tube is hitched to the coil, separate the sliding rods the entire distance of the maximum spark gap. See to it that the terminal tapes or the tube are not near any conductor, or the current may jump to it—the conductor. If this occurred from the tube it might be punctured.

Turn on the switch just for a moment, then off, then on, then off, and so on, slightly lengthening the time the current is left on until it is observed to pass through the tube without a spark at the tube-regulating spark gap. This warms the tube gradually. In cold weather it is well to warm it slightly over a register before sending the current through it. Sometimes no spark will occur at the tube-regulating spark gap at all. This simply means that the vacuum of the tube is such that it does not need lowering.

Fig. 81. The tube too low, and the resulting radiograph.

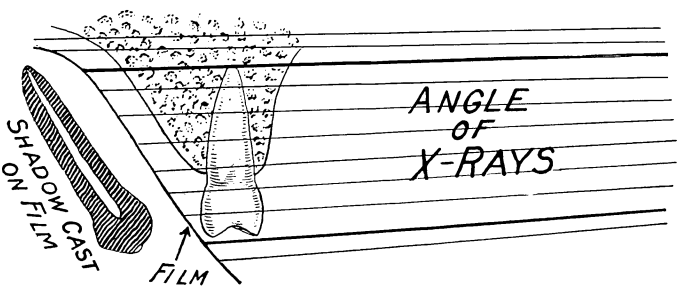


Fig. 82. Diagrammatic illustration of the X-rays striking the tooth and film at such an angle as to cause a lengthening of the shadow cast on the film. (For this idea of diagrammatic illustration the writer is indebted to Dr. Price.)

Fig. 83. The proper pose for making radiographs of the upper bicuspid and molar region, and the radiograph which was made from this pose.

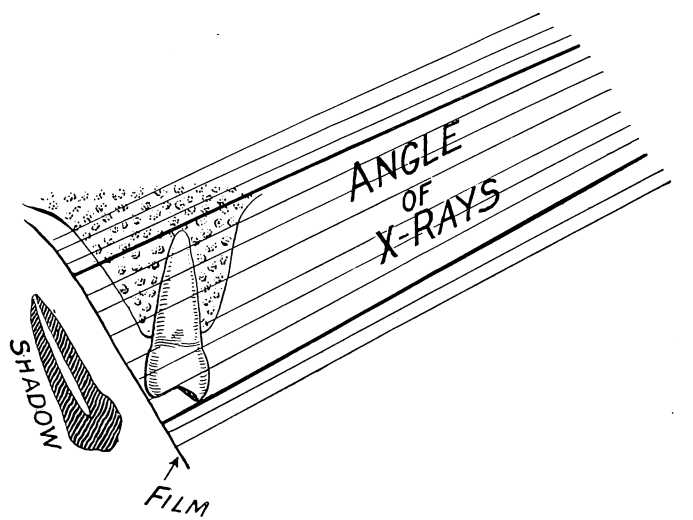


Fig. 84. Diagrammatic illustration of the rays striking the tooth and film at such an angle as to avoid either lengthening or shortening the shadow cast on the film.

Fig. 85. The tube too high, and the resulting radiograph.

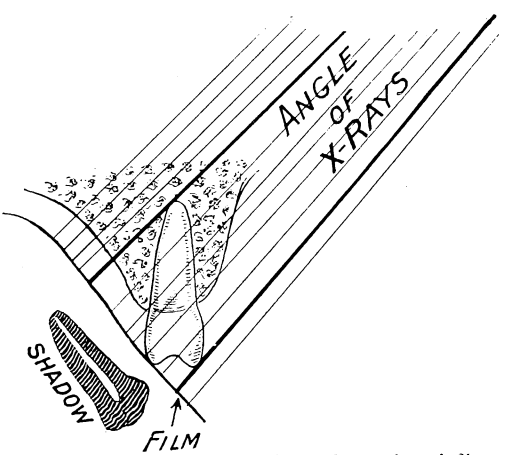


Fig. 86. Diagrammatic illustration of the rays striking the tooth and film at such an angle as to cause a shortening of the shadow cast on the film.

Turn the current on now for a few moments and see that the tube lights up properly. In order to observe the fluorescence the room should be either dark or semi-dark. Turn off the current, shorten the spark gap, turn on the current again, and observe whether it passes through the tube or jumps the spark gap. Repeat this until the current jumps the gap. This tells us the condition of the tube by showing how many inches of parallel spark it will back up. The tube should back up about 6 inches

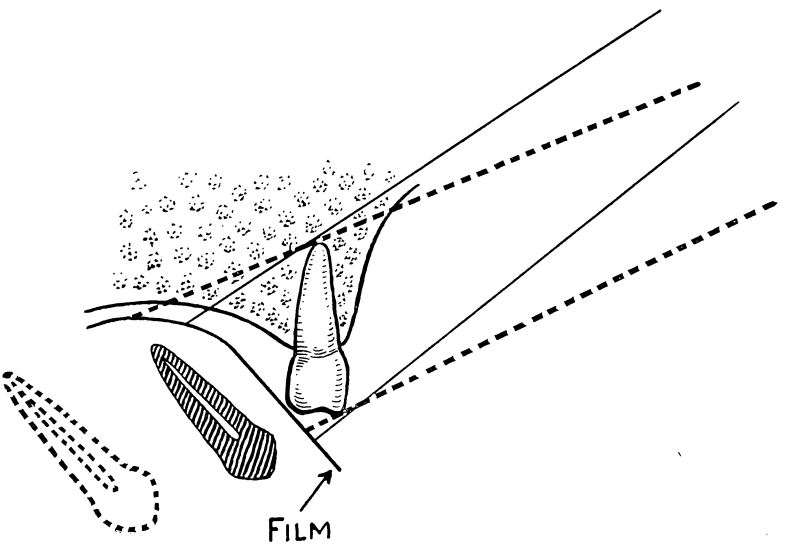


Fig. 87.

of spark. After the operator is well acquainted with his tube and coil this test of the vacuum of the tube will not be necessary. The operator will be able to judge the vacuum fairly well by the fluorescence of the tube and the length of the tube-regulating spark gap.

We are now ready to pose the patient. As we do this we must constantly bear in mind that we are simply throwing a shadow on the film, and that, like all shadows, this one is liable to be distorted unless the tube, the part to be radiographed, and the film are in their proper relative positions.

The ideal position would be so that the X-rays would strike the part to be radiographed and the film at right angles, as in Fig. 70. But this is quite impossible when radiographing the upper teeth.

Position of Film and Direction of Rays.

With the film in the mouth, as per Fig. 80, the common mistake will be to have the tube too low (Fig. 81). The result of this is shown in the radiograph in Fig. 81, and the reason for it in the diagram (Fig. 82) in which the angle of the rays, the object, and the film are in about the same relative positions as in Fig. 81.

The proper position and the radiograph made from this pose are shown in Fig. 83. Fig. 84 diagrammatically illustrates the pose in Fig. 83.

Fig. 88. As a film is placed in the mouth for the pose and radiograph shown in figure 89.

If the tube be placed too high the teeth on the radiograph will be shorter than the teeth themselves, somewhat distorted and blurred (Fig. 85). Fig. 86 diagrammatically illustrates the pose in Fig. 85.

A study of Figs. 82, 84 and 86 will show that in order to make a radiograph which will not picture the teeth too long nor too short the X-rays should strike the film almost, but not quite, at right angles to its surface. The angle of the film in Figs. 82, 84 and 86 is what it would be in the average mouth. Suppose, however, the vault is very flat. In such an event the angle of the X-rays as illustrated in Fig. 84 to be correct would cause a marked lengthening of the shadow, as illustrated by the dotted lines and drawing in Fig. 87. The angle of the X-rays should be as in Fig. 86 to avoid, as nearly as possible, any distortion. (Notice in Fig. 87 that the bending of the film would cause a lengthening of the shadow.)

Fig. 89. The pose with the film in the mouth, as in figure 88, and the radiograph made from this pose.

Just in proportion as the vault becomes more flat the film departs from the vertical and the tube must be at a different and higher angle. And so, inversely, as the vault is higher the film may be placed more nearly parallel with the teeth and the tube may be lowered.

From the foregoing it will be understood why we can never be *sure* that our radiograph gives the *exact* length of upper teeth.

Owing to the fact that it causes distortion, bending of the film should be avoided as much as possible.

Fig. 83 shows the proper pose for making a radiograph of the bicuspid region. The slight changes of this pose necessary to make radiographs of the anterior and extreme posterior teeth are apparent. When making radiographs of the posterior upper teeth the mistake at first will probably be that the X-rays will not be directed at a point far enough back on the face and pictures of the bicuspids will be made when the operator desired to picture the molars.

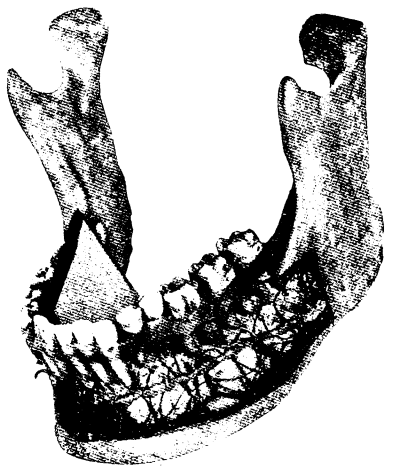


Fig. 90. Position of the film in the mouth for making radiographs of the lower molar and bicuspid region.

Instead of placing the film in the mouth, as in Fig. 80, a larger film may be used and placed as in Fig. 88, the sensitive side towards the upper teeth. With the film in this position the patient is instructed to close the mouth, so holding the film firmly in position. With the film in such a position either the tube must be placed higher and the rays directed more nearly straight down; or the head must be tipped downward toward the tube, which accomplishes the same result, viz., causes the rays to strike the film more nearly at right angles. (Fig. 89.) The radiograph made on a film held in this position is very likely to be distorted. (Fig. 89.)

The usual position of the film for taking pictures of the lower teeth is illustrated in Fig. 90. With the film in this position it should be covered with rubber or oil paper to protect it against moisture.

Fig. 91 shows the proper pose for taking pictures of the lower bicuspid and molar region. If the radiograph does not show the apices of

Fig. 91. Proper pose for making radiographs of the lower molar and bicuspid region, and the radiograph made from this pose.

the roots it is because the film was not pressed down far enough, or the tube was not low enough. The slight differences in the poses to make radiographs of the anterior teeth and the third molars from the pose shown in Fig. 91 are apparent.

With the film placed in the mouth as in Fig. 89, except with the sensitive side of the film presenting toward the lower instead of the upper teeth, and a pose as per Fig. 92, radiographs of the lower teeth may be made.

Distance Between Tube and Patient.

The distance the tube is placed from the film is about 12 to 20 inches, measurements taken from the target of the tube. A good rule to follow is to place the tube so that there is a distance of about 8 inches between the glass of the tube and the patient's face. If, as is almost

Fig. 92. Pose for making radiographs of the lower anterior teeth, and the radiograph made from this pose. The lack of detail in this radiograph is due to the fact that a negative cinematograph film was used. When a terminal of the tube is brought as close to the patient as is shown in this picture it is necessary to place a piece of wood or glass, or some other non-conductor, between the terminal and the patient—in this case over the patient's breast—to prevent the current "sparking" into the patient.

invariably the case, a 6-inch tube is used, this makes the distance between the target and film about 12 to 13 inches. I never have the glass of the tube closer than 6 inches from the face. A tube of medium vacuum must be brought a little nearer to the film than one of high vacuum if the same length of exposure is to be made, because the X-rays from it are not so penetrating. The advantage in having the tube as far away as possible lies in the fact that both the patient and film are then more nearly out of range of the soft, secondary rays. These rays may burn the patient (set up a dermatitis) and fog the film.

In most works on radiography the writers advise 18 inches as the proper distance between target and film. I believe this to be needlessly long. As I have just stated, I bring my tube much closer, and I have never had any trouble from dermatitis or fogging of the radiograph. By bringing the tube as close as I do I am able to get a clearer, better picture in about one-half the time of exposure that would be required if the distance between the target and the film 18 inches.

Before placing the film in the mouth, after the tube and the patient

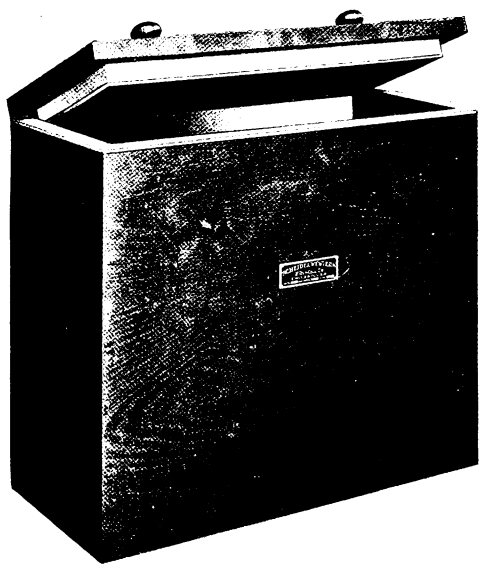


Fig. 93. Lead-lined, X-ray-proof box.

are in their proper positions it is well to turn on the current for a moment, that the patient may become accustomed to the sound and light. Otherwise the patient would probably be startled, move involuntarily and spoil the picture.

Protection of Films.

If the films have been in the same room while we have been testing the tube, or even if they have been in a room immediately adjoining the operating room, they must have been kept in an X-ray proof, lead-lined box, the lead of which should be about ⅛ inch thick (Fig. 93). All films, plates or papers must be kept in such a box if they are to remain in the same room, or even an adjoining room, while the tube is lit, to keep them from becoming fogged.

Methods of Holding Films in the Mouth.

If the position of the film is as per Fig. 88, with the mouth closed, the problem of holding the film while making the exposure is solved. If, as in Figs. 80 or 90, however, the film must be held immovable by either patient, assistant, or operator. The patient can hold the film, and it is best that he should. If the operator or assistant holds it he or she should wear X-ray proof gloves to protect the hands. Otherwise the repeated exposure of the hands to the rays might prove disastrous. See chapter on "Dangers of the X-Rays."

Dr. Tousey, of New York, and Dr. Ketcham, of Denver, have designed little devices, film holders, for holding the film in the mouth during its exposure. But the writer has never felt the need of such devices for ordinary dental radiographic work.

It has been recommended that a modeling composition impression of the mouth may be made, a place cut out for the film, which is placed therein and the impression reinserted in the mouth. This method of holding films I consider extremely impracticable, because of the time consumed in unnecessary work and the considerable bending of the film.

When using square or rectangular film packets bend the sharp corners to keep them from digging into the tissues of the mouth.

When making radiographs of the lower teeth with the film in the mouth, as per Fig. 90, the patient should be warned not to swallow during the exposure. Movement of the tongue in swallowing would move the film.

Time of Exposure.

As stated in Chapter IV, the length of time of exposure depends on several things. With the coil capable of giving a fat, fuzzy spark 10 inches long, the tube backing up 7 inches of parallel spark and the distance of the target from the film about 12 inches, the time of exposure for an Eastman film will be between 5 and 10 seconds.

I have seen tables giving the exact time of exposure for the different teeth—upper molar teeth so many seconds, upper anterior teeth so many seconds, lower molar teeth so many seconds, and so on—but such tables are utterly useless. No fixed rules for the length of time of exposure can be made and adhered to. For example, I had been making 10-second exposures. I purchased a new tube—the same make tube I had been using—and found that with it pictures could be made in half the time, 5 seconds. Then after using the tube a few weeks it became necessary to again increase my time of exposure to 10 seconds.

As to a longer exposure being required for some teeth than for others, very little need be said. The time of exposure for radiograph-

ing upper third molars is slightly longer than for any other teeth of the same mouth, but the difference is only a matter of two or three seconds.

Age increases the density of bone, and so the time of exposure necessary to make radiographs will be somewhat proportionate to the age of the patient.

Use of Intensifying Screen.

The time of exposure can be shortened from one-half to four-fifths by using an intensifying screen. An intensifying screen is a piece of paper, or cardboard, or sheet metal covered with calcium tungstate, or platino-barium cyanide.

The coated side of an intensifying screen is placed against the coated side of the film or plate, and both screen and film are placed in the light-proof packet as usual. Thus we get a double action on the film when it is exposed, the action of the X-rays themselves and the action due to the fluorescence of the intensifying screen.

When using an intensifying screen the uncoated side of the film should present toward the object being radiographed. This is contrary to the rule that to obtain the best results the coated side of the plate or film should present toward the object to be radiographed.

The advantages of the intensifying screen are: (1) Just in proportion as it reduces the time of exposure it protects both patient and operator against any ill-effects of the X-rays. (2) By shortening the time of exposure the life of the tube is lengthened. From a financial standpoint this is of importance. (3) By using an intensifying screen one is able to do tolerably rapid work even with a very small coil.

The disadvantages of the intensifying screen are: (1) It causes a granular appearance of the negative, blotting out detail. (2) It is liable to spot the negative, due to unequal fluorescence of its surface. (3) It fluoresces for a minute or so after exposure, and if the plate and screen do not maintain their exact relation to one another blurring of the negative results. (4) Unless one owns several screens, so that a number of packets may be made at a time, their use necessitates the making of a film packet before each exposure, which is discommoding.

Such grosser lesions as an impacted tooth, for example, can be radiographed satisfactorily with the intensifying screen, but when we wish to obtain detail, such as is necessary to observe pulp stones or a necrotic condition, for examples, the use of the intensifying screen is contraindicated. An intensifying screen disintegrates with use.

Development of Negative.

After the film has been exposed we are ready to develop it—to make the negative.

The trays for the developer and fixer should

be about 4x5 inches, or smaller. The author uses little white enamel soap dishes, about 3x4 inches.

If, owing to the particular developer or film used, development requires a considerable length of time, say, perhaps 20 minutes, and one does not wish to remain all this time in the dark room, the tray containing the developer and developing negative may be covered with a heavy board on the down side of which is tacked or glued thick felt or plush, and the operator may then leave and return to the dark room at will, the film being protected against the light from the opening of the dark room door.

Choice of Developer.

What developer shall we use? I obtained the formulæ for the developers used by twelve different radiographers, and they were all different! From this we may conclude that any clean, properly mixed developer will do the work.

The writer uses a prepared developer which may be purchased at almost any photographic supply store, the Eastman M. Q. developer, the formula for which is given in Chapter IV. This developer is sold for developing photographic paper, but it developes films and plates perfectly. The label on the tube containing the chemicals directs that they be mixed with 4 ozs. of water for one kind of photographic paper, "'Regular Velox," and 8 ozs. for two others, "'Azo" and "Special Velox." I use 6 ozs. of water. After the powder is dissolved in the water in my graduate I put 3 ozs. of the solution in the tray for immediate use and 3 ozs. in a 3-oz. amber glass bottle. In this bottle, tightly corked, the developer will keep as long as a month. Even if it does discolor slightly it can still be used for negatives, though it might stain paper. When the negatives are developed—one or many may be developed—the developer in the tray is thrown away. I never try to save developer that has been used, with the idea of using it again in the future.

Since writing the foregoing I have been using another prepared developer, rodinal. My limited experience with it teaches me to believe that it is as good as the M. Q. developer. My chief reason for using it, however, is because it is so extremely convenient to handle. It is a liquid. When I wish to develop a film I take 2½ ozs. of tap water to 2 drams of rodinal. This makes a 1-10 solution. The water and the rodinal are simply placed in the tray together, and the developer is ready for use; one does not need to wait for powders to dissolve.

When conditions and length of exposure are as given above, the time the film remains in the developer is usually about 5 minutes; the high lights come up in about 15 seconds and the image can be seen tolerably well in 30 seconds.

Fixing and Washing.

The time in the fixer varies according to the film used. The Eastman film requires about 5 minutes; the Ilford film, because it is so much thicker, 15 or 20 minutes.

The writer uses a prepared acid fixing powder, mixing about a pint at a time. The solution will keep indefinitely. As with the developer, no attempt is ever made to save for future use any of the solution once used.

The negative should be washed in running water for 15 to 30 minutes, then hung up to dry. (Fig. 94.)

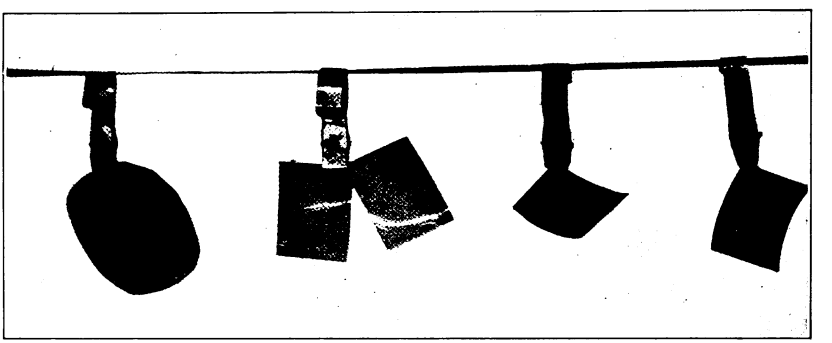


Fig. 94. Films hung up to dry

Instead of washing the negative in water for 15 to 30 minutes it may be soaked in Thioxydant, a "'hypo eliminator," for about five minutes. This dissolves out all the "hypo," and so accomplishes the object of washing. Thioxydant is a proprietary preparation made by the Lummiere Dry Plate Mfg. Co. The advantage in using it lies chiefly in the saving of time. It may also be used in the summer to advantage, when tap water is so warm that it softens the emulsion and washing is fraught with the liability of spoiling the negative. It may be used for photographic paper as well as for plates and films.

Drying requires several hours, unless the negatives are placed in the breeze of an electric fan as suggested in Chapter IV. It requires a longer time for the Ilford negative to dry than for the Eastman product, because the emulsion on it is thicker.

Making Prints.

When the negative is dry we may then make as many prints therefrom as desired, immediately or years after. The technic for making prints was given in the preceding chapter.

The negative is laid on the glass in the printing frame, film side up, and the paper placed over it sensitive side down, and so on as given. The best prints can be made on glossy, contrasted paper. Using glossy, contrasty Azo paper, the time of exposure to a 16-candle power electric light at a distance of about a foot is from 1 to 10 minutes. When the negative is badly over-exposed or over-developed, and it is therefore very dark, the time of exposure to a 16-candle power electric light may be as long as 20 to 30 minutes. If the exposure be made to sunlight instead of the electric light this time may be reduced to a couple of seconds. I use M. Q. developer to make my prints.

Fig. 95. A Roller.

Prints may be made more glossy and altogether more beautiful by placing them on a ferrotype, or squeegee board. The ferrotype is a sheet of metal on one side of which is baked black enamel. After the prints are washed they are laid face down on the enamel side of the ferrotype, rolled with a roller (Fig. 95), covered with a lintless blotter and rolled again with a roller. The ferrotype is now set on end, and as the prints dry they fall off. Before placing the prints on the ferrotype the enamel surface should be polished with ferrotype polish. Ferrotype polish is a solution of paraffin in benzine. It is put on the ferrotype, allowed to dry for a few minutes, then the enamel surface polished with chamois skin. If the prints do not come off the ferrotype as they should, but stick tightly, more paraffin should be added to the polishing solution. The most common cause for prints sticking to the squeegee board, however, is the failure to allow them to dry thoroughly.

Placing Films Outside the Mouth.

In all the poses thus far described the film has been placed inside the mouth. Though it is not often expedient to do so, because of the longer exposure necessary, it is nevertheless sometimes advisable to place the film outside the mouth. (Fig. 96.) The film packet may be held, sensitive side toward the cheek, with adhesive tape. With the film placed as in Fig. 96, the pose should be as in

Fig. 96. Film packet held against the cheek with adhesive tape.

Fig. 97. The time of exposure for this pose is about six times as long as it would be if the film were placed inside of the mouth and the same field radiographed. The increase in time exposure necessary is due to three things: First, the increased distance between the target and the film. Second, the great thickness of tissue to be penetrated. Third, the increased distance between the teeth and the film; the closer the object to be radiographed is to the film or plate the better and more quickly it can be radiographed.

Owing to the curvature of the dental arch it is often extremely difficult to obtain a good picture of the lower incisors with the film placed to the lingual and parallel to the long axis of the teeth. This is because the film cannot be placed in this position without bending it considerably, and the bending results in distortion and blurring of the radiograph. A film may be placed in the mouth as in Fig. 92, or a plate or large film,

Fig. 97. Pose for making a radiograph of the lower molar region with the film outside of the mouth, as in figure 96, and the radiograph made from this pose.

4x5 inches or larger, may be placed on a stand, sensitive side up, and the patient posed as in Fig. 98. It is usually necessary to have the patient remove the collar for this pose. Fig. 98, because of its lack of perspective, is perhaps a little misleading. The rays are not directed straight through the neck, as the picture seems to show. The tube is a little to one side. Fig. 99 is the radiograph made from the pose Fig. 98. Notice how clearly the antra of Highmore show in this picture. I believe that in posing my patient as just described to make radiographs of the lower incisors I have by accident stumbled on to the best pose for making pictures of the antra.

Except Fig. 98, all of the poses so far described have been with the patient in the dental chair, and films have been used.

Fig. 98. Pose for making a radiograph of the lower incisors, and the antra.

Poses for Large Plate Radiographs.

To make the radiograph shown in Fig. 100 the pose was as in Fig. 101 and the radiograph was made on a 5x7 plate.

Fig. 101 illustrates the principle of posing for large plate radiographs. Modifications of this pose are of course necessary, according to what particular region is to be pictured.

Note that the patient is covered with rubber matting such as is used in halls and on stairways. This serves as an insulator to keep the current from jumping to the patient's body. In case the current did jump to the body of the patient a blister would probably be made at the point of entrance and the shock would be more or less painful, but not dangerous.

The tube is of course insulated from the metal of the compression diaphragm. An additional precaution to guard the patient against shock is to hook a chain—any conductor, in fact—to the metal of the compression diaphragm and adjusting apparatus and fasten the other end to a chandelier, gas pipe or water pipe. With this arrangement, if any current passes into the compression diaphragm or metal adjusting apparatus

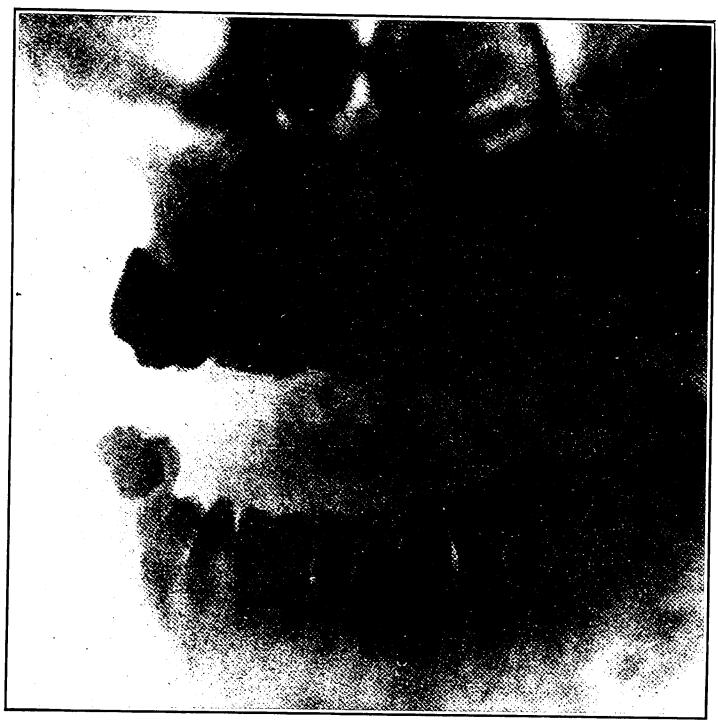


Fig. 99. Radiograph made from the pose shown in Fig. 98. Notice how clearly the antra show.

it will follow the chain into the gas or water pipe, and on to where the pipe may lead, until it dissipates itself, eventually reaching the earth, *possibly*. This is called "grounding the current."

While it is always best to have the patient in a recumbent position to make a radiograph such as Fig. 100, it is not necessary to use a special radiographic table and compression diagram as is shown in Fig. 101. The patient may recline on the ordinary couch, and a plain tube stand used to hold the tube. Though it is hardly practical, because the position is so awkward, it is nevertheless possible to take radiographs similar to figure 100 without having the patient assume the recumbent position.

Seat the patient on a stool or chair and have him lay the head on the plate, which is placed on a stand (Fig. 102). Fig. 103 is a radiograph made from a pose similar to Fig. 102.

Fig. 100 was made on a 5x7-inch plate, Fig. 103 on an 8x10-inch plate. Plates are used instead of films for these large radiographs be-

Fig. 100. Radiograph made from the pose similar to figure 101. The arrow points to an impacted upper third molar. The lack of detail in this, and all radiographs made from a similar pose, is due to a super-imposition of shadows—the shadow of one side of the jaw is mingled with the shadow of the other. (Radiograph by A. M. Cole and Raper.)

cause they are less expensive and just as well adapted for the work. Plates could not be used satisfactorily inside the mouth, because they will not permit the slightest bending. Large plate radiographs are sadly lacking in detail compared to those made on films held in the mouth.

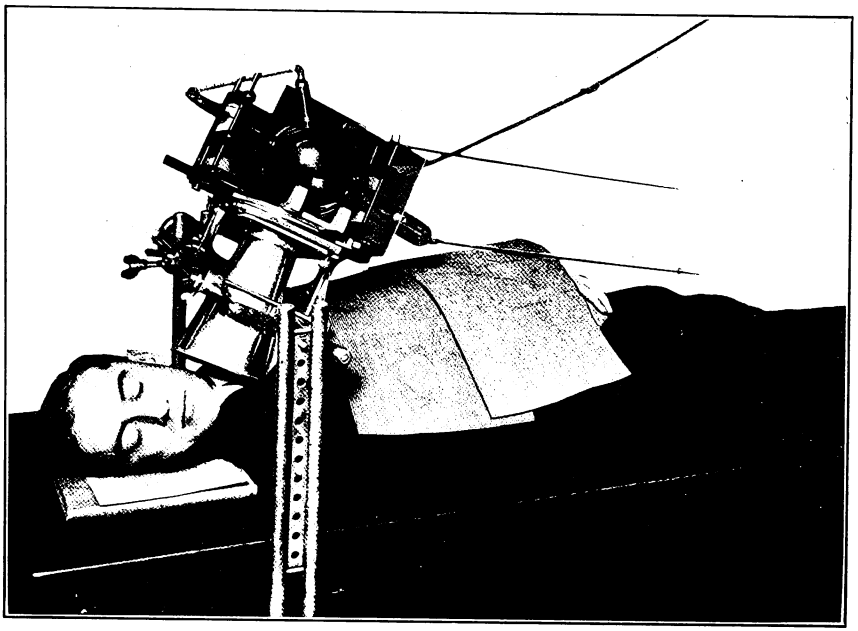


Fig. 101. Pose for the radiograph shown in figure 100.

Fig. 102. Pose for the radiograph shown in figure 103.

This loss of detail is due, not to the fact that a plate instead of a film is used, but to the greater distance between the teeth and the photographic emulsion, and a super-imposition of shadows.

The most popular pose for taking a radiograph of the antra of Highmore is shown in Fig. 104, and the radiograph made from this pose

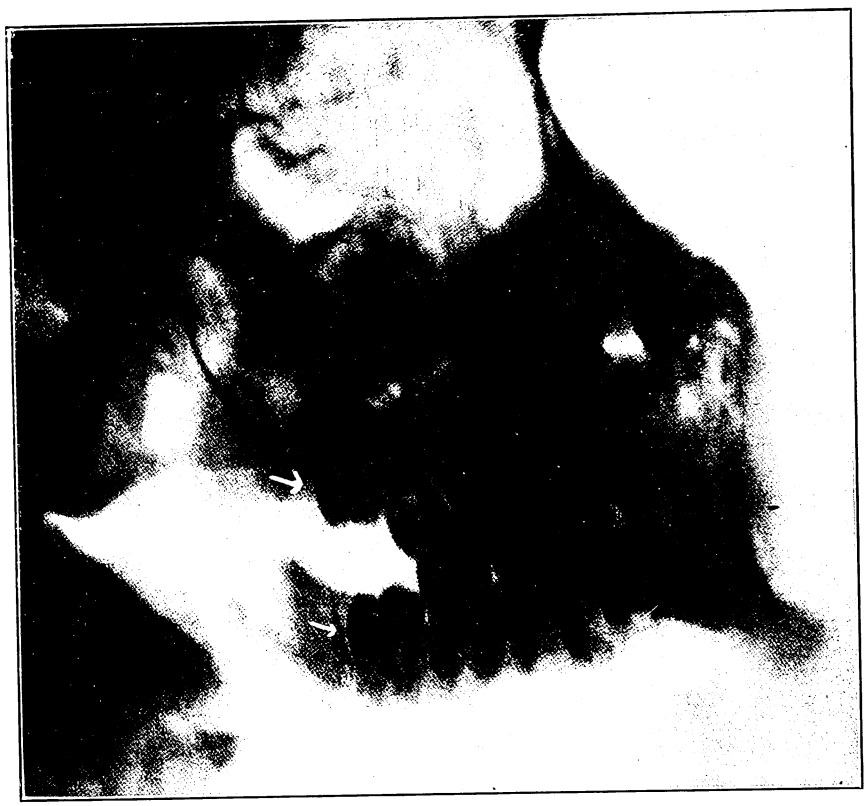


Fig. 103. Radiograph made from the pose shown in Fig. 102. The arrows point to unerupted upper and lower third molars.

in Figs. 105 and 106. This radiograph shows also the frontal sinuses and the ethmoidal cells. To obtain the best results when making such a picture a diaphragm should be used. To avoid unnecessary straining of the tube it is well to use an intensifying screen. Instead of using the radiographic table and having the patient posed as in Fig. 104, the patient may assume a pose similar to Fig. 98.

A picture of one of the antra, or a part of it, may be made on a film held in the mouth, the pose being quite similar to Fig. 85. A picture

of one antrum can also be made on a plate by a modification of the pose, shown in Figs. 101 and 102. (Fig. 107.)

Advantages of Film Radiographs.

The advantages of the small dental radiographs made on films held in the mouth over the large plate radiographs are: (1) There is no super-imposition of shadows, and therefore a clearer, better radiograph can be made on the small film. (2) The

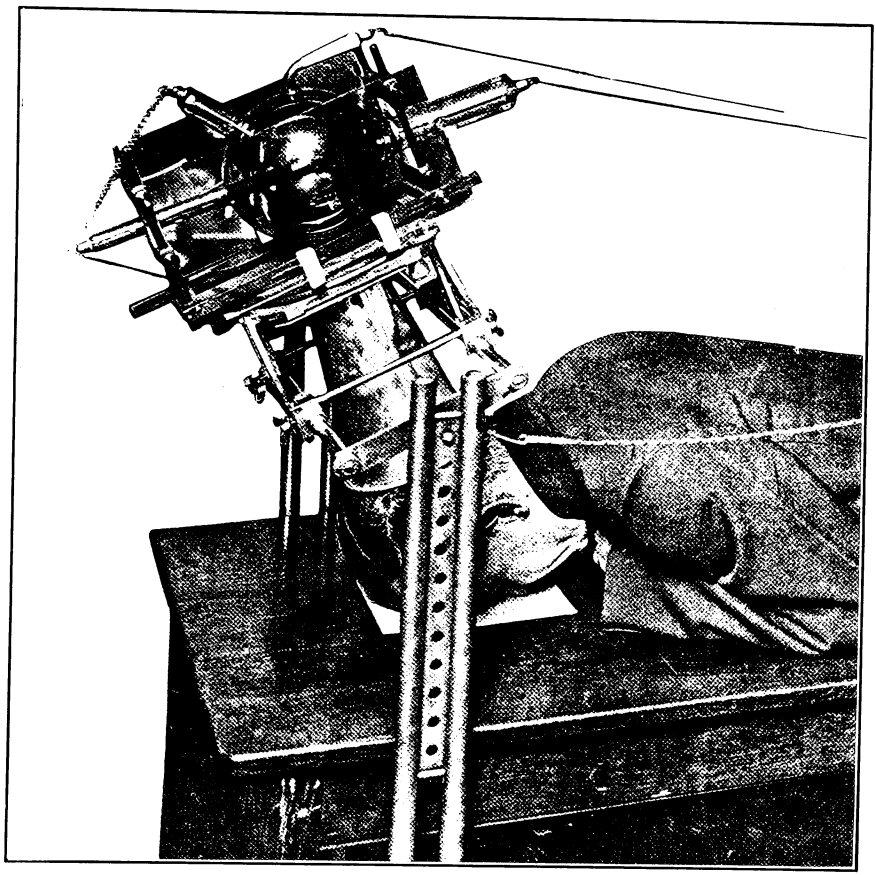


Fig. 104. Pose for making radiograph of the antra of Highmore.

patient may be seated in the dental chair while the exposure is made when small films are used. (3) The time of exposure is shorter for the small films. (4) Small machines with which it is necessary to make an exposure of one minute or longer for large plate radiograph will make

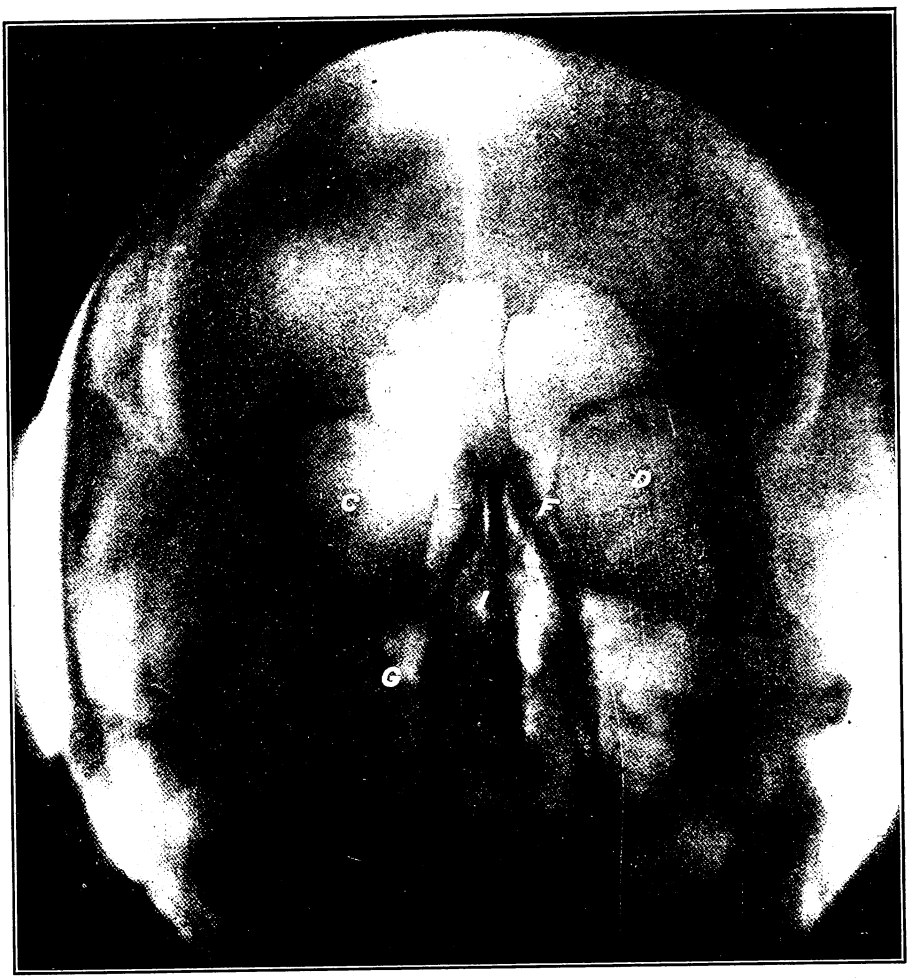


Fig. 105. Radiograph made from the pose shown in figure 104. A. B. frontal sinuses. C. D orbits. E, F, ethmoidal cells. F does not show as well as E because the cells of this side are full of pus. G, H, antra of Highmore. I. J. nasal cavity. As an aid in reading this radiograph observe figure 106. (Radiograph by A. M. Cole, of Indianapolis.)

a good dental radiograph on a film held in the mouth in 10 to 30 seconds. (5) A compression diaphragm, though always a valuable appliance, is not so essential when small films are used as it is when large plates are used. (6) The negative on celluloid cannot be broken.

The great advantage of the large plates over the small films is that a larger field can be pictured.

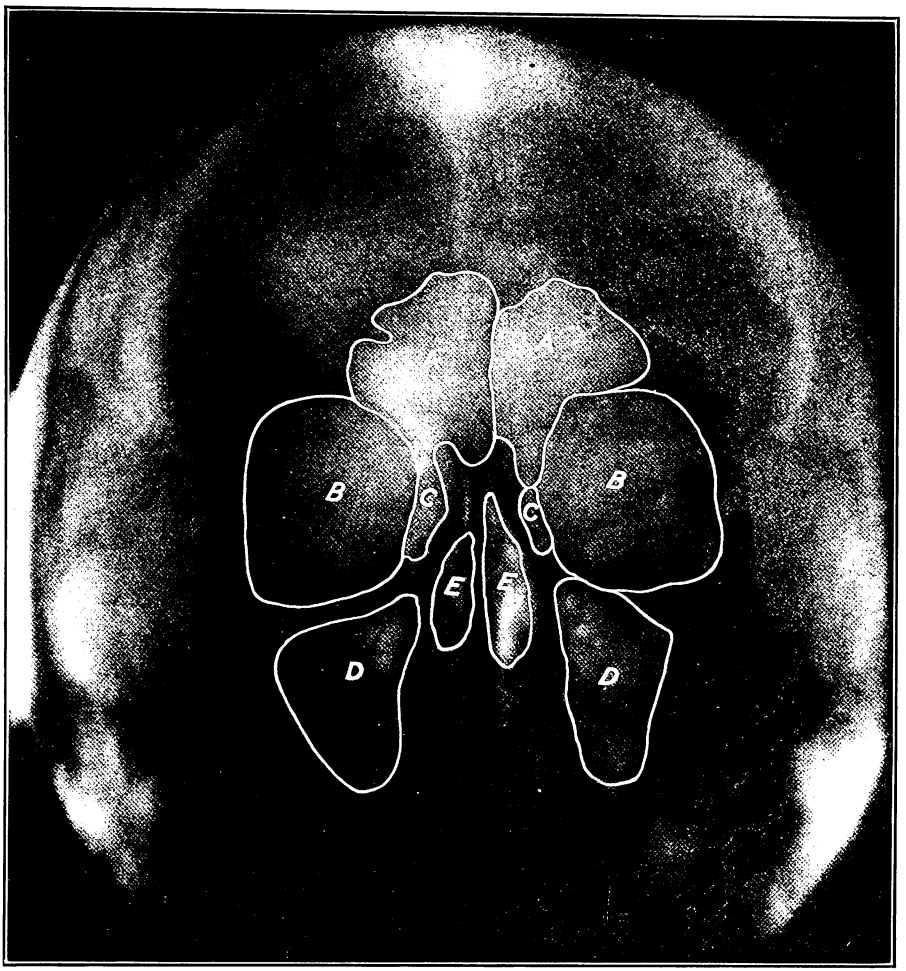


Fig. 106. Same as figure 105. A, frontal sinuses. B, orbits. C, ethmoidal cells. D, antra. E, nasal cavities.

Radiographs Made on Paper.

Instead of using a photographic plate or film a radiograph may be made directly on photographic paper. This paper should be the most sensitive made, so that the exposure will be as short as possible. Glossy "bromide" paper is the best. Fig. 108 illustrates a radiograph of the hand made directly on bromide paper. (Reduced one-half.)

When cutting the films as desired and covering them with black paper—in other words, when making the film packet—a piece of bromide

paper may be cut the same size and shape and wrapped up with the film. The paper will then, of course, be exposed at the same time the film is, and may be developed also at the same time. (Figs. 109 and 110.)

After making a radiograph as shown in Fig. 89, it may be trimmed

Fig. 107. The more or less oval shadow at which the arrows point is a piece of tooth root in the antrum. (Radiograph by Carman, of St. Louis, Mo.)

to a more symmetrical form. In other words, the film, as wrapped up in the film packet, may be left an indefinite, unsymmetrical form and trimmed to a more pleasing outline after the picture is made. The length of exposures when making a radiograph directly on bromide paper is slightly longer than when using a film or plate. Unlike the other sensitized papers—Azo, Velox, or Cyko—the bromide paper must not be exposed to the orange light. The light must be the same as for films and

plates, a ruby light. The radiograph made directly on paper lacks good detail.

Prints from negatives may be made on bromide paper. The advantage in using it is that less time is taken up in making exposures, and the disadvantage is that, since the work must be done in the comparatively weak ruby light instead of the orange light, it is difficult to tell just when development is complete.

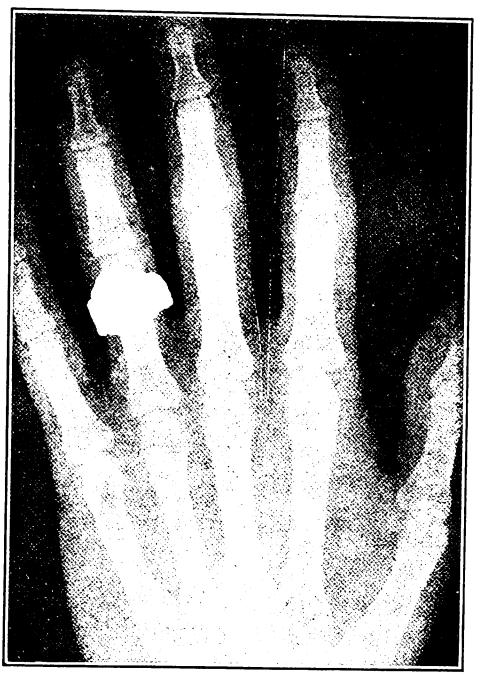


Fig. 108. Radiograph made on bromide paper. The conditions for making this radiograph were exactly the same as those given in Chapter IV for the negative of figure 51, except the time in the developer, which was about 100 seconds.

Fig. 109. Dental radiograph made directly on bromide paper.

Fig. 110. The negative for this radiograph was made at the same time with figure 109, the film being enclosed in the same packet with the bromide paper.

Lantern Slides.

Lantern slides may easily be made from a good negative. A lantern slide plate is a photographic plate 3¼x4 inches, manufactured especially for the purpose. Like all other photographic plates, it should be "worked" in the ruby, never the orange, light. The negative is placed in the printing frame, sensitive side up, and the slide laid over it, sensitive side down. The average celluloid, dental, radiographic negative is of such density that the time of exposure of the plate to a 16-C. P. electric light, at

NOTE.—Fig. 110 appears to be reversed. This is due to the fact that it is a print from the film. In the film itself the teeth would appear in same positions as in Fig. 109.—ED.

a distance of two feet, is between one and two seconds. Allow the slides to remain in the developer a few seconds after the radiograph shows best, until it shows a little too dark. Wash in water quickly and transfer to the fixing bath, where it should remain until the picture shows clearly as desired. The writer uses Seed's lantern slide plates and Seed's prepared metol-hydrochinone developer. After fixing, the slide is washed and dried the same as any photographic plate. When dry a piece of transparent glass, the same size as the slide, is laid on the film side of the slide and the two stuck together at their edges with binding tape, such as is used for *passe-partout* work. The piece of clear glass is used to protect the emulsion of the slide against scratching.

If the negative from which the slide is to be made is larger than the slide, as is always the case when the negative is on glass, the work had better be turned over to a professional slide-maker.

Dr. Kells makes lantern slides of, instead of from, his celluloid dental negatives. This is accomplished as follows:

On a clear glass 3¼x4 inches place a piece of black paper the same size, with a hole in the centre large enough to show all of the negative that the operator wishes to exhibit. Place the negative directly over this hole in the paper. Place another piece of glass 3¼x4 inches over the whole and bind the two pieces of glass together at their edges with binding strips. The advantage of this method over making photographic slides are: The ease and dispatch with which they may be made—a dark room and equipment is not necessary—and, since we are using the negative itself, there is no loss of detail such as might occur when the other method is employed and a new picture is made on the photographic slide. The disadvantage is that the negatives with good detail are usually so dark that the light from the lantern is not strong enough to penetrate them, and therefore the picture cannot be thrown on the screen at all.

A Non-Irritant Substitute for Carbolic Acid in the Treatment of Septic Conditions of the Mouth.

By Dr. Samuel Hess, New York.

Carbolic acid and other members of the phenol group, as cresols, occupy so prominent a place in dental surgery that we have become thoroughly acquainted with their advantages, as well as their shortcomings. While the possession of powerful antiseptic and analgesic properties renders the phenols particularly suitable for dental work, their objectionable

features are equally apparent, especially their irritating and caustic action upon the gums and mucous membrane of the mouth. Even with the exercise of the greatest care these undesirable effects cannot always be avoided, and they certainly constitute a serious disadvantage in the use of the phenols.

About a year ago a new phenol derivative was brought to my attention by Dr. Nathan Sulzberger, the inventor, which was stated to be as valuable a dental antiseptic and analgesic as carbolic acid and the cresols, yet completely free from any irritant and caustic action. As was explained to me, this irritant and caustic action of carbolic acid and the cresols is due to the free hydroxyl which they contain, the latter group having been eliminated by chemical treatment in this new compound.

Phenandyne.

Phenandyne, as this preparation has been named, represents a water-clear, absolutely staple liquid of an agreeable odor, soluble in oils and alcohol, and insoluble in water, to which latter fact is due the advantage that it adheres well to the site of application, and is not speedily carried away by the secretions. My tests, extending over nearly a year, have completely verified these statements and others made in the literature issued on phenandyne. During this time I had occasion to employ it daily, and have found it an excellent substitute for carbolic acid and the cresols, possessing all their valuable antiseptic and obtundent properties, while entirely devoid of any irritating or escharotic effects. I am using it now wherever a powerful antiseptic action is desirable, as in the cleansing and desensitizing of cavities preparatory to filling, and in the treatment of septic pulp canals, alveolar abscesses, and also in the treatment of pyorrheal pus pockets.

In this brief report, however, I wish to call special attention to the value of phenandyne in the treatment of pyorrhea. In these cases it is of particular value, since it can be most freely used without any deleterious effects. Its application to pyorrheal pus pockets causes them to heal very rapidly. Phenandyne being less a coagulent of albumen, seems to penetrate more deeply into the tissue and to adhere better to the same than carbolic acid or the cresols, therefore exerting a more prolonged analgesic and antiseptic action, and I have never found its use followed by the least irritation or other untoward action. If the tissues are particularly sensitive, its analgesic action may be still further enhanced by the addition of cocaine, free alkaloid. The manufacturers also put up a solution of 4 per cent. cocaine in this preparation, forming a water-clear liquid, which does not undergo any decomposition, embodying the combined analgesic effects of the preparation and cocaine, coupled with the powerful antiseptic action of the phenandyne.

The following two cases will serve to illustrate my method of use of this preparation in the treatment of pus pockets:

Cases from Practice.

Case 1.—Mr. C., aged twenty-nine, presented with spongy, bleeding gums, fetid breath, and pus pockets at the gingival margins. After removing the calculus deposits and syringing with hydrogen peroxide, the mucous membrane was protected with napkins and a generous amount of phenandyne injected under the gum and into the pockets. On his return two days later, the patient stated that he had had the first night's uninterrupted sleep in a week, as previous to this treatment the pain had kept him awake. The improvement in his general health was very marked, and, after three more treatments, the case was discharged cured, as regards the local condition, with instructions for further and continued prophylactic measures.

Case 2.—J. H., aged 36, specific case, eruptions on the nose and mucous patches in the oral cavity. The condition of his teeth and gums was similar to that of the above case, except in a still more aggravated form. The treatment was similar, and yielded equally good results. After five weeks he was dismissed cured, as far as the local manifestations in the buccal cavity were concerned.

Although, as will be noted, I use napkins to protect the mucous membrane, this is rather a matter of custom than a necessity, for phenandyne can be injected into pus pockets without such precautions, since it does not produce any escharotic effect or sloughing. Since resorting to its use, I have discarded carbolic acid entirely.

While aware of the prejudice against proprietary preparations, it is my conviction, based upon an extensive experience, that phenandyne possesses so many desirable qualities as to merit the attention of dental surgeons.

Unusual Reflex Pains in Nose Troubles, of Interest to Dentists.

Dr. M. J. Schoenberg.

Ophthalmic Surgeon at the Mt. Sinai Hospital Dispensary, Assistant at the New York Ophthalmic and Aural Institute, New York City.

I. A Case of Acute Frontal Sinusitis Simulating a Tooth Trouble.

Patients suffering from pains in the region of the superior or inferior maxillary bone usually go to the dentist to have their teeth treated or extracted, and are often surprised to hear that their teeth are in good condition, and that they ought to consult a physician for their trouble.

I have recently seen a most unusual and perplexing case, whose history is so interesting that I consider it worth while to relate it briefly.

Patient F. M. was referred to me on March 5th, 1911, by Dr. L., dentist, to "have his whole head looked over and to discover the cause of his trouble." This patient, 28 years of age, of a general healthy appearance, told me that for the last 10 weeks his teeth ached him constantly. The pains were worse at night and reached their maximum early in the morning, around 5-6 A. M.

When he first became ill, the patient consulted his dentist, and was told that his teeth were in good condition. He then went to his family physician, who thought it was "plain neuralgia," and gave him some powders, which only relieved him for half hours. As the patient did not improve in the course of several weeks, when all the usual coal tar products, as well as general diet, baths, warm compresses, etc., were tried, his physician gave the matter a closer investigation, and found out that this patient had had a chancre some ten years ago. Wasserman's test of the patient's blood was made and found "positive." This fact and the nocturnal character of the neuralgic pains induced the physician to conclude that he had to deal with a neuritis of specific origin. The treatment seemed simple. The patient was immediately put on an antisyphilitic cure, but 8 weeks of daily and faithfully performed mercurial inunctions did not bring forth the expected result. The patient was tormented by his "neuralgia" worse than ever.

Entirely disappointed, the physician sent his patient to a neurologist, who, after a most exhaustive examination, did not find any organic nervous disease, and referred the patient back to a dentist. The patient was carefully examined by my friend, Dr. L., who did not find any sign of trouble in his teeth, and, as he could do nothing for this unfortunate man, he referred him to me, "to look over his whole head."

My examination revealed a slight edema extending over the right face, up to the upper lid and right eye-brow and reaching its maximum over the right side of the root of the nose. By *slight pressure on the inner-upper angle of the orbit* the patient complained of *extreme pains;* no pains by pressure on any other part of the superior or inferior maxillary bone.

The examination of the nose showed a *deviated septum* and a *large swollen middle tubinate,* tightly wedged in between the septum and outer wall of the right nasal cavity. A *drop of pus could be seen covering the inferior margin of the middle turbinate.*

The severe pain elicited by pressure over the right frontal sinus, and the large edematous middle turbinate were pointing clearly where the neuralgia was originating. I covered the middle tubinate with a

small tampon of cotton saturated with a 10 per cent. solution of cocaine and adrenalin, and let the patient wait for ten minutes. When I took out the tampon the middle turbinate was shrunk to half its size, and a large amount of pus was dropping down from the frontal sinus into the middle meatus and further down on the floor of the nasal cavity. I then washed out the sinus and the patient was rid of his "neuralgia," which had evidently been caused by the pressure exerted by the mucous and pus accumulated in the frontal sinus.

There was in this patient a lesson for every one concerned: a positive Wasserman reaction and a history of a specific infection do not mean that every trouble such a patient may ever have must necessarily be of syphilitic nature, to be treated only with mercury or salvarsan. *The region where the patient had most of his pain was not over the frontal sinus,* and this, of course, misled the physician and the neurologist. At any rate, the dentist can be congratulated upon the idea he had to have the patient's "whole head looked over," and this shows once more how often the dentist can do a lot of good by giving his patients good advice.

II. A Difficult Eruption of the Third Molar Simulating a Sinus Trouble.

M. S., business man, 32 years of age, called upon me on February 3rd, 1911, and gave a history of "a chronic catarrh in the head" of a very long duration (about 15 years). He added that this cold would not have brought him to me, but for repeated attacks of pains in the occipital region, recurring daily, mostly in the morning and lasting for several hours.

His general condition, the family and personal history, do not present anything of importance bearing on his present trouble. The examination of his eyes reveal a moderate degree of hyperopia, for which the patient wears the proper glasses. Having eliminated the refractive error as a possible source of the occipital headaches, I proceeded to the examination of the nose and throat, and found *a polypoid degeneration of both middle turbinates, due to a chronic frontal, ethmoidal and sphenoidal sinusitis.*

This condition seemed sufficient to explain the headaches. Although there was drainige for the mucus and pus secreted by the diseased mucous membrane, lining the accessory sinuses of the nasal cavities, an occasional stoppage of the contents in one of these sinuses was sufficient to produce the pressure symptoms and consequently intense pains. The examination of the throat showed the usual chronic pharyngitis, met with in similar conditions; mouth, nothing abnormal.

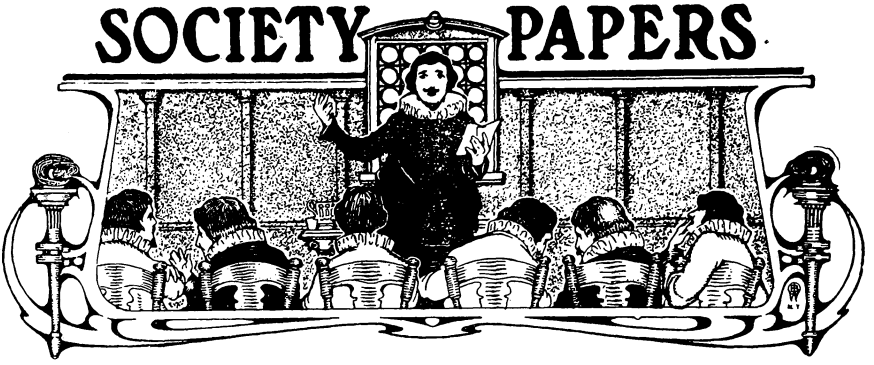
I advised the patient to submit to the removal of the middle turbinates and a cleansing of the sinuses of the necrosed tissues and pus

they contained. The patient consented and the treatment was instituted.

After several weeks of treatment the patient's headaches did not recede. I was puzzled, indeed! One day, while I was examining again the patient's throat, I saw his gums corresponding to the third lower molar—on each side—swollen. A gentle touch was sufficient to elicit most *excruciating pains in the occipital region.* I called in a dentist and asked his advice.

We decided to incise the gums on both sides and wait further developments. As the patient's headaches did not improve, we extracted the molar three days later. Since then the pains disappeared as though by magic.

An inspection of the wisdom tooth might add to our wisdom once in a while!



An Improved Porcelain Filling With Minimized Cement Line.

By Frederick H. Nies, D.D.S., Brooklyn, N. Y.

Read Before the Second District Dental Society, April, 1911.

An improved porcelain filling with minimized cement line is the subject of my paper. It should be, rather, the construction of a porcelain inlay without a metallic matrix. To work without the necessity of making a gold or platinum matrix is to greatly simplify the making of a porcelain filling. To simplify and improve the porcelain filling is to invite its more general use at a time when caries seems world-wide rampant and the teeth of the average person resemble white coral islands in a sea of gold. If we accept those cases where the unfortunate wearer considers it an insignia of wealth, or where the erring judgment of practitioners leads them to decorate the anterior teeth with shell crowns—which frequently represent commercialism in dentistry—the gold filling has represented the filling that has best endured and conserved our patients' teeth. If by supplying a simpler and more accurate means of constructing the porcelain filling its adoption should become more general, and if my labors result in saving my fellow workers the anxiety that attaches to this class of work, I shall feel more than repaid.

Inaccuracies of Matrix Methods.

In the method of burnishing gold or platinum foil directly into the cavity there is a nerve-racking tediousness to the operator and patient—not to mention pain—the frequent tearing of the matrix when almost in place; the uncertainty of having it adapted in all places; the liability of distortion while removing; its expansion while heating, and lastly, its fatal defect—that of warping, of yielding to

the pressure exerted during the contraction of fused porcelain, are all defects inherent in these metallic matrices.

Swedging into a model of the cavity made of amalgam, Spence or Mellotte metal obtained by the impression method, while less trying to the patient and operator, does not relieve the defects that obtain in the porcelain inlay when using a metallic matrix. There is the contraction of the wax—not as great as has been stated, I believe—with consequent smaller cavities in the dies; the contraction of the dies themselves in some of the materials used; the additional space occupied by the matrix; the expansion of matrix when heated. Granting that none of these usual errors have crept in, the matrix, after leaving the die, is still warped in the fusing and contraction of the porcelain. Byram, speaking of labial and buccal and four-wall cavities, says: "Such forms of cavities cannot be prepared so that the matrix can be burnished into the cavity and the inlay compensate for the space of the matrix, unless it be constructed with frail margins of porcelain which lack edge strength, and are so thin that change of color is noticeable along these margins."

Nor is there relief found in swedging over the cavity. This method, although permitting a more accurately fitting inlay than any in use, because of the heavier foil it is possible to use (the thickness making no difference in this method, the thicker matrix offering stouter resistance to the shrinking porcelain, but not enough), does not prevent this metallic matrix also from being warped in the fusing. The advantage of swedging over the cavity is sometimes lost in the multiplicity of changes that some men go through in securing the model over, or into which to swedge. The swedging should be directly over the first impression of the cavity, taken in oxyphosphate of zinc or copper when possible.

It does not matter whether the metallic matrix is directly burnished into the cavity or swedged in, or over, dies made by the impression method—the fatal defect of warping is inherent in both methods. The invested gold matrix has no advantage over the uninvested platinum one in the matter of warping. The Price method of burnishing the platinum or gold foil over a stone model and baking in the matrix while it is in place on the model has the same fatal defect of a warped matrix, due to the fused porcelain contracting while cooling. None of the investments furnished for this purpose could hold the delicate foil against the tension of shrinking porcelain.

Every metallic matrix takes up an appreciable amount of space, ranging from 1/500th to 1/1000th of an inch, which means an inlay just that much too small and a cement line of that thickness to take its place, which often mars the beauty of this work. There is the possible distortion caused by the expansion of the gold and platinum themselves. This may also contribute to a poor fitting inlay.

Tapered Cavities.

I have felt that tapered cavity preparation could not always be exact enough to do the work some of us have imagined it did. For the plan to be entirely successful, it is necessary that the margins of the porcelain inlay project beyond the natural surface contour of the tooth, so that when the matrix foil is removed the inlay will sink down and be just right. Were it contoured even with the surface of the tooth before the foil was disturbed, it would sink below the surface after the foil was removed, or if built up, it could only be at the centre and a peak of cement would result. The difference between diameters of pulpal surface and outside surface might also effect shrinkage unevenly. The smallest deviation from a geometric taper might prevent the proper seating of an inlay made by this method.

Qualities Needed for an Ideal Matrix Material.

Having briefly metioned the inherent mechanical errors that obtain throughout the impression and die-making process, which are later inherited by the metallic matrix and its product, the porcelain filling, which also contracts, it must be apparent that some form of matrix is needed that will be free from the errors which the metallic one posseses. A matrix is needed that will take a sharp impression, withstand the intense heat of a high fusing porcelain, and maintain its shape in this heat without warping; one that slightly expands when set and does not contract, nor on drying become porous; a matrix that will present smooth surfaces, that will not vitrify or fuse at highest temperature, with walls hard and unyielding enough to withstand the tension of shrinking porcelain while cooling, and finally, when the inlay is baked, a matrix that can be decomposed, permitting the inlay to be freed from its investment.

The Ideal Matrix.

These qualities must be contained in the ideal matrix, and are embodied in the porcelain matrix that I give you to-night. I give you to-night a matrix that will not warp; that has unyielding walls; that does not tear; that does not distort; that occupies no part of the cavity space; that admits of addition and subtraction of porcelain, and changes of porcelain shades to your heart's content; that allows repair when cracked or chipped; that permits formation of perfect retention cavities, and insertion of metallic and porcelain pins and retainers; that has a slight expansion on setting and no contraction on cooling; and, owing to the stability of the matrix, resists the shrinking porcelain, holding it to its margins and walls, thereby producing a perfectly adapted inlay, thus minimizing the cement line. Let us begin and make an inlay with this matrix.

New Technique For Porcelain Inlays.

Commence with me by generously separating the teeth to secure space for work. Selecting a German silver or celluloid strip the width of the tooth and about five inches long, bring the ends carefully together and place in its base a piece of soft rubber. Pressing the walls of the strip together, insert this between the teeth to be filled, the loaded end on the lingual side, and then draw it up tightly against these surfaces of the teeth, thus molding it. This I always try to do before trimming the walls of the cavity. We now withdraw it pending our cavity preparation. Isolate the tooth or teeth with a rubber dam; desensitize in any manner you see fit.

Painless Cavity Preparation.

I use ethyl-chloride put up in metal tubes. I hesitate to mention its use, since one of my dear friends, to whom I recommended it, almost blew himself up by handling it improperly. Before applying the ethyl-chloride, the temperature of the tooth should be lowered by gradually chilling with a pledget of cotton dipped in ether, placed in the cavity and evaporated by a continuous spray of compressed air under high pressure. The tube of ethyl-chloride, which in the meantime has been cautiously heated as warm as can be comfortably held in the hand, is opened and the spray is thrown intermittently on the tip of the tooth, gradually working it up toward the neck. The pulp seems to recede under this treatment and is not injured. I have used this method for many years, and have not known a pulp to be destroyed by it. The process takes but a minute. I mention desensitizing because it is absolutely necessary to cut deeply and freely to obtain frictional surfaces for proper retention.

We now rapidly prepare our cavity with burrs, small stones and polishing disks, doing this work under a powerful glass known as *Loope stereoscopique,* which has the great advantage of focusing the vision of both eyes on a single point, and which can be worn over glasses, or glasses can be built into it. After preparing our cavity carefully, we drill in a safe place a small depression, which reappearing in our matrix leaves on our inlay a small papilla, which serves as a guide in placing it. Then we paint the cavity with a small camel's hair brush dipped in pure white vaseline oil—not vaseline or crude petroleum. In those cases where there is much saliva this coating is, of course, unnecessary. Much has been said against the use of such separating oils, but when one considers the daily food baths of fats and oils that teeth are treated to, I can see no harm in their use. If harm there be in the use of petroleum, it must largely be due to the wax that manufacturers add to give it body. Of course, this objectionable ingredient does not exist in pure vaseline oil.

Taking Impression of Cavity.

Here we depart from one of the well-known ways of making an inlay, namely, that of burnishing the platinum or gold foil directly into the cavity. Following the impression method, only so far as taking the impression in wax, or other impression compounds, we proceed to take our impression, in a wax which I have had especially prepared for the purpose of taking impressions of the anterior teeth, largely without the use of impression cups or trays. My object in doing away with the tray where possible is that the space it occupies is often sorely needed to successfully withdraw the impression. The wax I have had prepared is tough, non-elastic, and contracts only slightly, which is easily corrected by the expansion which takes place when we reheat the impression to its workable temperature. It takes an impression as sharp as any, burns up without a residue, and has a high melting point. Other waxes on the market that burn up without a residue are, when warmed, found to be elastic and sticky, adhering to the teeth; they are brittle when chilled and melt at too low a temperature.

I wish to emphasize that it is necessary that a wax have a high melting point, for it permits greater heat to be used in drying the poured impression, which reduces the liability of distortions that frequently obtain when a wax with a low melting point is used. I am partial to the wax impression, and while recognizing that wax expands when heated and contracts when chilled under *normal* conditions, I am convinced that the conditions that obtain in taking an impression of a cavity are not those that obtain when a bar of wax is measured in a water-bath without pressure by a micrometer arranged expressly for the purpose. In the case of the impression there is always the forcing into the cavity of new wax by heavy pressure to compensate for the shrinkage in cooling. This movement of wax is possible even at normal room temperature. It is admitted that the contraction of gold can be minimized by pressure. The same must be true of wax if clinical results count for anything.

To continue, we take a small piece of wax, a trifle larger than the cavity, which we soften in a small bowl of hot water, held close to the patient's face. Now force the wax into the prepared cavity with fingers, next using a steel spade-like blade, which is passed between the teeth for pressure and separation, introducing now the German silver or celluloid strip previously prepared for this purpose, which we tightly draw against the wax, and with strong lateral pressure force the wax into the cavity, making our tooth contour at the same time. When too large, we cut it away and trim with a sharp instrument, always reheating the wax with a hot napkin to remold it. Some of the inlay waxes can be used for impressions. The contraction of these materials is said to be considerable,

but I question whether the greater part is not overcome by the forcing of more wax into the cavity as it contracts in cooling, and later when expanding the impression by heat. In all bicuspids and molars I prefer a cup to hold my impression material and furnish me a means of pressing home my wax. With pressure at right angle we secure perfect adaptation of the impression material to our edges, using preferably cups made for each case of platinoid of 28, 30 or 35 gauge.

The set seen in my exhibit has kindly been made for me by Dr. F. T. Van Woert, of Brooklyn. Some of the brass cups devised by Dr. Price have many excellent features. These I have also mounted for your inspection. The use of modeling compounds is not practical with the porcelain matrix, because this matrix material takes time to set and is hardened by heating. Many of the impression compounds, which contain shellac with whiting as a base, swell and form gases when heated, which distort the impression beyond all usefulness before the matrix has had time to set. I shall give you later in my paper, however, a convenient material, which would be ideal could its contraction be controlled, that can be used with these impression compounds.

A splendid impression can also be taken with the oxyphosphates. Before inserting cement in the cavity, test withdrawals should first be made with modeling compound. After all the undercuts shown to be present have been removed or filled with cement, the cavity is painted with vaseline oil and the cement pressed into the cavity with instruments dipped in alcohol. The impression should be withdrawn as soon as it is sufficiently hard to handle. An advantage of this material is that it can be fractured for withdrawal and later united by additional cement.

Where it is possible to take the bite and impression together it is advisable to do so, the wax filling made first and removed adhering to the bite.

We proceed in the case of wax impressions without cups to support the frail edges of the impression by imbedding it in a plate of softened wax whose melting point is lower than the piece which we are investing. This procedure is necessary to prevent these tiny impressions from being engulfed and disappearing below the surface of the pouring composition. With a thermometer as a guide, we place our impression next to a stove and heat it almost to the temperature at which it was when we introduced it into the cavity. This temperature was determined by a bath thermometer, immersed in the same cup with the wax. One reading suffices for the whole box of wax. The wax impressions need no treatment. The cement impressions, however, are covered with a solution of gutta to prevent chemical action between the matrix material and the impression material.

The Porcelain Matrix.

We have now reached the point where we abandon the metallic matrix for the porcelain matrix. It is a porcelain matrix because the materials that enter into its composition are those that enter into the composition of porcelain, namely, silicate of aluminum and free aluminum and lime, which on treatment with phosphoric acid form phosphate of lime and aluminum, which give this mixture setting qualities. The difference between this matrix material and many porcelains is the absence of the feldspar and the fluxes, which are incorporated into the porcelains to increase their fusability; for example, such substances as sodium carbonate, potassium carbonate, sodium borate, or glass. These fluxes would be fatal to the porcelain matrix, because their presence would cause the aggregates in its composition to vitrify or fuse and thus coat them with an insoluble glaze, making it very difficult for the decomposing mixture to enter the interstices between the atoms of the matrix to disintegrate it. The phosphate of lime and aluminum, which are slowly soluble in the decomposing mixture, would be protected by the coating, and would not be acted upon, thus making it impossible to free the inlay.

The matrix powders are finely ground, separately mixed in the right proportions and heated to a bright red heat to expel all water, both free and combined. The mass is then finely ground to impalpable powder and is ready for use by mixing with dilute glacial phosphoric acid.

I have found this material so difficult to properly prepare, without adequate laboratory facilities, that it has been necessary for me to secure the services of a chemist.

Pouring the Porcelain Matrix.

We are now prepared to pour our matrix. On a glass five by five we place our powder and liquid, mixing thoroughly with a bone, glass or gold spatula, to a thick, workable consistency. With a tiny brush we pick up this mixture and paint our impression with it, adding thereto until the impression is coated. Now thicken the mixture and fill in the impression with the thicker mix. Wrap the impression in bibulous paper and gently press the mixture against the impression. Leave it in this condition for a few hours to set, after which place it near a source of heat of some kind and allow it to dry for a few hours longer. In this drying the advantage of having a wax that fuses at high temperature is apparent, for it is possible to use a greater heat in drying, hence the better adhesion of the material. Now place the poured impression in or on a stove and gradually heat it, to burn up the wax, continuing this heat until model is hard. The matrix is allowed to cool, and if too thick is ground down on a carborundum stone. By grind-

ing the matrix as thin as possible the decomposing mixture has less material to penetrate when freeing the inlay; the thinner it is the more quickly the heat penetrates the matrix and fuses the porcelain. In low fusing porcelains the grinding has the additional advantage of so permitting us to form the base that we can direct our porcelains to flow where we wish.

The Use of Gutta.

When the mold is cold, we carefully paint the outer surface with a fine camel's-hair brush right up to the marginal edges of the cavity with a solution of gutta, which I had prepared for the purpose of varnishing teeth to protect them from the destructive action caused by the wearing of regulating appliances. This solution I have adapted to the additional purpose of varnishing my matrix. It is made from Balata gum, from which the resins have been extracted by the usual wash roll process. It is then dissolved in bisulphide of carbon, washed in acetone, filtered and re-dissolved in chloroform. This makes a pure solution of gutta, with more body and tougher than before obtainable. This gutta has the valuable faculty of swelling under heat, and if when filling your matrix any unfused porcelain should happen to accidentally extend beyond your cavity margins, the swelling gutta largely dislodges the superfluous porcelain and prevents its adhesion to the outside of the mold. Great care should be exercised to prevent this. After each baking the outer surface of the mold is revarnished.

Method of Fusing in the Porcelain Matrix.

We now prepare to fill the matrix with porcelain. There are numerous ways of doing this, and every man prefers his own, but in the process it is necessary that the first layer in direct contact with the matrix be first fused or glazed.

It is highly important with the porcelain matrix that the mold be heated gradually and thoroughly. The porcelain should be fused by receiving its heat from contact with the walls of the matrix rather than from direct furnace heat exerted on the porcelain itself. If the mold has been improperly heated the tendency of the porcelain is to ball up and leave the cavity margins, making it necessary to fill in between the inlay and matrix—a thing which we should seek to avoid. If the mold is properly heated, the tendency of the porcelain is to cling to it and form a perfect adaptation to the cavity surfaces. To bring about this result a clay hood to cover the matrix while baking is absolutely necessary, for it prevents direct action on the porcelain and enables us to hold back the fusing of the porcelain until the matrix is properly heated. In large contours or long cavities a thin film of baked porcelain should first cover the model; then

cervical and incisal ends are filled and baked, the intervening space being filled later. Filled in this way I have found that the porcelain does not shrink away from the interior surfaces of the mold, but on the contrary clings to the same tenaciously, so that if any shrinkage takes place it is not at the point where the inlay contacts with the walls of the cavity, but is in the interior, which is later filled in and the piece baked. As it is gradually heated, so it is gradually cooled. Additional porcelain is now added with brush and spatula, pressing and forming it with fingers and bibulous paper. The addition of gum tragicanth, mixed in the water used to wet the porcelain, is a great help with some high and medium fusing bodies. I recommend that medium fusing porcelain be used, because there is no liability of checking from contraction with these bodies, while with low fusing porcelains there is, unless the cavity is almost filled with quartz. This trouble with low fusing bodies seriously threatened the success of my work until I substituted medium and high-fusing porcelains. The fact that cracks do not occur with low-fusing porcelains when baked in a metallic matrix is proof that the matrix yielded and was distorted as the porcelain contracted. Did the walls of the metallic matrix hold firm, cracks would also be common in this type of inlay. High-fusing porcelains contain a high percentage of silex and kaolin. Both of these materials are virtually constant, adding compression, strength and stability. The high-fusing porcelains having far less contraction than the low-fusing porcelains, it must follow that the men who have been working with the high-fusing porcelains have made more perfect fitting inlays, for there has been less shrinkage to their material, and consequently less distortion of their matrices.

The piece having been repeatedly carried to a high biscuit for contraction—and there are men who claim it must be carried to a glaze to secure maximum shrinkage—allowance should be made for the lightening of the selected shade by repeated firings, and a porcelain should be chosen a few shades darker than the tooth. This rule holds with labial cavities, but should not be applied to approximal cavities, where the shade should never be darker than the tooth in the mouth, because when exactly matched in this location it looms up darker than the tooth. It should be a trifle lighter.

Shaping and contouring should now be done, and there is no safer means than the carborundum disk, grade No. 00. It cuts cleanly and smoothly, and will not chip the inlay. Ruby, garnet, emory or sand disks should not be used in inlay work. If in the final fusing it is not the exact shade you seek, the glaze may be ground off with the same carborundum disk, No. 00, and a better shade of porcelain applied and fused. The inlay can also be removed from the matrix, tried in the

mouth, re-invested and finally glazed. But this takes time. As no porcelains have a definite fusing point, they should be gradually heated. The thorough heating of the mold should always be done before the point of high biscuit is reached.

Cement Matrix.

Earlier in my paper I promised to give you a material that can be used as a matrix mold, to pour into modeling compound impressions, to form matrix molds to be used with low-fusing porcelains. This material is no other than the oxyphosphate of cement that we have had on our shelves the greater part of our lives. It is mixed in the usual way and worked into the compound impression, covered with bibulous paper and pressed home. After setting it is slowly dried over a Bunsen flame and is ready for use. The melting point of this oxyphosphate is a little over 1,700, varying slightly with the different cements. As low-fusing porcelains have no fixed melting point, by slowly heating they can be glazed at about 1,600 Fahrenheit, according to my pyrometer. The compound impression should be expanded before using to counteract the shrinkage. In mixing the cement as much powder should be incorporated as possible. I have used Harvard, Ash & Sons' C. A. S., Vyvex and Ames. Other cements may be just as good for this purpose, but I have never tried them. This is a convenient material that you all have in your offices, and will afford you an opportunity to test for yourselves the process I am giving you to-night. If some of you could devise a means of overcoming shrinkage in this material, it would supplant all others as a matrix for low-fusing porcelains in combination with silex.

This material produces a beautiful inlay, and there is an immense saving of time in its use. Its shrinkage and the danger of melting it without a pyrometer are its disadvantages.

Dr. Price's Stone Model, while perfect for this purpose in many respects, is to-day almost impossible to dissolve. It also melts below the point of high-fusing porcelains. If he could overcome these two difficulties, there would be a wider field for this valuable material.

Use of Quartz Crystals for Retention.

Undercuts are formed on the matrix by additions of matrix material that leave depressed recesses for cement, while metallic tubes and pins baked in the inlay can also be used. Cubical crystals of quartz, a material with minimum of expansion and contraction I frequently use to form a crystal surface for adhesion of cement. The cement, encircling each crystal, not only furnishes an arch action by binding around, but also adheres to each particle, and by its own strength gives support to the porcelain that the voids between the crystals might be thought to have weakened.

We know that maximum density is maximum strength, yet where compression strength is sought—as in concrete work, for instance—the maximum of stone properly shaped with a minimum of cement is recommended by experts in that line and should hold true in our work. The crystals of quartz are rolled in a paste of porcelain and placed in the matrix some distance from the margins and as carefully baked as if they formed the inlay. When finished and cooled the voids should be filled with chalk or cement to prevent the porcelain filtering through them and filling them up.

The porcelain is now filled in, as experience will guide you, baked in the prescribed way and slowly and gradually cooled in the muffle without opening it.

Method of Freeing Inlay from the Matrix.

When I reached this step in working out my process, I found I had a filling baked in a mold much harder than my porcelain, and how to remove it safely was a problem. The thought of adding a separating medium occurred first, and I began by first coating my mold with amorphous graphite, chalk and finally Higgins's India Ink. I very soon found the carbon in this ink burning up in the great heat of my furnace. To prevent this I introduced a jet of carbonic acid gas, and later hydrogen, into my furnace through a tube, driving the oxygen out of my muffle in an effort to prevent the oxydation of my carbon. This process did not work well, and I found my inlays turning green, which caused me to suspect traces of cobalt or copper, and not finding any in the matrix, I concluded that the copper was in the India ink; so I set that process aside and took up the subject of a possible acid solvent. Hydrofluoric acid, with which I had been working, naturally suggested itself, and into this I threw my inlay. In a few hours I discovered that I had etched my inlay, but apparently had produced little or no impression on the mold. I then heated the hydrofluoric acid, and was delighted to see a softening of the outer surface of the mold. I left it over night, and the next morning had the pleasure of seeing a trace of my fast disappearing inlay and a small portion of my mold. I rescued what was left, washed it in clear water, and found that the acid had effected a dissolution of my mold. After finishing the next inlay I carefully coated the exposed surface with melted wax. This I similarly immersed in cold hydrofluoric acid, and while I succeeded in disintegrating my mold, having saved the glazed surface from destruction by coating, the inside of my inlay, which had no wax or gutta protection, was eaten up by the acid which had been absorbed through the matrix material. This caused me to give up hydrofluoric acid for this purpose.

I next tried a mixture of equal parts of nitric and muriatic acids. Again covering the glazed surface of my inlay with gutta, I immersed it in this solution and gradually disintegrated the mold. The time consumed was four hours, and many unpleasant odors filled my office and blackened all the metal in it. Finally, after many trials, I found the acid that would disintegrate my mold. I found that a solution of one part hydrochloric acid to four of water is exceedingly effective, cheaper, simpler, and less dangerous than any of the others. We now place the inlay, coated with wax or gutta, in a bottle of cold dilute hydrochloric acid, leaving it when possible over night. If you are pressed for time, the separating process can be hastened by heating, which will cause disintegration of the mold in a short time. A chimney should be used to carry off the fumes. Even with this weak solution of hydrochloric acid it is important that the inlay be covered with melted wax or the gutta solution before immersing it, otherwise it will be found that this weak solution has acted on the porcelain and destroyed its lustre.

The inlay is now cleaned with small burrs and brushes dipped in a solution of Bonsit to remove any trace of foreign material from its surface. The inlay is now ready to set.

The length of my paper and the lateness of the hour prevents my showing you the application of this method in constructing all manner of crowns as well as artificial dentures.

As but few processes are perfect when first introduced, so in this, *certain results* will only be reached by the process of evolution that all inventions must pass through before they are perfect; and I hope with your aid, at no distant time to see the perfection of this process of making a porcelain filling.

A New Process of Filling Teeth With Cast Porcelain Inlays.

By F. S. Welden, D.D.S., Brooklyn, N. Y.

Read before the Central Dental Association of Northern New Jersey.

From the very foundation of dental science, the ideal has been to restore the character as well as the form of the human teeth when attacked by any traumatic or pathological force. This ideal, of necessity, must be to restore the teeth as nearly as possible in texture, color and form. Diverse and numerous means have been utilized to bring about this ideal. Hitherto, color and texture have been sacrificed to the main and central idea of preservation; hence, dentists have used any or all means of preserving the human teeth, without regard to texture or color.

The history of dentistry points with distinct emphasis to the failure of any and all of the materials employed for the preservation of teeth, that anywhere approached the color and texture of the teeth, and the fundamental and all-prevailing practice has been to use materials such as gold and amalgams, as offering the best assurance of permanency and safety.

To be sure, thousands of skilled operators, with conscientious care, have succeeded in prolonging the important use of the dental organs, by the means of metallic substances used for filling. Innumerable are the experiments that have been made, and it has remained the province of very few and exceptional experts to introduce a means of preserving the human teeth in the texture and color, as well as durability. I refer to those experts who have conquered the method of applying porcelain for the preservation of human teeth. I will not dwell upon their individual methods of accomplishing this, but my purpose to-night is to set forth a method and material by which even the moderately skilful in the practice of dentistry may be able to fill teeth, by means of porcelain, matching color and texture and restoring form.

Before I proceed in outlining the substance of my paper, it is fitting that I should pay the necessary and just tribute to the man who has made this possible. I refer to Doctor Taggart, of Chicago, who has the honor, and should have the homage of the profession, for revolutionizing dentistry by means of his casting system, and if I felt at liberty to encroach upon your time, I would have more to say upon this wonderful theme. As my offering to the dental profession is subservient to his great idea, I will proceed at once to describe my process.

Recognizing, as all thoughtful dentists must, that gold in its color and physical properties of conductivity is not an ultimate ideal as a dental restoration, and being enthused with the idea of the cast filling, as set forth by Dr. Taggart, I was led to search for some substance that would be as amenable to the casting process as the metals, and which would conform more readily to the color and texture of the human tooth.

It was after a prolonged and industrious research, from the oldest to the newest accomplishments of the chemical world with the silicate group, that I have accomplished the end which I set forth to you at this time. In my experiments with the silicates, I discovered that an alloy of the silicates could be formed in the same sense that an alloy of the metals is formed, such as is represented by Rose's metal, Melotte's metal and other alloys with which you are familiar. For example, a fusible alloy fuses at a lower temperature than any of its constituents, as illustrated by Rose's metal, which fuses at the boiling point of water, while any one of its constituents fuses at a much higher temperature.

Welden's Casting Porcelain.

This particular alloy of silicates which I advocate, embodies silica, felspar, kaolin, fluorspar, with the addition of the necessary chemicals, which makes it possible for all of these substances to fuse at or about the temperature of gold.

This, briefly stated, is the history of what I call "Welden's Casting Porcelain." The different shades are made possible by the addition of various metallic oxides, as in the manufacture of baked porcelains with which the profession is more or less familiar. The peculiar constituency of my porcelain, which is necessary for its castible attribute, lead many to ask the question, "What is the difference between porcelain and glass?" There is very little difference in the chemical constituency of porcelain and glass, the main difference being that porcelain is a group of silicates, with a body, which renders it opaque, while glass is the combination of a group of silicates free from any opaque body, and is therefore transparent.

Inasmuch as my casting porcelain is distinctly an opaque or opalescent substance, made to closely imitate the texture of the human tooth, it is an error to call it glass. It is a vitreous porcelain, with all the attributes and character of any porcelain. Its great strength, according to the tests by the machines of a New York expert, is 1.82 times greater than any porcelain that has hitherto been presented to the dental profession for manufacturing purposes. Its fusing point is variable, but reaches the ultimate at about 2,200. This variability depends upon its constituent materials.

Complying with the immutable laws of nature, I have found that this casting porcelain casts with greater facility when fused by means of a gas blast, and while the heat of the blast is keeping it to its maximum fluidity. It is essential, therefore, that the casting be accomplished over a vacuum. If the necessary heat could be maintained while the casting is being done, there is no reason, in my mind, why the same casting could not be accomplished by means of compression, because when all is said, a vacuum is but the resultant of the physical laws of atmospheric pressure involving the idea of compression.

I will now, as briefly as possible, endeavor to set forth the steps to be taken in order to cast porcelain, to obtain as good or even better adaptation than is possible to obtain with any metallic substance.

Technique of Casting Porcelain.

I will not dwell upon any personal means that I may employ to obtain a wax pattern. Any deficiency of any dental organ that may be reproduced in a wax pattern may be cast in porcelain. The wax that I choose must be one that is free from residue when melted. The best of these waxes, I have found, to be either Klewe's pink or Taggart's new inlay wax.

After obtaining a suitable pattern, from any cavity that I wish to restore, I mount it upon a sprue wire of suitable proportion, conforming with the size of wax pattern. To illustrate, for a restoration of one-third of a molar, I would use a sprue wire, of the diameter of a bur shank, and would recommend the same proportion of diameter of sprue, according to the size of pattern, taking the former relation as a standard.

In order to insure a proper volume for the atmospheric pressure to act upon this viscid mass of molten silicates, I have deemed it more convenient and sure to devise a crucible former through the apex, of which I can place a sprue wire. This sprue wire is about 12 gauge, or the diameter of an ordinary bur shank. The cone of this crucible former is formed at an angle of 45 degrees, being seven-eights of an inch wide at its base, thus forming quite a marked cone. This particular shape is adopted, because of the sluggish activity of the molten porcelain when fused, and, as I said before, to give a thicker mass for the vacuum pressure to draw upon, without involving the casting with an influx of air, thus causing bubbles.

Special Investment Required.

Having a carefully prepared wax pattern upon the sprue wire set in the apex of the crucible former, as the relations described, I then proceed to invest. As most of the investment compounds hitherto found on the market are exceedingly rich in silica, which is not always pure silica, being contaminated with iron, sodium and other chemical combinations, I have found it necessary, in order to get the best results in the way of a clean-cut reproduction of my pattern, to devise an investment compound that would be free from silica or other contaminating substances. The result of my efforts is embodied in a mixture of magnesite and plaster, with a very small proportion of pure refined silica. This gives me the results desired, but as the large crystals of silica are generally put into investment compounds for the purpose of strengthening the investment and producing a constancy of volume, I soon learned that my investment material, while it always produced a clean-cut inlay, would not always withstand the intense heat and the pressure necessary for casting porcelain over a vacuum. I then devised a casting ring expressly for the purpose of confining my investment material in such a manner as to withstand any degree of pressure that I see fit to use in casting my porcelain.

It is not necessary for me to say that the results I have obtained have been eminently successful. The distinguishing feature of my casting ring is that I have used a perforated bottom to support the investment, and this withstands any stress whatever that may be put upon it. The manner of mixing my investment material is as follows: To one-half

fluid ounce of tepid water, add 19 or 20 pennyweights of the investment compound, mixing and spatulating thoroughly, and investing the pattern as for gold fillings, and placing the perforated cover on the top against a soft mass of investment. This investment hardens in about 20 minutes. When the investment has thoroughly set, remove the crucible former and sprue wire, place over a very gentle heat, and allow all vapor and steam to pass away, and the wax pattern to melt without any violent agitation, which would injure the walls of the mold. When confident that all steam has left the investment, increase the heat gradually until all of the wax pattern has disappeared. This is best denoted by an absence of any dark stain in the investment. The investment should be nearly white. Allow the ring and investment to remain over the Bunsen flame until it is thoroughly red hot throughout, so that red heat may be seen upon looking into the sprue hole.

Casting the Porcelain.

Having prepared my vacuum to no less than 25 inches on an Elgin casting machine, I place my casting ring with its contents upon the plate, carefully seating and testing the vacuum. I place enough casting porcelain in the crucible to insure an excess over the demand made by the size of the pattern, and fuse the same with a highly efficient gas blowpipe. When the porcelain is fused to the point of transparency, I release the vacuum, continuing to play the flame upon the molten mass until I am satisfied that the pattern chamber is filled with molten porcelain. If my vacuum indicator runs down to near exhaustion, I increase the vacuum, so that elastic expansive force of the vacuum is exerting itself upon the viscid slowly cooling mass of silicate that is contained in the investment. This is the reason, above all reasons, why we have such a perfect replica of the wax pattern.

Cooling the Casting.

Referring to cooling the porcelain casting, I most strongly recommend and advocate that the following steps be taken:

When the casting ring and contents have cooled enough to bear the touch of the hand, I would again subject it to the heat of the Bunsen flame, and allow it to attain a temperature indicated by redness, and would even advocate that this process be repeated. The reason for this is that the time involved in the fusing, casting and cooling of this molten mass of silicates is not enough to allow a complete adaptation of molecular arrangement, and where the molecular affinity is uncertain and weak, a fragile mass must necessarily result. This procedure, which I have briefly described, might be known as tempering. If this procedure be followed, you will have a much tougher and stronger mass embodied in your inlay than would otherwise be possible.

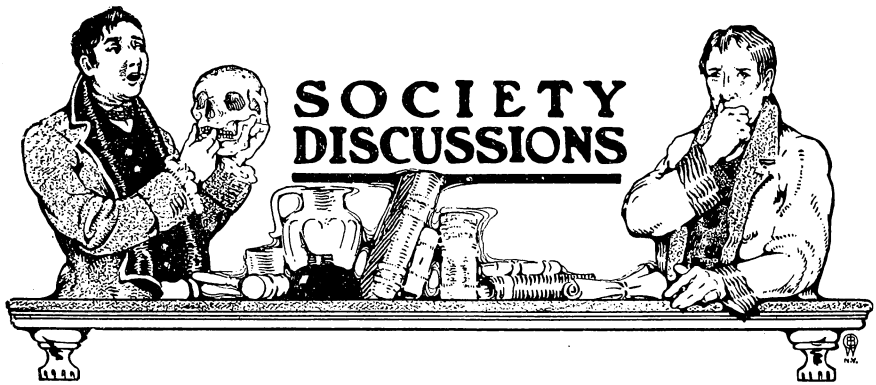
Polishing the Casting.

After the inlay has become completely cooled, the ring may be emptied and the casting cleansed from its surrounding investments, and you should find a clean, clear-cut reproduction of the wax pattern. This casting porcelain is capable of being polished to the highest desired gloss. This is done with a clean felt wheel on the lathe, and using a preparation known as gloss sticks; or by first using medium fine pumice powder paste, and finishing by means of polishing putty. If there is any area of the inlay or restoration that should be stained or colored, I have provided metallic oxides of suitable colors for that purpose.

Shading Cast Porcelain.

Dictated by the required artistic sense, the operator judiciously and delicately blends the shading desired upon the required portion of the inlay to be shaded, invests the inlay in investment compound, leaving exposed the portion to be shaded, taking care not to have any delicate margins exposed. After the investment is thoroughly set, the investment and inlay are gradually heated, either in the electric furnace, or by exposure to the flame of the gas blowpipe, until the very slightest indication of a glaze appears. The operator will then find that the shading metallic oxides are indelibly imprisoned in the glaze thus made.

I have merely set forth the various fundamental steps in this new departure in dentistry, very well aware of the fact that I have by no means exhausted the subject. There is much more to say, and much more that will be said, but I will not tire you longer by recounting the many possibilities which this new idea involves. There are many minds who will apply and concentrate thought upon this new idea, but I am convinced most thoroughly that this is an opening which I modestly offer to the dental profession which will, by process of evolution and through emulation become a useful addition to the knowledge and attainments of the years gone before.



Second District Dental Society.

Annual Meeting.

The annual meeting of the Second District Dental Society of the State of New York was held on Monday evening, April 10, 1911, at the Kings County Medical Library Building, No. 1313 Bedford Avenue, Brooklyn, N. Y.

The President, Dr. Ottolengui, occupied the chair, and called the meeting to order.

The reports of the various officers and committees were presented, and the same were received and placed on file.

President Ottolengui. In addition to what Dr. Hyatt, of the Committee on Public Health and Education, has told you, I would like to state that on account of my official position I have been in touch with the work of this committee, and especially have I noticed the unselfish and splendid work done by Dr. Nodine. I regret that Dr. Nodine is leaving us to take up his residence in Texas, and I think it would be a very pleasant thing if the Society would express its appreciation of his work, and bid him Godspeed.

Dr. Ash, of the Executive Committee, moved that a committee of three be appointed to draft a formal letter of thanks to Dr. Nodine as an expression of the appreciation of this Society.

The motion was carried, and the President appointed Dr. Ash, Dr. Hyatt and Dr. Van Woert.

Dr. Hyatt. We have started in Brooklyn, with the co-operation of the Board of Health and the Board of Education, to take a certain number of children who are defective in their dental organs, and put them in the hands of members of our Society—first we will take a report of their physical and mental condition, and then at the end of a year find out what improvement will

take place mentally and physically through having their mouths in perfect condition. Thirty-five members have agreed to take one or two children in their own private practice in their offices, and take care of those children's mouths for one year—treat them and put their mouth in good condition, and teach them to take care of their mouths. Any member who has not already handed in his name, who would be willing to do this, is invited to do so, and we think we shall get a very valuable report as a result of that work.

Dr. F. H. Nies then read the paper of the evening, which was entitled: "An Improved Porcelain Filling with Minimized Cement Line."

Discussion of Dr. Nies's Paper.

President Ottolengui. We have with us to-night two of the best authorities on porcelain in the United States and Canada. I ought to call on the man of highest authority first, but I do not know which is he. Neither do I know which of these men I love the most, but I do know the one I have loved the longest, and he has come the longest distance. I will ask Dr. Fred. Capon, of Toronto, to open this discussion.

I was introduced to Dr. Fred. Capon by Dr. William H. Atkinson, and at the time he said to me: "Here is a boy well worth knowing."

Dr. Fred. Capon, Toronto. I am certainly very much pleased to see you. It is a good many years since I have been with you—I think it was in 1887 that I first appeared before this society, with my confrère and dear friend, Dr. Ottolengui.

He has completely taken me off my feet by his opening remarks. I think they are rather too sweeping for my modest standing, but I assure you I appreciate it highly, and, as I have come a long distance, I appreciate it the more. I decided to come, especially because I had such pressing invitations from Dr. Ottolengui and Dr. Ash, who told me it would pay me to come, and I am thoroughly repaid by hearing this wonderful essay.

To discuss the paper is rather puzzling. Of course, it is entirely new to even a porcelain worker of my lengthy experience, as it is along new lines. When I was asked to come here, I was told it would be a big thing, but I did not realize how big.

I want to congratulate the essayist on his hard work, his excellent paper, and his ideas, and the splendid research he has made to find for

us a new method and a new matrix, wherewith we can get the results he is showing to-night, which are excellent.

We have always made a great deal of the wonderful discovery that our dear friend, Dr. Taggart, has made along the gold inlay line, and we talk of placing Dr. Taggart on a pedestal. I think that will have to be a double pedestal, because if, as gold workers, we have felt proud, now as porcelain workers we can feel proud again.

I am glad that porcelain has been taken up and an effort made to bring it back to the place it deserves, as I have felt during the last few years that those who have desired an invisible filling have slipped away from porcelain, supplanting it with the newer silicate cements. It is rather a pity that it should be so; because the difficulties of porcelain should be surmounted, so good are the results that can be obtained, if proper time be taken and the porcelain properly worked.

Dr. William Capon, Philadelphia.

I have great pleasure in taking part in this discussion, and I am glad to be one of the first to congratulate Dr. Nies on giving the profession something entirely new in porcelain, something nobody has done for a long while. It has already been said it is so new, and we have had so little opportunity of seeing and knowing what it is, that we do not quite know where we stand. I would also say that I think you ought to be proud to have a member of your society, who has given so much time to the subject, is such a student, and has gone into details in the chemical side in such a thorough way. I have often wondered if essay committees ever write essays, because it is such an easy thing for them to ask others to read essays. I have reached the point where I would like to condemn each member of an essay committee to write four or five papers before he ask anyone else to write one for his society. Therefore I highly appreciate what has been given to-night, because I have been through the mill, with all the trimmings off. I bow to this gentleman who is pre-eminent in the porcelain line, because he has done something which none of the rest of us has done, and which I could not do.

In regard to the real discussion of it, while he has reached a certain acme of clinical success, I am afraid there will not be a stumbling over the seats, or a grabbing for the process, at the same rate that there was when Dr. Taggart gave his great method to the world, because that was something that was universally demanded, and everybody wanted it. The only thing that prevented Dr. Taggart from being a rich man, and where he ought to be to-day, was that he was a little short-sighted, and did not have about five thousand machines at $100 each ready. You would all have bought one, and he would have been better off. (Applause.) However, that is not to the point.

All the students in this work will say the same thing, and as one said to me once when I read a paper before a society: "I wish to God I could make a true matrix; then I could do this beautiful work." That is the key to the situation in porcelain work—a large part of it, at any rate.

I cannot criticize, because the end justifies the means. I do criticize the way, because to gain this end requires a great deal of study and close attention to detail, although, of course, if you succeed in getting better results, that will be forgotten. In these busy days a dentist tries to do everything to cut off corners. The more he hustles the more he has to hustle, and he becomes a little awed if he has to spend several hours to gain a point, if it can be done more quickly.

Now this one-thousandth of an inch that the essayist mentions may be lessened, and I think the essayist was very lenient when he said one-thousandth of an inch. The cement line is often three or four times that, and perhaps I am not exaggerating when I double those figures again. I am perfectly satisfied to get a cement line no greater than one-thousandth.

There is only one other thing wanted, and that is a cement suitable not to show up at the joint—something translucent. We threw up our hats when we heard of one that we thought had the required translucency, but, of course, it was a myth.

One of the drawbacks in my mind in connection with this method is the fact that in making contours at different times, particularly central corners and tips, you are debarred from the trial in the mouth that is almost necessary with all of us, to know just what that contour should be, and I do not see how it is to be avoided. It can be in this instance, but it means the taking away of that matrix and making a new one; whereas with the older methods it did not mean any extra time.

The withdrawing of wax from a model, and from the natural tooth, particularly the anterior teeth, are two different things. It is a difficult thing to remove the impression wax from a mesial cavity in a central that extends labially and lingually. Unless you have a great deal of time, you cannot take it out. I think you would need to have half again as much space with the wax as for a metal matrix. I have seen this in wax contours as our students make them. They could not get them away without more separation, but with a metal matrix there would be no difficulty.

The essayist spoke of the use of carborundum disks. I am not very clear as to what No. 00 carborundum disks would do. I believe they are quite fine. I do not think there is anything in porcelain work that has done more harm for the beginner or the practitioner than the use of carborundum stones. If you use a carborundum stone, and run it rapidly, you roughen the porcelain. You cannot see this very distinctly, but you will

find the whole surface pitted if you examine it with a magnifying glass.

There have been more teeth cracked and more porcelain spoiled by this than almost anything else. In these days when carborundum stones are so popular, I am still a great believer in corundum stones.

Dr. F. T. Van Woert, Brooklyn.

I want to say in the beginning that I appreciate thoroughly the efforts made by this member of our society, and the magnificent work he has done in investigating and originating this new method of making porcelain fillings. I want to say, too, that the greatest thing he has achieved is the effort he has made to bring forth that which is of the most value to the dental profession to-day. It is a shame that porcelain has been dropped to the level that it has within the last six or eight years, because it does not deserve it, and when a man will give up the time for investigation, for elevating it and placing it on the pedestal where it belongs, as our essayist has done to-night, he has reason to be proud, and I congratulate myself that I am a fellow member of the society with him.

As you know, it is my nature to be contrary, and find fault, and I cannot quite agree with the essayist in all he has said. I am in the same situation as the two previous speakers; I have not had a fair chance to know whether I understand what he has been talking about, beyond believing in him because of my faith in the man and his sincerity in what he has been doing. I have confidence that it is all right. If I could have gone over this paper more thoroughly, I would have arranged a rather more intelligent discussion of it.

Warpage of Matrices.

He speaks in the early part of his paper of the burnishing of gold and platinum, or the swedging method. I think there is something to discuss there. I think it is a little misleading when he says the metal matrices will change every time, whether burnished or swedged. I believe a burnished matrix will change every time without exception, and I believe this because of a mechanical fact which is well known in manufacturing lines, for instance, let us consider this in connection with a spun or burnished fixture of any kind. Take the canopy on top of one of these lights; if that canopy be heated, not beyond the melting point, where it will change shape on account of the heat, but barely to the red heat, the molecular structure will have changed. While that is true of a burnished piece, it is not true of the swedged. We can prove this by taking an ordinary patty-cake pan, heat it to a cherry red and let it cool, and if it does not resume the same form as before, I will not talk about it again. A matrix made by burnishing is bound to change. That leads up to the question, "Which is the better method, the impression or the direct?" You know where I stand on that, and there is no use arguing

it; but we know we can make matrices of metal,—of platinum or gold,—where the warping is not appreciable, and we know even without this new system there is no excuse for you gentlemen not to use porcelain. If what Dr. Nies says is true, and I believe it is, you ought to be ashamed not to use porcelain.

The essayist said that the investment of a matrix does not prevent distortion during the fusing of the porcelain. If this is true, what is to become of our position with the gold inlay, understanding, of course, in the beginning that there is nothing perfect; a gold inlay, a cast gold filling has not yet been made that is perfect; nor a porcelain filling: nor will it ever be; but we are getting at an approximation of it, and to do that we must accept the best means at our hands.

Dr. Taggart's material, which some of us have had a little experience with, can be manipulated so that there is no appreciable change in it. Those who have tried that, in the investment of a matrix for the fusing of porcelain, know that the matrix will not change any more than a gold filling cast into the same material. The shrinking or warpage of the material is in proportion to the ability of the man who invests it. I would guarantee there are men in this room who can fuse porcelain into a metal matrix invested, and never change it so you can detect it with a differential micrometer. If it cannot be detected with that, why need we worry?

That is no reflection on the great work of Dr. Nies, but simply in reply to what has been said against the older methods. I am as thoroughly appreciative of what Dr. Nies has said as any man in this room. At the same time, I am thoroughly sick and tired of the knocking that has been given porcelain by a lot of people who do not know what they are doing. I would not be doing what I am to-day, if there were not some possibilities in it. I feel sometimes mad and sometimes sad and sorry for those who do not take advantage of the Godsend that is before them.

I will not discuss the question of the high or low fusing bodies, but there is another question that I can heartily agree with, and that is in regard to the use of vaseline or petroleum oil in cavities. I think it is difficult to get vaseline absolutely pure. I think we should keep it from the inner surface of the cavity, and that one of the essential oils should be used as a lubricant, one which would be beneficial and not detrimental.

Pyrometers Useless.

Further on he speaks of the necessity of a clay hood to protect the porcelain from the heat of the furnace, depending for fusing on the heat generated through the matrix itself. That goes back to the original method of Jenkins, when he used a platinum hood for the same

purpose, for fear of gasing. Dr. Nies does not fear gasing, or changing the color, but he uses it simply to get the heat through matrix, and he must therefore rely on a pyrometer. That is one of the things I take exception to. There are no two mixes of porcelain body that are alike. It makes little difference who makes it, you can go to the best manufacturers in the world to-day, and they cannot produce two lots that are alike. One lot will fuse at 1800, and from the same identical material the next lot will only make a perfect fuse at 1700 or 1900. Why do all the manufacturers throughout the entire world debar the use of the pyrometer? They know they cannot get a product that is uniform. Ask the men who spoke this evening, before me, with their vast experience. They will tell you the same story. There is only one way to tell whether porcelain is properly or improperly fused, and that is by the human eye. There is where so many have failed and cast aside porcelain fillings, and gone back to gutta-percha and the silicate cements, and such things, to save themselves.

Undercutting and Roughening Inlays.

The essayist describes his method of making undercuts in the inlays for the retention of the fillings. This I can hardly criticize, because anything that will tend to make that easier, and do away with the hydrofluoric acid in etching those surfaces, will be an advantage. I read a short article in the *Scientific American* some two months ago, which made me believe there might be a possibility of usefulness in an entirely different method, which I will give to you because I think Dr. Nies will be sure to try it, and with a man of his capability and resource, we will find out if there is any advantage in it.

There was a description of a sand-blast for the marking of bottles, labels, etc., for druggists, dentists, physicians or chemists. It was a little brass tube with a funnel at the end of it, and from the top ran another tube down to the opening of the orifice nearly—something like a Mellotte's blowpipe—the air passing through the center and throwing the sand out through a fine point. The statement was that the pressure required was only about four or five pounds to etch a label in glass in a few seconds. That portion you want to etch you throw the blast on, and turn it around just as though the glass were being ground with a wheel. If that is true, a very small instrument could be made to throw carborundum for etching a groove in the smallest inlay, without holding it in your hand, and I think you will be able to get something to relieve us of these very difficult methods of making a surface suitable for absolute retention.

I want to thank the essayist, and congratulate him. I want to congratulate the Society upon having a member of this kind.

Dr. Charles Ash, New York.

You can understand perhaps something of the effort it was for the Executive Committee to keep this method a secret, as it were. The real reason for not divulging the nature of the paper and the name of the essayist sooner was that however long the time may be to a man who is getting up something that is new, it is always far too short for the way he would like to prepare it, and Dr. Nies told me no later than a week ago that he wished he might have three weeks longer instead of one, in which to complete his work to present to you to-night.

Dr. Van Woert said he was proud to be a member of a society that numbered Dr. Nies among its members.

Dr. Will Capon said he was glad to see a member of an Executive Committee who had gone through the process of writing a paper himself. Now, gentlemen, I am proud to have been the chairman of the committee —one of the members of which has presented something to you that was worth while hearing.

While I did not present a formal report to the meeting, it seemed unnecessary, due to the fact that all of the members know of the work that has been done thus far this year, and if you will stop to analyze it, you will recall that in every instance every paper you have had this season has been along absolutely new lines on various subjects. If there is one thing that is newer than all the rest, it is this last paper, and I believe we are to be more than congratulated in having Dr. Nies prepare it for us.

Nobody can realize the amount of time Dr. Nies has put into this work, and I do not believe you would credit the story were I to tell you the amount of money he has spent. It is really hard coin of the realm that has gone into this, as well as hard work.

I do not feel any more competent to discuss the paper than the gentlemen who have preceded me, but there are a couple of points I want to ask about. How does Dr. Nies remove the wax impression without distortion, without the use of the cup?

Another thing is in regard to the addition of wax. After wax has been forced into the cavity, and it is necessary to add more wax, is it necessary to apply sufficient heat to melt the wax already there, or can it be made sufficiently sticky by a slight amount of heat, so that the added wax will adhere to that taken from the cavity?

He speaks of varnishing the matrix with gutta-percha up to the cervical margin. I presume he means not quite to the margin.

Dr. Nies. Right up to the edge, not covering it.

Dr. Ash. If he re-varnishes with the gutta-percha, what becomes of the gutta-percha that is put in the first time? Is it burned out, or what becomes of it? Or did I misunderstand him?

Dr. Nies. It is carbonized. As to how I remove the wax, I take a piece of German silver or celluloid, double it and load it with rubber; I pass this between the teeth and draw its large end against the lingual surface of the tooth to shape it. I remove and then insert my wax, which I separate with a thin steel blade passed directly through it. Into this separation I reinsert the German silver or celluloid loop, rotating it to mold my wax in the cavity. In the movement I do not remove all the surplus, and as the wax chills I have sufficient to continue the forcing process. That gives me a film of wax over all margins. If there is too much, I cut it off. I then take it out and put it on a clean sheet of wax, whose surface is softened. I allow it to sink into that and cool. Then I invest it. I do not varnish my cavity. I varnish outside of it. I do not varnish the inside of it with this solution of gutta. My idea is to keep the porcelain from sticking to my mould, because if it does the shrinkage will crack my inlay. I try to keep my porcelain inside of my mould—never over the edges, but always flush to them.

Dr. Ash. Another point was the possibility of removing the inlay from the matrix and re-investing it. I presume that meant re-investing it in a new investment of the same nature.

Dr. Nies. Reinvestment is easily done.

Dr. Ash. Another point was the possibility of incorporating pins into the porcelain. It is an extremely difficult thing in making inlays with the matrix method, to put pins where you want them, and keep them there while you are baking. I can see how, with this method, it would be easy to obviate those difficulties.

I want to again thank Dr. Nies, and congratulate him.

Dr. Nies. I greatly appreciate the many kind words and kind criticisms that my paper has received. I realize that this is but a beginning—that no invention when first put on the market is perfect. All must necessarily go through a process of evolution. There is with this method the objection that it takes time; but while it takes time, I cannot help feeling that the results are more positive, especially for those who are not experienced porcelain workers. To those who have not followed porcelain closely, it will be a help.

Dr. Capon spoke of the difficulty of taking impressions of compound cavities. By compound cavities I would understand a cavity that extends from the lingual to the labial, on the approximal surface. There are cups invented by Dr. Van Woert and Dr. Price for that purpose. They are sectional cups, and I have one mounted on the board, which I passed around. There is no great difficulty in taking those impressions. One section is taken of the upper portion, and one of the lower. Sometimes it is almost easier to remove them with the space the cup seems to take up.

Dr. Capon spoke of the carborundum stones. I had simply in mind the use of them in mounting, not the cutting of the inlay. I always wet my carborundum stones. I never attempt to use them dry.

Dr. Capon. You mean for the final setting?

Dr. Dies. Yes.

Dr. Capon. Oh, that is different. I did not have that in mind. I thought you meant during the fusing.

Dr. Dies. Dr. Van Woert spoke of the use of the pyrometer, and his inability to depend upon it. As a matter of fact, I do not depend on it, but I like to use it. I find I can heat my case more gradually. It is a guide to me, but I should not hesitate in porcelain work to open my furnace at times and look at my porcelain. The pyrometer is simply a guide to me in heating up. It is also a guide where I use the oxyphosphate cement, where the melting point is very low, and I do not think the eye is quite accurate enough to let me know when I reach the danger point. I have depended in such cases on my pyrometer, and it has carried me safely through.

I thank you again, gentlemen, for your many kind expressions.

A hearty vote of thanks was unanimously extended to the essayist, and the meeting was then adjourned.

Central Dental Association of Northern New Jersey.

Discussion of Dr. Welden's Paper.

Dr. Straussberg. When I first heard of the casting of porcelain, I was very much surprised, and scarcely believed that it could be done. Since then I have seen some demonstrations with this new material, and, after due consideration, I believe that with some improvements the dental profession will have a very suitable filling material, especially for posterior teeth. But to those who are over-enthusiastic in every new venture, I would like to say that the methods of using porcelain now in vogue should not be abandoned as yet.

The two main advantages of porcelain are its texture and color re-

sembling tooth structure, and the fact of its being a non-conductor of heat, cold and electricity.

When a tooth is presented to us with the enamel remaining only, we can very readily see that the enamel is a colorless substance, and any color put under will be seen through the enamel; therefore, it is a physical impossibility to blend colors suitably on the surface of any porcelain. We can only modify it in this manner. The blending of colors can be done best in layers in that part of the porcelain representing the dentine. Therefore, porcelain, as presented by the essayist in its present state, is not suitable for the anterior teeth.

The essayist stated that the chemical difference between porcelain and glass is very slight. This holds good mainly with low fusing porcelain. If you take a high fusing porcelain, it contains 82 per cent. of feldspar, 13½ per cent. of silex and 4½ per cent. of kaolin, with potassium carbonate (glass) as a flux. That means the more flux we use, the lower the fusing point, and the greater resemblance to glass.

A very interesting idea was brought out this evening, in reference to the annealing of porcelain. I certainly agree with the essayist on this point. Slow and repeated annealing and gradual cooling, makes a very tough porcelain.

If you have fine china or glassware, and would like to avoid the chipping or easy breaking of it by the careless handling of the servants, you can readily improve it by placing your china in cold water, gradually heating it to a boiling point, and keeping it there for a while, then cooling slowly.

Having been unable to obtain a copy of this paper in due time, I have not been able to test the strength of this material, but if it has the strength the essayist claims, it is certainly an ideal filling for posterior teeth, being a non-conductor, while the exact shade is not of importance in that location. A few words of warning as to the danger of using large cast gold inlays in living teeth may not be out of place. A tooth with an approximo-occlusal cavity needs a good deal of cutting for the mechanical retention of a cast filling. A good deal of cutting means quite some irritation and a large bulk of gold. An irritated tooth and a large mass of gold do not agree very well, and I can assure you that in the near future we will have a great many dead pulps, due chiefly to thermal changes.

If we could have a material without these faults, and, at the same time, be capable of restoring lost tooth structure with such simplicity and perfect adaptation, and which would still withstand the stress of mastication, we would certainly be greatly benefited, and for this idea brought to us to-night, I would like to ask the essayist to accept my sincerest thanks.

Dr. Weinstein. I will discuss a few points that Dr. Weldon perhaps did not impress on you strongly enough.

Within the past three days I have come to the conclusion that we must, under no condition, use more than twenty-five inches of protracted vacuum; that is, pump up your machine twenty-five inches, cast your porcelain and keep your blowpipe on it. If you have a really good machine that holds up its suction well, it will stay between twenty-five and twenty-two inches, for over a minute, so that you have time to lay your blowpipe down and keep pumping up the machine. If the machine is not good, you must have an assistant, but the idea is that you must keep it for a full minute at a range of twenty to twenty-five inches, and then you will succeed.

As to the amount of porcelain needed to make a casting, I have found that one pennyweight exactly works very satisfactorily. So I would weigh out a pennyweight of porcelain, and then put on a piece about the size of your wax pattern, and that will be about right.

You probably have noticed the remarkable fit of the porcelain in the models that have been shown. That is accomplished by protracted pressure. The same protracted pressure applied to low fusing metals, such as aluminum and other alloys, which contract considerably less than gold, causes shrinkage.

In porcelain, when you are protracting the pressure, you are constantly pushing down more and more porcelain, because it does not run fluid, as a metal would.

In reference to cleaning and polishing of the inlay, I believe, in course of time, that Dr. Welden will have a perfect polishing material, although at present even that which he has seems to work well. I think it is a good plan to wash the inlays in soap and water, and boil them.

Some of the specimens I have made are not good, because they have dirty spots in them. That is entirely due to uncleanliness. The wax must be absolutely clean, or it will deposit dirt in the mold, which the ordinary gas burner will not burn out. These spots are not due to the porcelain, but to the dirt in the mold.

Dr. S. C. G. Watkins. I cannot add anything to what has been said, but I have been a very interested listener, and I believe that Dr. Welden has brought out one of the greatest things that has been presented to the dental profession in a long time, and I feel that the C. D. A. should be very proud in being the first society to which this has been presented.

We have been trying for a long time to get something to look natural and approach nature, which is not a conductor as the metals are, and it

does seem that Dr. Welden has just about found it. The work he has presented here is simply wonderful.

I shall watch the progress of this new method with a great deal of interest, and if ever I get to the point where I can make one of these beautiful fillings, I believe that I shall want to retire from dentistry, and rest on my laurels then and there.

I thank Dr. Welden for bringing this great news to us, and again congratulate the society as being the first to witness and hear it.

Dr. Brinkman. I have listened with a great deal of attention to the paper, and I think it one of the greatest discoveries in dentistry that has been made in a long time.

I wish to ask whether it can be done in a centrifugal machine.

I think the C. D. A. is very much honored in having this paper and clinic, and I congratulate the society, and believe the members who have not attended have lost something they will always regret.

Dr. Hahne. I was particularly struck at the clinic this afternoon, with the extreme hardness and density of this porcelain, which I regard as one of the principal advantages of this system.

As an inlay perhaps it does not make so much difference whether we have that density, but when it comes to building up an artificial crown it is an advantage par excellence. Any crown that must be built up with a metallic base on the root, under the old system, does not show enough strength, but with this porcelain we can use it anywhere without having any fear of a breakdown.

Dr. Brinkman. There is another thing that interested me very much, and that is the subject of annealing porcelain.

I do not know whether the members are familiar with the methods by which malleable iron is annealed. When it is first cast it is very brittle, and is put in a box with certain chemicals and kept at a certain temperature for two weeks, and then allowed to cool down. It thus obtains its malleability, and I see the same principle is carried out in the essayist's idea of annealing this porcelain; and I think it is a good idea.

Dr. Woolsey. Is it possible to use this material in a Taggart machine?

Dr. Welden. I desire to thank Dr. Straussberg for the conservative and scientific way in which he discussed this paper. He seemed to be a little bit doubtful as to how the porcelain would look in the front teeth, and I want to point

out a little step in the evolution of this porcelain. When I first made it up I had this material (indicating), which is not translucent, but nearly opaque. When I attended the Albany convention, where I gave a table clinic, I had in mind then its faults, and I thought I knew how to correct them. My deductions were correct, and when I came back I put them in operation, and in a very short time I had a very different substance in the translucent material that you see here to-night. You can put it in the front of the mouth, and you can have just as many colors as you have in any other porcelain. This is done by the application of the metallic oxides, and you can obtain a restoration in the front of the mouth that will probably be better than anything you ever saw before in dentistry.

The question of high and low fusing is one confined to the old method of using porcelain, and I do not think it can be considered with this new method. The fusing point is not a question at all, because when you cast porcelain you obtain the density required.

Dr. Weinstein spoke about cleaning the porcelain with soap and water. The way I clean it is to put it in a copper basket, and very quickly dip it into hydrochloric acid, then put it in cold water, and brush off the little white scum that is upon it, when it is absolutely clean.

This scum, in my opinion, comes from a generation of carbon monoxide, and that is the reason we reduce the silica to a minimum. Of course,, we must have plaster of Paris, but the moment that is subjected to high heat there will be a throwing off of the silicate gases arising from the heating of the plaster of Paris. I do not think the porcelain itself boils. It is merely the escaping of the gas from the investment coming up through the porcelain. This only indicates that the porcelain is heated enough to cast.

As to the use of the Taggart machine, Dr. Weinstein has succeeded in casting inlays with a Taggart machine, but not with the nitrous oxide flame. He used the oxyhydrogen flame, because the excess of oxygen you have in the other flame is never consumed, and you burn out the color in the porcelain.

Dr. Weinstein, as I understand, used a blowpipe, with as little oxygen as possible, fusing the porcelain down and casting it with compressed air. That means that he did not use the nitrous oxide that comes out of the cylinder attached to the Taggart machine.

I cannot emphasize too much the idea of annealing, because I believe that will prove to be the salvation of the casting proposition as it relates to porcelain.

I do not think this process can be used in a centrifugal machine. I have not tried it personally myself, but others have, and have reported failure.

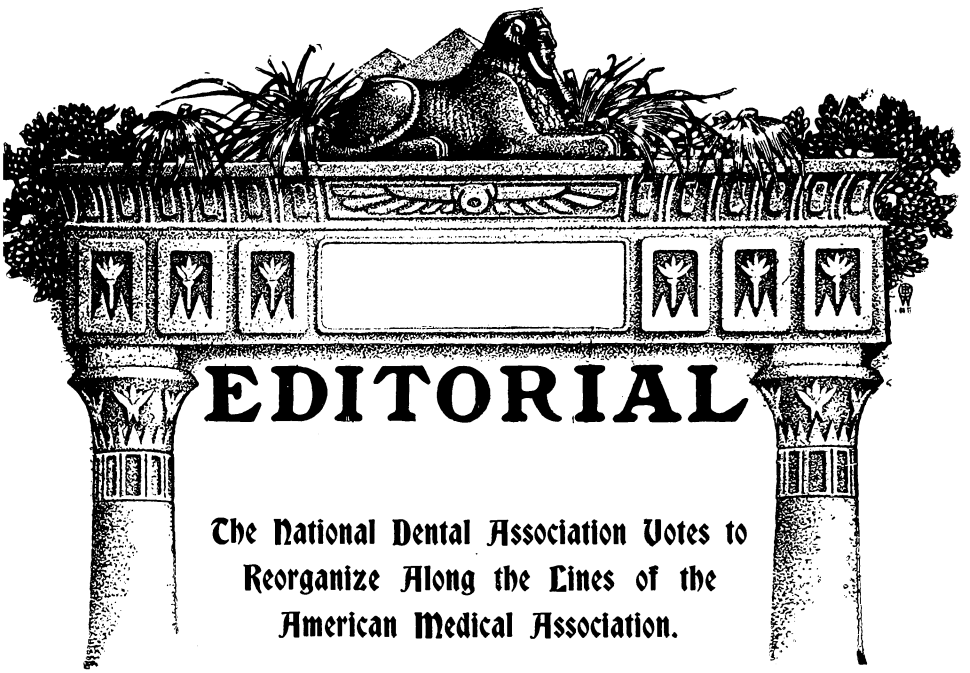
Dr. Straussberg. My reason for not using it in the front teeth is that this porcelain contains but one color, and one color you cannot blend.

Dr. Welden. You will find the cutting edge of a tooth is almost always a monotone, but up at the neck there are blends.

Those who desire to overlay their colors may do so in the following manner. After making the wax pattern, take a sharp knife and cut away the upper two-thirds of the labial surface. The pattern may then be invested and cast in the lighter shade. The part of the wax that was cut off may then be replaced on the cast inlay, and again invested and cast, this time using a darker shade.

Dr. Straussberg. Do you get a good union of the two casts?

Dr. Welden. Yes, the union is perfect.



EDITORIAL

The National Dental Association Votes to Reorganize Along the Lines of the American Medical Association.

At the meeting of the National Dental Association, recently held in Cleveland, the subject of paramount interest was the disposition of the vexing question of alteration of the constitution. At the Boston meeting, in 1908, a Committee on Revision of the Constitution was appointed, and to this committee was referred a draft of a constitution compiled in conformity with that of the American Medical Association. At the next meeting, held in Birmingham, this committee reported a revision of the existing constitution. This report was laid over for one year. Between the Birmingham and Denver meetings the secretary, Dr. Brown, conducted a correspondence with the secretaries of State Societies, asking the State Societies to express their wishes in regard to the National. Dr. Brown's report, given at Denver, was most unsatisfactory, few State Societies having evinced much interest in the National. The subject, therefore, was laid over for another year, and each State Society was requested to appoint and send a delegate, who should meet with the Revision Committee, and as far as possible inform the committee as to the wishes of his society.

Joint Meeting.

The joint meeting of the Committee on Revision and the State Society Delegates was held at the Hollenden House on Monday, July 24th, one day prior to the convening of the National. The meeting was fully attended, a gratifying number of delegates being present, twenty-four State Societies being represented.

The two propositions, revision of the old Constitution and complete reorganization, were presented in detail, and then the chairman, Dr. Patterson, called upon each delegate in turn to speak for his home society. Thus a very broad and full discussion shed much light upon the situation, so that in the end the Revision Committee was well acquainted with the situation throughout the country. At the termination of this discussion it was

Resolved, That "It is the sense of this meeting that the National Association be requested to reorganize along the lines of the American Medical Association." This was adopted, the representatives of twenty-two States voting for it, and only one against, one being absent.

Committee Meeting.

In the afternoon the Revision Committee met, and again discussed the situation. In view of all that had been stated by the delegates, it was readily determined that the National Association could do no more than express a willingness to accede to the request of the delegates to reorganize, but that such reorganization must necessarily depend upon the co-operation of the State Societies. It was therefore decided to revise the Constitution which had been presented at Boston, making it conform as nearly as possible with the status as disclosed at the conference with the delegates, and then to recommend that the Association send a draft of this Constitution to each State Society, inviting it to make application for Constituent Society Membership. This was done, and this revised draft of a constitution was presented to the Council and to the Association, with the result that the Council recommended, and the Association adopted the following resolution:

Reorganization Resolution.

"*Resolved,* That in accordance with the expressed wish of the State Society Delegates to the meeting which considered the alteration of the con-

stitution, the National Dental Association will reorganize along the lines of the American Medical Association;

"Resolved, That a draft of the Constitution, drawn in conformity with the above, be printed and forwarded to the State Societies, with the request that such as may desire shall make application for Constituent Membership at the next meeting, stating how many members they can guarantee;

"Resolved, That if properly supported by the State Societies, the Constitution and By-Laws be finally revised and adopted at the next meeting, the same to take effect at the meeting of 1913."

The Present Status of the Reorganization.

There were some who chafed at the seeming delay in finally accomplishing reorganization. These gentlemen have not fully studied the situation. The State Society Delegates voiced their views, but a number of them expressly declared that they could not bind their Societies to union with the National until after a Constitution of some kind had been at least tentatively adopted. Therefore, it was essential to move cautiously. The Constitution (presented elsewhere in this number) has not been finally adopted; consequently those Societies which conclude to join as Constituent Members will have opportunity at the next meeting to suggest such alteration in language or plan as they may desire. Moreover, it is manifest that no "House of Delegates" could be convened until such delegates had been elected, and no such elections could occur until after the State Societies had actually become Constituent Members of the National Association. Thus 1913 is the very earliest date at which a meeting of the reorganized association could be held.

Changes in the Proposed Constitution.

The changes in the constitution proposed at Boston may be seen by comparing the present draft, published in this issue, with that which was printed in ITEMS OF INTEREST for September, 1908. The chief alterations will be here pointed out for the convenience of our readers.

The original constitution followed the plan of the American Medical Association, and provided that any member of a constituent society would be eligible for membership in the National body, but such membership

was not made compulsory. On the other hand, dues in the National body were set at $5 annually, as at present, and as it is in the American Medical.

During the expression of views by the State Society Delegates, it was made very plain to the Revision Committee that no great number of dentists can be made to join the National, paying $5 dues, even though a journal were included. The general consensus of opinion was that $2 would be the limit of what could be collected. On the other hand, while the representative for Massachusetts, New Hampshire and Vermnot thought that these three Societies, with a membership of about one thousand, would join in a body, other delegates could not state how many members could be guaranteed, even at $2 per year, journal included.

This was the problem which the committee had to solve. Much criticism has been made of the fact that the present National has but 800 members. But 800 members, paying $5 per year, gives the Association an annual income of $4,000. No reorganization scheme would be a sound business proposition which reduced this income. At $2 per year, 1,200 new members must be added to the present 800 to maintain even the existing income. Moreover, if the journal be started, the Journal Committee should have $1 per year per member, to be placed on an equal financial footing with the other dental journals. This means that we must have 3,200 new members. These, with the 800 which we already have, would pay into the treasury $8,000 per year, of which one-half should go to the Journal Committee, leaving a balance of $4,000, only about what we now have in cash.

But, of course, we would have a larger and more powerful organization, and a journal of our own. These are the cold facts, and the Revision Committee has presented tentatively a plan which, it is hoped, may prove efficacious. The dues have been set at $2, but the Constituent Societies are asked to guarantee to the National at least two-thirds of their members. Of course, this guarantee of two-thirds may be reduced to one-half; or the guarantee may be omitted altogether, provided the State Societies, when applying for Constituent Society Membership, can at the same time offer to the National a membership large enough to make the reorganized association financially as prosperous as at present.

Organization of Constituent Societies.

Another stumbling block for some State Societies was the fact that the proposed constitution exacted that Constituent Societies should be organized in conformity with the plan of the National, or along the lines of what has come to be better known as the Illinois Plan. Notwithstanding the fact, therefore, that numerous State Societies have already reorganized after this manner, the committee deemed it wise for the present to eliminate that section, and consequently State Societies may become constituent members without reorganizing their constitutions.

Other Changes.

Two other changes of importance were made. At Denver one evening meeting was given over to the subject of Oral Hygiene, and a deep impression was made, those in attendance noting the great success which was achieved by holding a meeting at which the general public was admitted. No better nor more dignified method of educating the public can be devised. The similar meeting, held at Cleveland, at which the experiments with the Marion School class were reported, and the class itself exhibited, impressed the Revision Committee with the wisdom of elevating this work to a position above that of a mere committee. A new section, Section IV, was therefore provided for, said section to have charge of "Public Oral Hygiene."

As there had been much discussion in the South as to what would become of the Southern Branch, in case reorganization were effected, this doubt was effectually eliminated by definitely providing for the continuance of the present Southern Branch.

The committee have thus far only presented a revised Constitution. Much work remains to be done to have the by-laws in proper shape for adoption at the next meeting, but now that the Association has taken definite action, the committee will certainly complete its work in time for final vote at the meeting which will be held in Washington, in September, 1912.

New Constitution for the National Dental Association.*

Proposed at Boston, by R. OTTOLENGUI, and referred to Committee on Revision of Constitution and By-Laws. Revised by the Committee and reported to the Association at Cleveland.

ARTICLE I.—*Name.*

The name of this organization shall be the National Dental Association.

ARTICLE II.—*Object.*

The object of this Association shall be to promote the art and science of dentistry. To achieve this the Association shall endeavor to unite the dental profession of the United States into one compact body, thus creating a power the units of which, working with a harmony of purpose, will foster fraternal relations and intercourse among dentists; safeguard the material interests of the profession; elevate the standards and improve the methods of dental education; secure the enactment and enforcement of just dental laws, while aiming at a unification of State dental statutes, and enlighten and direct public opinion in relation to oral hygiene, dental prophylaxis, and advanced scientific dental service, to the end that dentists and dentistry shall be held in higher esteem in the community.

ARTICLE III.—*Membership.*

The membership of this Association shall consist of the present members, and such members of the Constituent Associations, and such members of the Army Dental Corps, and of the Naval Dental Corps (when established), and such others as shall be elected in accordance with the By-Laws, as hereinafter provided.

ARTICLE IV.—*Constituent Societies.*

SECTION 1.—State and Territorial Societies which have, or which hereafter may, become organized in conformity with the general plan of the National Dental Association, and which have declared their allegiance to said National Association, and which shall agree to the formation and perpetuation of the House of Delegates, shall be recognized as Constituent Societies. Each Constituent Society shall maintain a membership in this Association equal to not less than two-thirds of its own membership.

SECTION 2.—The term "State Society" shall be understood to mean the representative dental organization of any one of the States which have been received into the Union, and whose active membership is restricted to legal practitioners practicing within the legal borders of such State. The term "Territorial Society" shall apply in similar manner to the representative dental organization of any of the territorial possessions of the United States. Provided, however, that the term "Terri-

*Compiled and adapted in conformity with the Constitution and By-Laws of the American Medical Association.

torial Society" shall be held to include the societies of the District of Columbia, of the Canal Zone, and of the insular possessions of the United States.

ARTICLE V.—*The House of Delegates.*

SECTION 1.—There shall be a business body known as the House of Delegates of the National Dental Association. It shall consist of delegates elected by the Constituent Societies, and by the other dental bodies named in Section 2 of this article. The House of Delegates shall represent the delegated powers of the members of the National Dental Association, and shall be the national representative body of the Constituent Societies. It shall elect the general officers of the Association and a board of nine trustees, and shall transact all the business of the Association, public, professional, or scientific, not otherwise provided for. The trustees shall be members of the House of Delegates, without the right to vote.

SECTION 2.—The total voting membership in the House of Delegates (exclusive of the Board of Trustees) shall not exceed fifty, but may be less if equitable apportionment should demand. One delegate shall be allowed from each scientific section, and from each of the following: American Society of Orthodontists, National Association of Dental Faculties, Association of Dental Faculties of American Universities, National Association of Dental Pedagogics, National Association of Dental Examiners, the Army Dental Corps, and the Naval Dental Corps (when established); and the remainder shall be apportioned among the Constituent Societies, as hereinafter provided in the By-Laws.

ARTICLE VI.—*Sections.*

SECTION 1.—This Association shall be divided into four sections, as follows:

Section I shall have charge of operative dentistry, nomenclature, literature, dental education and allied subjects.

Section II shall have charge of oral surgery, anatomy, physiology, histology, pathology, etiology, prophylaxis, materia medica and allied subjects.

Section III shall have charge of prosthodontia, orthodontia, metallurgy, chemistry and allied subjects.

Section IV shall have charge of public oral hygiene.

SECTION 2.—New sections may be created, or existing sections discontinued or modified by the House of Delegates.

ARTICLE VII.—*Branches.*

In addition to the existing Southern Branch the House of Delegates may create such branch organizations as may be deemed essential to the welfare of the National Dental Association and of the dental profession.

ARTICLE VIII.—*Annual Sessions.*

The National Dental Association shall hold an annual session at the time and place chosen by the House of Delegates. The time and place for the session, however, may be changed by the unanimous vote of the Board of Trustees, but not later than sixty days prior to the time selected for the session.

ARTICLE IX.—*Officers.*

SECTION 1.—The general officers of the Association shall be a president, three vice-presidents, one from the East, one from the West, and one from the South; a general secretary, a recording secretary, and a treasurer.

SECTION 2.—These officers shall be elected annually by the House of Delegates, to serve for one year, or until their successors shall have been elected and installed.

SECTION 3.—No member of the House of Delegates shall be eligible to the office of president or vice-president.

ARTICLE X.—*Board of Trustees.*

SECTION 1.—The Board of Trustees shall have charge of the property and of the financial affairs of the Association.

SECTION 2.—Three trustees shall be elected annually by the House of Delegates, each to serve for a period of three years.

SECTION 3.—No voting member of the House of Delegates shall be eligible to election on the Board of Trustees, but the Board of Trustees after election shall be members of the House of Delegates, without the right to vote.

ARTICLE XI.—*Dues and Assessments.*

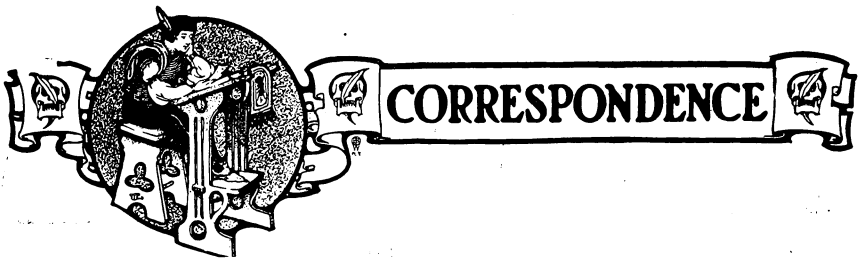
SECTION 1.—The annual dues in this Association shall be two dollars.

SECTION 2.—Members of the Army and Navy Dental Corps may be elected to full membership, with all privileges, without payment of dues.

SECTION 3.—In case of need, in order to raise funds, the House of Delegates may order an assessment not to exceed two dollars in one year, for each member; or an assessment not to exceed fifty dollars in one year upon each Constituent Society, but not both.

ARTICLE XII.—*Amendments.*

The House of Delegates may amend or alter this Constitution at any annual session, due notice having been given at a previous meeting of said annual session, provided unanimous consent may be obtained. Otherwise all amendments must lie on the table until the annual session next following their introduction, at which time a two-thirds vote will be requisite for their adoption. In the latter procedure due notice of the substance, or if not too lengthy, the exact wording of the proposed changes must be sent to each member of the House of Delegates with the regular notice of the annual session.



An Open Letter to My Friends of the Dental Profession.

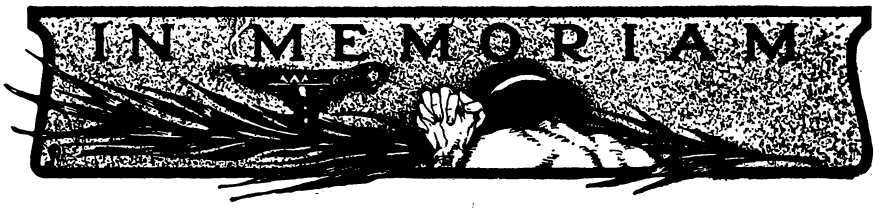
Editor ITEMS OF INTEREST:

I must take this means of thanking my friends, both far and near, for their splendid present given to me at the supper of the Kansas State Dental Association, June 7, 1911, at Topeka, Kansas, and to express my appreciation of their generosity and the love and esteem which prompted the action. It was a royal gift and royally bestowed! However unworthy I may deem myself of this magnificent demonstration, I cannot but accept it in the sweet and loving spirit in which it was given. It will gladden the rest of my life to its latest day, and I will bear the participants in my "heart of hearts" in sweetest remembrance.

Again thanking all my friends, I am

Sincerely yours,

ALTON HOWARD THOMPSON.



Dr. James E. Power.

Resolutions Adopted by the Rhode Island Dental Society.

WHEREAS: This Society has heard with feelings of sincere sorrow of the death of one of our esteemed members, Dr. James E. Power, it is hereby

Resolved: That in the death of Dr. Power this Society has lost a member whose untiring devotion to his chosen field won for him a foremost place among the men of his profession. With an energetic temperament calling for progress in his life-work, he labored on, without thought of self, and though his young life was taken from us all too soon, his efforts for his profession should stand as an example to all young men in the field of dentistry. And be it further

Resolved: That this Society extend to his bereaved family its sincere sympathy, and a record of the same be spread upon our minutes.

JAMES E. HEAP,
JOSEPH E. FARNUM,
PRESTON B. WHITMARSH.
Committee appointed by R. I.
Dental Society.