

Interrupterless
X-RAY TRANSFORMER
No. 2



The Universal
Equipment

Instructions for Installing and Operating
**The Fischer No. 2 Interrupterless
X-RAY TRANSFORMER**

"The Universal Equipment"



Manufactured by

H. G. Fischer & Co.

Physician's and Dentist's Electrical Equipment

**2341-43 Wabansia Avenue
CHICAGO, ILL.**

THE UNIVERSAL EQUIPMENT

This equipment, as usually shipped, consists of five (5) pieces, as follows:

No. 1—1 Crate Cabinet, in which is mounted the Motor and Rectifying Wheel, Transformer, and all regulating devices including Rheostat, Switches, etc.

No. 2—1 Box Accessories: Plates, Lead Box, and all Dark Room supplies.

No. 3—1 Box Tube Stand Parts.

No. 4—1 Crate Pole for Tube Stand.

No. 5—1 Bale Tripod for Tube Stand.

Carefully unpack boxes and crates and check *each item* on the following sheet. Report any shortages at once, unless *not checked* (items *not checked* are *not included* in the order), and we will give same prompt attention.

In case of damages to Cabinet or parts, due to careless handling by the transportation companies, please have their representative go over the outfit with you, and send us a "Bad Order Receipt," to enable us to put in proper claim.

Complete Transformer Equipment No. 535 consists of:

1—No. 2 Transformer, the "Fischer Universal Machine," with all necessary Connecting Cords, Regulating Devices, Milliampere Meter and Instruction Booklet.

3—No. 528 Cord Reels.

1—No. 1005 Fischer Tube Stand.

1—No. 1010 Lead Glass Dental Cone.

1—No. 997 7" Tungsten Target Transformer Tube.

1—No. 1020 Calcium Tungstate Fluoroscope, in Lead Protected, Light Proof Holder.

1—No. 575 Lead Lined Plate Chest.

1—No. 1600 Electric Dark Room Ruby Lamp.

3—No. 1605 8" x 10" Steel Enameled Developing Trays.

1—No. 1659 Dozen 8" x 10" X-Ray Plates.

1—No. 1542 Dozen Sets X-Ray Envelopes.

3—No. 1640 Packages Dental Films.

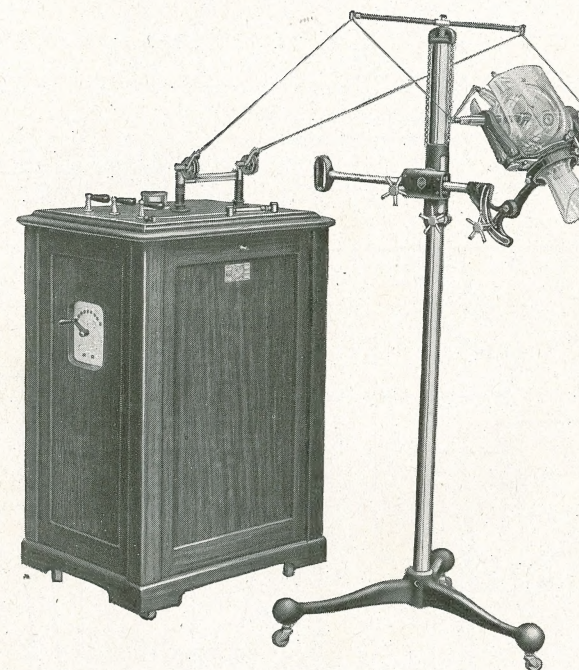
3—No. 1609 Porcelain Developing Bowls.

3—No. 670 Packages Fischer Developer.

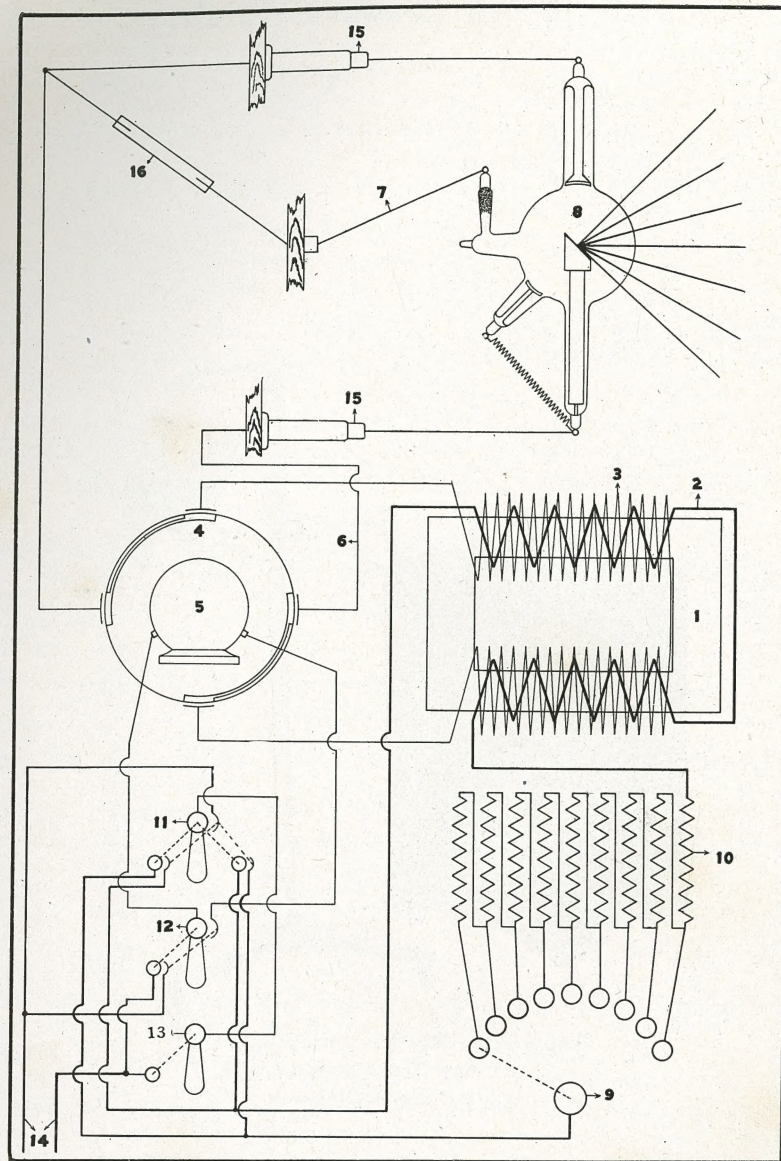
1—No. 1623 Package Fischer Hypo Fixer.

WIRING TO LINE The No. 2 Fischer Transformer is constructed to operate on the 220 Volt A. C. Line, 60 Cycles, Single Phase. To obtain full efficiency the service wires should be size No. 10, or if the city supply transformer is more than 200 feet away, No. 8 wires should be used. Certainly the outfit will operate on considerably smaller wires, but not to full capacity.

These wires should terminate at a double pole, single throw knife switch, fused for 30 Amperes, and mounted on the wall as near to the machine as possible, and about five feet from the floor. The flexible cable supplied should be connected directly to this service switch, and, with the stage connector, to the Cabinet. It is always advisable to consult some authority at your electric supply station on wiring of this character.



The Fischer No. 2 Interrupterless
X-Ray Transformer
"The Universal Equipment"



Explanation of Numbering on Wiring Diagram

- | | |
|----------------------------------|------------------------------|
| 1—Transformer Iron Core. | 9—Rheostat Controller. |
| 2—Transformer Primary Winding. | 10—Rheostat. |
| 3—Transformer Secondary Winding. | 11—Pole Changing Switch. |
| 4—Rectifying Wheel. | 12—Motor Starting Switch. |
| 5—Synchronous Motor. | 13—X-Ray Switch. |
| 6—Positive High Tension Circuit. | 14—220 Volt Line Wires. |
| 7—Negative High Tension Circuit. | 15—High Tension Terminals. |
| 8—X-Ray Tube. | 16—Vacuum Regulating Device. |

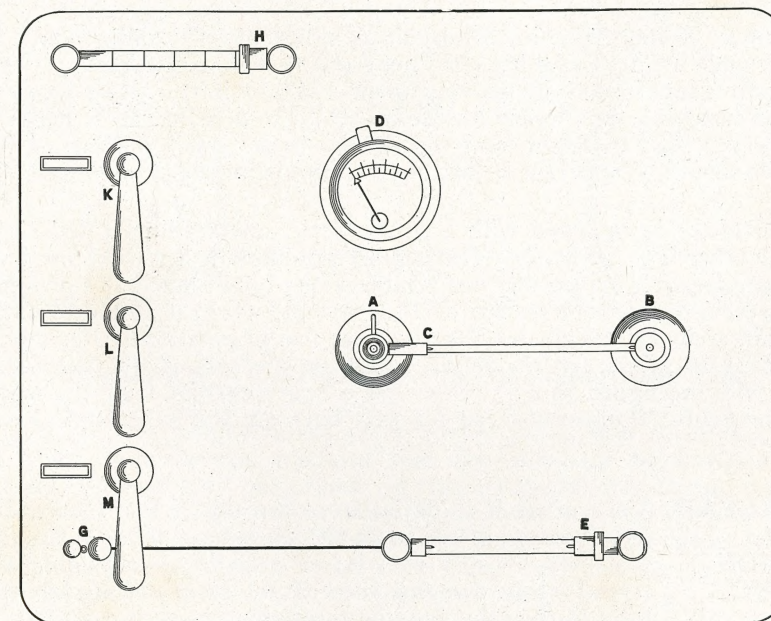
The Synchronous Motor used in this outfit requires only the usual amount of care given an ordinary fan motor. The bearings are fed lubricating oil by means of wicks saturated with any good thin oil, through the small openings at the top. These openings are protected from dust and grit by means of small caps supported by springs; depress these caps with the end of the oil can spout when lubricating.

The motor should be oiled, for the first months, about every two weeks, and after that time, when the bearings have worn together fairly well, oiling once a month should be sufficient.

The Rectifying Wheel, consisting of one plate of Micanite, will require no attention whatever, as same is pinned and screwed directly to the shaft of the motor. There will be no danger of this ever slipping from its proper position.

The Rheostat is wound on heavy asbestos tubes, and entirely encased in iron; needs never have attention.

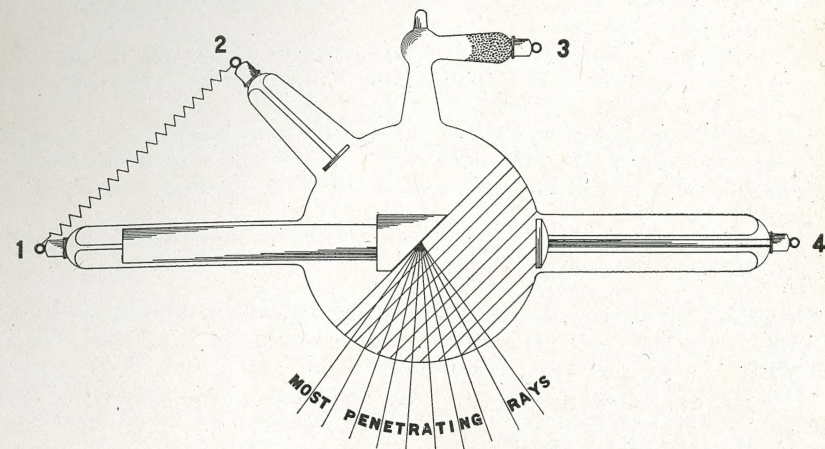
TO OPERATE Refer to drawing: Set Cord Reels in tops of posts "A" and "B." Have lever "L" set on point 1, marked "Weak." Be sure that slide indicators "C"—"E" and "H" are resting at points as shown on drawing. Also controls "Motor Switch," "Polarity Indicator" and "X-Ray" must be at "Off" position, in line with the edge of Cabinet.



Explanation of Lettering

- | | |
|--|------------------------------------|
| A—Positive High Tension Terminal. | G—Isolated Control for Slider "E". |
| B—Negative High Tension Terminal. | H—Indicating Slider for Spark Gap. |
| C—Spark Gap Slider. | I—Rheostat Control Lever. |
| D—Milliamperes Meter. | J—Foot Switch Connection. |
| E—Slider carrying Current to Cord Reel "F" for Tube Vacuum Reducing. | K—Pole Changing Switch. |
| F—Cord Reel Connection for Reducing Vacuum. | L—Motor Switch. |
| | M—X-Ray Switch. |

Throwing lever "L" to left starts the motor, which is in turn directly connected to the Rectifying wheel. To ascertain Polarity throw lever "K" to left, set lever "I" on point 1.



Connect X-Ray Tube in the circuit as indicated on the diagram, "A" to Anode, and "B" to Cathode. "F" need not be connected, to start. Close circuit to Transformer by moving lever "M" to left. Move lever "M" quickly, watching the Needle on Meter "D." If Needle moves backwards throw lever "K" to Right, and try again. Some small reading of Milliampers should be apparent if the tube vacuum is in proper condition.

The Meter is equipped with a double scale, one reading 0 to 10 M. A. and the other 0 to 50 M. A. The coarser graduations are to be used when small amounts of current only are being passed; for instance, if 2 or 3 M. A. only are desired for Treatment of Fluoroscopic work, it would be difficult to obtain accurate enough reading from the fine graduations. For any currents over 10 M. A. the regulating button on the side of the meter should be set with the figure 50 up. Never use a heavy current from the machine with the figure 10 uppermost, as you may burn out the meter entirely.

OVERHEAD HIGH TENSION WIRING Very often it is desirable to set the X-Ray Transformer in one corner of the room and the tube stand or radiographic table some ways from it; or even in an adjoining room. Aerial wires, carrying the current from the machine overhead to the tube must be resorted to in such cases.

This Overhead Wiring generally consists of three strands of No. 12 gauge copper wire suspended between Rubber Insulators from one side of the room to the other, 12 inches apart, and at least 10 inches from any other wire, water pipe, or any metal of any nature. The rubber insulators are fastened to the wall with hooks or screw eyes, or in case of fire proofed walls, toggle bolts. In most cases it is advisable to fasten wood strips on the walls first; then the screw hooks can be easily fastened in the wood.

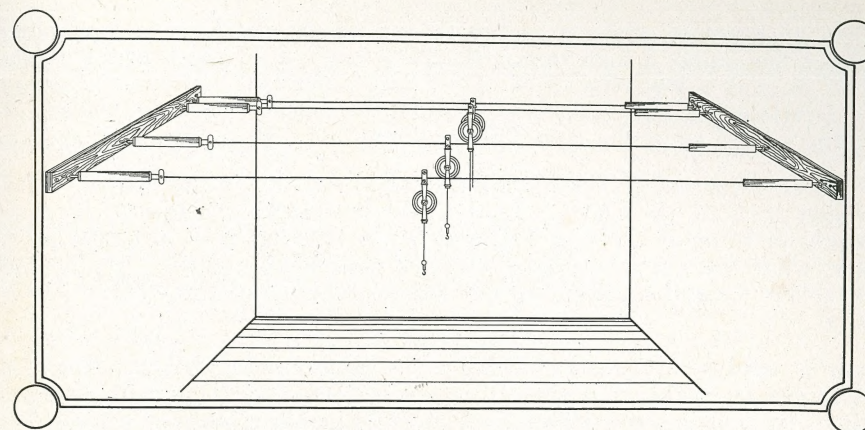


Figure "C"
Installation of Overhead Wiring for Coolidge Tube

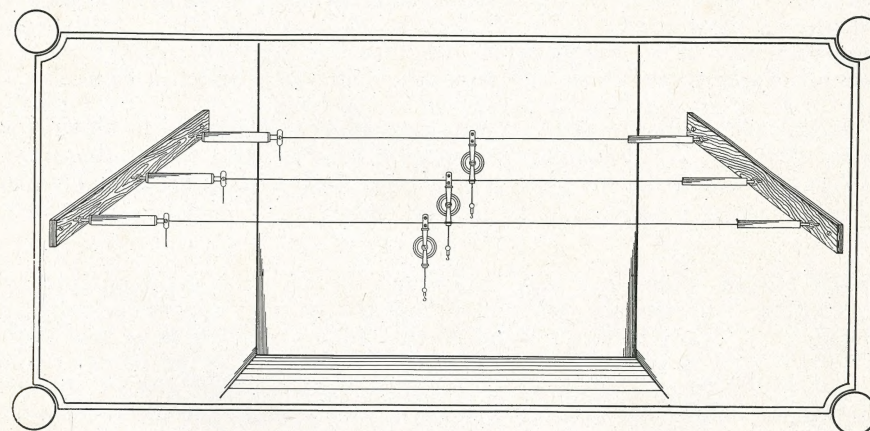


Figure "G"
Installation of Overhead Wiring for Regular Gas Tube

Three of the insulators are plain rubber stock, and three made with turn buckle attachments arranged that the wire can be stretched taut. Unscrew the ends until only about six threads are holding before fastening the wire in place. Then turn the small extended rods until the wire is as tight as desired. The Special Trolley Cord Reels are to be suspended from the wires, and regardless of where the tube stand may be moved underneath, the wires will always go straight down to the tube.

This method allows the entire free space in the room for the operator to move around, without danger of coming too close to the high tension circuit.

TUBE TECHNIQUE A low vacuum tube will give a *high* milliamperage reading; a *medium* vacuum tube will give a *medium* milliamperage reading; while a *high* vacuum tube will show a comparatively low reading.

As an example, given a certain setting on the machine, and all other points being equal, a high tube will take possibly 5 M. A., a medium tube 10 M. A., and a low tube 15 M. A. or over. For that reason the operator can ascertain the approximate vacuum of the tube by means of the M. A. reading as well as by the Back-Up Spark method. (See page 11)

Reverse Current (inverse), will appear in the tube in the shape of rings of light back of the anode. If the tube is operating properly, the half directly in front of the target (anode), will light up with an apple green color, while the upper rear half remains considerably darker. A distinct hemisphere must be apparent; the more pronounced, the better will be results.

It is always advisable, especially on Interrupterless Transformers, to have tubes maintain their proper vacuum as long as possible without regulating, but as it is not possible at all times to obtain tubes that will do this, it is recommended that you put these tubes through a preliminary seasoning process. This can be done by using the tube with *light currents only* for Fluoroscopy or treatments for a while, alternating with light radiography, and after a short period they will become seasoned and hold a fairly constant vacuum. It is a regrettable fact that this seasoning process is too often overlooked, but it will well repay the operator to watch it carefully.

If the tube lights up properly you may advance lever "I" to obtain the power desired. To determine Penetration of the tube, adjust the slider "C" to different distances from pole "B" by means of insulated controller "H."

VERY HIGH VACUUM TUBE Tubes *too high* in vacuum, or with too great an internal resistance, will not illuminate, as it is impossible to force any current through them. Such a tube will have light spots or streaks of yellow coloring at the back of the anode around the glass, or will sometimes show a diffused light without a sharp distinct hemisphere. This tube must be reduced before passing any heavy currents through it (see *reducing*), as any slight dampness or dust will sometimes cause the current, on account of the extreme internal resistance, to jump around the bulb and cause a puncture.

HIGH VACUUM TUBE When a tube lights up with the spots mentioned above apparent, but with a distinct hemisphere, it is too high for any except the very heaviest work, and should be reduced for best results. This *high* condition will also be indicated at the *spark gap*; this is, sparks will jump the entire gap between poles "A" and "B."

The reason for this is the fact that the internal resistance of the high vacuum tube is very great, and the energy from the transformer, instead of passing through and producing X-Rays, will jump the less resisting air gap between the terminals "A" and "B." The more gas you allow into the tube the less the internal resistance; the tube absorbs more of the discharge, and leaves less to leak off at the high tension terminals and along the wires, and produces a softer, but richer ray. Never use a *high* tube for Kidney or any soft tissue work.

MEDIUM VACUUM TUBE

A tube of medium vacuum produces more X-Rays than a hard tube, but of less penetration in proportion as the back up spark is lessened, and is best suited for medium radiographic work such as Dental Films, Lateral Skull, Knee, Shoulder, etc., as well as most soft tissue exposures. This tube should give a well defined and sharp hemisphere of apple green color.

MEDIUM LOW VACUUM TUBE

A *soft*, or medium low vacuum tube, will show a pale green hemisphere in front of the anode, and as the low vacuum is only indicative of gas in the bulb, there may be a trace of a bluish or bluish white coloring in back of the active hemisphere. Generally there is not enough penetration from a tube of this kind except for making radiographs of the lighter parts such as Hand, Elbow, Foot, etc., or by lengthening the exposures somewhat, Dental Films, etc. A *low* vacuum tube, providing there is still enough penetration, will render fine contrast and photographic detail, but it will heat up considerably if a heavy current is used; therefore care should be taken not to over-heat it as it is liable to crack or break off at the cathode stem.

VERY LOW VACUUM TUBE

A blue cathode stream (visible between the anode and cathode) indicates the presence of too much gas in the bulb, either produced from over-reducing or as a result of over-heating. This tube is too low for any kind of radiography, but may often be brought back to normal by running it once or twice a day for a few minutes at a time with a light current. (See *over-reducing*.) Tubes showing purple or bluish coloring only must be returned here for re-exhaustion.

PUNCTURED TUBE

A puncture is indicated by white sparks passing between the anode and cathode, and no coloring whatever in the bulb. Generally a tube can be repaired when in this condition, that is, the puncture sealed over and tube re-exhausted, but if the bulb is discolored, or the fracture or puncture near the bulb itself it must be entirely rebuilt.

REGULATING VACUUM OF TUBE

In making your initial tests, if your tube fails to glow properly, or sparks jump the entire distance from slider "C" to post "B," the vacuum is too high and must be reduced. A fairly *high* tube, one best suited for heavy work such as Hip, Spine, Ant. Post. Skull, etc., will back up about 5½ inches taking 25 to 30 Milliamperes from the No. 2 Machine, on last button of rheostat, under usual conditions.

A *medium* tube, one best suited for Dental work and parts requiring penetration equivalent to the Shoulder, Knee, etc., should back up 4½ to 5 inches, taking 25 to 30 Millis on button 8, and about 35 M. A. on button 9.

A tube backing up 3½ to 4 inches will make excellent Dental Films or plates of Hand, Elbow or Foot with slightly longer exposures than called for on our exposure chart. This tube will take between 40 and 50 M. A. on button 9.

TO REDUCE

the vacuum in the tube place rheostat lever "I" on point 1. Attach wire from cord reel "F" to reducing chamber 3 on

tube. Close circuit to X-Ray Tube and pull slider "E" over to terminal "F" by means of knob and string "G." *Pull over and release quickly*; a very small amount of current usually is sufficient to bring the vacuum down to a working basis. Another method is to pull slider "E" over to terminal "F" before closing switch "M." By using this system, especially with a "stub-born" tube, less heat is generated in the tube while undergoing regulation.

The chamber 3 is filled with asbestos, treated with chemicals which vaporize when warmed by the passing of the current, and the gasses thus formed in turn reduce the internal resistance. If no sparking appears in the reducer when operating as above, the reducer is not working properly due to lack of enough current. To remedy, set rheostat lever on button 2 or 3, try reducing as before, always being positive that slider "E" goes back to its proper position before trying the tube with heavy current.

Considerable care should be exercised in regulating the vacuum of an X-Ray Tube as they are often injured, and sometimes punctured in the process. Should the vacuum be reduced a trifle too much, let it rest a few moments so that it may regain its vacuum before attempting to use it for radiographic work as most always a tube vacuum will rise with a short rest. Don't persist in using a *too low tube* for heavy exposures, as usually one of two things will take place: a puncture from overheating or there will not be enough penetration to affect the X-Ray plate properly.

As the tube warms up from repeated flashing, its resistance will go down gradually, and the back-up spark be correspondingly shorter, even at the same setting of the rheostat. Therefore when making tests be as quick as possible, and use no more current than is absolutely necessary; merely to prevent this heating as much as possible.

A *cold* tube frequently has a *high* appearance until the current has been flashed through it a few times, to warm it up. Hence reducing a *cold* tube is not good practice.

It is well not to overdo tube vacuum reducing as you can repeat the operation any number of times, whereas, if you allow too much gas in the bulb it is necessary to again raise the vacuum, spending considerable time and effort, or sending it back here for re-exhausting. Some reducers are more *lively* than others, and will have considerable effect on the vacuum with only a slight amount of current. Others again need a heavier discharge to accomplish the desired result. Therefore, *watch the regulating chamber*, and *know your tube*, before going too far.

OVER REDUCED VACUUM

If you do accidentally allow too much gas in the tube, very often the vacuum can be brought back to normal by running a small amount of current through, with the third terminal detached entirely from reducer 3. Have rheostat "I" on button one or two, and run this light current through tube for one full minute. Cut off the current and place the fingers on the under part of the bulb, toward the larger or Cathode neck. If still cold, repeat.

If fairly warm, wait a few moments before again turning on the current. Repeat as soon as possible, and as often as necessary to bring the vacuum back to normal, but never long enough to produce heating.

The theory is: —passing a light current through the tube will consume the excess gasses without producing enough heat to cause the reducer to

operate. It is not the spark passing through this asbestos that produces the gas; it is the heat resulting from that spark; and for that reason if the current is allowed to pass through the tube in sufficient quantity and for a long enough length of time to produce heat, the vacuum will be lowered whether the third terminal is connected or not. The most common cause of over-reduced vacuum is overheating during exposures or treatments.

When not in use, tube should be supported against the wall up out of the way with a wooden holder, which will carry the tube in a vertical position, and not by means of the former type of wire supports which hold the tube horizontally. These racks should be of all wood.

SPARK GAP OR BACK-UP-SPARK

The approximate degree of penetration of the X-Ray from most any tube may be determined by what is commonly known as the Back-up-Spark. We know that the higher the vacuum in the tube the harder it is to force current through it. We also know that the more air we allow in the bulb the easier will be the path of the current. If the tube vacuum is high, and any considerable current is turned on, and the spark gap is set at say 4", the current will choose jumping the air gap rather than go through the tube on account of the lesser resistance at that point.

As the spark gap is opened you will come to a point where the current ceases to jump across and all the energy goes through the tube. This point is called the "back-up-spark" of that particular tube at that same setting. If the rheostat setting be altered (current increased or decreased), the back-up-spark will be altered accordingly, as this changes the Voltage; and Voltage alone is responsible for the length of spark. Hence it is advisable to determine the back-up-spark at the setting desired to complete the work in hand.

After adjusting tube to proper back-up-spark, see that slide controller is allowed to come back out of the way before attempting to make an exposure; otherwise some of your current will be lost across the gap, whereas all of it should produce X-Rays.

No two tubes will work exactly alike in this respect, and the operator should become thoroughly acquainted with his tubes to know at what setting, back-up-spark, milliamperage, etc., they will perform at their best. Gas tubes will show somewhat different spark lengths as compared with the Coolidge Tubes.

COOLIDGE TUBE

This tube is operated on an entirely different principle, having a constant, very high, vacuum. In the cathode is mounted a small Tungsten filament, directly connected to some low voltage source (on D. C., a 10 volt Storage Battery; on A. C., small Step-down Transformer), and the amount of current regulated by means of a rheostat. When the filament is burning its brightest, or with maximum current, the resulting X-Rays will be soft, or the same as a Gas tube with considerable air in it. The more resistance placed in the low voltage circuit the harder the rays will become. It will thus be noted that one can obtain any desired penetration of the ray, hard or soft, for any purpose, by simply altering the heat of the cathode and the volume of high tension current from the transformer itself.

(Complete instructions for the operation of Coolidge Tubes accompany each tube shipped out, and for that reason will be brief here.) After the desired setting has been selected (usually the 8th or 9th button), according to the required penetration, the amount of milliamperes are controlled by the heat of the Cathode filament, by means of the controller furnished. As the filament temperature increases the Milliamperage will increase also. A setting delivering about 2 or 3 M. A. with a spark gap of $5\frac{1}{2}$ inches will be found most suitable for Fluoroscopy, while a range of from 20 to 50 M. A., with spark gaps of 6" down to 4" can be used for your various plate work.

Once a setting has been decided on for obtaining best results on any class of work, you need only make exact notes of positions of rheostat controllers, M. A. meter, etc., and the same results can be repeated precisely any number of times.

G. E. CO. COOLIDGE TUBE IN- STRUCTIONS

The higher the filament current, the greater the milliamperage.

The higher the Voltage backed up by the tube, the higher will be the Penetration.

A simple method of starting radiographic work with the tube follows:

Take a case, for example, where the operator has been instructed to work with the rheostat on the ninth button with the tube drawing 25 M. A. In this case, all that is necessary with the Coolidge Tube is to set the main rheostat on the ninth button; light up the filament in the tube, having the Filament Controller at lowest setting, close the main X-Ray switch, and increase the Filament Current until the tube is drawing 25 M. A. To reproduce this condition he then needs only to adjust the filament current to this same value and set his X-Ray Rheostat on the same button.

In this way, after the technique is once established, it is not necessary to test the tube by operating it, but operation is guided solely by the setting of the controllers. Occasionally line conditions will have some small bearing on results, as if your current supply fluctuates, you will need exercise more care than if operating from a perfectly stable supply.

In other cases, the radiographer will be accustomed to adjust his tube by means of the milliamperage meter and the parallel gap. This procedure can be applied equally well in all cases where the operator is not familiar with his machine. Knowing that you want, for example, 20 M. A. with a 5" parallel spark gap, you will start with the filament controller on the weakest setting, and with the transformer main rheostat on a low button. Then increase both the filament current and the main current to machine at the same time until your tube is drawing 20 M. A. at the required 5" gap. As described in the first method, readings of M. A. and settings of rheostat levers are noted, and the same discharge can be obtained at any future time.

The tube may be safely run with the target (anode), at white heat. For long continued running in an enclosed space and with fairly heavy currents, some means of cooling the glass will be necessary, as with a small fan or blower. The glass can, however, be allowed to get quite hot; in fact it is all right as long as it does not soften and draw in.

Coolidge Tubes can be obtained with three sizes of focal spots; broad, medium and fine. For Therapeutic, Fluoroscopic and most Radiographic work, the medium focus will be found most suitable. If extremely sharp definition is desired, the fine focus should be used. The broad focus tube is only recommended where excessive amounts of current are used for rapid work. Not recommended for the No. 2 Transformer.

FLUORO- SCOPY

Light currents, usually not over 2 or 3 M. A., with a fairly hard tube, will generally give most satisfactory results when using a Fluoroscopic Screen. A tube of high vacuum, operating on this low amount of current will not heat up except on a very long run. A Foot Switch is an invaluable addition for this work.

FOOT SWITCH

The two outlets "J" on the rheostat control board are for foot switch connection. A Foot Switch, with long flexible cable permits the operator to have full use of both hands while operating the tube, especially valuable for Fluoroscopy. Pressing the controller on the foot switch closes the circuit to the tube same as switch lever "M."

This arrangement also permits of isolated control should the operator prefer to work at a distance, or behind a lead protection screen. In the latter case, the foot switch can be mounted directly to the back of the screen, and operated by hand if desired.

STEREOSCO- PIC RADIO- GRAPHY

In very particular cases where it is either inconvenient or impossible to obtain two plates of the object, that is, one lateral and other anteroposterior, Stereoscopic Radiography should be employed. This method consists of making two plates with the patient occupying the same position, but moving the tube to the side $2\frac{1}{2}$ " (pupillary distance), between exposures, and tilting the tube so that the ray will be focused to the same spot for each exposure. If your radiographic table is not equipped with a compartment for holding plates where they may be easily removed without disturbing the patient, some sort of shallow tunnel should be used.

A thin box of the proper size to hold the envelope covered plate may be constructed (or purchased) with an aluminum or celluloid top. This is placed under the part to be radiographed, and the patient then instructed that *two* plates are to be made, and not to move after the first exposure. Center the tube directly over the center of the affected area. Then move it to one side $1\frac{1}{4}$ ", and tilt it slightly to focus the ray on the center of the plate. Make the first exposure as described under proper heading for that part, and withdraw the plate, substituting a fresh plate as quickly as possible.

Make sure the second plate occupies the same position as the first, move the tube back across the center until it occupies position $2\frac{1}{2}$ " away from first setting, tilt to focus to center as before, and make second exposure; give same length of time, at same setting and same amount of milliamperage to obtain same density on the result.

When placing the plates in the boxes before the exposures, make sure they are shaken to one corner of the envelope, and placed in corresponding positions. This caution is necessary as the plates are somewhat smaller than the envelopes themselves, to facilitate loading.

After the set of stereoscopic plates have been completed they should be set up in two view boxes, mounted on a frame which permits of their being brought closer together or farther apart until they focus as one when observed through the mirrors mounted directly in the center. This contrivance is termed a Wheatstone Stereoscope. The effect of the result obtained will be as though the operator were looking directly through the part; the perspective, in the majority of cases, being perfect. This method is the most satisfactory known for exactly locating Bullets or foreign objects, as well as for compound fractures.

Two Intensifying Screens mounted in aluminum cassettes are invaluable aids in this important work, as much shorter exposures can be made, and, the plates occupying the same relative positions in the holders, they can be placed in exactly the same positions under the patient.

EXPOSURES For Radiographic, as well as Fluoroscopic work, some judgment must be used as to the density of the object to be penetrated. Some objects are more easily penetrated than others, the following being list of common substances in order of penetrability.

Placed in order of resistance to the X-Ray:

No. 1—AIR	No. 7—RUBBER
No. 2—CELLULOID	No. 8—FLESH
No. 3—ALUMINUM	No. 9—BARIUM
No. 4—CARDBOARD	No. 10—BONE AND TEETH
No. 5—SOFT WOOD	No. 11—STEEL
No. 6—HARD WOOD	No. 12—LEAD

A good point to remember here is, you can almost always gauge the opaqueness (to the X-Ray) of any object by its atomic weight; the rule being that the greater the specific gravity the greater the difficulty to penetrate.

Owing to the fact that so many factors enter into the determination of the proper lengths of exposures, the following is only approximate; based on an average built patient of 150 pounds.

Exposure Chart for No. 2 Transformer

Part	Distance of Anode from Plate	Spark Gap		Milliamperes Thru Tube	No. Seconds with Int. Screen	Exposure No Screen		Rho. Button
HAND	15"	4	"	35		1 sec.		8
WRIST	15"	4	"	35		1 "		8
ELBOW	15"	4	"	35		1 "		8
FOOT	15"	4	"	35		1 "		8
ANKLE	16"	4½"		35		1 "		9
TEETH	13"	4	"	45		1 "		9
KNEE	17"	4½"		35		2 "		9
SHOULDER	17"	4½"		35		2 "		9
HEAD—LATERAL	17"	4½"		35		3 "		9
HEAD—ANT. POST.	Cone in contact.	5½"		20	2 sec.	6 "		9
HIP	18"	5	"	25	1½ "	5 "		9
SPINE	18"	5	"	25	1½ "	5 "		9
CHEST	24"	5	"	25	½ "	2 "		9
KIDNEY	Cone in contact.	5	"	25	1½ "	5 "		9
STOMACH	24"	5	"	25	1½ "	5 "		9
INTESTINES	24"	5	"	25	1½ "	5 "		9

In order to keep the tube from overheating, it is good policy never to make any exposures of over one second duration; on five second exposures, cut the time to 5 *individual flashes* of 1 second each. If the exposure is to be 1½ seconds it may be made at one time. For patients weighing over 150 pounds, or where the part to be radiographed is especially heavy, increase not only the exposure somewhat, but also have the tube vacuum a trifle higher (longer back-up spark).

Don't forget; Radiography is Shadow work, and you cannot get a good outline of any part unless it differs in Density from the surrounding tissue.

INTENSIFY-ING SCREEN The intensifying Screen is to be used where it is desirable to radiograph the heavier parts of the body, especially the moving organs, as quickly as the extremities. It will cut the time of exposure to about one-fifth, depending on the speed of the plate, the quality of the screen itself, and the milliamperage in the tube. With a fairly high tube, passing a relatively small amount of M. A., the difference in speed will not be nearly as marked as with a medium vacuum tube and correspondingly high M. A.

The Screen is generally made in the form of a sheet of cardboard coated with a perfectly smooth layer of Tungstate of Calcium or other substance which will fluoresce when exposed to the X-Ray. It is best to have this screen mounted in an Aluminum holder into which the plate can be inserted; and which holder, while practically transparent to the X-Ray, when closed prevents any white light from attacking the sensitive surface of the plate. Even the minutest quantity of the ray will affect the screen, causing it to light up.

The Screen should be mounted in the cassette, or holder, so that the emulsion side of the plate is placed next the screen, and the ray must pass through the glass itself before affecting the screen. When the exposure is made the X-Ray which reaches the screen causes the latter to fluoresce with a blue light, which has an intense chemical effect on the silver in the emulsion on the plate. The Screen and Plate must be held tightly together, in close contact, to obtain the best results and full efficiency from this method.

Special care must be taken that no developer or hypo spots get on the screen, or that it is not scratched, as each such spot will show up on every plate throughout the life of the screen, and destroy the diagnostic value of most of them. Our screens are mounted in protected cassettes or holders, with strong clamp springs, and are easily handled in the dark room.

Intensifying Screens respond best with tubes of low vacuum, and therefore a fairly soft tube, and long plate development give best results. The common error is over-exposure, and the latitude of error very small, in fact much more care must be exercised with a screen than without. Unless the plate be exposed just right a faulty negative will result.

Remove the plate from the cassette as soon as possible after making the exposure, either developing it at once or placing it in an ordinary set of envelopes, as some screens fluoresce for some time after the exposure has been made, and if the plate is not removed the fine detail in same will be ruined.

Always dust the screen carefully with a bit of very soft cotton, before inserting the plate, as each spot of dust will mean a magnified spot on the finished negative.

Don't overlook the fact that when using a plain plate in the envelopes you have some latitude in time of exposures; that is, a trifle over or under exposure will make no material difference in the final result, whereas when employing an intensifying screen, your exposures, and tube technic, must be exact.

EXPOSURE TECHNIQUE The time of exposures will vary with the distance of the tube from the plate; greater exposures being necessary as this distance increases. Also must be considered the thickness of the part, evident transparency, and the vacuum of the tube and its consequent penetration. Don't overheat the tube with too long exposures; use one second flashes only, unless for fluoroscopy or light treatments, when only small amounts of current are being passed through the tube.

As the intensity of the X-Ray varies inversely with the square of the distance between the tube and the plate, the tube should not be too far away. As an example: If it takes an exposure of 1 second to make a perfect radiograph of an elbow with the anode of your tube 12" from the plate, it will mean an exposure of 4 seconds if that distance is but doubled. On the other hand, setting the tube too close to the plate tends to enlarge and distort the image.

Make your exposures as short as practicable, as long exposures will often produce an effect in some plates whereby they will not develop out clear; due to chemical changes in the silver salt in the emulsion. However, do not start out as a Speed Maniac. Learn first to make good radiographs; then speed up if necessary.

Always bear in mind that a new tube must be treated with considerable more care than a seasoned one, as it is what is sometimes called "green" and "untrained," and can be easily affected from overworking. With proper care not to overheat or over reduce, your tube should be better at the end of a year than when new.

The age of the patient should be also taken into consideration, as fairly soft, medium vacuum tubes will always give best results with children, where the contrast between the bony structures and tissues will be great. With aged patients it is generally more difficult to show detail on account of lack of contrast between bones and tissue.

* * * * *

Before placing the plate or film in position, after you have the patient ready, *be sure the tube is tested* to work properly at the desired setting. This will obviate the necessity of shifting the patient around and probably save many plates as well.

The most penetrating X-Rays are those proceeding from the center of the target (anode) at right angles drawn from end to end of the tube, and 45° from the face of the target. Consequently it is necessary to place the tube with the center of the target, or anode, directly over the center of the part to be radiographed, and the plate directly beneath, so that the full image desired will appear.

Buttons or pins on the clothing of the patient or odd articles in the pockets will all appear on the finished negative, causing shadows which will greatly interfere with the diagnosis. Therefore it is desirable to remove the clothing entirely from the part under observation, covering with an ordinary white washable gown if necessary. It is much easier to place the plate and tube properly with part uncovered.

The lesion or part to be radiographed should always be nearest the plate, and in as near actual contact as possible. As examples, exposure for Kidney, Spine, etc., should be made with the patient lying on the back, while for Gall Stones, Stomach, etc., have the patient lying face down.

It is advisable to use sand bags for all fracture work to hold the part quiet, and, as the very slightest movement of the patient will blur the detail in the negative, and in many cases necessitate another exposure, it is important that the patient be made as comfortable as possible during exposure. Sand bags are used to good advantage too when making Spine and Kidney plates. With the patient lying on the back, insert bags under the knees to the height of a foot or so, in this way bringing the spine closer to the plate.

For Spine, Kidney or in fact most any heavy part, the use of the compression cone is advisable, as you can clamp down the patient practically immovable on the plate. Compression also has the advantage of reducing the thickness to a minimum, thus permitting shorter exposures. The compression cone also cuts off most all secondary rays, which, if allowed to reach the plate, will cause indistinct outlines of the image.

LEAD DIAPHRAGMS

While the compression cone cuts off the greater majority of secondary rays, it is advisable to use a lead diaphragm in order to obtain the clearest and sharpest possible negative. One with an opening of 1" in diameter if the tube is placed about 16" from plate will fully cover the small size, while a diaphragm with 3" opening will cover the largest plate. Those sizes which are advisable to have in stock have 1, 2 and 3" openings respectively.

* * * * *

In the foregoing we have mentioned X-Ray Tubes of different degrees of vacuum. It is true that the vacuum of a tube can be altered to suit the case at hand (that is, made lower for light work and somewhat higher for the heavier parts), but any tube which is in this way made to do all classes of radiography will very soon develop "freaky" traits, and be worthless. Two tubes at least should always be available; by constantly using the tube at say a 5" back-up-spark for your medium and heavier work it will retain that vacuum almost constantly, unless misused. Adjust the other tube to back up about 4", use it for all lighter work, and you will be called on to regulate it but rarely. Your tubes will last longer if used alternately, and give better results, and should any accident befall one you always have another on hand for an emergency case.

Until quite lately it has been common practice to test the penetration of an X-Ray tube with a fluoroscope; that is, hold the hand or arm in the direct line of the ray between the fluoroscopic screen and the tube, and if the image of the bones was clearly defined to go ahead with the plate. *Don't do it!* Certainly it is safe enough to use the fluoroscope occasionally for fracture work, or for demonstration, but don't make a practice of it, as it is bound to leave a bad effect in time. If a little caution is exercised no danger of burns from the ray need be feared by the operator for himself or patient. Practically all of the burns we know of were produced years ago, due to lack of knowledge of the X-Ray.

In the great majority of cases, especially so where we are called on to make a demonstration, we are required by the rather inexperienced operator-to-be to make all manner of plates, in most cases fast work of the heavier parts, and for that reason when shipping machines will choose tubes of slightly higher vacuum than would ordinarily be shipped later. Simply because tubes of slightly higher vacuum will give more satisfying results, when new, but such tubes, being high, will require almost constant attention, the reducing chemicals will become worn out, and before long must be re-exhausted. Therefore, when reordering tubes, specify the vacuum desired, use it for light work until thoroughly seasoned (about 2 months), and have gratifying results for a long time. A medium low vacuum tube will always give less trouble and more satisfaction than a higher vacuum tube.

HAND AND WRIST

For making plates of the lighter parts there is not much technic to master. One exposure, with a medium low vacuum tube, using about 35 M. A., on the eighth button; time one short flash; plate $6\frac{1}{2} \times 8\frac{1}{2}$. Develop, for fleshy detail, until only faint traces of the bones may be seen when held up to the ruby lamp; for bone only, leave in developer until quite dense all over.

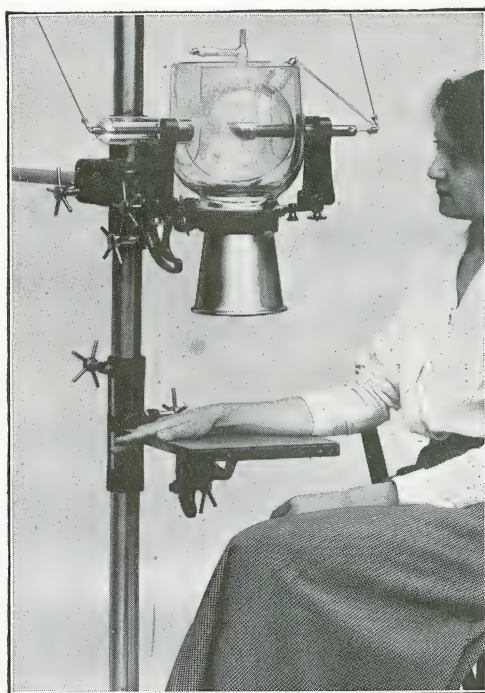


Figure No. 26
Wrist, Anterior Posterior Position

Make two exposures for the wrist, one lateral and other anteroposterior, either using two 5 x 7 plates, or one 8 x 10. Cover one-half of the 8 x 10 plate with a sheet of $\frac{1}{16}$ " lead if this latter method is used, making first exposure on half not covered, marking pencil line to show position of lead, and then use other half for the other position. One short flash will be sufficient for the ant. post. view, but an exposure of one full second will be necessary for the lateral on account of the extra thickness, and to have same amount of detail on both views.

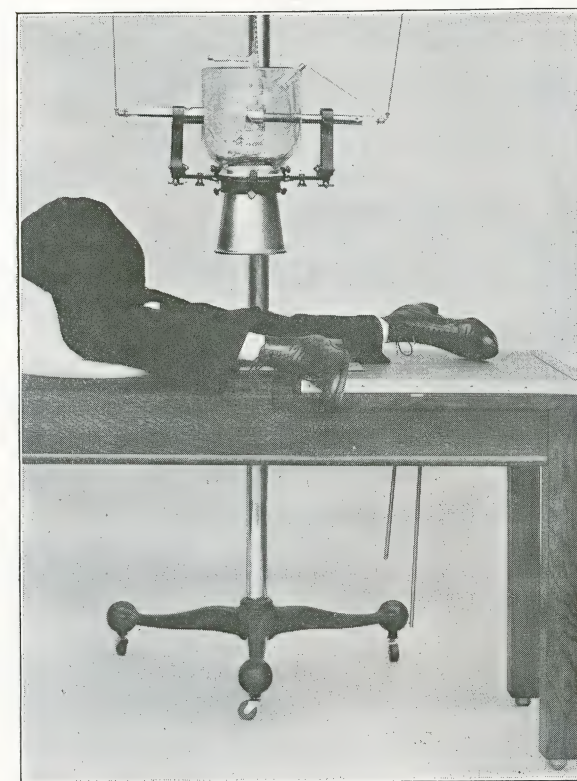


Figure No. 27
Position for Lateral Knee

KNEE

Two views; two individual plates; exposure about same for each. Use 35 M. A., 9th button, exposures 2 seconds. Develop thoroughly.

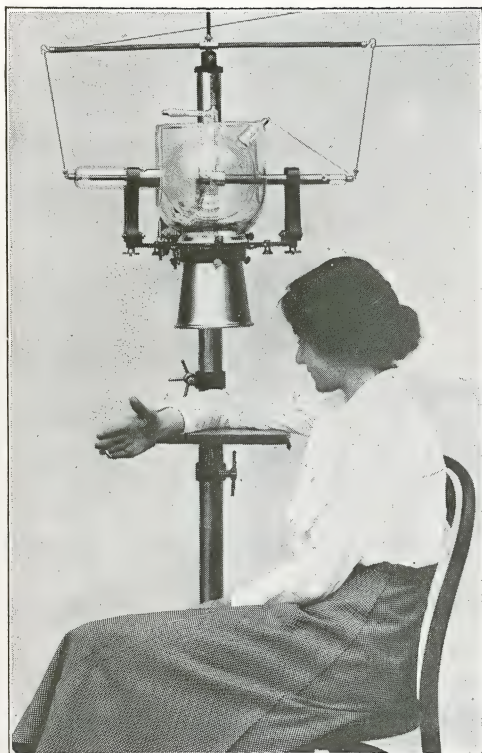


Figure No. 28
Lateral Elbow Position

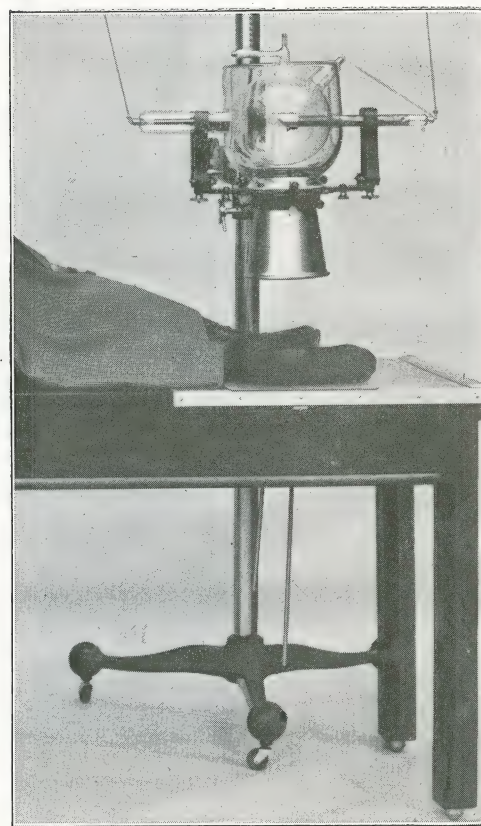


Figure No. 29
Lateral Ankle Position

ELBOW AND FOOT

Two views, as for Wrist. Same technic applies, with exception of time of exposures and size of plates. For single views use 8 x 10 plates. For both views on one plate use 10 x 12. For bone detail only develop quite dense. Medium tube, 8th button, 35 M. A., 1 second time.

ANKLE

Two views are recommended, on separate plates, on account of the extreme difference in thickness between lateral and ant. post., and the difficulty in obtaining good results from two exposures on one plate for that reason. Lateral view, 1 sec., 35 M. A., 8th button. Anterioroposterior, 1 sec., 35 M. A., 9th button; vacuum of tube slightly higher.

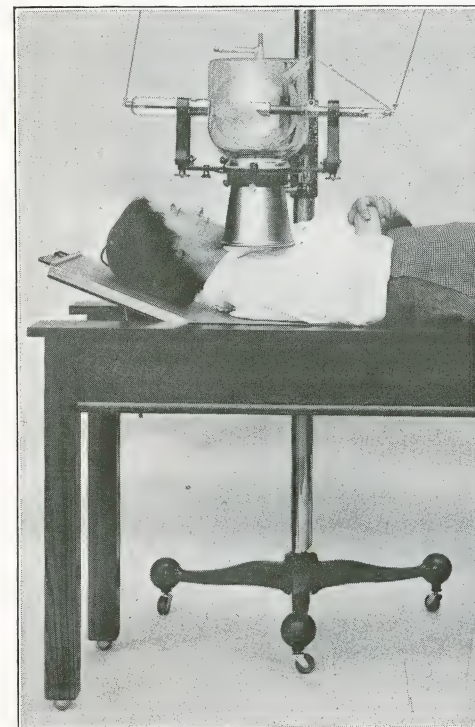


Figure No. 30
Shoulder Position

SHOULDER

Generally one plate is sufficient, unless the Clavicle, Scapula, and shoulder joint proper are all desired. For *Clavicle*, place patient on chest, arms straight down toward knees. Use 8 x 10 or 10 x 12 plate, centered directly below Clavicle. Have patient hold breath (see *Chest*), during exposure, as the slightest movement will spoil the detail. Time 2 seconds, 35 M. A., button 9. Full development. It is not advisable to attempt to show both shoulders on one plate unless the tube is raised up to about 28" from the plate, to avoid distortion due to angle of the ray.

For *Scapula* place patient on back. Use 8 x 10 plate, centered directly below. Use same technic as for clavicle.

For *Shoulder Joint* use same method as for Scapula, but center the tube directly over the joint itself. Any deviation from this rule will mean distortion of the parts as shown on the finished negative. Same technic as for Clavicle throughout.



Figure No. 31
Clavicle Position

HEAD LATERAL

Position will depend almost entirely on the desired result; Mandible, Mastoids, Antrum, etc., all requiring different angles of ray. Exposures will average 3 seconds, with tube backing up $4\frac{1}{2}$ ", 35 M. A., button 9. Full development. *Mandible* position: Place head as shown on illustration No. 32, with neck stretched to its fullest extent. Tilt the tube back so that the rays are centered directly under the jaw on the upper side, and slightly to the rear. If it is desirable to show the cuspid teeth, tilt tube even farther back, and rotate the head slightly so that the chin and nose just touch the plate.

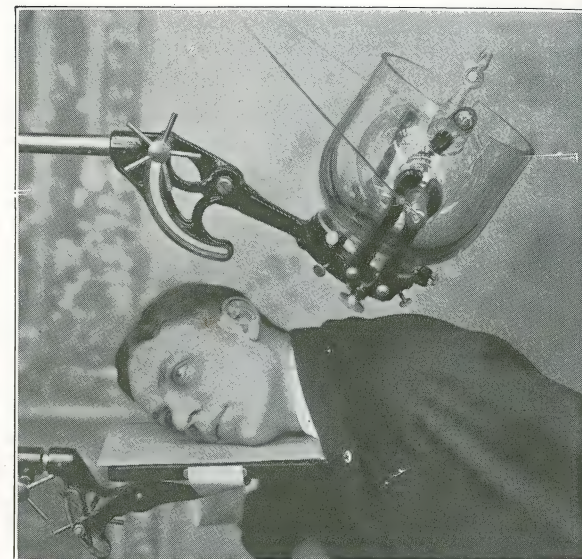


Figure No. 32
Mandible Position

Mastoids: Have head placed that a line drawn through point of the chin through nose and to center of forehead will parallel the plate. Tilt tube in opposite direction as called for for Mandible, passing rays over top of ear on the upper side. This method will show both clearly, whereas if rays were allowed to pass straight through the skull neither side would be clearly defined. Same exposure technic as Mandible.

Lateral Antrum: Place head as for Mastoids, but have ray pass directly through and at right angles to plate. Same exposure, etc., as for Mandible.

SKULL ANTERIO- POSTERIOR

Position again will depend on result required. For Frontal Sinus plate place patient on abdomen, if a table is used; or follow position as shown in figure No. 33. Draw an imaginary line at an angle of 25° upward from a line drawn from the opening of the ear to the bridge of the nose, and set the tube so that rays will follow this angle. Center the rays to pass directly through the sinuses. Have patient's forehead and nose touching the plate. Use a fairly high vacuum tube, backing up $5\frac{1}{2}$ "; expose average patient 6 seconds; Tube taking approximately 20 M. A., with rheostat on button 9. Develop fully.

To obtain the desired 25° angle as mentioned, a tapered wooden block will be found advantageous. A tapered pillow of this kind is to be used with the point of the wedge toward the patient and the heavier part under the forehead for Frontal Sinus radiography, and by reversing, it will give excellent results on plates of the lower jaw.

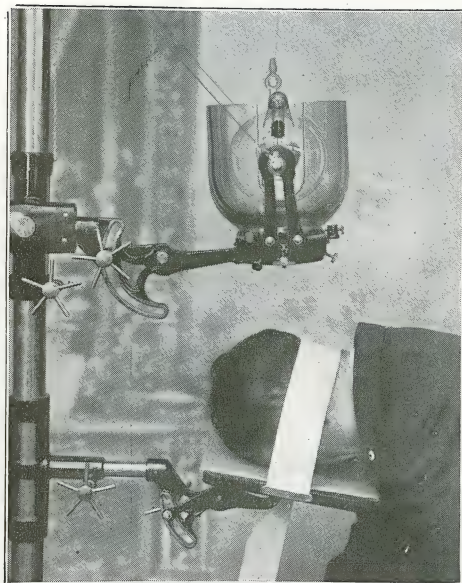


Figure No. 33
Skull, Anterior Posterior
Sinus Position

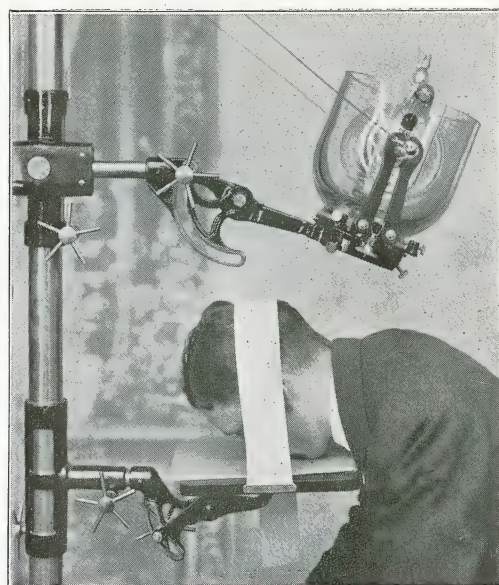


Figure No. 34
Skull, A. P. to show
Antra Region and Centrals

To show the Antrum of Highmore to best advantage have patient rest the chin and nose on plate, and set tube that rays will pass through back of neck. See illustration No. 34. If it is desirable to show more of one side than the other move the tube sideways; if more of the left is desired move the tube to left a trifle, and vice versa. Expose from 3 to 5 seconds, tube adjusted as for Lateral Skull.

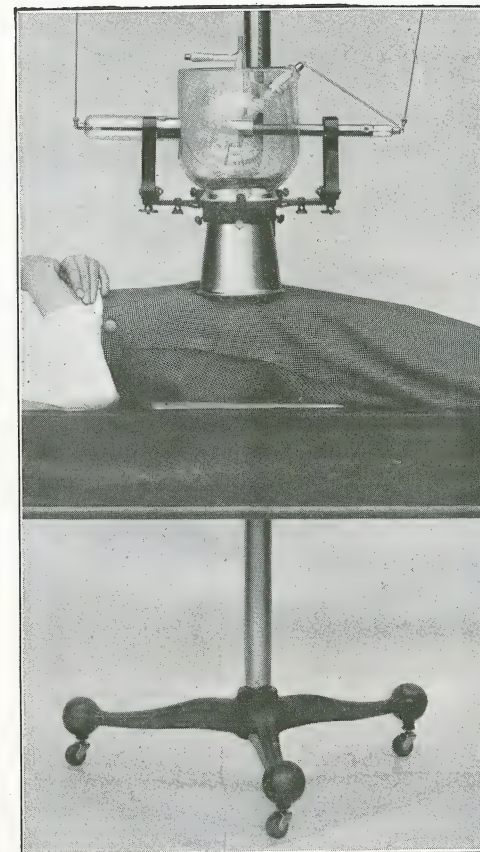


Figure No. 35
Position for Hip, Head of Femur

HIP-HEAD OF FEMUR

Have patient on back. See figure No. 35. If head of femur only is required, an 8 x 10 plate is used. A 10 x 12 size is recommended in cases of doubt as to the extent of injury or lesion. Use medium vacuum tube for patients averaging 150 pounds, and tube of higher vacuum, and consequent sharper penetration, in proportion as the weight is increased. Place the thumb at the crest of the ilium, the second finger on the greater trochanter, and with the index finger form a triangle, reaching over as far as possible. Center the tube directly above the center of this triangle, and the plate below, and the hip will always show up well. Use the compression cone, just touching the body. Expose 5 seconds with tube backing up 5", 25 M. A., button 9.

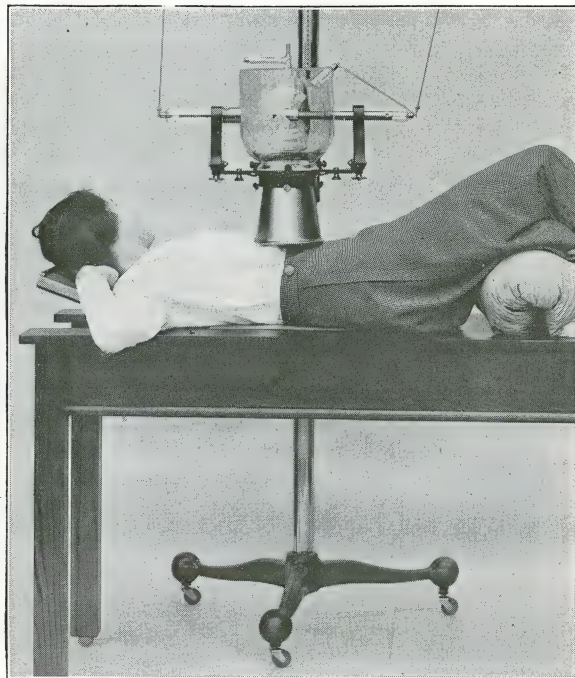


Figure No. 36
Position for Lumbar Spine

SPINE Center the tube directly over the desired section, using either 2-10 x 12 plates or 3-8 x 10's, for entire spine (2 or 3 exposures). Using sand bags under the knees will assist greatly in bringing the spine closer to the plate, and producing sharper outlines. Have patient at rest, with arms over head for lumbar radiograph, or extended on sides for dorsal plate. Use medium vacuum tube, expose 5 seconds, rheostat on button 9, 25 M. A. Develop fully.

CHEST Place patient face down, with chin extending slightly over edge of table. Have arms raised up over head, and then dropped down over end of table, grasping lightly the table legs. Use 11 x 14 plate for small patients or 14 x 17 for average adults. Place plate well up under the chin to insure covering entire desired area. Train the patient somewhat while in position so that there will be no breathing during exposure. Have the lungs filled, emptied, refilled, etc., a few times, always at your word of command. Snap the exposure with the lungs fully inflated. Generally this can be done while the patient is waiting for the word to let go, is entirely relaxed in body, and the best result obtained.

To avoid an enlarged heart shadow, on account of its position, the tube must be raised up from the plate about 24". Remove the compression cone so that entire area is in line of ray, and use diaphragm with 3" opening. Use medium hard tube, backing up 5", 25 to 30 M. A., and expose, *in one flash*, 2 seconds. It is not advisable to use an intensifying screen for chest work, especially where good lung detail is desirable, except for heavy patients, as the finished screen negative always shows some spotted mottling effect of the screen itself. This mottling, while it may be very little, will detract from the diagnostic value of the plate.

If Dorsal Spine or good rib shadows are desirable, develop the plate fairly dense; if for lung tissue, develop until only the heart shadow remains. Too long development for this latter result will destroy fine detail, especially in the apices.

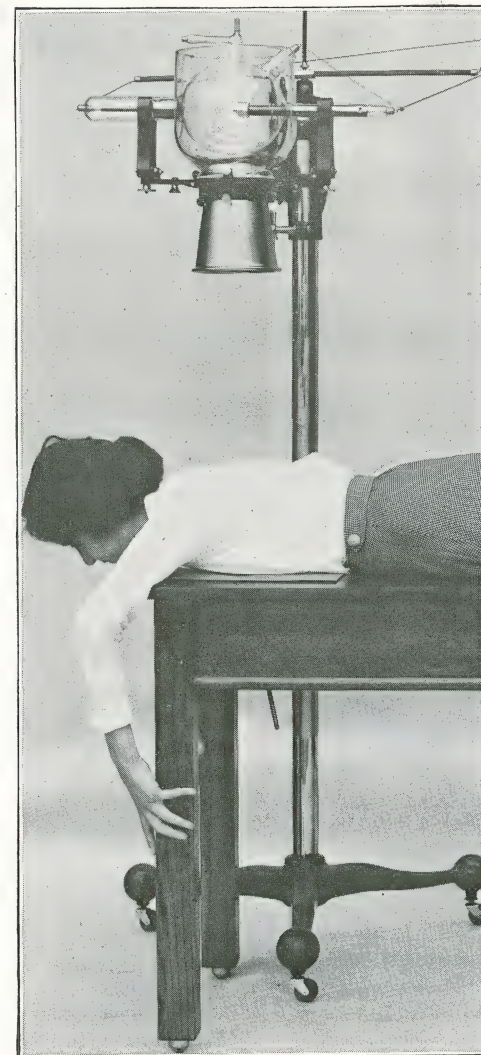


Figure No. 37
Position for Chest
Radiograph

KIDNEY

Have patient lying on back, with knees supported with sand bags or cushion, and shoulders raised slightly, to bring the spine as close to the plate as possible. Center the tube slightly to one side of the spine, and place plate that at least one lower rib, spine and crest of the ilium will show up. Tilt tube slightly (see illustration), and use heavy compression. Use tube of medium vacuum as a high tube will have too sharp penetration, and stone shadows, as well as the outline of the kidney itself will be obliterated.

(See Illustration on Page 26)

For best results use fresh developer at 68° F. Do not develop as dense as a spine plate. Expose 5 seconds without screen, or 1 full second with screen; rheostat on button 9, 25 M. A. at 5" back-up-spark. An Intensifying Screen is used to good advantage in all Kidney work, simply on account of the cutting down of the exposure which in turn insures sharper outlines, especially in cases of nervous patients.

If the lower Rib, Spine, Crest of Ilium and Psoas Muscle show up on the negative, an outline of the Kidney itself should be easily discernible except in very heavy or fatty persons. Stones, if they contain sufficient calcarious deposits, will always show if these other land-marks are present.

When going after stones in the bladder or ureters have patient on stomach, and use much the same procedure as above for kidney, bringing the compression cone down in contact with the spine. It is best to use individual plates to cover small areas only at one time, using one 8 x 10 plate for each side and just below kidney, and another 8 x 10 directly under the pelvis. When possible have patient hold the breath during exposure as any movement will destroy shadow outlines.

STOMACH

There are two distinct ways of making Abdominal Radiographs: either with the patient lying face down on the table, or sitting or standing in an upright position with plate supported against the stomach. It is absolutely essential that the patient's clothing be removed, covering with a white washable gown.

An opaque meal consisting of buttermilk or gruel of some kind with either Bismuth or Barium, is first given the patient, as without this opaque substance no shadows of the digestive organs will be obtainable. We prefer referring to some physician or surgeon who is an authority on this subject for more particulars on this line of work.

The usual technique for Gastrointestinal Examination, however, is: Patient shall go without food for at least eight hours, and then be given the opaque meal consisting of five (5) ounces of Barium Sulphate mixed well in sixteen (16) ounces of Buttermilk. Other vehicles are used, such as gruel of various kinds, corn meal mush, farina, etc., but the buttermilk mixture is the easiest to prepare, and the material generally easy to procure. Hence our recommendation. Adopt some one kind of meal and stick to it; switching from one to another is not advised as all will give varying results in filling of the stomach, emptying time, etc.

One 14 x 17 plate should be made at once, with the patient standing, and then a series of 11 x 14 or 10 x 12 plates to trace the barium through the intestinal tract. While the average stomach will empty itself in 6 hours,

and the entire tract be cleared in 24 hours, cases have been noted where the barium has lingered for 72 hours. Place a dime or small lead marker over the umbilicus as a land-mark to assist you in your decision as to the proper position of the stomach.

Ordinarily an entire series of plates are necessary. Use 11 x 14 or 14 x 17 plates with Intensifying Screen. Adjust tube to back 5", 25 M. A. rheostat on 9th button. Expose 1½ seconds in one flash with Screen, or 6 seconds without. Have patient hold breath during exposure.

INTESTINES

Use same technique as described under "Stomach." It is essential that exposures be made as short as possible, and give full development to the plate. Often a Bismuth or Barium injection will show better results than the meal above mentioned.

A plate marker or marking device of some kind should be used wherever possible, as some definite means of identification is absolutely necessary; in Medico-legal cases especially. There are various types of plate markers on the market, one consisting of a small strip of aluminum, on which the desired lettering has been punched and filled with red lead, which shows the name of the operator or hospital to good advantage.

Another is a contrivance with numbered wheels which can be rotated to show desired combinations of numbers, over which the name is punched on a permanent strip.

Lead numbers or letters on a strip of adhesive tape can be altered at will and cause very distinct shadows. This latter is truly the most simple way of marking plates.

DENTAL EXPOSURES

Rest the patient in a light straight backed chair without arms or head rest, unless you are using a head support especially designed for the work, as most others have a tendency to complicate positions.

Next adjust tube stand, focusing the ray in an approximate line for position desired with the patient always in an upright "at attention" position. Then try the tube and regulate if necessary to back up between 4 and 4½ inches of spark gap. Next get a dental film out of the lead lined chest and place same in the patient's mouth at the correct angle as illustrated on drawings (Figures 1 to 8 and also figures 17, 19, 21 and 23), depending on just which tooth you are after, and let the patient steady the head by resting the face against the lead glass cone. There is sufficient lead in this cone to cut off all secondary rays; also to keep the X-rays from spreading, and enough glass to act as a perfect insulator. The X-Rays pass only through the opening. You are then ready to make the exposure.

Timing your exposure is made simple in the following manner. If you have a clock of the old fashioned variety with a long pendulum exposed, spend a little time in front of it, and as the pendulum moves from side to side repeat to yourself "one thousand and one" having the last "one" timed to meet the pendulum at the end of it's swing. In a very short time you will be able to count off the seconds automatically. When making your exposure, repeat to yourself "one thousand and one," throwing the switch in on the first "one" and withdrawing it immediately after the last. Count "one thousand and one," "one thousand and two," etc. A trifle over or

under exposure, that is, an error of a fraction of a second will make no material difference in the result. A slight over exposure will take a little shorter development, and an under exposure means longer development. Using a watch is not advisable for a transformer, as, if you attempt to keep eyes on the tube, the patient, Milli-ampere meter and watch, at the same time, you will find it rather difficult.

Certainly a little movement of the entire head during an exposure does not necessarily mean a spoiled negative, as the film, if held firmly in the mouth, will retain its position against the teeth; but should the patient allow the film to move, another exposure will be necessary; in fact, second exposures should always be made unless the first shows all the desired detail. The poorest known technique is to attempt to diagnose an imperfect result.

In getting the focus be sure that the center of the target (anode) of the tube is placed directly over the center of the opening of the lead glass cone to insure maximum rays passing through.

There are two distinct types of films on the market, the regular paper wrapped films and those with the metal backing. When using the ordinary film, the smooth side should be against the teeth and toward the tube. When using the metal backed films the black paper side should be toward the tube.

For a radiograph of the upper teeth, patient should hold the film with the ball of the thumb only (see figure 23). For the lowers use only the index finger to hold the film. When making an exposure of the uppers, the head of the patient should be in every case in an upright position, the features parallel to a vertical line. If the head of the tube stand is then swung back until the angular cut surface of the lead glass cone is parallel to the face of the patient, and the top edge of the cone on an even line with the eyebrow, it will be found that in most instances the center of the cone is then properly placed to take in the apical area without distortion, and it only remains to place the film properly behind the teeth to be rayed.

For all lowers tilt the entire tube support back as far as it will go until the rays are focused in almost a horizontal line and at nearly right angles to the teeth. The patient's jaw should rest against the hollow of the cone (see illustration No. 17).

POSITIONS AND ANGLES Always bear in mind that Radiography is shadow work, and that the angle of the ray as compared to position of teeth and film have a most important bearing on the final result. Far too often the X-Ray tube is tilted too high or allowed to drop too low in position, with the result that the images or negatives are distorted; some lengthened, and some shortened.

In studying the figures numbers 1 to 8, you will notice that in order to produce results where the images are neither lengthened or shortened the rays will strike the films at nearly (but not quite) a right angle.

Figures 1 to 4 are illustrations of uppers.

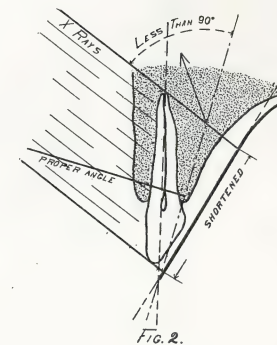
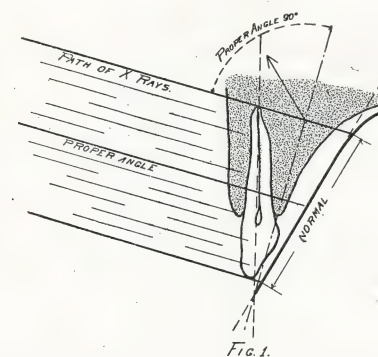


Figure No. 1 shows position of Film and angle of Ray adjusted properly. Result will show normal length of tooth.

Figure No. 2 shows angle of Ray when tube is tilted too high. The image on the film will be too short for proper diagnosis.

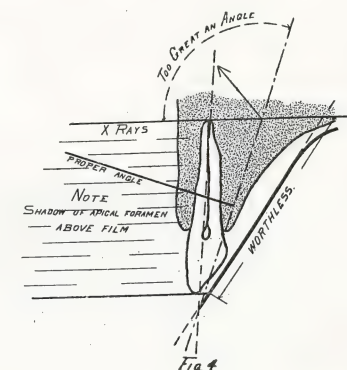
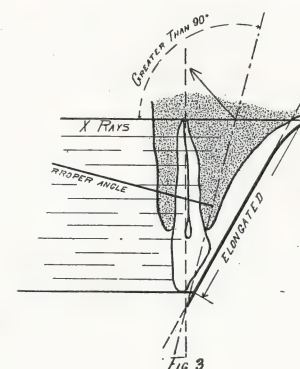


Figure No. 3 shows Tube too low in position. The resulting image will be too long.

Figure No. 4 illustrates position of Tube so low that the shadow of the apical end of the tooth passes over the top of the Film. The resulting negative is worthless.

* * * * *

Practically the same arguments hold good on Lowers as on Uppers, with the exception that too high an angle on the tube will produce Lengthening, and too low, Shortening.

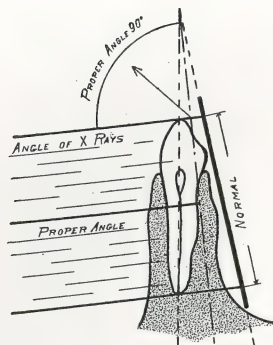


Fig 5

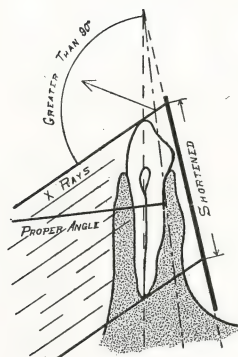


Fig 6

Figure No. 5 illustrates proper angle of Ray for Lows. Also proper position of Film.

Figure No. 6 illustrates angle of Ray when tube is placed too low. The resulting image of the tooth will be considerably shortened.

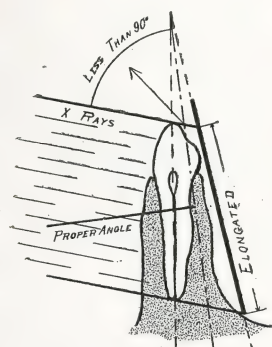


Fig 7.

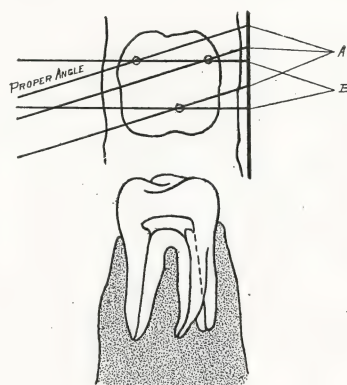


Fig 8.

Figure No. 7 illustrates angle of Ray with tube too high. The resulting image on the negative will be lengthened.

In order to show all three roots of molars clearly, it is necessary to make two or even three exposures, from different angles; that is, figuring from front to back. This point you will find illustrated on Figure No. 8.

Figure No. 8 shows both lateral view of molar and view of top of crown. You will note, from the lines drawn through the approximate positions of the roots, the different results that may be achieved by using various angles. "A" indicates proper angle for picturing all three roots. "B," indicating position of tube and resultant angle of Ray, will show but two roots clearly, with the third rather indistinct.

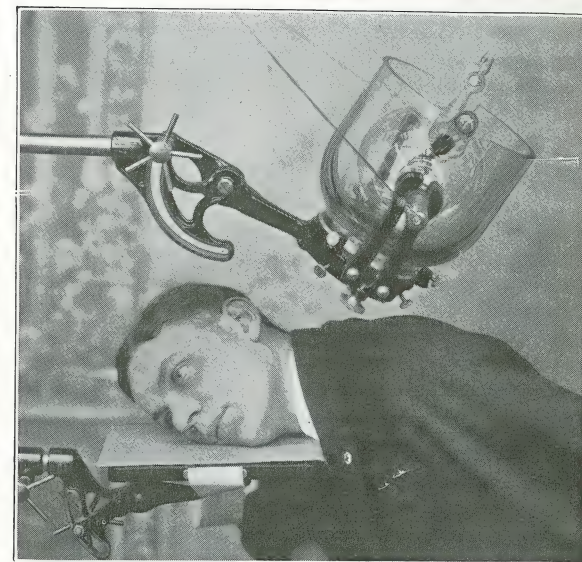


Figure No. 11

Figure No. 11 shows position of patient and tube for making radiograph of mandible of right side; also takes in teeth as shown on Figure 12.

Figures No. 12 and No. 12A illustrate the result from position No. 11.



Figure No. 12

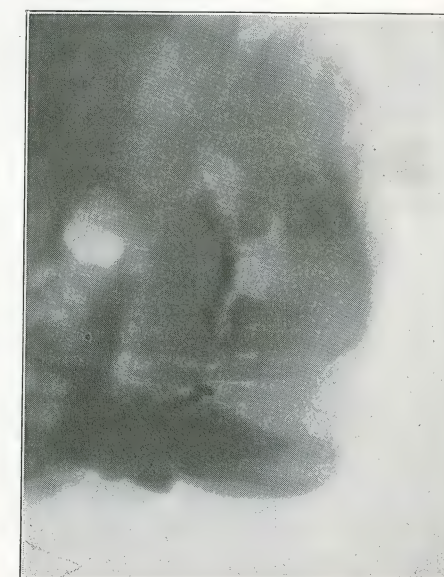


Figure No. 12A

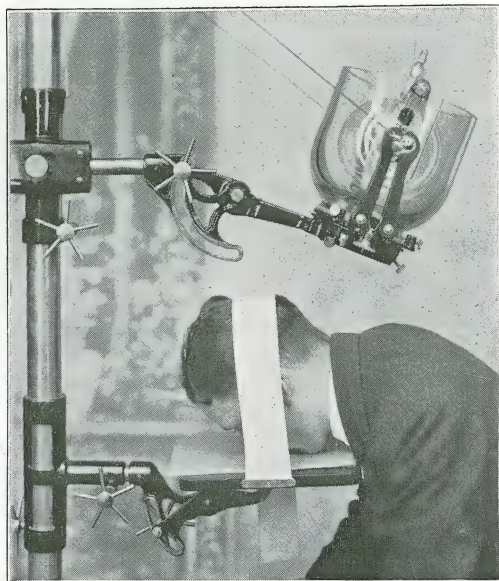


Figure No. 13

Figure No. 13 shows proper position for making radiograph of the antrum of Highmore through back of neck; also the centrals and laterals. (See Figure No. 14.)



Figure No. 14

Figure No. 14 illustrates the result from position No. 13.

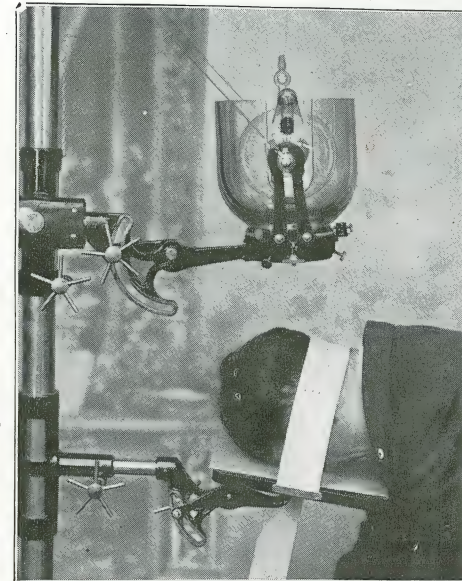


Figure No. 15

Figure No. 15 shows position for making radiograph of the frontal sinuses and antrum of Highmore through back of head; passing rays in line over top of ear and in line with orbits. (See Figure No. 16.)



Figure No. 16

Figure No. 16 illustrates result from position No. 15.



Figure No. 17

Figure No. 17 shows position for making film radiograph of lower centrals and laterals. Head tilted back slightly, tube support tilted all the way back. (See Figure No. 18.)

Figure No. 18 illustrates result from position No. 17.



Figure No. 18



Figure No. 19

Figure No. 19 shows position for making radiograph of upper centrals and laterals. Cut edge of cone parallel with face. (See Figure No. 20.)

Figure No. 20 illustrates result from position No. 19.



Figure No. 20



Figure No. 21

Figure No. 21 shows position for making radiograph of lower molars. Head held upright, chin resting in hollow of cone. (See Figure 22.)

Figure No. 22 illustrates result from position No. 21.

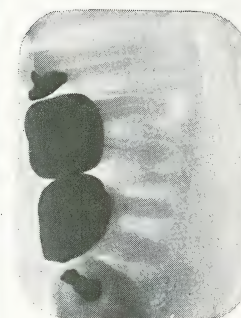


Figure No. 22



Figure No. 23

Figure No. 23 shows position for making radiograph of upper molars. Cut edge of cone parallel with face. (See Figure No. 24.)

Figure No. 24 illustrates result from position No. 23.

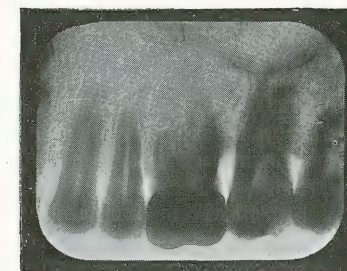


Figure No. 24



Figure No. 25

Figure No. 22A illustrates result from position No. 21, when using the medium size (No. 1A) Film.

Figure No. 25 illustrates result when using the large size (No. 2) film, inserted straight into the mouth, in what is often referred to as the "Bite Method." Have the patient in position similar to that shown in Figure No. 19, but tilt the tube to a slightly higher angle to avoid the lengthening of the image which would result with the tube placed too low. Figures Nos. 22A and 25 are valuable helps where a Roentgen-diagnosis of the entire oral cavity is to be made.

DENTAL FILMS

Ordinary dental films come two in a packet, both with emulsion coated sides facing the smooth side of the outer wrapper. This outer covering is of oiled paper which will resist saliva, and protects the inner black light proof wrapper and films.

These films come in three popular sizes:

No.	
1	—measuring..... $1\frac{3}{8}$ " x $1\frac{5}{8}$ "
1A	—measuring..... $1\frac{5}{8}$ " x $2\frac{1}{4}$ "
2	—measuring..... $2\frac{1}{4}$ " x 3"

The No. 1 small size is suitable for all ordinary Dental Roentgenographs.

The No. 1A size is to be used when larger areas are to be covered, as for instance, in making a roentgen diagnosis of the entire mouth. It requires ten exposures on the No. 1 films to accomplish this, while it can be done with eight when using some of the No. 1A.



Figure No. 22A

The No. 2 Film is to be used when the desired position and result are impossible with either of the smaller sizes (see Figure 25). These large films make excellent negatives of the upper or lower centrals; in the case of the upper, showing nasal cavities and antrum shadows. Should be used where it is difficult to insert small films behind the teeth in the usual way. Place the film straight back (horizontally) in the mouth. The angle of the tube is then raised slightly so that the rays are focused to insure the proper length of shadows.

We advocate the use of the No. 2 film in cases where necrotic areas extend beyond the apices of the teeth; in which cases the large film is quite requisite to make a complete negative for diagnosis.

In selecting a method of procedure for making radiographs, especially of children or nervous patients, the comfort of the patient must be taken into consideration. The more quiet your patient will remain during the process of making the picture, naturally the better your result will be. Very often with this idea in mind, you will find it advantageous to use the extra-oral or plate method quite freely. By extra-oral, we mean placing the film on the outside of the face and adjusting the angle of the ray so that the proper shadow will be cast on the film. A good method is to use a large cork, spreading the jaws as widely as possible (cork is transparent to the ray), and adjusting the line of ray to pass through the opening on the one side but to strike the teeth properly on the other. The film may be held in place with a small bit of adhesive tape. Were you to attempt making a radiograph of this kind by sending the ray straight through from one side to the other, you would merely have one row of teeth super-imposed over the other and be unable to distinguish outlines, and the result would have no diagnostic value.

The wisdom of this extra-oral method will be apparent to any one who has experienced the discomfort of having films placed lingually to the lower teeth, where the tissues are extremely sensitive, or who has had them placed back in the molar region against the palate, where they so frequently induce gagging. Many patients simply cannot retain a film in the mouth far enough back to take in the entire teeth. All of these unpleasant features can be eliminated by using the extra-oral "plate" method.

X-Ray plates come in several sizes, from the 5" x 7" to 14" x 17", and for all dental purposes we recommend the 5" x 7" and 8" x 10" sizes as they will be found ample. Plates are most often used in cases of suspected fractures of both the superior and inferior maxillary bones; locating foreign bodies in the antrum; broken broaches and sometimes even teeth; for badly impacted third molars where films are impractical, and for locating Osteoma, Cysts, Tumors, etc., of the Mandible.

There are different kinds of plates, and the films themselves come in several varieties. We recommend either the Paragon or Diagnostic plates, and the Fischer or Eastman Films. The Fischer Films packed two in a packet, give best results with richest detail, but are just a trifle slower than the Eastman Fast, or Negative Film. The Eastman Fast Film will give results with shortest exposures, and the Eastman Slow, or Positive Film will give very good results with longer exposures. We believe the Fischer Metal Backed Films will give the best results in all cases, as they are easily formed into shape, and have perfectly round, smooth corners which will not cut and scratch the sensitive tissues.

PLATE LOADING TECHNIC, ETC.

Always keep your plate and film stock in a lead lined box in a cool, dry place. Dampness, turpentine or oil odors are all equally harmful. Never depend on the ordinary walls for protection from the X-Ray. Either keep your films and plates in a lead lined receptacle or not less than fifty feet from the tube.

Do not load plates into the envelopes in large quantities, unless they are to be used at once. Whenever possible, plates should be loaded the day you intend to expose them, as the paper in the envelopes has a tendency to fog the emulsion and your detail will never be as clear, nor negatives as brilliant, as when you use proper care.

Your dark room must be absolutely dark, except for the Ruby Lamp. It must have no cracks, holes or curtains through which even the faintest trace of light may enter, as X-Ray plates are even more sensitive than the ordinary photographic plates, and fog very easily.

There are possibly ten distinct steps from the time you load your plate, test the tube, make the exposure, carry out development, etc., to the finished negative, and if the greater majority of these steps are followed according to our cautions, your results will always be of diagnostic value. A photographer will generally tell you, if consulted, that the precautions which we advise are in the extreme, but it is to your advantage to disregard utterly such remarks. What you are after are good Diagnostic Negatives.

Another thing, those developing formulas which work very well with portrait and landscape work do not give proper results with X-Ray plates, and we advise following our instructions in this particular very carefully.

If your space permits, it is advisable to build a dark room with an entrance, as illustrated on the sketch No. 40. This will enable you to walk in and out the dark room while your plates are in the solutions without harming them in any way. It is sometimes imperative that you leave the dark room before the plates have been finished, and we make this suggestion for your convenience.

Running water should be had if possible.

Arrangement where ice can be used in extremely warm weather is also advisable.

Keep your developing bowls and trays absolutely clean, rinsing them thoroughly both before and after using. Do not use the hypo fixing container for developer nor vice versa. Mark your trays with a bit of adhesive tape, and never change.

Your dark room equipment should consist of the necessary trays, two bowls for dental films, and a few dental film clips, thermometer stirring rod, ruby lamp and glass stoppered bottles for developer and hypo. These bottles should be just large enough to hold that amount of solution generally used. Do not use a sixty-four ounce container for sixteen ounces of solution. The mixtures will retain their original strength and last much longer if you will use glass stoppered bottles of *proper size*. A supply of developer and hypo fixer in packages which can be mixed on a moment's notice are also advisable, although where considerable work is being done, a goodly stock may be mixed up. It is not well, however, to expect one batch of developer to last more than a week's time, nor to attempt developing more than six or eight plates with any one tray full of solution.

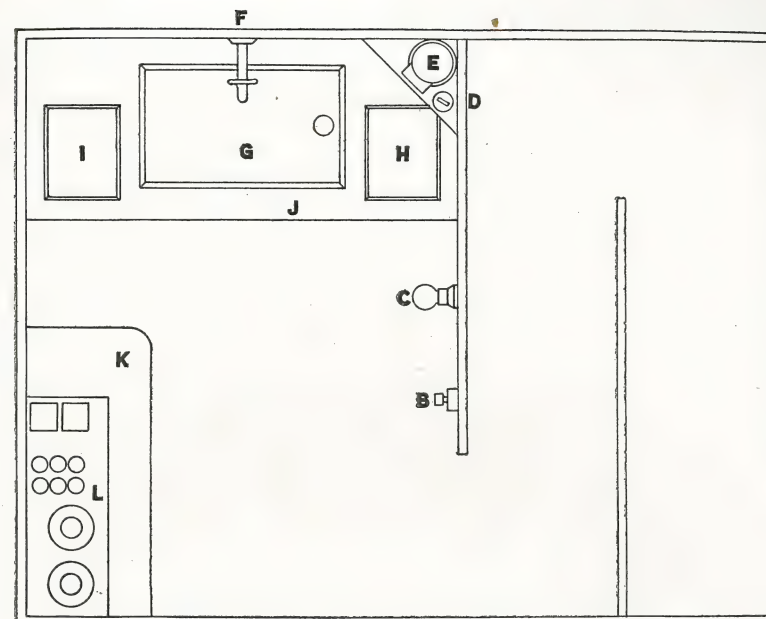


Figure No. 40

Explanation of Lettering on Dark Room Diagram

- A—Light Proof Entrance.
- B—Switch for White Light.
- C—Electric Lamp on Wall.
- D—Switch for Ruby Lamp.
- E—Ruby Lamp.
- F—Cold Water Inlet.
- G—White Porcelain Sink.
- H—Tray for Developer.
- I—Tray for Hypo Fixer.
- J—Table Shelf supporting Sink and Trays.
- K—Wide Shelf for Plate Loading.
- L—Small Shelf for Stock—Developer, Hypo, etc.

When about to load plates, it will be found convenient, saving both time and trouble, if you arrange your envelopes before turning out your white light. After everything is ready, the ruby light also should be turned out. Envelopes should be alternated on your table or shelf, first laying down an orange and then a black envelope, with the flaps toward you and the seamed sides up. In this way there can be no question as to which envelope is picked up in the dark, nor any delays caused by inserting the plates into the orange envelope first, which, on account of the larger size, will not fit into a black one. By passing the ball of the thumb lightly over the corner of the plate, the film or emulsion side can be detected in the dark, it having a fine matte surface in contrast to the other or clear glass side.

Care should be exercised in this, as if the plates are loaded bottom side up, the glass will cut off some of the X-Ray, the image will not be quite as clear and will also appear reversed.

Place the plate with the emulsion side against the smooth blank side of the black envelope; close the flap and insert flap first into the orange envelope in the same manner, leaving the seamed sides of both turned the same way.

When this rule is followed, you can always be sure that the film or sensitive side of the plate is turned toward the smooth side of both envelopes, and you will then never make the mistake of taking the radiograph through the glass accidentally, if the printed side of the orange envelope is turned from the patient.

Do not overlook the fact that your plates are just as sensitive after loading as before, and should never be allowed in a room with an X-Ray tube when same is in use, unless under lead cover.

There is a new Eastman Film on the market, which is coated on both sides with sensitive emulsion and which is supplied with a special holder in place of envelopes, which films are especially valuable in Medico-legal cases where the finished negative is to be handled considerably, and where there is any danger of breakage. They are also very easy to handle, and have a very fast emulsion. When used with double intensifying screen, they will enable you to make more rapid radiographs than any other known method or combination.

DEVELOPING

To obtain best results, use some good standard formula, proven to be good to your entire satisfaction, and then stick to it. Learn to your own satisfaction what length of development gives best results with each class of work, and then disregard most of the many suggestions which will be put to you by all others connected with X-Ray work, your local photographer included.

If you wish to make up a quantity of developing solutions, we recommend the following formula:

No. 1—The B-D Formula. Solution A.

Water, 1 gallon.
Metol, $\frac{1}{4}$ oz.
Hydroquinone, 4 ozs.
Sodium Sulphite (dry), $7\frac{1}{2}$ ozs.

Solution B.

Water, 1 gallon.
Sodium Sulphite (dry), $7\frac{1}{2}$ ozs.
Sodium Carbonate (dry), 10 ozs.
Potassium Carbonate, 5 ozs.
Potassium Bromide, $\frac{3}{4}$ oz.

Use equal parts A and B.

This formula will give best results with a four or five-minute development under normal exposures and can be depended on for uniform results. However, if you are not doing a great deal of X-Ray work, we suggest developer in packages which make up 10, 12 or 20 ozs. of solution, according to the size (see catalog section in back of booklet).

As stated above, do not attempt to develop more than six or eight plates in one tray of solution. You might try this and imagine you can develop a dozen as well as six, but on close examination you will find the last six very inferior in general appearance and detail to the first. This difference will not be noticeable until after the finished negative has been dried and is ready for examination.

If your plate has had sufficient exposure, it should grow more dense as the time of development increases. Start development in the dark, being sure the plate is instantly covered all over with the solution, only using your ruby lamp at intervals to watch that you do not carry development too far. First take your plate out of the envelopes, holding same carefully by the edges. Never place your fingers over the center of the plate, as if they are damp for any reason, they will leave permanent marks. Lift up one edge of your tray so that all of the developing solution flows to the opposite edge. Place plate in tray and quickly drop the tray flat and start rocking gently back and forth. This causes the plate to be covered evenly and at once with fluid, and will prevent streaks which would otherwise show on the finished negative. Continue to rock the tray throughout development. If undeveloped corners or streaks show up, this indicates insufficient solution.

At the end of approximately $4\frac{1}{2}$ to 5 minutes, your plate should appear about the same shade in front and back when held up to the ruby light, and dense enough that no red light shines through. The heavier the object the more dense should be the development. Lighter parts, such as hand, if tissue shadows are desired, should be developed less dense than hip, spine, etc.

If your result is obtained in less time, you have either over-exposed your plate, or your developer is too strong, or too warm. A tube of the proper vacuum will give an absolutely dense black velvety appearance on the plate where the body does not cover it. If you can see your hand through this part after developing as above, you have not used the best technique throughout.

If longer than five or six minutes are necessary, your trouble may be too cold or too weak developer, or under-exposure. Sixty-eight degrees Fahrenheit will be found ideal.

In some sections of the country the water from the faucet will contain chemicals (alkali especially), which will prevent the developing chemicals from working at their best, and for that reason if your plates have a tendency to show any trace of blue or pink coloring, use only distilled water.

A tube of too high a vacuum will not give the desired dense black plate. They will show lack of contrast and appear thin, generally showing too much gray color, due to the fact that penetration has been too sharp, the ray going through the bony and tissue structures in almost equal proportion. Too low tubes will show a dense black to the part not covered by any object, but will show the bones and teeth clear but with no detail.

Too long exposure will cause the plates to appear dense all over, while if the exposure has been too short, no end of developing will bring out the desired density.

In the above, wherever "plates" are referred to, "films" are to be understood as included.

The Eastman dental Films are wrapped in a double covering and come two in a packet. The Fischer Films are wrapped in single covering only, but also come two to a packet. Separate these before immersing in the solution, as if they stick together they will both be ruined. The balance of the technique as outlined herewith will be practically the same for films as for plates.

Dental Films should be set into small clips, which in turn should be hung over the edge of the developing bowls. This will obviate the necessity of handling them and will enable you to take them out of the solution to observe density, etc., without getting your fingers in the solution, and the resulting negative will be much cleaner in appearance. The most common complaints are due to over-exposure and lack of proper development. Sometimes it is impossible to hold your solution down to 68 degrees, and the desired result will show up in three minutes' time. Occasionally, if your developer drops below 68 degrees, ten or even twelve minutes' development is necessary to bring out the result.

Time development is ideal where you know the exact penetration of the tube, gauge your exposures very carefully, always use same back-up-spark, same distance from plate, and with all conditions equal the same result can be looked for on each occasion, but where conditions are subject to change, and where so many factors enter into the proper time of development, we advocate "watch your development."

FIXING After thoroughly developing, wash plate in cold water (running water, if possible), being careful not to touch the emulsion side with the fingers; then place in the Hypo bath.

Use our acid Hypo fixer such as is furnished with the equipment, mixed strong enough to clear all the milky white appearance off the plate or film in about five minutes. After plate is clean, allow it to remain in the Hypo about five minutes more. A plate is not ready for final washing as soon as the milky appearance has left, but should be considered only half fixed. If taken out, washed and dried at this time, you may look for a fogged, stained plate later, as generally there is some silver left on it.

After the plate has been in the Hypo two or three minutes, depending on the freshness and the strength of same, it is perfectly safe to open the dark room door or turn on a white light. Be especially careful of bright sunlight or of too bright a tungsten lamp. It is better and safer to have a small lamp in the dark room which either has a coating of orange coloring, or if the ordinary lamp is used, slip an orange envelope over it. The emulsion is not nearly as sensitive to this light.

After thorough fixing, the plate must be washed in running water for at least twenty minutes. When no running water is available, wash for half an hour, changing water at least five or six times. Be careful, especially in summer, of ordinary faucet water. Very often it is just warm enough to so soften up the emulsion that it will cause same to run and spoil the negative. Do not allow a stream of water to run directly onto a plate while washing, to avoid blistering the emulsion. Dental films are somewhat less easily damaged than X-Ray plates.

After washing, plate should stand on edge to dry; films should be hung up in the clips, preferably in slight draft. Never dry them in sunlight, as it increases the density of the entire plate and is apt to melt the emulsion.

DEVELOPING DON'TS

Do not attempt to use old Developer or old Hypo. It may be hard to get your patient back again, and it certainly will cost more than the small cost of your solutions.

Do not use warm Developer or warm Hypo. Stick to 68 degrees F.

Do not examine plate by any white light until thoroughly fixed. Fading will be the result of carelessness.

Do not use too bright a Ruby light. Our No. 1600 Ruby Lamp is perfectly safe. If the bulb burns out, be sure that you replace it with one of equal candle power. If this is impossible, and the light is increased, cut it down with a thickness of orange paper cut from one of the X-Ray envelopes, which can be set between the glass plates in the window.

Never allow a Ruby light to shine directly on a plate throughout development. Any lamp will cause some fogging if this is permitted. Either turn it out or to the side and only flash it over the plate for observation purposes.

Do not use Pyro or any patent developers on X-Ray plates and films, as although they may be exclusively used for landscapes and portraits, and may be a particular hobby of your photographer, they seldom, if ever, give good results on radiographs.

After your negative is finished, study it; decide in your own mind how to improve it, or send us an occasional sample and let us look it over, criticizing if necessary. If the beginner or novice in radiography will decide to make each plate better than the last, in a surprisingly short time it will be found that the only difficult part of radiography is most of the literature on the subject.

The average photographer should rarely be given X-Ray films or plates to develop, except in extreme emergency, unless he is thoroughly instructed as to how to handle them. A photographer is guided entirely by the appearance of the image on the negative, and is very apt to take them out of the developer too soon. Poor radiographs will result and you will blame the machine or the tubes when really most of the trouble lies in the dark room. For the above reasons, we earnestly recommend that all development be done in your own quarters, and, if not by yourself, at least under your supervision.

Remember, you cannot see through a good negative when it is fully developed, when held up to the ruby light. The length of development depends largely on the speed of the plates used, time of exposure, vacuum of the tube, strength of the current used as measured in Milliampères and back-up spark, strength of the developer, temperature of your solutions and the purity of the chemicals and the water used.

We endorse both the Diagnostic and the Paragon plates as being sure to give uniform good results.

Always rinse the hands thoroughly after dipping in developer or Hypo, as some chemicals have a somewhat poisonous effect on the skin, as well as staining the fingers. Always remember that one drop of Hypo in your Developer will ruin it, and if the fingers have any Hypo on them and the plate is touched while developing, a natural stain or fog will result.

Good diagnosis is just as important as good radiographs. You will have to look for the unexpected and not be content to be a mere photographer. Text books and X-Ray negatives do not always agree as to the location and shape of parts, but nevertheless, a thorough knowledge of anatomy will greatly assist in focusing the tube, and knowing how the parts should look on the finished plate.

A good illuminating box with properly placed lamps and covered on the inside with a flat white paint, is absolutely necessary for the correct examination of negatives. If a plate is held up to an ordinary lamp or to the sky through a window, the result is not as satisfactory.

After the plates have been made, it is absolutely necessary that you have some method of filing them, not only to preserve the plates themselves, but so that you can refer to them when necessary by means of a card system. The style of rack or cabinet is inconsequential, but you should store the plates in an upright position, isolating the various sizes if possible, filing each plate in an individual manila envelope, the outside of which should contain as much of the history of the case as possible. These envelopes today are a stock article.

HINTS ON X-RAY DIAGNOSIS

In examining negatives, one should bear in mind the fact that very dense tissues are characterized by white areas, while less dense tissues appear darker; and the absence of tissue is indicated by blackness. To avoid confusion, remember this refers to X-Ray negatives and that imprints and lantern slides are reversed.

The Radiograph is not a Picture of Disease. It is a record only of the varying resistance of the passage of the X-Ray offered by the parts pictured. The Interpretation of the meaning of these shadows, and the decision as to whether they are caused by pathological conditions or not, requires on the part of the diagnostician a full knowledge (1) of Anatomy, which must be coupled with (2) the Symptoms, (3) the clinical examination, (4) the present and past condition of the portion being Rayed, and (5) due consideration of the possible effects of the treatment already given.

A reducing lens, if used about 4 feet from the plate, and with proper illumination behind the plate, will often show up rather indistinct particles, such as Kidney or Gall Stones, etc., which do not show up when the plate is viewed in the regular way.

PLATE TROUBLES

Soft emulsion on the plate is due to *too high* temperature of the solutions. Use ice around the developing trays, and after washing in *cold* water, stand the plates where there is some circulation of air.

Persistent soft emulsion trouble can be cured by placing the plate in a hardening solution, made up as follows:

- 1 part Chrome Alum.
- 9 parts Distilled Water.
- Dash of Formalin.

The plate should be soaked in this solution immediately after development, but *before fixing with hypo*. Wash and fix as usual.

Small holes or transparent spots are not the fault of the plate, and are only due to tiny globules of air which adhere to the plate during development. Either go over the plate while in the developer with a bit of cotton,

carefully, or rock the tray vigorously.

Small dark spots are generally caused by water spattering on the plate before development.

Streaks across the plate may be caused by rocking the tray in one direction only. Rock *both* ways; vigorously at first, and gradually to finish.

Pitted Negatives are mostly due to too slow drying.

Gray, flat negatives are either due to under-exposure, too weak solutions, too cold developer, or under-development. One is just as important as the other, and should receive the same amount of attention.

Stains are mostly due to improper fixing; either the hypo bath has become decomposed, or does not contain the proper amount of acid. Rinse the plates thoroughly when changing from developer to hypo bath, or green or bluish stains will result. Stains may be due to insufficient washing, too long development or under-exposed plates, or too warm developer. A dark stain over the entire plate may be caused by examination by bright light before the plate is completely fixed in the hypo.

A dark shadow on a film around the apex of a tooth means, naturally, that at this particular portion of the alveolis there is a lessened density, loss of obstruction to the passage of the Ray, and increased permeability; and inasmuch as it is the Calcium Salts in bone that produces the shadow on a photographic plate or film, this dark apical shadow would naturally indicate a loss of lime salts, i. e., decalcification.

The X-Ray will, in the majority of instances, if the correct technique is employed, record on the film any abnormal or diseased condition which may be present beneath the surface. Healthy tissue has more resistance to the Ray than any diseased tissue; therefore more of the Ray strikes the film through the diseased tissue than through the healthy tissue; consequently, the portion of the film behind the diseased area will be darkened as compared to the portion behind the healthy tissue, teeth, fillings, crowns, foreign bodies, etc.

In Root Canal investigation it is advisable, when possible, to insert a broach, wire, or temporary filling before the film is made. By this method the length, size and direction of the canal can be shown plainly.

The statement that the X-Ray proves that a tooth has been filled properly or not is open to question. Some solutions and filling materials do not show shadows in all parts of the canals. It depends on the solidity of the filling cones or other agent used, and whether metal is used or not. Unless a sufficient quantity of filling material is present to cast a shadow, it is very often not reproduced.

In a recent issue of the International Journal of Orthodontia there appears the following: "In seeking out the various anomalies and pathological conditions to which the teeth and oral structures are subject, we should not be misled by indefinite shadows upon X-Ray Plates and Films. The very nature of these structures, their gross as well as minute anatomy, renders them somewhat difficult to radiograph, and necessitates a refinement of technique greater than that demanded with most of the other portions of the human body. Therefore, only radiographs made in accordance with a definite and exacting technique should be relied on for diagnosis.

"If a doubt exists in any given instance, an additional, or even two more, exposures should be made, so that any conclusion reached will be founded upon definite evidence."

This subject is being gone over so thoroughly and so repeatedly in most every journal of Dentistry which one can pick up that there is no need of going deeper into it. These well described cases, generally fully illustrated, will prove a wonderful help to any dentist who will but take time to look them up.

The following are sixty-three cases in which the X-Rays are not absolutely indispensable, but in which Radiographs will prove a wonderful aid.

The Uses of Roentgen Rays in Dentistry

1. In cases of delayed eruption to determine the presence or absence of the unerupted teeth.
2. In cases where deciduous teeth are retained long after the time when they should have been shed, to learn if the succedaneous teeth be present.
3. To learn if the roots of children's teeth are fully formed.
4. To determine whether a tooth be one of the primary or secondary.
5. To determine when to extract temporary teeth.
6. To show the Orthodontist when he may move the coming permanent teeth by moving the deciduous teeth.
7. To observe moving teeth.
8. In cases of supernumerary teeth.
9. In cases of impacted teeth as an aid in extraction.
10. To determine the number of canals in some teeth.
11. As an aid in filling canals with large apical foramina.
12. To learn if canals are opened and enlarged to the apex before filling and to observe the canal filling after the operation.
13. To determine whether an opening leading from a pulp chamber be a canal or perforation.
14. In cases of pulp stones (Nodules).
15. In cases of secondary dentin being deposited and pinching the pulp.
16. To learn if the filling in the crown of a tooth encroaches on the pulp.
17. In cases of teeth with large metal fillings or shell crowns which do not respond to the cold test, to learn if the canals are filled.
18. To learn if the apical sensitiveness is due to a large apical foramen or an unremoved, undevitalized remnant pulp.
19. In cases of Chronic Pericementitis (Lame Tooth).
20. In cases of alveolar abscess to determine which tooth is responsible for the abscess.
21. In cases of alveolar abscess to determine the extent of the destruction of the tissues, bone and tooth.
22. In cases of alveolar abscess to determine how many teeth are involved.
23. In cases of abscess of multirrooted teeth; to learn at the apex of which root the abscess exists.
24. In cases of crowned teeth which are abscessed to learn if the canals are filled.
25. As an aid in differential diagnosis between Chronic Alveolar Abscess and Pyorrhea Alveolaris.
26. To observe destruction of tissue due to Pyorrhea Alveolaris.
27. In cases of Pericemental Abscess.
28. In cases of persistent suppuration which do not yield to the usual

treatment. In fact, all cases that do not yield promptly to the usual course of treatment.

29. To observe the course of the Fistulous Tract.
30. To observe the field of operation before and after Apicoectomy.
31. To locate foreign bodies, such as a broach in the canal or tissue at the apex of a tooth; a piece of wooden toothpick in the Peridental membrane, etc.
32. To determine the presence or absence of a bit of root imbedded in the gum tissue.
33. To diagnose fracture of a root.
34. To observe the size and shape of roots of teeth to be used in crown and bridge work.
35. As an aid and safeguard when enlarging canals for posts.
36. To examine bridges about which there is an inflammation.
37. To observe the field before constructing a bridge.
38. To observe planted teeth.
39. In cases of cementoma.
40. In cases of bone whorls.
41. To locate stones (Calculi in the Salivary Ducts or Glands).
42. In cases of Bone Cysts.
43. In cases of Dentigerous Cysts.
44. In cases of tumor, benign or malignant.
45. To observe anomalous conditions, such as the fusion of the roots of two teeth for an example.
46. To observe the location and extent of necrotic or carious condition of the bone.
47. To diagnose Antral Empyema.
48. To observe the size, shape and location of the antrum, as an aid in opening into it.
49. To locate foreign bodies, such as tooth roots or broaches in the antrum.
50. To observe cases of luxation before and after reduction.
51. In cases of fracture of the jaw.
52. In cases of Ankylosis of the Temporo-Mandibular Articulation or the joint formed by the tooth in the jaw.
53. To observe the field of operation before and after resection of the Mandible.
54. In all cases of Facial Neuralgia with an obscure Etiology.
55. To observe the Inferior Dental Canal.
56. In cases of Ludwig's Angina.
57. In cases of Insomnia, Neurasthenia, Insanity and kindred Nervous disorders.
58. In cases of periodic Headaches.
59. In cases of Facial Gesticulatory Tic (Spasmodic Twitching of a set of facial muscles).
60. To allay the fears of Hypochondriac.
61. In cases where the patient cannot open the mouth wide enough for an ocular examination.
62. In cases of hidden Dental Caries.
63. In research work to study osteology, the development of the teeth, the action of Bismuth Paste, Bone Production and Destruction, Changes occurring in the Temporo-Mandibular Articulation when jumping the bite, Blood supply to parts, Resorption of teeth and the causes for it, etc.

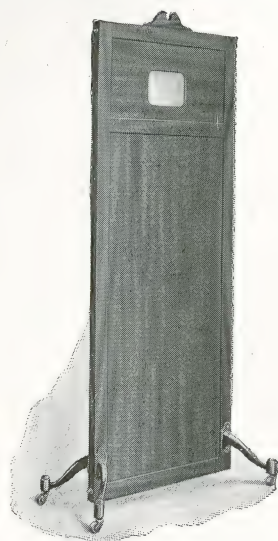
Lead Protection Screen

Designed and built for the X-Ray operator who desires the maximum protection from the rays. Made of $\frac{1}{16}$ " sheet lead, covered all over with mahogany finished panels. Size over all, 27" x 7". Has an 6 x 8" imported lead glass window to enable the operator to see the tube in action without exposing himself. Handsome in appearance; durable in construction. Mounted on large, free-rolling casters, it is easily moved about.

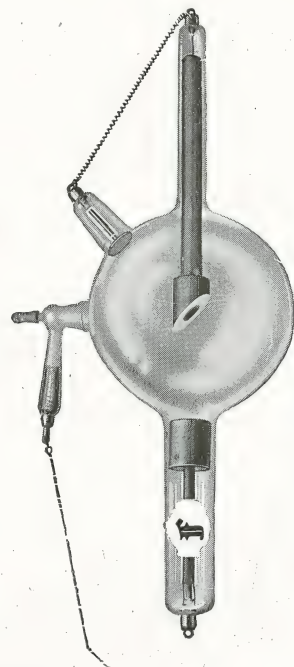
No.	Code
349 Oak Screen	Amice
350 Fischer Protect. Screen, Mahogany finish.....	Alum
351 Fischer Protect. Screen, Solid Mahogany.....	Amara

Other finishes on request.

Price
\$40.00 47.50
40.00 42.50
50.00 7.50



No. 350
Lead Protection Screen



No. 994 Transformer Tube

X-Ray Tubes

We have a well-equipped factory for the manufacture of all types of X-Ray and High Frequency Tubes, with an efficient corps of experienced glass blowers. This enables us to supply the best possible tubes with the least possible delay. Not only orders for new tubes, but all manner of repairs as well are handled promptly and satisfactorily. When ordering an X-Ray Tube always specify the make and type of apparatus on which it is to be used. This is absolutely necessary, as a tube must be pumped to a certain degree of vacuum to obtain the maximum efficiency from your machine. As an example, a transformer or coil tube cannot be used to advantage on a high frequency type of outfit, or vice versa. While a transformer or coil tube look exactly alike, they have widely different vacuums.

No.	Code
993 6" Tungsten Target Transformer Tube.....	Elbow
994 7" Tungsten Target Transformer Tube.....	Elder

Price
\$33.50 38.50
38.50 43.50

Repairing and Rebuilding X-Ray Tubes

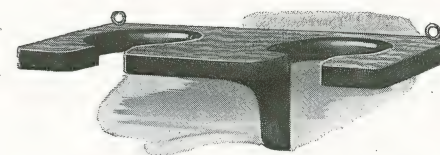
When an X-Ray Tube has become punctured, the minute hole can usually be sealed over and the tube re-exhausted. When a tube has been over reduced and the usual method of careful, repeated warming and cooling does not serve to raise the vacuum back to normal, re-exhausting is necessary. When the terminal ends are cracked in such a way that they can be re-sealed, repairs will be made at the same price as ordinary punctures. However, where cracks are beyond repair, re-building will be necessary. In rebuilding we use only the anode of the old tube. This is placed in a new bulb, with new cathode and regulator, and the finished article as returned to you will work as well as a new tube.

X-Ray Tubes for repairing should be sent to us by Parcel Post or Prepaid Express. Package should be carefully marked and Express Company informed that same contains a valuable X-Ray TUBE. This will insure its receiving careful handling.

Prices for Repairing

Re-exhausting and mounting new regulator 6" tube.....	\$ 5.00	7" \$ 6.00
Repairing puncture and mounting new regulator 6" tube.....	6.50	7" 8.00
Complete re-building 6" tube.....	15.00	7" 20.00

Wooden X-Ray Tube Racks



We recommend these racks as being the best designed tube support made. No metal whatever used in the construction. Arranged to hang on the wall, and to hold two, three or four tubes. Handsomely finished in mahogany.

No.	Size	Code	Price
375 To accommodate 2 tubes.....		Echo	\$1.75 2.00
376 To accommodate 3 tubes.....		Ecoid	2.50 2.75
377 To accommodate 4 tubes.....		Ectad	3.50 3.75

Lead Diaphragms

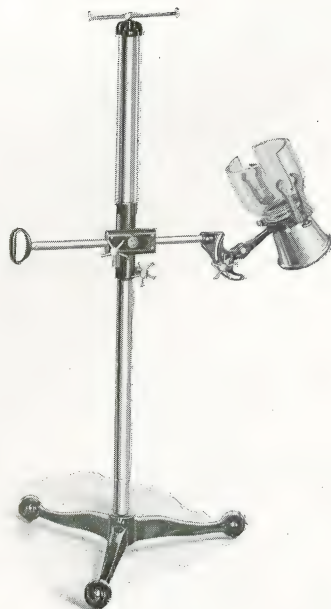
Made of heavy sheet lead, arranged to slip in the cone holder on the Tube Stand, directly over the cone. Furnished with two sizes holes.

No.	Code	Price
107 Lead Diaphragm, 1 inch hole.....	Doom	\$.50
1008 Lead Diaphragm, 2 1/2 inch hole.....	Dory	.50

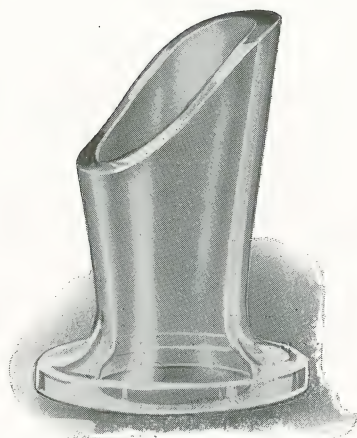
Aluminum Filters

Made of pure Aluminum, 1 M.M. thick. Either 1, 2 or 3 thicknesses can be inserted over the cone on No. 1005 Tube Stand, enabling the operator to use the proper amount of filtering resistance between the X-Ray Tube and the patient. Especially recommended for treatment work.

No.	Code	Price
1006 Aluminum Filter, 1 M.M. Thick.....	Donga	\$.50



No. 1005 Tube Stand



No. 1010 Lead Glass Cone

Fischer Compression and Protection Tube Stand

Our No. 1005 Tube Stand combines protection to the operator and patient with perfect ease of adjustment. It enjoys a sales record not approached by any other Counterweight tube support on the market; because of the large quantities manufactured, we are able to furnish a superior article at a popular price.

The Protection Bowl is built of heavy Lead Glass, affording ample protection. The X-Ray Tube is held firmly in the bowl by double-action clamps, which are self-centering and quick-acting. The Metal Head, supporting the Bowl, is in turn mounted on a swivel base, giving every conceivable position and desired angle.

The heavy Steel Upright, mounted on a heavy, properly designed Tripod Base, insures stability. The double counterweighted Cross Arm and Support are free floating. The Cross Arm is mounted on Roller Bearings, which insure ease of movement. The firm Locking of all adjustments is made with little effort on the part of the operator, the Locking Clamps each having Five Wings affording a good grip.

A rigidly constructed Lead Compression Cone 6" in diameter is furnished, above which Aluminum Filters can easily be attached. The Guide for the high tension Cords is sufficiently long and mounted on a Swivel support. The base being mounted on large free rolling Casters, it is easily the most complete, adaptable Tube Support obtainable.

The Finish is in heavy Nickel Plate and black Enamel. Mahogany finish will be furnished at the same price on request, and other special enamels at a slight additional cost. Metal Compression Cones of various sizes can be furnished on application.

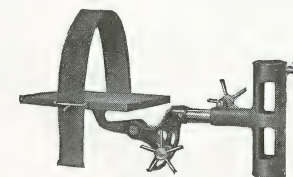
No.		Code	Price
1005	Fischer Stand, as illustrated.....	<i>Dossil</i>	\$60.00 ⁶²⁵⁰
1009	Lead Lined Compression Cone, 5" Diameter..	<i>Dura</i>	5.00
1050	Lead Lined Compression Cone, 3" Diameter..	<i>Buret</i>	8.00
1051	Lead Lined Comp. Cone, 8" Diameter.....	<i>Burn</i>	8.00

Lead Glass Dental Cone

For cutting off all except those X-Rays necessary for Dental Film work. The glass is shaped to conform to the contour of the face, not only affording a rest to hold the patient steady during exposure, but focusing the rays where they are needed. Gives exact position for all uppers automatically, and insures maximum of perfect results with the least amount of "chance." Indispensable to anyone doing any considerable amount of Dental Radiography. Fitted to our 1005 Protection Tube Stand.

No.		Code	Price
1010	Lead Glass Cone.....	<i>Carus</i>	\$8.50

Head Rest or Plate Support



Arranged to fit our Protection stand No. 1005. An exceedingly handy arrangement for supporting plates while making Radiographs of extremities and for all forms of Head work. Very practical for Dentists. The supports are all metal, partly Enameled and Nickel Plated to match the balance of the stand. The top plate is of wood, with a Canvas band and clamp to hold down the part to be radiographed. Easily adjusted to any position.

No.		Code	Price
975	Plate Support, Black or Mahogany.....	<i>Dolor</i>	\$15.00

Fischer Rewind Cord Reel

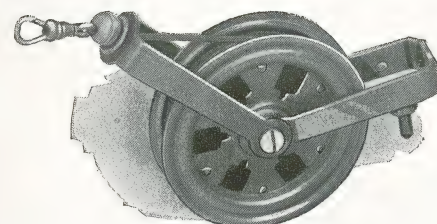
For making connections from the high tension terminals on the X-Ray machine to the tube these Rewind Cord Reels are indispensable. They take up all slack wire, and yet allow the tube to be moved to any position without the danger of breaking off the connecting tips, a common complaint when ordinary cords are used.

The Springs are made of finest watch spring stock, and the reels are so constructed that the last foot of cord puts no more strain on this spring than the first foot, a feature of perfect workmanship not found in the great majority of such articles on the market.

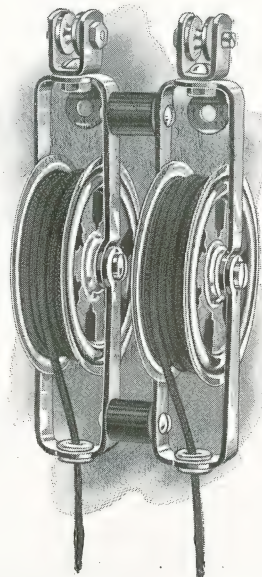
The cord, composed of Tinsel copper strands interwoven with linen threads, is run through a glass eyelet, insuring length of wear; a hole merely drilled through the supporting frame will wear out the cording all too quickly. Thus our guarantee that our Reels will outwear all others.

The Special Hook Connector on the end of the cord, as well as the glass eyelet guide, are protected against accidental quick return by the addition of a soft rubber bumper, which takes up the shock. Heavily nickel plated. Length of connecting cord, 8 feet.

No.	Code	Price per Pair
528 Fischer Reels	Fagin	\$5.00



No. 528 Cord Reel



No. 531 Trolley Cord Reel

Fischer Reels With Special Cord

The very flexible copper wire used on these reels is covered with a mercerized sheathing, affording proper insulation when used in connection with the Coolidge Tube. Carried in stock either single or double, with tips to fit any type of machine terminals or with trolley wheels. These Reels are the same high quality as the No. 528.

No.	Code	Price
530 Single Fischer Reel, with Green Silk covered wire, arranged with Trolley Wheel for overhead wiring	Hemoid	\$3 00
531 Double Fischer Reels, covered same as No. 530, with Trolley Wheels, each set	Hemp	7.00
532 Single Fischer Reel, same as No. 530, but with metal tip instead of Trolley Wheel, each	Hoist	2.50
533 Double Fischer Reels, same as No. 531, arranged with metal tips, each set	Holly	6.00

Illuminating Boxes

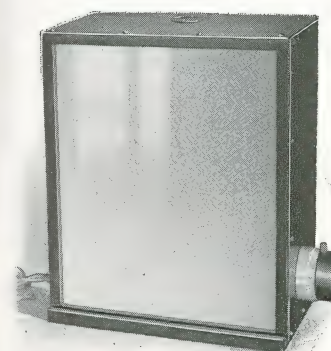
For examining X-Ray Negatives up to and including 8 x 10. Frame made entirely of metal. Has opal glass front, insuring a perfect lighted surface for diagnostic purposes. Tungsten lamp illumination.

No.	Code	Price
551 Illuminator	Dartos	\$7.50 <i>8.50</i>

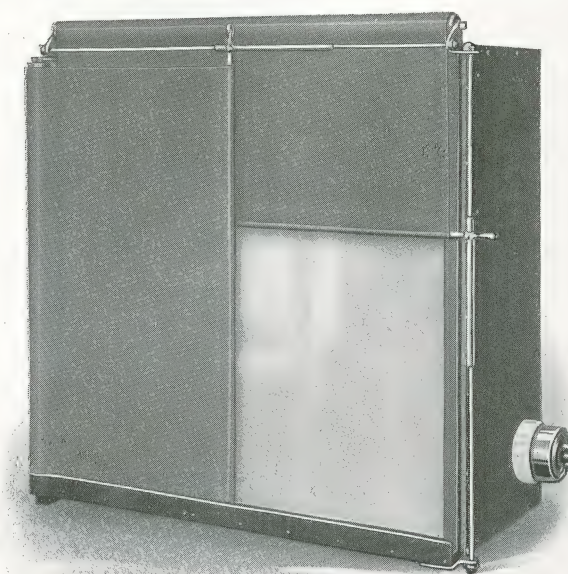
Making a good radiograph is one thing—good diagnosis is quite another. In order to make accurate diagnosis of an X-Ray plate, an evenly graduated white light is absolutely necessary. We use Tungsten lamps, and cover the inside of the box with white paint. About half-way between the lamps and the ground glass is arranged a sheet of special material for diffusing the to avoid white spots which would otherwise show directly in front of the globes.

The result is a clean blank WHITE background for your negative, which is so very valuable to you, especially in compound fractures, stones in the kidneys or bladder and soft tissue work. Lighted area will accommodate a 14 x 17 plate, either way, or can be cut down to a 5 x 7 size, with the sliding curtains. All metal construction, except the diffusing material and curtains.

No.	Code	Price
553 Illuminating box	Degote	\$30.00 <i>32.00</i>



No. 551



No. 553

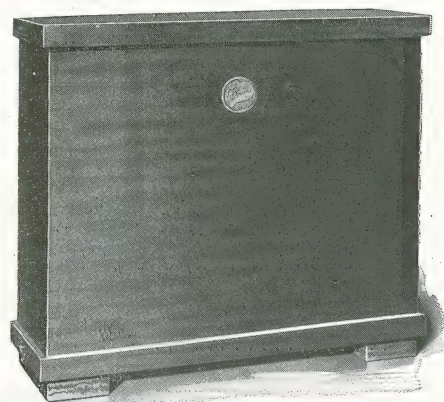
Special Illuminating Boxes

Very often an Illuminating Cabinet to fit some certain section of the office or laboratory is desirable. Where much X-Ray work is being done, a few specimens of that work, set in a rather conspicuous place, will act as a valuable bit of harmless advertising.

We are prepared to submit to you sketches drawn up to accommodate any number of any size plates, if you will but let us know your requirements. Prices moderate.

Lead Lined Plate Boxes

The Fischer Plate Boxes are carefully constructed and lined with heavy sheet lead. All joints are sealed, and nail and screw holes are soldered over to prevent any possible chance of the X-Ray leaking into the contents. The lead on the cover is pressed out to insure a snug fit into the box, and reinforced to protect it from sagging. These boxes are finished in mahogany. Made up in three sizes.



No. 575

No.		Code	Price
573	For Dental Films only, size 4 x 5.....	<i>Dun</i>	\$6.00 6.50
575	For plates up to and including 8 x 10.....	<i>Dens</i>	10.00 11.00
577	For plates up to and including 14 x 17.....	<i>Deric</i>	15.00 16.50

Opaque Rubber Tube Shields

This shield is made of heavy lead impregnated rubber, affording excellent protection from the X-Rays. May be left on the tube at all times. Especially useful in connection with Portable Coils. Is provided with three diaphragms, with one, two and three-inch openings. Very handy for confining the rays to the desired area for treatment work.

No.		Code	Price
355	Tube Shield, for 6" Tubes.....	<i>Algor</i>	\$10.00
356	Tube Shield, for 7" Tubes.....	<i>Alnus</i>	12.00

X-Ray Protection Cloth

X-Ray Protection Cloth, in strips 36" wide, any length, made of heavy lead impregnated rubber.

No.		Code	Price
383	Cloth, per square foot.....	<i>Ameba</i>	\$1.25

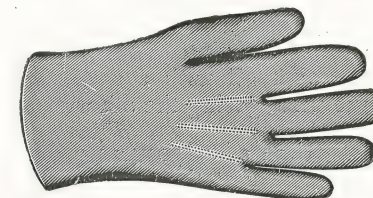
X-Ray Protective Aprons

X-Ray Protective Aprons, made of the same material as No. 383.

No.		Code	Price
385		<i>Amot</i>	\$12.00

Flexible Rubber Protection Gloves

They form a very effectual protection, and should be used where much Fluoroscopic work is being done. Made of practically the same material as the Tube Shields, but heavier in weight. These gloves are heavy enough to insure ample protection and yet are flexible enough to enable the operator to have full use of his fingers.



No. 360

No.		Code	Price
360	Protection Gloves	<i>Aloes</i>	\$10.00
361	Protection Gloves, are the same as No. 360, but have Gauntlets for wrist protection.....	<i>Alsol</i>	12.00

Sheet Lead

Sheet Lead, $\frac{1}{16}$ " thick, for mounting on doors or walls of X-Ray rooms. Code—*Glomus*. Prices on application.

Lead Glass

Lead Glass, for use as protection in cabinets and for shields. Extra heavy thickness, containing about 40% lead.

No.		Code	Price
390	Lead Glass. Per sq. in.....	<i>Glona</i>	\$0.06
391	Lead Glass. Size 5 x 7".....	<i>Gloss</i>	1.40
392	Lead Glass. Size 6 x 8".....	<i>Glusit</i>	1.85
393	Lead Glass. Size 7 x 9".....	<i>Glutin</i>	2.25
394	Lead Glass. Size 8 x 10".....	<i>Glycin</i>	2.80
395	Lead Glass. Size 10 x 12".....	<i>Goad</i>	4.15
396	Lead Glass. Size 11 x 14".....	<i>Goblet</i>	5.50

Lead Glass Bowl

Made of moulded glass, containing about 50% lead, affording excellent protection to the operator. Large enough to accommodate either 6" or 7" X-Ray Tubes. This bowl is furnished on our Compression Stand No. 1005.

No.		Code	Price
1015	Protection Bowl	<i>Gord</i>	\$10.00

Intensifying Screens

Intensifying Screens are to be used when Radiographs of the heavier parts are desired with shorter exposures than are required with the usual method of using the plate only. The speed of a Screen depends mainly on the quality of the chemicals used thereon.

We offer the Fischer Intensifying Screen as a satisfactory photographic intensifying medium. We have selected what we know is the best quality obtainable at any price, and the coating of Tungstate of Calcium being mounted on a smooth sheet of hard pressed cardboard, makes it very convenient to handle.

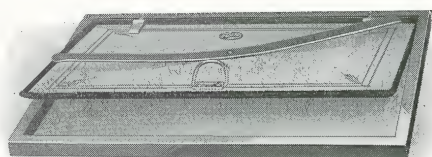
The Emulsion is a perfect chemical combination. It is permanent, that is, not affected by heat or moisture; and further, will not deteriorate under the action of the X-Rays. The surface of the screen is smooth, giving perfect contact with the photographic plate. The polish is high, assisting the intensification; it is coated over all with a waterproof enamel, permitting of its being cleaned without endangering the otherwise very delicate material.

These Screens are fast (time of exposures reduced from 50 to 75 per cent), and will fluoresce brilliantly at the time the X-Ray is turned on, but fade out quickly; therefore, there is no mottling effect, and the detail is perfect. Screens which do not fade out quickly tend to produce a clouded, faded effect in the finished negative.

Do not use a smaller size plate than the size of the screen, owing to the danger of damaging the sensitive emulsion with the edge of the plate.

No.		Code	Price
1040	Fischer Screen. Size 8" x 10".....	<i>Diatom</i>	\$20.00
1041	Fischer Screen. Size 10" x 12".....	<i>Digest</i>	30.00
1042	Fischer Screen. Size 11" x 14".....	<i>Dinus</i>	40.00
1043	Fischer Screen. Size 14" x 17".....	<i>Disk</i>	60.00

Intensifying Screen Holder



No. 1044

An all aluminum Plate Holder or Cassette, which can be used with or without an intensifying screen. Being constructed of metal throughout, all warping is eliminated. Absolutely light-proof. Strong springs hold the screen and plate tightly together, insuring the maximum of efficiency from the screen itself.

As practically all aluminum is used, the holder will not become damaged from chemicals or moisture in the dark room.

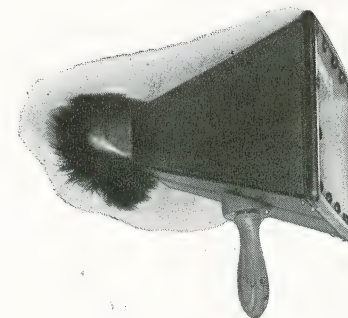
No.		Code	Price
1044	Fischer Aluminum Cassette. Size 8" x 10".....	<i>Dermis</i>	\$10.00
1045	Fischer Aluminum Cassette. Size 10" x 12".....	<i>Derrid</i>	12.50
1046	Fischer Aluminum Cassette. Size 11" x 14".....	<i>Dew</i>	14.00
1047	Fischer Aluminum Cassette. Size 14" x 17".....	<i>Diad</i>	16.00

Fluoroscopes

As much success depends on the quality of the Fluoroscopic Screen as on the Tube, or X-Ray Machine itself, we absolutely guarantee our screens to be the best on the market at any price. The Fluorescent Salt from which the Screens are made is absolutely stable; is not affected by Heat or Dampness, nor by continuous bombardment by X-Rays.

The color emitted by the screen is the nearest approach that has yet been made to giving long desired Black and White Contrasts. The screen has NO Visible Grain, shows up a very brilliant image, and can therefore be used to examine for the finest details.

If the Screen is properly treated, and protected by a suitable mounting, the image will be as bright and sharp after long continuous usage as the day it is purchased.



No. 1020

Finest quality Calcium Tungstate Fluoroscope Screen, mounted in a handsome black leatherette covered box; has heavy roll of fur around eye piece, making it absolutely Light-proof.

No.		Code	Price
1020	Mounted. Size 5" x 7".....	<i>Drain</i>	\$15.00 ^{16.50}
1021	Screen only. Size 5" x 7".....	<i>Drench</i>	10.00
1022	Screen only. Size 8" x 10".....	<i>Duct</i>	21.00
1023	Screen only. Size 10" x 12".....	<i>Dulcin</i>	30.00
1017	Screen only. Size 11" x 14".....	<i>Dutch</i>	40.00
1018	Screen only. Size 12" x 16".....	<i>Dyad</i>	50.00
1019	Screen only. Size 14" x 17".....	<i>Dyne</i>	60.00

No.		Code	Price
1025	Mounted Fluoroscope Screen with Lead Glass Protection over entire surface and heavy sheet lead hand protector. Size 5" x 7".....	<i>Dull</i>	\$20.00

1027	Fluoroscope Screen only, best quality, same as above. Per square inch.....	<i>Dram</i>	\$0.30
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Fluoroscope Screen Mountings, consisting of polished Wood frame, covered with Lead Glass, and equipped with protected metal hand clasps.

No.		Code	Price
1032	10" x 12" Frame.....	<i>Calix</i>	\$15.00
1033	11" x 14" Frame.....	<i>Callus</i>	18.00
1034	12" x 16" Frame.....	<i>Calor</i>	20.00
1035	14" x 17" Frame.....	<i>Caly</i>	23.00

Paragon X-Ray Plates

The Paragon X-Ray Plates are made especially for fine Radiographic work. They can be relied on at all times, as they run uniform in speed, and will make negatives of the highest class with fine detail and deep contrasts with comparatively short exposures. The finest bone structure or soft tissue details are rendered on these plates, even with the small apparatus, where the use of inferior plates would be out of the question.

No.	Size	Code	Price per Dozen	
			With 2 Env.	With 12 Env.
1618	5 x 7	Febris	\$ 1.40	\$ 1.65
1619	6½ x 8½	Felon	2.10	2.50
1620	8 x 10	Femur	3.00	3.50
1621	10 x 12	Fern	5.15	5.90
1622	11 x 14	Ferric	7.25	8.25
1623	14 x 17	Fervin	11.25	13.00

Diagnostic Plates

We have recently added the Diagnostic Plates to our stock, and find them to be of very excellent quality. They work equally well with or without an intensifying screen, and produce negatives with very fine detail and contrast.

No.	Size	Code	Price with	
			2 Env.	12 Env.
1657	5 x 7	Centra	\$ 1.40	\$ 1.65
1658	6½ x 8½	Cera	2.10	2.50
1659	8 x 10	Cerin	3.00	3.50
1660	10 x 12	Cestod	5.15	5.90
1661	11 x 14	Ceylon	7.25	8.25
1662	14 x 17	Cheek	11.25	13.00

EASTMAN DUPLITIZED X-RAY FILM This is a new product and we do not hesitate in saying that there is nothing on the market that can compare with it in speed. The sensitive emulsion is coated on both sides of the transparent base. By this means not only is increased speed obtained, but the process of developing and fixing are simplified, the time required in developing and fixing being considerably lessened.

The selling prices as given below do not include Exposure Holders.

No.	Code	Price Per Doz.
1685	5 x 7	Cholin \$1.25
1686	6½ x 8½	Cronic 2.00
1687	8 x 10	Chyle 2.85
1688	10 x 12	Cina 4.50
1689	11 x 14	Circle 5.75
1690	14 x 17	Claret 8.75

X-Ray Envelopes

These are sold in sets consisting of a heavy black Light-proof Envelope, into which the Plate is placed, this envelope fitting inside the Orange wrapper. The outer envelope has a regular printed form on it for the data of the case. Two sets of envelopes accompany each dozen plates, gratis.

No.	Size	Code	Price per Doz. Sets
1540	5 x 7	Fania	\$0.30
1541	6½ x 8½	Fango	.45
1542	8 x 10	Farad	.60
1543	10 x 12	Farna	.95
1544	11 x 14	Favus	1.25
1545	14 x 17	Faun	2.25

Plate Marker

Marked Plates, for positive identification, are positively necessary for Medico-Legal cases. This whole instrument is well made from heavy sheet metal, nickel plated. Any name not having more than ~~two~~ lines of more than 20 letters ~~each~~ may be cut in the top section. The four wheels may be manipulated to show any number up to 9999. A fifth wheel is provided with letters "R" and "L" so that the right and left may be plainly marked.

No.	Code	Price
570 Plate Marker	Fames	\$5.50

Developer in Packages

Metol-Hydroquinone Developer, put up in handy packages, for convenience of those who do not care to mix their own chemicals. Comes in two sizes, for ten and twenty ounces of solution.

No.	Code	Price
1610 For 10 oz. Solution	Funi	\$0.20
1611 For 20 oz. Solution	Fur	.30
1615 For ½ gal. Solution	Foxie	.90
1616 For 1 gal. Solution	Fuller	1.65

Acid Fixing Bath Powder

Ready to dissolve in water. Small quantities can be measured out as desired.

No.	Code	Price
1613 1 lb. Package	Fusin	\$0.25
1614 5 lb. Package	Feebe	1.00

Fischer Special X-Ray Developer

Put up in handy size containers, enough to make up 12 ounces solution. Remains practically transparent after mixing, and develops out good, clear negatives. Packed 6 packages to the carton.

No.	Code	Price
670 Fischer X-Ray Developer, package	Flare	\$0.15
671 Fischer X-Ray Developer, carton	Flash	.90

Manila Filing Envelopes

Made of heavy Manila paper, to be used for filing finished negatives. Have record blanks on side same as the Orange X-Ray Envelope.

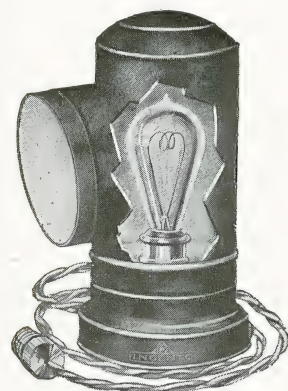
No.	Size	Code	Price
1650	5 x 7	<i>Fovea</i>	\$0.45
1651	6½ x 8½	<i>Frax</i>	.50
1652	8 x 10	<i>Fret</i>	.60
1653	10 x 12	<i>Frost</i>	1.00
1654	11 x 14	<i>Focus</i>	1.35
1655	14 x 17	<i>Funda</i>	1.80

Electric Ruby Lamp

In the Dark Room much care must be used not to fog the negatives with an imperfect Ruby Light. Much of the appearance of the finished plate depends on the care exercised during development, and unless your Ruby Lamp is absolutely safe, poor results may be looked for. The Fischer Lamp is a compact, neat article designed to stand on a shelf or sink. Made entirely of metal with a sheet each of Orange, Ruby and Ground White Glass as a window. The full light may be thrown on the plate or by slightly turning the lamp the plate may be left in the dark.

Furnished with Lamp, Cord and Connecting Plug.

No.	Code	Price
1600	<i>Acoria</i>	\$3.50



No. 1600 Electric Ruby Lamp



No. 545 Washing Tank

Washing Tank

Will accommodate thirty 14 x 17 negatives. The water is forced upward through small holes in the bottom of the plate support, insuring positive washing of the plates. A rubber tube may be connected to your water supply and a steady circulation maintained. The overflow is near the top. An inside rack is provided and arranged so that it may be lifted out and used as a drain and for drying. Made throughout of heavy galvanized iron.

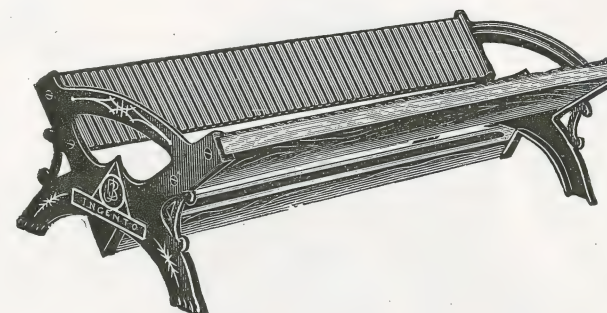
No.	Code	Price
545 Washing Tank	<i>Acorn</i>	\$10.00 11.50

Thermometer Stirring Rod

Serves a double purpose. Handy as a stirring rod, and automatically indicates the temperature of the developing solutions.

No.	Code	Price
200 Stirring Rod	<i>Adult</i>	\$1.00

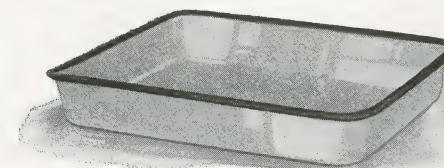
Drying Rack



Wooden drying rack for accommodating 42 plates of any size. Made of hardwood with black japanned iron ends.

No.	Code	Price
590 With Trough	<i>Acrose</i>	\$1.50
591 Without Trough	<i>Active</i>	1.25

Steel Enameled Developing Trays



Our Developing and Fixing Trays are the best obtainable. Made of heavy sheet steel and stamped in one piece. Coated with four layers of white enamel. Made in this way, they are absolutely acid and chemical-proof, at the same time being lighter and stronger than rubber or porcelain.

No.	Code	Price
1604 For 5 x 7 Plates	<i>Adeps</i>	\$0.85
1605 For 8 x 10 Plates	<i>Adler</i>	1.25
1606 For 10 x 12 Plates	<i>Agaric</i>	1.60
1607 For 11 x 14 Plates	<i>Agave</i>	2.25
1608 For 14 x 17 Plates	<i>Agnea</i>	3.50

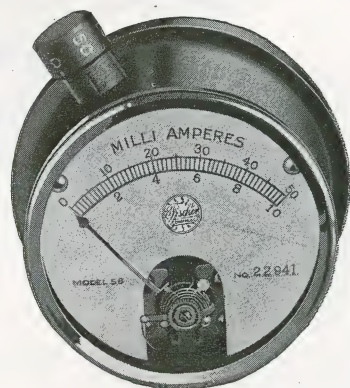
Porcelain Developing Bowls

Will be found more convenient than trays for developing dental films. Especially suited for use with our No. 1602 Portable Dark Room and in connection with our No. 978 Aluminum Film Holders.

No.	Code	Price
1609	<i>Agonia</i>	\$0.18

Fischer X-Ray Meters

The X-Ray Meters are constructed to give accurate amounts of Milliamperage passing through an X-Ray Tube when operating same on the Interrupterless type of Transformer. Provided with double scales, shunt controlled, small amounts of current such as are used for Fluoroscopy or Roentgen-Therapy can be read just as accurately as heavy discharges for Plate work.



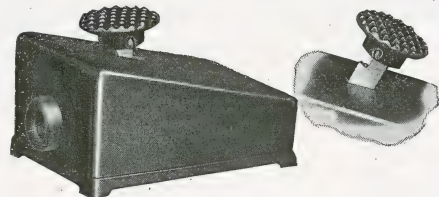
Fischer X-Ray Meters are calibrated 0 to 50, 0 to 100 and 0 to 200 M. A.

No.		Code	Price
442	Fischer X-Ray Meter, 0 to 50 M. A.....	<i>Excect</i>	\$25.00
443	Fischer X-Ray Meter, 0 to 100 M. A.....	<i>Explot</i>	30.00

Books

No.	Author	Code	Price
662	Dental Radiography.....Raper	<i>Etude</i>	\$7.50
663	Oral and Dental Radiography.....McCoy	<i>Etime</i>	2.25
655	X-Ray Diagnosis & Treatment. Bythel & Barclay	<i>Elate</i>	5.50
656	X-Ray Technique.....Christie	<i>Elong</i>	2.00
659	Prince's Roentgen Technic.....Prince	<i>Egypt</i>	2.50
664	Thoma's Oral Roentgenology.....Thoma	<i>Exist</i>	4.00
665	Thoma's Oral Abscesses.....Thoma	<i>Event</i>	4.50

Fischer Foot Switch



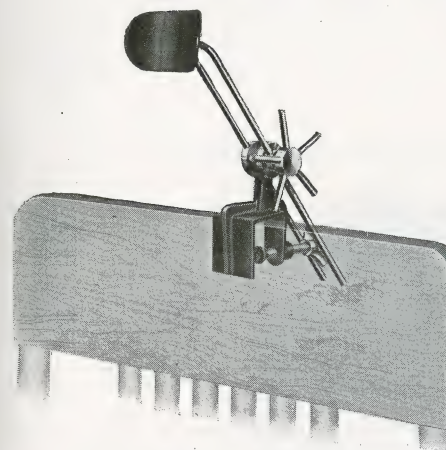
For Fluoroscopic work this will be found exceedingly convenient. Also for Fulguration, or in any work where the current is turned on or off to advantage without the use of the hands. Arranged that the current can be left on or off indefinitely by merely pushing forward or backward the contact lever.

No.		Code	Price
400	Foot Switch.....	<i>Fant</i>	\$6.00
401	Foot Switch Cable, per Foot.....	<i>Fall</i>	.20

Fischer Adjustable Head Rest With Chair Clamp

Especially useful for the Dentist as an aid in supporting the head of the patient while making Dental Radiographs. Can be attached to any chair. Made of all metal, part nickel plated and part enameled.

No.		Code	Price
1012	Fischer Head Rest.....	<i>Calsis</i>	\$7.50



No. 1012 Fischer Head Rest



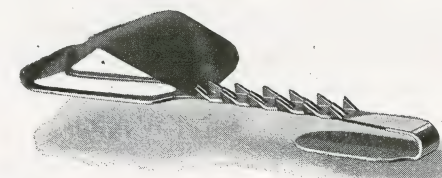
No. 560 Fischer Dental Film Illuminator

Fischer Dental Film Illuminator

Designed for illuminating Dental Films only. The Ball hood, enclosing the Tungsten lamp, is finished in White Enamel, to match the porcelain lamp receptacle, which is in turn mounted on a polished Mahogany base. Spring clips are mounted on the sides to hold our Duplex Film Mounts No. 1587, and will accommodate either the All Celluloid or Black Mounts described herewith. Illuminator has green silk connecting cord and swivel plug, ready to attach to any lamp socket.

No.		Code	Price
560	Fischer Dental Film Illuminator.....	<i>Bovine</i>	\$8.00

Aluminum Film Holder



For holding the dental film (of any size) during developing, fixing and drying. Marking the record number of letters of the case on the small roughened tab serves to identify same when more than one set are being developed at one time. The fingers can also be kept perfectly dry and clean during the whole operation. Made of aluminum, stamped in one piece, they are practically indestructible.

No.		Code	Each	Doz.
1646		<i>Casein</i>	\$0.15	\$1.25

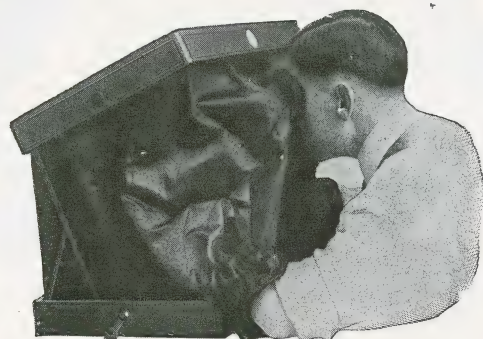
Dental Film Holder



Metal Dental Film Holder, for 10 films. Nickel plated.

No.	Code	Price
1647	Film HolderCactus	\$1.50

Fischer Portable, Collapsible Developing Box



No. 1603 Fischer Developing Box in operation

This is beyond doubt the best Developing Box on the market today. Weighs but a few pounds complete. Portable; can be easily knocked down and carried. Absolutely light-proof and durably constructed.

No.	Code	Price
1603	Fischer Portable, Collapsible Developing Box..Capote	\$30.00

Films for Dental Radiography

The Eastman Negative (fast) Dental Films, packed two in a packet, are arranged to place directly in the patient's mouth, no extra preparation being necessary. They are light and waterproof. Put up in three handy sizes.

No.	Size	Code	Price Doz. Prs.
1640	1¼ x 1⅝	Brain	\$0.50
1642	2¼ x 1⅝	Branc	.85
1643	2¼ x 3	Brash	1.75

The Eastman Positive (slow) Dental Films, having a slower emulsion than the Negative, but preferred by some operators as having a richer finish and more detail, can be furnished in the same sizes and at the same prices as above. Unless otherwise specified, the fast Negative Films will be furnished on all orders.

The New X-Ograph Film Packets

The rapid advance of Dental Roentgenography has caused a steadily increasing demand for a Dental Film Packet which is easily placed in position and will conform readily to the curves of the mouth; a packet which is extremely THIN, and which has SMOOTHLY ROUNDED CORNERS. In view of these conditions the new X-OGRAPH PACKET was placed on the market. These Films not only meet all of the above requirements, but, on account of METAL BACKING on each individual packet, will produce dental Roentgenograms of extreme brilliancy, rendering beautiful detail of the most delicate structures; and with proper technique, the perspective is so perfect as to appear almost stereoscopic.

These new films are not as fast as the Eastman Negative, but a trifle faster than the Positive. Made up in one size only—1¼ x 1⅝—put up in boxes of two dozen packets each (doubles)—six boxes to the gross.

No.	Price Per Doz. Packets
1648	Bulla \$0.85

Fischer Duplex Film Mounts

Made of durable paper stock, arranged with a pocket in the center, through which the film is admitted and held very firm. The light side is printed with a form for recording all details of the exposure. The dark side is used when inspecting the film, the dark background and no window permitting an absolutely unobstructed view of your negative.

The great drawback to the celluloid holders is their high cost, so we have designed this paper mount and placed it on the market at a very reasonable figure. A record should be kept on file for every exposure made, and unless the filing cost is kept down, this feature is too often neglected.

These holders are die-cut to conform to the size and shape of the standard No. 1 film, and especially designed for use with our No. 560 Illuminator. Size of card 3 x 5 in., for holding one No. 1 film.

No.	Amount	Code	Price
1587	Fischer Duplex Film Mount..... 100	Bromol	\$ 1.95
1587	Fischer Duplex Film Mount..... 250	Bromol	4.50
1587	Fischer Duplex Film Mount..... 500	Bromol	8.50
1587	Fischer Duplex Film Mount.....1000	Bromol	16.50

Prices for imprinting No. 1587 Film Mount with customer's name and address:

In lots of 100.....\$0.75	In lots of 500.....\$1.15
In lots of 250......90	In lots of 1000..... 1.65

Black Dental Film Mounts

Dental Film Mounts, made of black pressed cardboard, with Celluloid windows, give fine contrast and bring out every film detail with distinctness. They afford protection to the finished negative and provide a most convenient form of holder for viewing, filing and recording Dental Films. Not only increase the detail in the negative, but act as an excellent advertisement when sent out. Also lessens the danger of loss of films.

Prices will be quoted on request for Special Forms, Special Sizes, and for films of other sizes. In requesting prices for any Special item, please send a diagram indicating your needs and the printing to appear thereon.

Mounts Nos. 1, 2 and 12 will be furnished for the No. 1A Film, size $1\frac{1}{2} \times 2\frac{1}{4}$, without extra charge.

Price List of Black Dental Film Mounts

No.	Size Mount	Size of Films	No. of Films	Position of Film	Code	25	50	100	200	500	1000
620-1	3 x 5	1 1/4 x 1 5/8	1	Horizontal	Iber	\$2.60	\$2.90	\$3.90	\$6.30	\$13.50	\$25.50
621-2	3 x 5	1 1/4 x 1 5/8	1	Vertical	Icon	2.60	2.90	3.90	6.30	13.50	25.50
622-4	3 x 5	1 1/4 x 1 5/8	2	Horizontal	Ictus	3.40	3.80	4.50	7.50	16.50	31.50
623-4	3 x 5	1 1/4 x 1 5/8	2	Vertical	Idea	3.40	3.80	4.50	7.50	16.50	31.50
624-5	3 x 6	1 1/4 x 1 5/8	3	Horizontal	Idle	3.70	4.20	5.50	9.50	21.50	41.50
625-6	3 x 5	1 1/4 x 1 5/8	3	Vertical	Idyl	3.70	4.20	5.50	9.50	21.50	41.50
626-7	3 x 7 1/2	1 1/4 x 1 5/8	4	Horizontal	Image	4.90	5.90	7.30	13.10	30.50	59.50
627-8	3 x 6	1 1/4 x 1 5/8	4	Vertical	Imbue	4.70	5.50	6.70	11.10	25.50	49.50
628-9	3 x 9	1 1/4 x 1 5/8	5	Horizontal	Impel	5.40	7.00	10.00	18.00	42.00	82.00
629-10	3 x 7 1/2	1 1/4 x 1 5/8	5	Vertical	Imphy	5.20	6.40	9.00	16.00	37.00	72.00
630-11	4 1/4 x 10	1 1/4 x 1 5/8	10	Horizontal	Inane	7.80	9.00	15.00	28.00	67.00	130.00

Price List: All Celluloid Dental Film Mounts

No.	Size Mount	Size of Films	No. of Films	Position of Film	Code	25	50	100	200	500	1000
631-12	3 1/4 x 4 1/2	1 1/4 x 1 5/8	1	Horizontal	Grub	\$2.80	\$3.60	\$4.80	\$8.90	\$21.20	\$41.70
632-13	3 1/4 x 4 1/2	1 1/4 x 1 5/8	2	Vertical	Guaco	3.30	4.20	5.50	10.20	22.30	47.70
633-14	2 1/4 x 6 1/4	1 1/4 x 1 5/8	3	Horizontal	Guad	4.50	5.70	6.90	12.30	28.50	55.50
634-14V	3 x 5	1 1/4 x 1 5/8	3	Vertical	Gull	4.50	5.70	6.90	12.30	28.50	55.50
635-15	3 7/8 x 4 1/2	1 1/4 x 1 5/8	4	Horizontal	Gum	5.50	6.40	8.00	14.00	32.00	62.00
636-16	3 x 7 1/4	1 1/4 x 1 5/8	5	Vertical	Gutta	6.30	7.80	9.00	16.00	37.00	72.00
637-17	4 x 10	1 1/4 x 1 5/8	10	Horizontal	Gyre	8.00	11.00	16.00	30.00	72.00	142.00
638-17V	4 1/4 x 9	1 1/4 x 1 5/8	10	Vertical	Gross	8.00	11.00	16.00	30.00	72.00	142.00
639-18	2 3/4 x 4 1/4	1 1/4 x 1 5/8	1	Horizontal	Grove		3.50	4.50	8.00	18.50	36.00
640-19	2 3/4 x 4 1/4	1 1/4 x 1 5/8	2	Vertical	Green	2.90	3.80	5.20	9.30	21.50	42.00

These prices include imprinting with customer's name and address. Mounts Nos. 620-1 and 631-12 can be had with No imprint if desired, in quantities of 100 to 500 at the 1000 printed price.
Mounts Nos. 620-1 in 1000 lots, unprinted, \$21.00.
Mounts Nos. 631-12 in 1000 lots, unprinted, \$35.00.

Aerial Overhead Wiring Accessories

An overhead wiring system normally consists of six or eight Rubber Insulators, sufficient Bare Copper Wire to permit of three or four strands completely across the X-Ray room, Trolley Cord Reels suspended from this wire to connect up the X-Ray Tube, and Turnbuckle arrangements to take up the slack of the wire.

Where the Coolidge Tube is employed, four strands of wire are necessary, as illustrated by Figure "C."

Refer to illustration on page 7

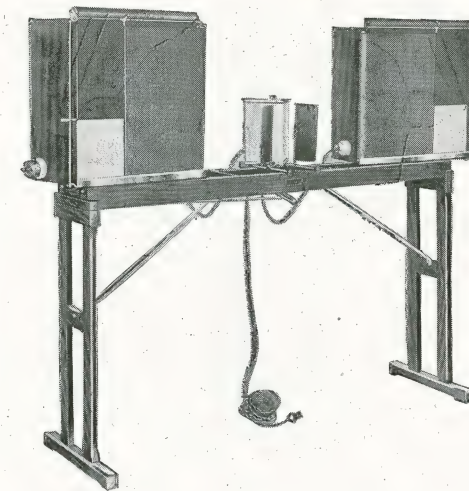
Where the Gas Tubes only are to be used, three wires are sufficient. See Figure "G."

These copper strands are to be mounted at least 10 inches from one another, and that same distance from any other wire, or any water or gas pipe, or any grounded metal, or from walls where metal lath has been used.

Made of Hard Rubber, with metal screw eye in each end. Neat and well finished.

No.		Code	Price
700	Rubber Insulators	Canal	\$0.65

Wheatstone Stereoscope



A Wheatstone Stereoscope is a very essential piece of apparatus, being of considerable value in the correct diagnosis of compound fractures, dislocations, foreign body localization, etc. Constructed to hold two plates of the same part in separate illuminated boxes, which, when viewed through the mirror arrangement, shows exact location and shape of object; almost perfect perspective.

No.		Code	Price
649	Wheatstone Stereoscope	Lapid	\$95.00

104-50

High Tension Wall Insulators

Some sort of turnbuckle arrangement is necessary to take up the slack in the wires and give the installation a neat, finished appearance, and the regular commercial turnbuckle supplied by most manufacturers is far too cumbersome for the purpose intended. We have made up an insulator with both right and left-hand threads and metal screws to match, the whole making up a combination Turnbuckle Insulator. This has the same general appearance as the insulator used on the other end of the wire.

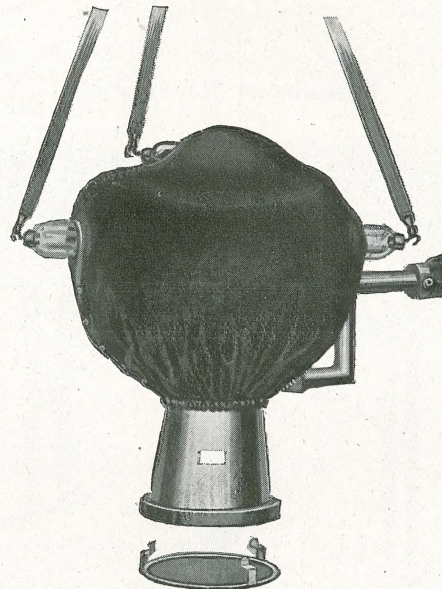
No.	Code	Price
701 Turnbuckle Insulator	Cancer	\$1.65

Copper High Tension Wire

Soft copper wire, smooth and easily mounted in place, No. 12 gauge.

No.	Code	Price
703 Soft Copper Wire, per Foot.....	Carbo	\$0.03

Opaque Cloth X-Ray Tube Cover

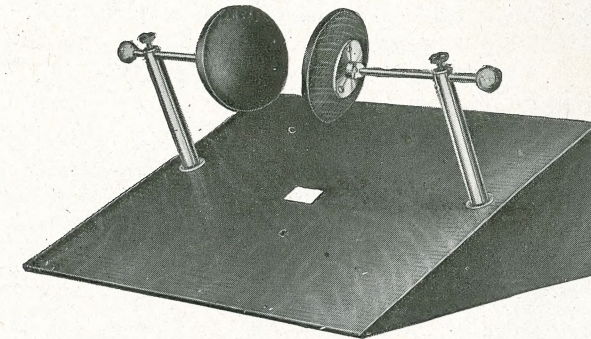


Those who use the ordinary tube stand with leaded glass shield and wish to do any extensive Fluoroscopy will appreciate this Opaque Cover or Shield. The very best fluoroscopy will naturally be done in a perfectly darkened room, and it is necessary, therefore, to eliminate the glow of the X-Ray Tube.

This shield accomplishes the desired result very satisfactorily, cutting off all light.

No.	Code	Price
646 Opaque Cloth Tube Shield.....	Lanced	\$1.50

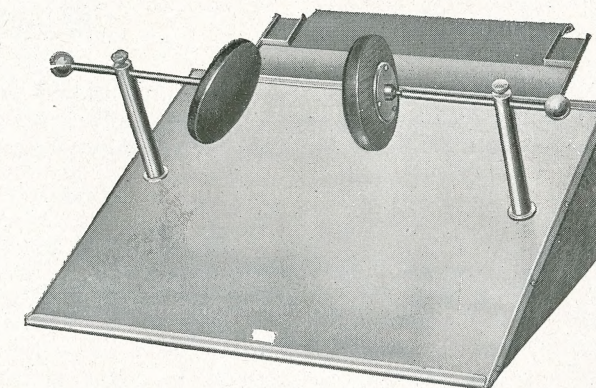
Plain Wooden Head Rest



For Radiographs of the Frontal Sinuses, for Dental Radiography, or any X-Ray work about the Head where a fixed position is desirable, these rests are necessary if sharp detail is desired. Mentioned on Page 23, under "Skull."

No.	Code	Price
647 Plain Head Rest.....	Landau	\$7.50

Head Rest With Plate Changing Tunnel



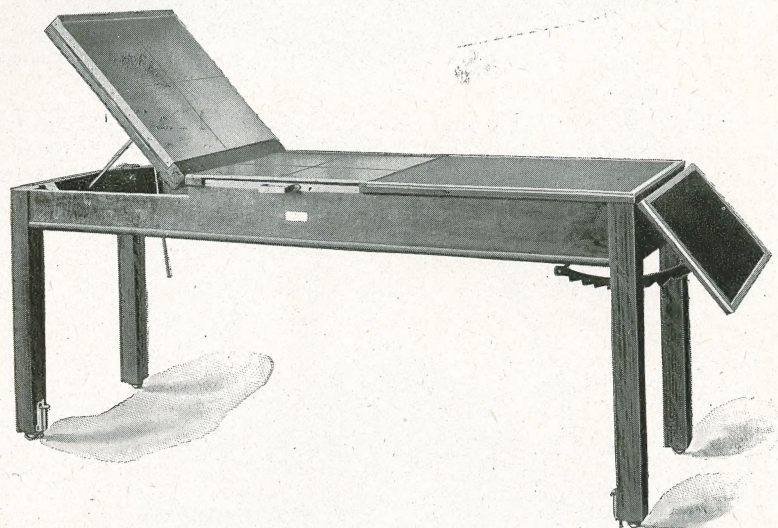
Designed for Stereoscopic Radiography. Plates may be changed without disturbing the patient.

No.	Code	Price
648 Head Rest with Plate Tunnel.....	Langue	\$12.50

Fischer Plain Radiographic Table

A well built, sturdy Table of quartered oak construction, arranged with two individual Plate Changing Tunnels, one at the end and one in the center. Table is covered with heavy linoleum, held in place with nickel plated metal strips.

There are a great many expensive Radiographic Tables on the market, but this is the only Table of reasonable price which permits the operator to make satisfactory Stereoscopic Radiographs. Illustration shows positions of Plate Tunnels.



This Table represents a departure from the conventional, and its great usefulness and adaptability have created a decided place for it. It is a first-class article in every respect. Shipping weight approximately 155 lbs.

No.	Code	Price
642E13	Table complete, with one 17 x 17 Plate Changer	90.00
	Lament	\$75.00
643	Extra Plate Changing Tray.....	12.00
644	17 x 17 Cassette for Intensifying Screen.....	20.00
	Lanary	

INDEX

A

Abdominal Radiographic Technique	28
Acid Fixing Powder.....	61
Aerial Trolley Cord Reels.....	7
Aerial Wiring	6 & 7-69
Aerial Wiring Insulators.....	7
Aluminum Cassette	58
Aluminum Film Holder.....	65
Aluminum Filters	51
Aluminum Plate Holder.....	58
Angles for Dental Radiographs	31-32
Ankle Position	20-21
Ankle Radiographic Technique..	21
Antrum of Highmore Position..	24
Antrum Radiographic Technique	23
Aprons—X-Ray Protective	56

B

Back-up Spark	11
Barium Meal	28
Bismuth Meal	28
Black Dental Film Mounts.....	67-68
Books	64
Bottles	40
Bowls—Developing	63
Bowls—Lead Glass	57
Buttermilk	28

C

Cassettes	15 & 58
Celluloid Dental Films Mounts	68
Chair Headrest	65
Chest Radiographic Position.....	27
Chest Radiographic Technique..	26
Clavicle Radiographic Position..	21
Clavicle Radiographic Technique	21
Cloth Tube Shield (Opaque)....	70
Cloth—X-Ray Protection	56
Compression Cone	17
Compression Tube Stand.....	52
Cone—Compression	17
Cone—Dental	52
Coolidge Tube	11
Coolidge Tube Aerial.....	7

Coolidge Tube Filament Controller	12
Coolidge Tube Filament Transformer	12
Coolidge Cord Reels.....	53-54
Cord Reels	53-54
Cord Reels for Aerial Wiring	53-54
Crest of Ilium.....	28

D

Dark Room	40-41
Dark Room Lamp	62
Dental Exposure Technique.....	29-39
Dental Films	38-66
Dental Film Holder.....	65-66
Dental Film Illuminator.....	65
Dental Lead Glass Cone.....	52
Dental Mandible Position.....	33
Dental Uses of X-Rays.....	48-49
Developer	61
Developing	42-43
Developing Bowls	63
Developing Box	66
Developing Formula	42
Developing Don'ts	45
Developing Lamp	45
Diagnostic Box	46 & 55
Diagnostic Hints	46
Diagnostic X-Ray Plates.....	39-60
Diagram of Wiring.....	4
Diaphragms—Lead	17-51
Drying Rack	63
Duplex Film Mounts.....	67
Duplitzed Eastman Films.....	60

E

Eastman Dental Films (Fast) ..	39
Eastman Dental Films (Slow) ..	39
Eastman X-Ray Films.....	60
Elbow Position	20
Elbow Radiographic Technique	21
Electric Ruby Lamp.....	62
Enameled Developing Trays.....	63
Envelopes—Filing	62
Envelopes—X-Ray	61
Exposure Chart	14
Exposure Technique	16
Extra Oral Plate Method.....	39

INDEX-continued

F

Filing Envelopes	62
Film Holder—Aluminum	65
Film Mounts	67
Films for Dental Radiography	38-60-66
Filters—Aluminum	51
Fischer Dental Films	39
Fischer Plain Radiographic Table	72
Fixing	44
Fixing Powder	61
Flat Negatives	47
Flexible Rubber Protection Gloves	57
Fluoroscopes	59
Fluoroscopic Screen	59
Fluoroscopy	13
Foot Radiographic Technique	21
Foot Switch	13-64
Frontal Sinus Position	24
Frontal Sinus Radiographic Technique	23
Fuses	2

G

Gastrointestinal Examination	28
Gas Tube, Aerial	7
Glass—Lead	57
Glass Stoppered Bottles	40
Gray Negatives	47
Gloves—Rubber Protection	57

H

Hand Position	18
Hand Radiographic Technique	18
Hardening Solution	46
Head Lateral Technique	22
Headrest—Plain	53-65-71
Headrest with Plate Tunnel	71
High Tension Insulators	70
High Vacuum Tube	8
Hints on X-Ray Diagnosis	46
Hip Position	25
Hip Radiographic Technique	25
Holder for Intensifying Screens	15-58
Hydroquinone	61

I

Illuminating Boxes	46-55
--------------------------	-------

Illuminator for Dental Films	65
Insulators for High Tension Wiring	70
Intestinal Radiographic Technique	29
Intensifying Screen Holders	15-58
Intensifying Screens	15-57 & 58
Inverse Currents	8

K

Kidney Radiographic Technique	28
Knee Position	19
Knee Radiographic Technique	19

L

Lateral Antrum Radiographic Technique	23
Lead Diaphragms	17-51
Lead Glass	57
Lead Glass Bowl	57
Lead Glass Dental Cone	52
Lead Letters	29
Lead Lined Plate Boxes	56
Lead Numbers	29
Lead Protection Screen	50
Lead Sheet	57

M

Mandible Position	23
Mandible Radiographic Technique	22
Manila Filing Envelopes	62
Mastoid Radiographic Technique	23
Medium Low Vacuum Tube	9
Medium Vacuum Tube	9
Metal Backed Films	67
Meter—X-Ray	6-64
Metol	61
Motor	5
Mounts for Dental Films	67

O

Opaque Cloth Tube Shield	70
Opaque Rubber Tube Shields	56
Overhead High Tension Wiring	6 & 7
Overhead Wiring Accessories	69
Over-Reduced Vacuum	10

INDEX-continued

P

Paragon X-Ray Plates	39 & 60
Penetration of X-Ray	14
Pitted Negatives	47
Plain Headrest	71
Plate Boxes	56
Plate Fixing	44
Plate Handling	41 & 42
Plate Holder	58
Plate Loading Technique	40
Plate Markers	29-61
Plate Support	53
Plates—X-Ray	60
Plate Troubles	46 & 47
Plate Washing	44
Polarity	6
Porcelain Developing Bowls	63
Portable Developing Box	66
Positions for Dental Radiography	29-39
Positions for Lower Centrals	36
Position for Lower Molars	37
Position for Upper Centrals	36
Position for Upper Molars	37
Protective Aprons	56
Protection Cloth	56
Protection Gloves—Rubber	57
Protection Screen	50
Psoas Muscle	28
Punctured Tube	9
Pyro	45

R

Rack—Plate Drying	63
Racks for X-Ray Tubes	51
Rebuilding X-Ray Tubes	51
Rectifying Wheel	5
Reducing	9
Regulating Tube	9
Repairing X-Ray Tubes	51
Rheostat	5
Root Canal Technique	47
Rubber Tube Shield	56
Ruby Lamp	45

S

Sand Bags	17
-----------------	----

Scapula Radiographic Technique	21
Screen—Fluoroscopic	59
Screens	50
Screens, Intensifying	57 & 58
Sheet Lead	57
Shoulder Position	21
Shoulder Radiographic Technique	21
Skull Antrum Position	24
Skull A. P. Position	24
Skull A. P. Technique	23
Spark Gap	11
Soft Tube	9
Spine Position	26
Spine Radiographic Technique	26
Spotted Plates	47
Stained Negatives	47
Stereoscope	69
Stereoscopic Radiography	13
Stirring Rod—Thermometer	63
Stomach Radiographic Technique	28
Streaked Plates	47
Switch—Foot	64
Synchronous Motor	5

T

Table for Radiography	72
Tank for Plate Washing	62
Thermometer Stirring Rod	63
Transformer Operation	5
Transformer Tubes	50
Trays—Steel Enameled	63
Tube Instructions	12
Tubes	50
Tube Shield—Cloth	70
Tube Shields, Rubber	56
Tube Racks	51
Tube Stand	52
Tube Technique	7 to 12
Tungsten Target X-Ray Tubes	50

U

Uses of X-Rays in Dentistry	48 & 49
-----------------------------------	---------

V

Vacuum Reducing	9
-----------------------	---

INDEX-continued

W

Washing	44
Washing Tank	62
Wheatstone Stereoscope	69
Wiring Diagram	4
Wiring to Line	2
Wrist Position	18
Wrist Radiographic Technique..	18

X

X-Ograph Film Packets.....	67
X-Ray Envelopes	61
X-Ray Meter	64
X-Ray Plates	60
X-Ray Protection Cloth.....	56
X-Ray Protective Aprons.....	56
X-Ray Tube Racks.....	51
X-Ray Tube, Repairing.....	51
X-Ray Tube, Regulating.....	9
X-Ray Tubes	6-50

The Sign of Service

