

Large posterior detachments can best be attacked with the six-point electrode, by repeated application, placing enough punctures to cover the desired area.

As in the case of the small points, it is necessary to first lightly contact the sclera with the needles, turn on current and then shut it off instantly when the points are plunged into their full depth. It is

important that all points be lightly and evenly in contact with the sclera before current is turned on.

The shanks of the long electrodes are made of a pliable metal that can be bent with the fingers to facilitate approach to the operative field in detachments lying far back.

STERILIZATION OF ELECTRODES AND ACCESSORIES

In preparing the Davis-Bovie Unit for aseptic surgery, all parts that are handled or touched in the course of an operation should be sterilized prior to use. These include the sterilizable instrument rack and its supporting standard; the operating electrode handles with their cords and plugs; sterilizable glass handles which fit into the three controls; all needles, knives, loops, blades and other operating instruments.

The metal parts, including the entire instrument rack assembly, the uninsulated loops, needles, knives, etc., can be sterilized by prolonged boiling or autoclaving without damage.

However, the bakelite handles, rubber cords and insulation on electrodes will be subject to some deterioration when heat sterilization is used, and they will require replacement from time to time.

The useful life of the insulating parts can be lengthened by sterilization in some adequate cold

solution, *i.e.*, 70% alcohol, mercuric cyanide (1 to 1000), etc. However, we do not recommend cold sterilization in Neuro-surgery, operations in the Thoracic Cavity, in the abdomen, etc., where immaculate conditions are essential.

For these operations where heat sterilization must be employed, the best method is to wrap all instruments and handles in a towel and sterilize them in the auto-clave for fifteen minutes at 15 pounds pressure. This is considered adequate for most major surgery and does not cause undue deterioration of the bakelite and rubber parts. Wrapping these parts in a towel, however, is important as this minimizes deterioration.

For Prostatic Resection instruments the customary mercuric cyanide solution is recommended. Phenol solutions should not be used on any bakelite insulated instruments.

SERVICE NOTES

The only thing on the Bovie Unit that will ever need special attention is the spark gaps which will require reconditioning after a large number of major operations. This would ordinarily be after three to five years' service in an average institution. This is handled on a replacement basis from the factory. The need for gap reconditioning is indicated by a gradual impairment of cutting quality and/or irregular, sputtery gap operation. When this occurs, communicate directly with the Company for detailed instructions.

Other than infrequent gap reconditioning as above noted, the only service or maintenance required will be repairs or replacements of electrodes, handles, and other accessories. Electrodes, handles, and their cords, the supply cable and foot switch cable may need repairs if the wires become frayed or broken. If any of the accessories or cables need repairs, communicate with our nearest representative or direct with the Company.

This booklet covers primarily the mechanics of adjusting and preparing the Davis-Bovie Unit for service. The accompanying booklet "The Fundamentals of Electro-Surgery" contains a great deal of information that will be valuable to those just undertaking Electro-Surgery. Its careful perusal and a thorough study of the reprints on Electro-Surgery is recommended before actual operative work is undertaken.

Instructions for Connecting and Operating THE IMPROVED DAVIS-BOVIE ELECTRO-SURGICAL UNIT

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO USE THE MACHINE. SPARK GAP ADJUSTMENT IS THE MOST IMPORTANT FACTOR IN PREPARING THE DAVIS-BOVIE FOR SERVICE. ADJUST GAPS CAREFULLY AS OUTLINED ON PAGE 4



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The
Liebel-Flarsheim Co.
Cincinnati, Ohio, U. S. A.

Instructions for Connecting and Operating The Improved Davis-Bovie Electro-Surgical Unit

After uncrating the apparatus we suggest checking accessories with the accompanying "Accessory List" to see that all items are duly received. All accessories and the sterilizable instrument rack are packed in the sub-cabinet.

Unless otherwise marked on rating plate (at back of cabinet) this machine is for operation on 115 volts 60 cycles *alternating current*. Consult your electrician and make sure correct current is used. Have fuses of adequate capacity installed on the line before turning on the machine.

General Description

The Improved Davis-Bovie Electro-Surgical Unit is a single cabinet containing two entirely separate electrical circuits. One delivers high frequency

CUTTING currents, the other an entirely different type of current for COAGULATION, DESICCATION and FULGURATION. The two circuits are electrically independent, but by means of an electro-magnetic current selector, controlled by a double-treadle foot switch, either current can be instantly connected to the outlet terminals and through these to the operating electrodes. To connect either current to the instrument, simply press proper pedal on double treadle foot switch. The LEFT hand treadle controls the CUTTING current, the RIGHT hand treadle the COAGULATING current. For convenience we will refer to these two parts of the machine as the "Cutting Section" and the "Coagulation Section."

Facing the cabinet, the Cutting Section with its power control lever and spark gap adjusting knobs

is at the left. The Coagulation Section, with its single power control lever and fixed spark gap is at the right.

At front center on top panel is the "Main Switch" for turning the machine on and off.

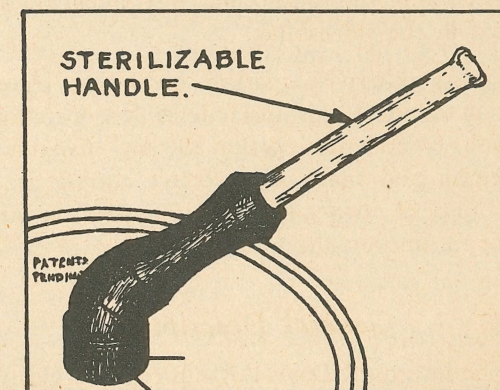
Immediately above the "Main Switch" is a control designated "Hemostatic Effect of Cutting Current," which governs the degree of hemostasis (dehydration) produced by the *cutting current* on the wound edges. *Carefully study separate section relating to the use of this control.*

Below, on the front panel is a pilot light which glows whenever unit is connected and Main Switch turned on, showing the machine is ready for use, but no high frequency current is generated until foot switch is depressed.

Immediately above the pilot light are four high frequency current connections of the plug-in type. The inactive (indifferent) electrode is connected to the single terminal, at left, marked "Patient." The active (operating) electrodes are connected to any of the three terminals marked "Electrodes." These

On the back of the cabinet are connections for the electrical current (marked "Supply Plug") and for the foot switch.

On each front corner of the sub-cabinet are small metal brackets for supporting the sterilizable instrument rack which can be mounted at either corner to best suit the operator's convenience.



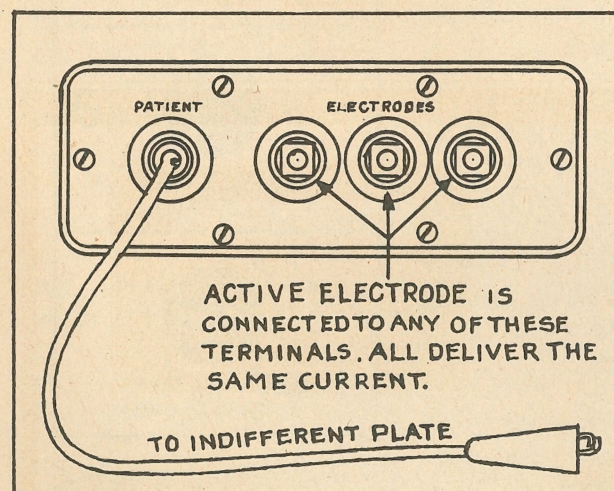
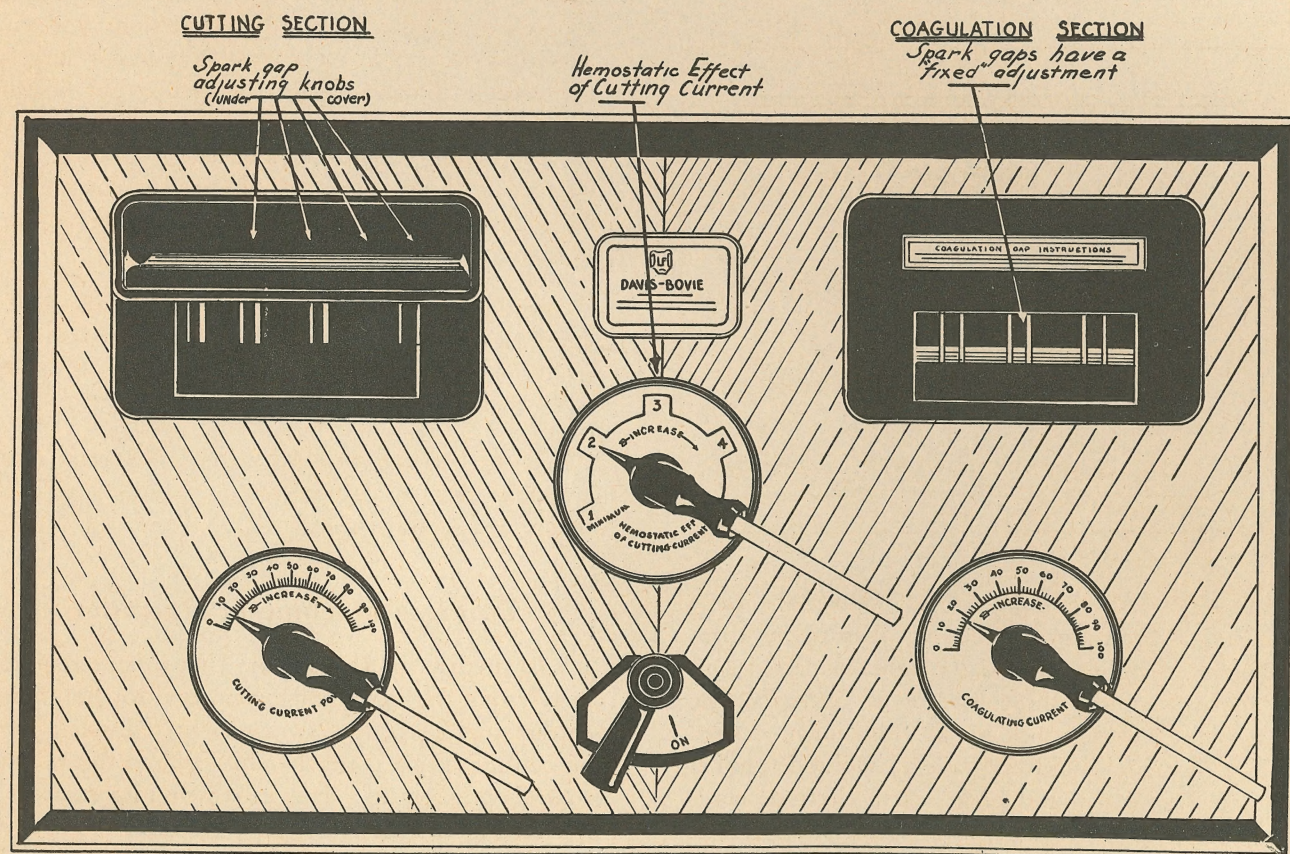
Sterilizable Instrument Rack consists of four separate pieces, the rack proper and three sections of supporting standard, two straight sections and one curved at each end. When used for major surgery this entire rack assembly may be sterilized by boiling or auto-claving and fastened to the machine. The curved section should be inserted in bracket and fastened with set screw. If the instrument rack is too high for convenience with both straight sections in place, leave off one length, or both.

Sterilizable Handles are provided for the three control levers. They are locked in the levers by turning each two or three times in a clockwise direction, screwing it in place.

At the back of the sub-cabinet is a special compartment that is convenient for storing the foot switch and supply cable.

To Place Machine in Operation

To prepare the Davis-Bovie Unit for use requires merely that the machine be connected to the proper current supply, the foot switch connected, spark gaps on cutting section correctly adjusted, and the various controls properly set. It is extremely important that the cutting current spark gaps be correctly adjusted prior to each operation, as covered in detail in a



terminals are in multiple and all deliver the same current. Three are provided so that up to three different operating electrodes can be connected simultaneously and in the course of an operation, the surgeon can simply pick up the instrument desired at the moment. Inactive (patient) electrode cord is equipped with a round plug; active electrode cords are equipped with square plugs so that they cannot be connected to the wrong terminal.

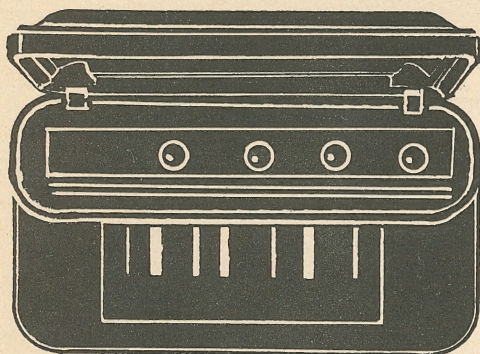
subsequent section. The gap setting on the coagulation section is fixed. We suggest that the various steps be carried out in the following sequence.

1—Connect Foot Switch and Supply Cable.

Be sure your electrical current is of the proper voltage and frequency. Unless otherwise noted on rating plate at back of cabinet, the Davis-Bovie Unit is designed for operation on 115 volts, 60 cycles, alternating current. Special models for operation on other alternating currents are so marked on the rating plate. When only direct current is available a rotary converter must be used. Make sure the fuses on your supply line are heavy enough to carry the machine in addition to any other load on the line at the same time. Refer to the rating plate on back of cabinet for current (amperes) of your machine.

2—Turn Main Switch to "On" Position.

3—Adjust Cutting Section Spark Gaps as follows: Cutting section spark gaps are below the glass window at the left. Firing of the gaps may be observed through the window. Immediately above the window is a hinged cover, which when turned back, exposes the four gap adjustment knobs. Each knob governs the adjustment of the individual gap below it. Turning the knob clockwise closes the gap; counter-clockwise opens the gap.



The four Circles in the above illustration indicate the Spark Gap Adjustment Knobs. A Hinged Cover is shown in raised position.

As the quality and performance of the cutting current is dependent on accurate gap adjustment, it is essential that this operation be properly performed. There is nothing difficult about this gap adjustment—on the contrary, it is a very simple procedure that requires only a few seconds—but it must be done right to insure satisfactory operation of the cutting current.

To adjust cutting gaps, first press left hand treadle on the foot switch to start current flow through the gaps. With the left hand pedal depressed, look at gaps through the observation window. If any of the gaps are not firing, turn its adjustment knob (or knobs) counter-clockwise to open the gap slightly until firing starts. It is essential that all gaps be firing prior to adjustment. IF UNABLE TO MAKE ALL GAPS FIRE, SEE FOLLOWING SECTION, page 5.

1—After all gaps are firing, take each individual gap (for example, start at left and work to right), carefully align your eye with the gap being adjusted and—

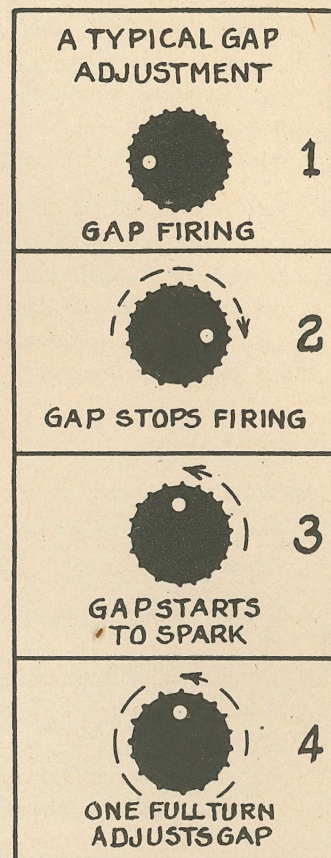
2—Turn its adjustment knob **CLOCKWISE** until it *stops* firing. Then—

3—Slowly turn knob **COUNTER-CLOCKWISE** until you see the gap start to spark **THEN STOP!**—and note position of small white dot on knob.

4—From the point where continuous sparking was first observed, **TURN KNOB COUNTER-CLOCKWISE ONE FULL TURN**, which will put that particular gap in proper adjustment.

ADJUST ALL GAPS IN THIS MANNER.

It is important that the observer's eye be lined up directly with sparking surface on gap being adjusted. The best way is to close one eye, and move the head laterally in front of the gap to the point where firing seems most intense. The arc that takes place is quite small and, if viewed from even a moderate angle, you may not see the first sparking in the gap,



from which point the subsequent one turn counter-clockwise adjustment must be made.

For safety, the gap adjustments should be made each time before an operation is started. While the gaps will, under ordinary conditions, retain their adjustment over quite a period of time, if the machine is moved around or jolted they may get slightly out of adjustment and for safety and assurance of satisfactory performance we recommend a complete gap adjustment *each* time before starting to work.

When correctly adjusted, intensity of the arc in each gap should appear about the same to the eye. If a particular gap appears to fire with less intensity than the others, it probably means that it *has not been opened enough* and should be completely readjusted in accordance with above instructions.

If any one gap fires irregularly or sputters, it very likely means that the gap needs readjustment because it *has been opened too wide*. If one or more of the gaps are opened too wide, or if they are adjusted improperly so that one takes most of the load, there will be a decided sputtering in that one gap (or all gaps, if all are opened too much). The sputter can be seen and its crackling sound distinctly heard. A single sputter at rare intervals is of no consequence, but if heard often or continuously, all gaps should be correctly adjusted.

We have elaborated on this spark gap adjustment, not because it is difficult or complicated, but rather on account of its relative importance. Correct gap adjustment is essential to satisfactory operation of the cutting currents. If the machine seems to lack cutting power—if it cuts slowly—these are sure signs that the gaps are not in adjustment and they should be properly set before further use.

Remember these simple instructions:

HAVE ALL GAPS FIRING BEFORE THE ADJUSTMENT IS STARTED.

HAVE THE EYE LINED UP DIRECTLY WITH SPARKING SURFACE and catch the point where firing first begins. This is a critical factor in the adjustment. You must see the very first continuous twinkle and open the gap one full turn, counter-clockwise, *from the point where firing was first observed*.

ADJUST ALL GAPS EACH DAY BEFORE WORK IS STARTED.

These Bovie gaps incorporate a unique, patented, self-compensating feature which insures their continuous, satisfactory operation and consistent performance. *When properly adjusted*, the machine is brought to a condition of stability and, under equivalent conditions, results can always be duplicated—you know in advance the results to be expected from a given power setting.

If Unable to Make Gaps Fire

1. Occasionally some uninformed persons may needlessly turn the knobs and close one or more gaps several turns or open them up a number of turns. If this occurs, it may appear impossible to get the gaps to fire. Fortunately there is a simple remedy for this seemingly perplexing condition.

The thing to do is first, *close all gaps completely* by turning each adjustment knob clockwise until resistance is felt and further motion arrested. This may require anywhere from two or three to thirty or more turns, depending on whether gap is partially open or closed at the start. Stops limit the number of possible turns in either direction and considerable resistance is felt when this limit is reached. Don't attempt to turn knob **BEYOND POINT WHERE RESISTANCE IS FELT**. To do so might damage gap mechanism.

After all gaps are completely closed—after all knobs have been turned clockwise until resistance is felt—then step on left pedal and *open one gap* until it starts firing. This will require from fifteen to twenty-five *counter-clockwise* turns. Then open the other gaps in same manner until all are firing. After all gaps have started to fire they should be correctly adjusted in accordance with instructions in preceding section.

2. Make sure that machine is connected to correct current supply.

3. Make sure that the supply line is not "dead" because of burned out fuses or other reasons.

4. See that the foot switch is connected.

Pilot light will glow when machine is connected to proper current supply and main switch turned "on", but no high frequency current is generated unless one of the foot switch treadles is pressed.

With the supply cable and foot switch connected and gaps properly adjusted, the machine is ready for service and you can:

CONNECT INDIFFERENT ELECTRODE to the terminal marked "Patient", using a cord with clip on one end and round plug on other. The clip is fastened onto the metal indifferent plate. (See accompanying booklet, "Fundamentals of Electro-Surgery" for further information on applying indifferent electrode).

When Used For Aseptic Surgery the various parts that require touching or handling during operation should be sterilized before they are connected. These include the sterilizable instrument rack, the electrode holders with their cords, and the required operating electrodes. (See subsequent section on methods of sterilization.)

With these parts sterilized you are ready to:

Insert Sterilizable Handles in openings in the controls. Turn handle two or three clockwise turns to lock it in place.

Insert Operating Electrodes in handles by unscrewing to release chuck, inserting electrode and then tightening chuck carefully.

Install Sterilizable Instrument Rack. If instrument rack is too high for convenience with both straight sections in place merely leave off one length, or both.

Connect Operating Electrode Handles to any of the three terminals marked "Electrode." All deliver the same current. One, two or three handles may be connected as required. Lay handles with their instruments in place on the sterilizable instrument rack.

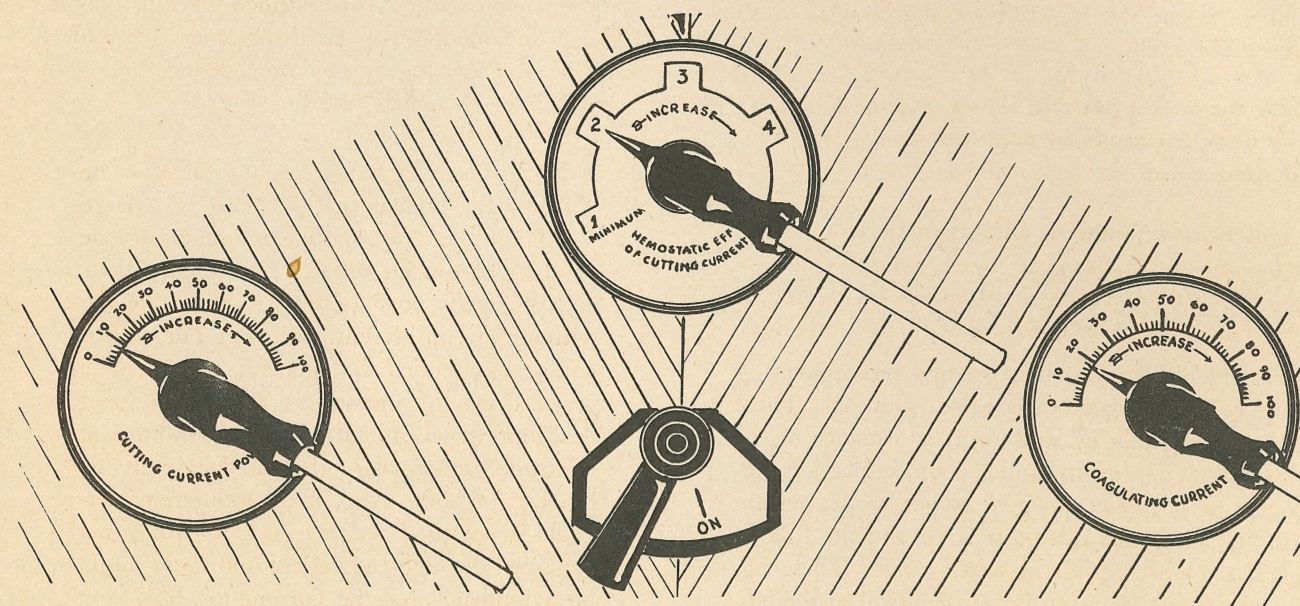
Setting the Controls

With the foregoing adjustments and connections made, the machine is ready for service except for setting the controls. These should be adjusted to best values for the work at hand.

Full control of the currents is afforded by the three rotating handles on the top panel, marked as illustrated at bottom of this page.

Rotating through their graduated scales, the two power controls afford a constant, unbroken range of power from zero up to maximum output of the circuit. These scales are purely arbitrary, indicating the relative current strength between minimum and maximum settings. The ratio of current strength to dial settings is not uniform throughout the scale.

The amount of power required—either cutting or coagulation—involves a number of variables so that experience and familiarity with the machine and different electrodes used under various conditions are really required to determine the best setting. However, if the fundamentals are understood, the operator will, with a little experience, have no difficulty in making correct settings for different types of work.



First, let us consider the variable factors that influence the power required for *electro-cutting*.

Cutting Power Required in General Surgery will vary, depending on—

A—*Nature of tissue being sectioned.* Fat or cartilage requires more power than skin or muscle. Sclerotic, fibrotic or cicatricial tissue will require more power than softer structures.

B—*Depth of Incision.* A deep incision (with the same electrode and a given speed of cut) requires more power than a shallow one.

C—*Rate of speed at which cutting electrode is moved;* fast cuts require more power than slow.

D—*Type of electrode used.* For a given depth of incision with equivalent speed of cutting, the amount of power required will depend on the thickness of the electrode used. The thinner the electrode, the less power required.

With these fundamentals in mind, it can be seen that power settings are *not* fixed arbitrary figures, subject to no variation. Rather, the surgeon should learn that this is a flexible factor and that best results are secured by varying the power settings to meet the immediate conditions.

There is one safe general rule that applies to all conditions, namely:

Use the lowest possible Power Setting which, with the Electrode in use, cuts freely to the desired depth.

This rule, if followed, will result in a minimum of sparking and flashing at the electrode—will prolong the life of operating instruments—will prevent charring or excessive coagulation of the wound edges.

As noted above, variables prohibit recommending definite power settings for different conditions. These can be learned only by studying performance of the unit on actual operations, under your own conditions. However, it is feasible to give power ranges within which certain results can be secured and the following will serve as a guide in starting out. These figures apply to the "Cutting Power Control" at the left.

Using the small flat blade, a power setting of 30 to 35 will permit fairly rapid incisions through skin or muscle, $\frac{1}{8}$ " to $\frac{1}{4}$ " deep.

Settings between 35 and 45 will make rapid incisions up to about $\frac{1}{2}$ " deep.

From 45 upward will cut the full depth of the small blade.

The above settings apply to the use of the small flat blade. The large flat blade, the small needle, and the large needle, in the order named, require slightly more power. To cut the full depth of the large blade around 55 will be required. About 60 will cut the full depth of the large *needle*.

With the smaller loop electrodes, around 40 to 45 will "scallop" small bits of tissue. From 45 to 50 will excise fairly large pieces of tissue and for big segments with the larger loops, from 55 upwards will be required.

Please recall that the above are not fixed arbitrary figures. They may vary if your line voltage is above or below normal. In a wet, bloody field, considerably more power may be required than in drier tissue. To cut under water, special electrodes are needed and considerable power must be used. Recall that fatty tissue or cartilage require more power than skin or muscle. As actual work is done, experiment with different amounts of power and note the settings that give best results under various conditions. Experiments on meat, as outlined in our booklet "The Fundamentals of Electro-Surgery," are very valuable and are highly recommended before work is started on an actual patient.

NOTE—Electro-cutting should always be done by the bipolar method; that is, a large indifferent electrode should be applied to the patient's bare skin. Under certain conditions it is physically possible for the surgeon to cut without an indifferent electrode, but this is not recommended for general use. For a given depth of incision it requires a great deal more power to cut without an indifferent electrode (monopolar) than it does with the bipolar method. Also, if an indifferent electrode is not used a direct current path is not provided through the patient and there might be a tendency for the current to "leak" out

through the operator. For these reasons we recommend that cutting always be done by the bipolar method. The approximate power settings shown above are based on an indifferent electrode being used.

Hemostatic Effect of Cutting Current

Electro-Cutting is accomplished by a small, intense arc which forms just ahead of the electrode. The intense heat of this arc volatilizes a small zone of tissue cells which pass off as vapor and, as the electrode moves along, the tissues part as though severed by the sharpest scalpel. As the electrode passes through, the heat of the arc creates on the edges of the wound a shallow zone of dehydrated or coagulated tissue and this dehydration seals off the capillaries and smaller blood vessels and prevents bleeding and oozing from these sources. The degree of hemostatic effect secured with electro-cutting depends directly on the depth of dehydration on the edges of the wound. The deeper this dehydration, the more hemostatic effect. The less dehydration, the more bleeding.

While the depth of dehydration caused by the cutting current depends, to a certain extent, on the electrode used, the amount of power and speed of cutting, it is governed chiefly by the "Wave Form" or "Characteristic" of the current.

A most important feature of this new Davis-Bovie Unit is the center control marked "Hemostatic Effect of Cutting Current" which, by changing the current characteristics, varies the depth of dehydration caused by the cutting current on the edges of the wound, other conditions remaining unchanged. This feature makes it possible to secure, at the operating electrode, a current of hemostatic qualities best suited to the particular work being done.

With this control at the No. 1 position, only a pure cutting current with little dehydrating (hemostatic) effect reaches the electrode. Rotating this control through its scale from No. 1 (minimum) to No. 5 (maximum), alters the current characteristics so as to increase the amount of coagulation on the wound edges, which in turn reduces hemorrhage.

The possibilities of these currents have not been fully explored, but the work to date shows clearly that this feature affords a degree of flexibility never

before achieved in any electro-surgical unit. The ability to select a cutting current with hemostatic effect that best suits the immediate condition is an obvious advantage.

For example, in making skin incisions, the "Hemostatic Effect" control should be set at No. 1 so as to produce an absolute minimum of dehydration on the skin margin, insuring strong healing per primum.

On the other hand, in cutting through extremely vascular areas where primary union is not expected, the "Hemostatic Effect" control can be advanced, a current with more dehydration effect fed to the electrode, and tissue severed with infinitely less bleeding. As an example, in working on extremely vascular areas such as the lip, tongue, cervix, etc., where primary union is not involved, the heaviest "Hemostatic Effect" can be used with a substantial reduction in hemorrhage. Under certain conditions truly bloodless cutting is possible. For example, using the Davis-Bovie Unit on heaviest "Hemostatic Effect" and with a large needle electrode, we have seen experimental incisions made bloodlessly in a dog's liver. This is cited simply to illustrate the extreme degree of hemostasis which can be secured from the cutting current by properly adjusting this control and selecting the correct electrode.

A careful study of the "Electro-Cutting" section of our booklet "Fundamentals of Electro-Surgery" will convey a good idea of the basic principles underlying the use of these currents.

One point requires special emphasis—namely—in making skin incisions where primary union is expected, set the "Hemostatic Effect of Cutting Current" control at No. 1—use only the smallest blade electrode—avoid the use of too much power—and make the cut rapidly. This will result in minimum coagulation of the skin margins and there will be little, if any, interference with primary union. *If any considerable amount of coagulation remains on the skin margins, healing per primum will be very slow and may not occur at all.*

Cutting Under Water

Under-water cutting requires electrodes with insulated shanks so that all current will be concentrated on the cutting area of the electrode. The uninsulated open-air electrodes will not cut under

water because a larger proportion of the cutting current will be dissipated into the water from the bare shank of the electrode.

Therefore, do not expect to cut under water except with electrodes designed especially for that purpose.

For under-water cutting (*prostatic resection*) only the first three steps of "Hemostatic Effect" can be used. As this control is advanced towards maximum, the current characteristics are altered so much that under-water cutting is decidedly interfered with. Towards the heavier "Hemostatic" settings it will cut poorly, if at all. Therefore, in Prostatic Resection, use only the first three steps on this control. For average conditions the No. 1 setting of this control is best but in an extremely Vascular Gland advancing the control to step 2 or 3 will tend to reduce Hemorrhage, with a slight reduction in cutting quality.

Power Settings for Electro-Coagulation and Desiccation

For this work current is applied by various methods through electrodes of different sizes and shapes so that an understanding of the different conditions is necessary before power settings can be worked out.

Electro-Coagulation can be defined as a process in which a high frequency current is employed to actually "cook" tissue surrounding the active electrodes. Enough heat to do this is generated within the tissues by the current passing from the electrode into the surrounding tissue.

Electro-Desiccation is a procedure similar to electro-coagulation except that the active electrode is not placed in actual contact with tissue. Current is allowed to jump through space and, sparking onto the surface being treated, dehydrates the superficial layers of tissue. This sparking action is sometimes called "Fulguration."

These two methods of application produce exactly the same effect on tissue—namely—the cells so treated are dehydrated, or coagulated, or, actually cooked—the difference being that contact coagulation penetrates more deeply, causes a greater depth of destruction—whereas desiccation affects only the

superficial layers.

Both coagulation and desiccation can be done with or without an indifferent electrode. To denote these two conditions the following terms are used:

- 1—*Monopolar* when a single active electrode is used without an indifferent electrode.
- 2—*Bipolar* when an indifferent electrode is used for current return path, or when the new type bipolar applicators, consisting of two needles in a common handle are employed.

These terms are used merely to indicate the method of applying current. There is no difference in the surgical effect of the current or in their electrical characteristics. The only difference is in the amount of power secured from a given setting. For a given power setting more current is obtained with bipolar applications than with monopolar.

The amount of power required for this work varies widely and depends on:

- A. Size of Electrode used.
- B. Area of Electrode in contact with tissue.
- C. Depth and area of destruction desired.
- D. Length of time current is applied.

Again, it is not possible to give definite power settings for various classes of work, but the following will serve as a starting point. These figures apply to the "Coagulation Power Control" at the right.

MONOPOLAR DESICCATION

Very light—15 to 20
Light —20 to 30
Medium —30 to 40
Heavy —40 upward

BIPOLAR COAGULATION

Very light—10 to 15
Light —15 to 20
Medium —20 to 30
Heavy —30 upward

BLADDER FULGURATION

From 40 to 60, depending on size of tip and amount of destruction desired.

Settings shown above will apply when the current is used for tissue destruction.

For electro-hemostasis by the clamp and coagulation method, power requirements will vary considerably, depending on the size of the clamp used, the amount of tissue picked up, the size of the bleeder

and other factors. In general, however, a power setting of around 25 (bipolar method) will prove adequate if only small amounts of tissue are picked up in the clamp and from 30 to 35 if larger clamps are used and larger bits of tissue picked up. See "Fundamentals of Electro-Surgery" for more details.

Instructions for Using The Braasch-Bumpus Resector With The Improved Davis-Bovie Unit

With the Braasch-Bumpus Resector, the segment of tissue engaged in the fenestrum of the sheath is rendered ischemic by coagulation with a multi-needle electrode before excision with the tubular knife. Following excision of the segment, bleeding from individual vessels is controlled by coagulation with a single pointed fulgurating electrode of the Bugbee or similar type.

For preliminary coagulation with the multi-needle electrode, the *cutting* current is used. This is perfectly safe and satisfactory as when applied through these large needles the current loses its cutting characteristics and will coagulate only. For sealing individual bleeders with the fulgurating electrode, the *coagulation* current is used. Settings of various controls on the machine are as follows:

Hemostatic Effect of Cutting Current—Step No. 1
Cutting Current Power—60
Coagulation Current Power—45

The multi-needle electrode is connected to any one of the three terminals marked "Electrode"; the single pointed fulgurating electrode is connected to another of these terminals. Both electrodes are thus ready for instant service without changing any wires

or connections. It should be remembered that *both* electrodes are activated whenever either foot treadle is pressed, therefore the electrode *not in use* should be laid at some place on the instrument stand where the operator or an assistant cannot accidentally contact its tip and get a high frequency burn. Also the electrode *not in use* should be placed on a dry towel or some other insulating material to prevent accidental short-circuiting of the entire output of the machine. This would not damage the machine but would very likely ruin the tip of the electrode.

With the tissue to be removed engaged in the fenestrum, the multi-needle electrode is thrust into the base and the *cutting* current turned on by pressing the *left* treadle on foot switch. Three to six seconds application of the current will be needed, depending on vascularity of the tissue, to render it ischemic. This being completed, the electrode is withdrawn and the segment of tissue excised with the tubular knife.

If uncontrolled bleeding from individual vessels is observed, it may be stopped by applying the *coagulation* current through the single pointed fulgurating electrode. To turn on coagulation current, press *right* treadle on foot switch.

FOR FULL DETAILS OF THE OPERATIVE PROCEDURE SEE THE BOOK "MINOR SURGERY OF THE URINARY TRACT," BY BUMPUS, CRENSHAW AND CLARK. PUBLISHED BY W. B. SAUNDERS COMPANY, PHILADELPHIA

Instructions for Using The Improved Davis-Bovie Unit in Treating Detachments of the Retina

In treating retinal detachments with high frequency currents, the object of the operation is to create through the sclera and choroid small punctures which will permit escape of the sub-retinal fluid with collapse of the detachment, and at the same time to create on the choroid minute spots of inflammatory adhesive choroiditis to which, in favorable cases, the retina will adhere.

Special single and multi-pointed needle electrodes (see accompanying bulletin), activated by the Davis-Bovie cutting current are used to accomplish these results. DO ALL DETACHED RETINA WORK WITH THE CUTTING CURRENT AND THE "HEMOSTATIC EFFECT" CONTROL SET ON NUMBER 4.

To prepare the machine for detached retina operation, adjust the cutting section spark gaps in the regular manner as previously outlined. Apply indifferent electrode under patient's shoulder and connect it to the "Patient" terminal. Connect operating handle (or handles) to any of the "Electrode" terminals.

Set "Hemostatic Effect of Cutting Current" control on number 4, which is always used for Retinal Detachments.

Set "Coagulation Current Power" at O. This is an important safety measure to prevent applying the coagulation current if the wrong foot switch treadle should be pressed.

The Left Treadle is Used for Turning Current On and Off

Set "Cutting Current Power" control on proper setting, depending on the number of points on the electrode being used.

In treating retinal detachments, bear in mind that the number of points on the electrode governs the power required. Correct current strength for varying numbers of points has been carefully worked out through extensive animal experiments and clinical work. The power requirements vary within narrow limits depending primarily on whether the surface of the sclera is absolutely dry and free from small tags of tissue, and to a very limited extent on the voltage of the line from which the machine is operated.

Under normal line voltage conditions and where it is possible to maintain an absolutely clean, dry field, the following "Cutting Current Power" settings should be used:

One-point electrode.....	20
Two-point electrode.....	22
Three-point electrode....	24
Four-point electrode.....	26
Six-point electrode.....	30

If an absolutely dry field can not be maintained—even with small amounts of moisture on the sclera—the above figures will need to be increased slightly, by about two or three scale divisions.

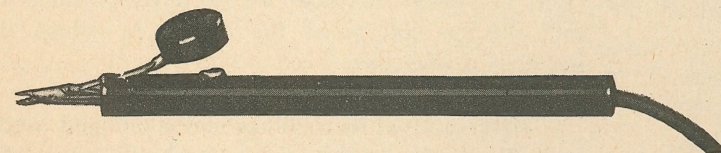
Also, if it is known that an extremely high or low line voltage exists, these settings may need to be altered a scale division or two to compensate for this. However, in most locations and under average operating conditions, the above settings will prove satisfactory.

BE SURE TO SET "CUTTING CURRENT POWER" ON PROPER DIAL SETTING FOR THE NUMBER OF POINTS ON ELECTRODE BEING USED. IF ELECTRODE IS CHANGED BE SURE TO CHANGE POWER SETTING

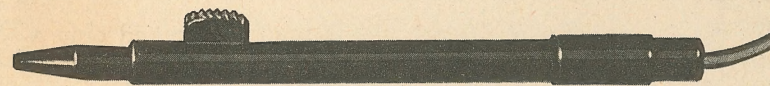
The Operating Instruments

The various electrodes used, together with handles, are illustrated below.

The forcep type holder is used in applying the small electrodes. It is arranged so that when the button is pressed about half way down, it will grasp and hold the electrode. When further depressed, it will establish contact with the current and so activate the point.



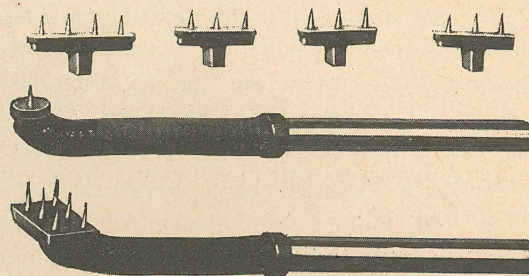
Forcep type holder with current cut-off for applying small electrodes.



Chuck type handle with current cut-off for applying extended shank electrodes.

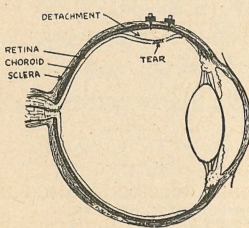
The chuck type handle, for applying the extended shank electrodes, is equipped with a current cut-off button. Electrodes are fastened in this handle by unscrewing the tip two or three turns, putting the electrode in place and then tightening tip.

Application of various electrodes is more fully described in the following section.



Above, a group of multi-point needles on small, insulated base with eyelets for sutures. Below, two extended shank electrodes, one and six points. Shanks are made of insulated, pliable material that may be bent with the fingers to facilitate approach to field. Illustrated about two times actual size.

Technique Suggestions in Treating Retinal Detachments



The needles are placed to encircle and seclude the TEAR.

The object of this operation is to create through the sclera and choroid minute punctures so placed that the *tear* will be encircled when the fluid escapes and the detachment collapses onto the choroid.

When the detachment lies well forward, near the ora serrata, it is best treated with the small multi-point electrodes (Safar's so-called "nails") which are applied with the forcep type holder and left in situ until treatment is completed.

A most important point in the application of this current is to have the surface of the sclera clean, dry and free from small tags of tissue before the electrode is applied.

In applying the small electrodes, first pick them up with the forcep and lightly contact the points with the sclera, having a light, even pressure on each point. At this stage it is important to avoid too much pressure on the electrode—only a light contact is necessary.

With the points lightly touching the sclera, first step on left treadle of foot switch to turn on machine and then further depress the button to contact current with the points.

If the needles have been properly applied, they will instantly sink into the sclera when the current is turned on, and when they have been plunged into their full depth—when the insulated base of the electrode touches the sclera—the current should be turned off *immediately*, the electrode released and left in situ.

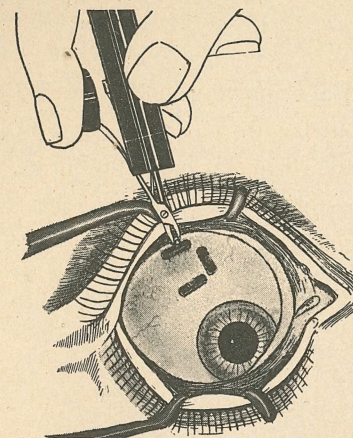
This is a very quick acting current and only a fraction of a second is required for the electrodes to sink in and create the puncture. **IT IS MOST IMPORTANT THAT CURRENT BE TURNED OFF INSTANTLY AFTER THE POINTS SINK INTO THEIR FULL DEPTH.**

In working near the margin of the eyelid, be sure that forceps or base of electrode does not come in contact with the lid or other tissue. If this occurs, current will go to this point rather than to the needle and the point will not sink in and create a puncture.

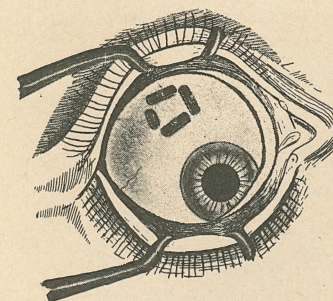
These small "nail" electrodes can be used successfully only in the case of anterior detachments and even in treating some of these, if working close to or under the lid margin, it may be necessary to apply the single point extended shank electrode to the posterior zone in order to avoid establishing contact with the lid or other tissue.

Detachments lying far back must be attached with the extended shank electrodes used in the chuck type handle. In the case of small detachments, the single point should be used, placing a row of punctures so as to encircle the tear as nearly as possible.

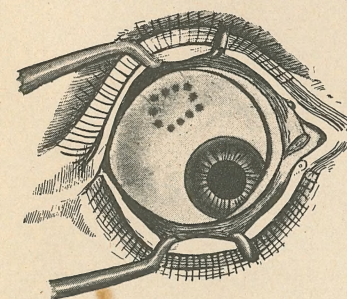
These electrodes can not, of course, be left in situ; there will be some escape of sub-retinal fluid, and extra care is required to keep the sclera dry in the region being punctured.



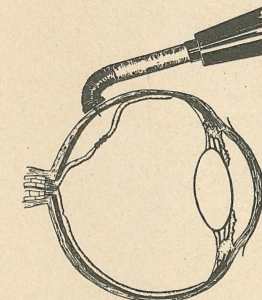
Application of small electrodes with forcep-type holder. Two are shown in place, the third being applied.



Four small multi-point electrodes in situ.



Appearance of sclera after electrodes are removed.



Detachments far back are reached with extended shank electrodes.

Large posterior detachments can best be attacked with the six-point electrode, by repeated application, placing enough punctures to cover the desired area.

As in the case of the small points, it is necessary to first lightly contact the sclera with the needles, turn on current and then shut it off instantly when the points are plunged into their full depth. It is

important that all points be lightly and evenly in contact with the sclera before current is turned on.

The shanks of the long electrodes are made of a pliable metal that can be bent with the fingers to facilitate approach to the operative field in detachments lying far back.

STERILIZATION OF ELECTRODES AND ACCESSORIES

In preparing the Davis-Bovie Unit for aseptic surgery, all parts that are handled or touched in the course of an operation should be sterilized prior to use. These include the sterilizable instrument rack and its supporting standard; the operating electrode handles with their cords and plugs; sterilizable glass handles which fit into the three controls; all needles, knives, loops, blades and other operating instruments.

The metal parts, including the entire instrument rack assembly, the uninsulated loops, needles, knives, etc., can be sterilized by prolonged boiling or autoclaving without damage.

However, the bakelite handles, rubber cords and insulation on electrodes will be subject to some deterioration when heat sterilization is used, and they will require replacement from time to time.

The useful life of the insulating parts can be lengthened by sterilization in some adequate cold

solution, *i.e.*, 70% alcohol, mercuric cyanide (1 to 1000), etc. However, we do not recommend cold sterilization in Neuro-surgery, operations in the Thoracic Cavity, in the abdomen, etc., where immaculate conditions are essential.

For these operations where heat sterilization must be employed, the best method is to wrap all instruments and handles in a towel and sterilize them in the auto-clave for fifteen minutes at 15 pounds pressure. This is considered adequate for most major surgery and does not cause undue deterioration of the bakelite and rubber parts. Wrapping these parts in a towel, however, is important as this minimizes deterioration.

For Prostatic Resection instruments the customary mercuric cyanide solution is recommended. Phenol solutions should not be used on any bakelite insulated instruments.

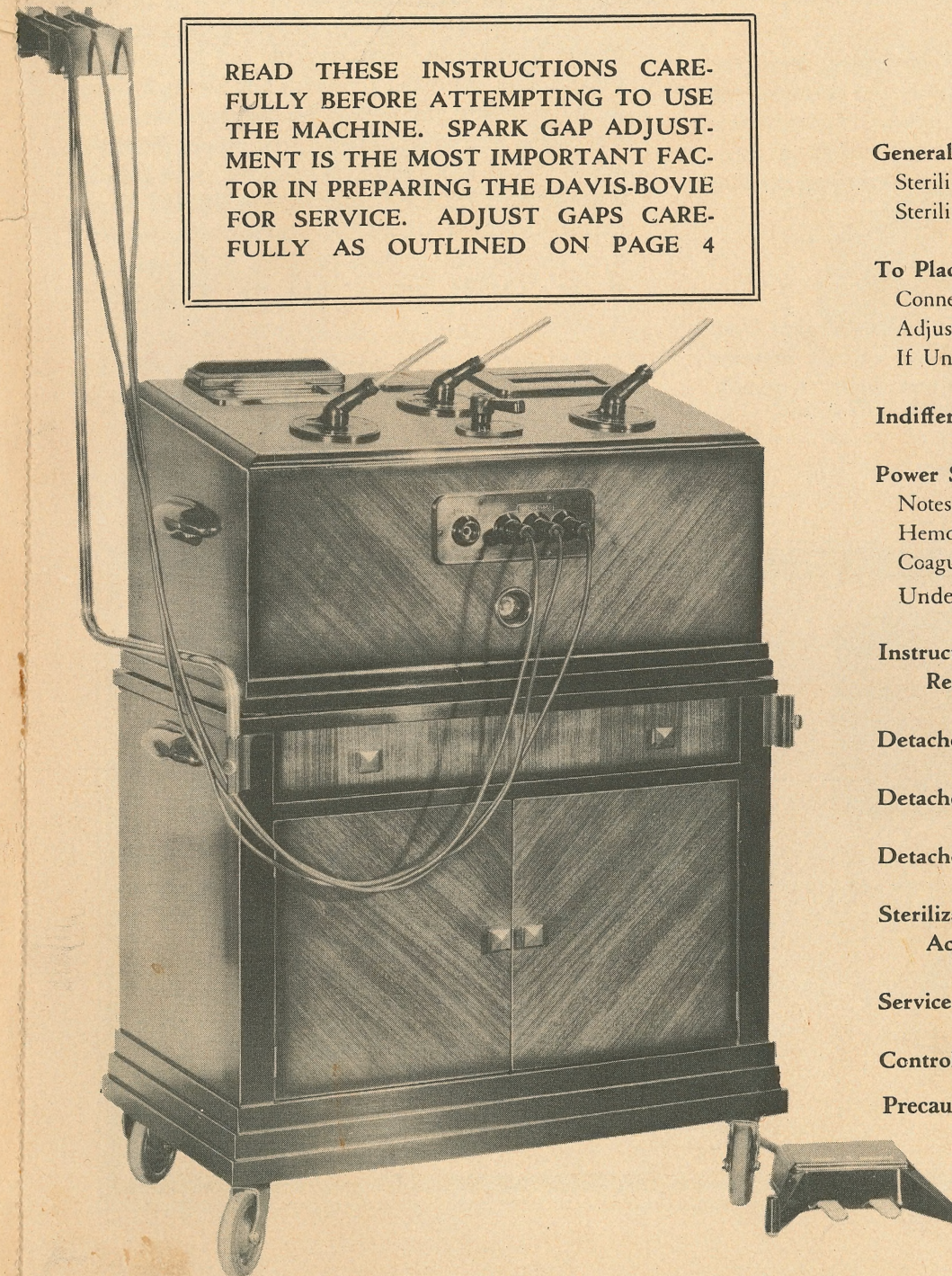
SERVICE NOTES

The only thing on the Bovie Unit that will ever need special attention is the spark gaps which will require reconditioning after a large number of major operations. This would ordinarily be after three to five years' service in an average institution. This is handled on a replacement basis from the factory. The need for gap reconditioning is indicated by a gradual impairment of cutting quality and/or irregular, sputtery gap operation. When this occurs, communicate directly with the Company for detailed instructions.

This booklet covers primarily the mechanics of adjusting and preparing the Davis-Bovie Unit for service. The accompanying booklet "The Fundamentals of Electro-Surgery" contains a great deal of information that will be valuable to those just undertaking Electro-Surgery. Its careful perusal and a thorough study of the reprints on Electro-Surgery is recommended before actual operative work is undertaken.

Instructions for Connecting and Operating THE IMPROVED DAVIS-BOVIE ELECTRO-SURGICAL UNIT

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO USE THE MACHINE. SPARK GAP ADJUSTMENT IS THE MOST IMPORTANT FACTOR IN PREPARING THE DAVIS-BOVIE FOR SERVICE. ADJUST GAPS CAREFULLY AS OUTLINED ON PAGE 4



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