

REPRINTS
AND
TECHNICAL DATA
DESCRIBING USES OF THE
Bovie Electro-Surgical Unit
THE LIEBEL-FLARSHEIM CO.
303 W. Third Street, Cincinnati, O.

INSTRUCTIONS

FOR SETTING UP AND OPERATING

UNIVERSAL BOVIE

ELECTRO-SURGICAL AND DIATHERMY UNIT

— GENERAL DESCRIPTION —

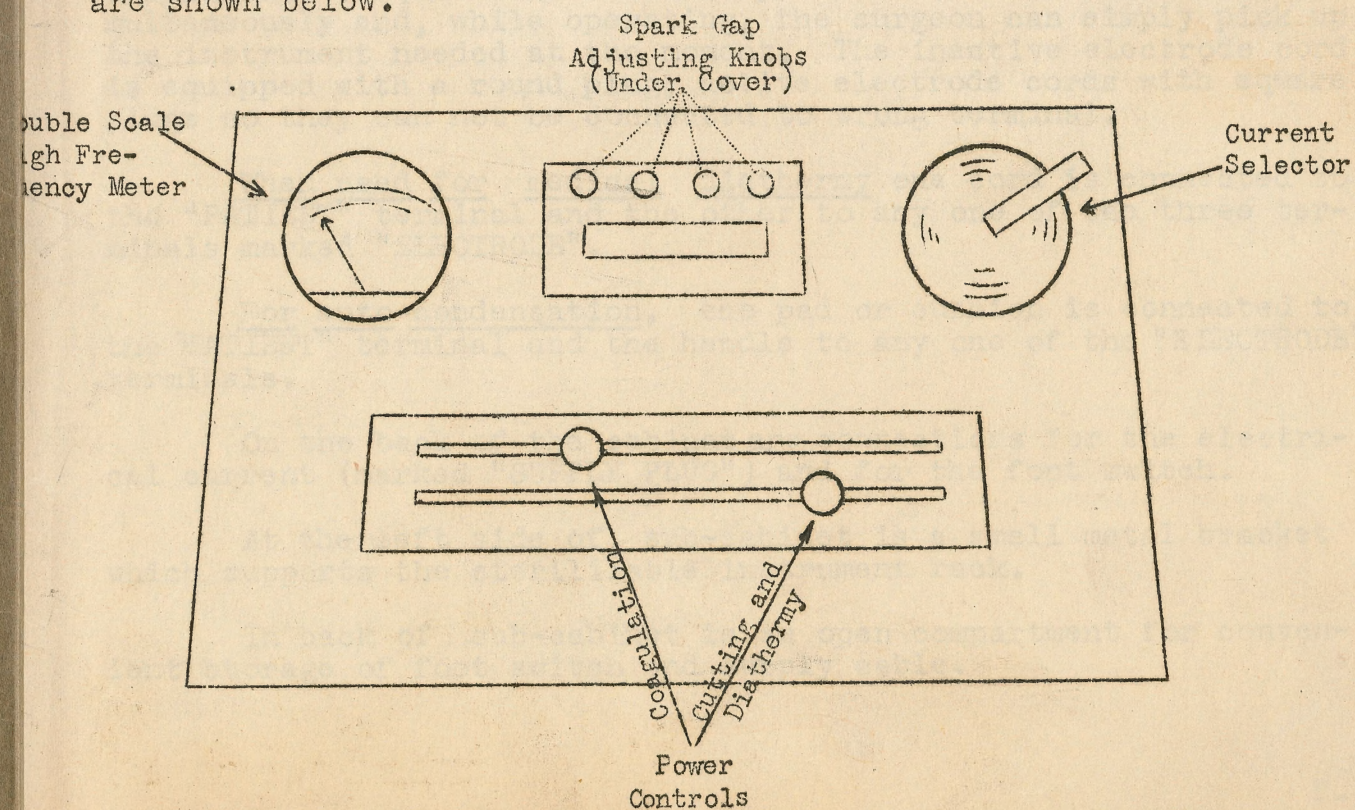
The Universal Bovie Unit generates high frequency current for three distinct services:

- 1 - Electro-Cutting.
- 2 - Electro-Coagulation. (Also desiccation and fulguration.)
- 3 - Medical Diathermy. (Including Auto-Condensation.)

These three currents are quite different as to electrical characteristics, voltage, amperage, etc. -- each being ideally suited to its particular function.

By means of the manually operated "SELECTOR SWITCH" any one of the three currents can be instantly connected to the outlet terminals and through these to suitable electrodes.

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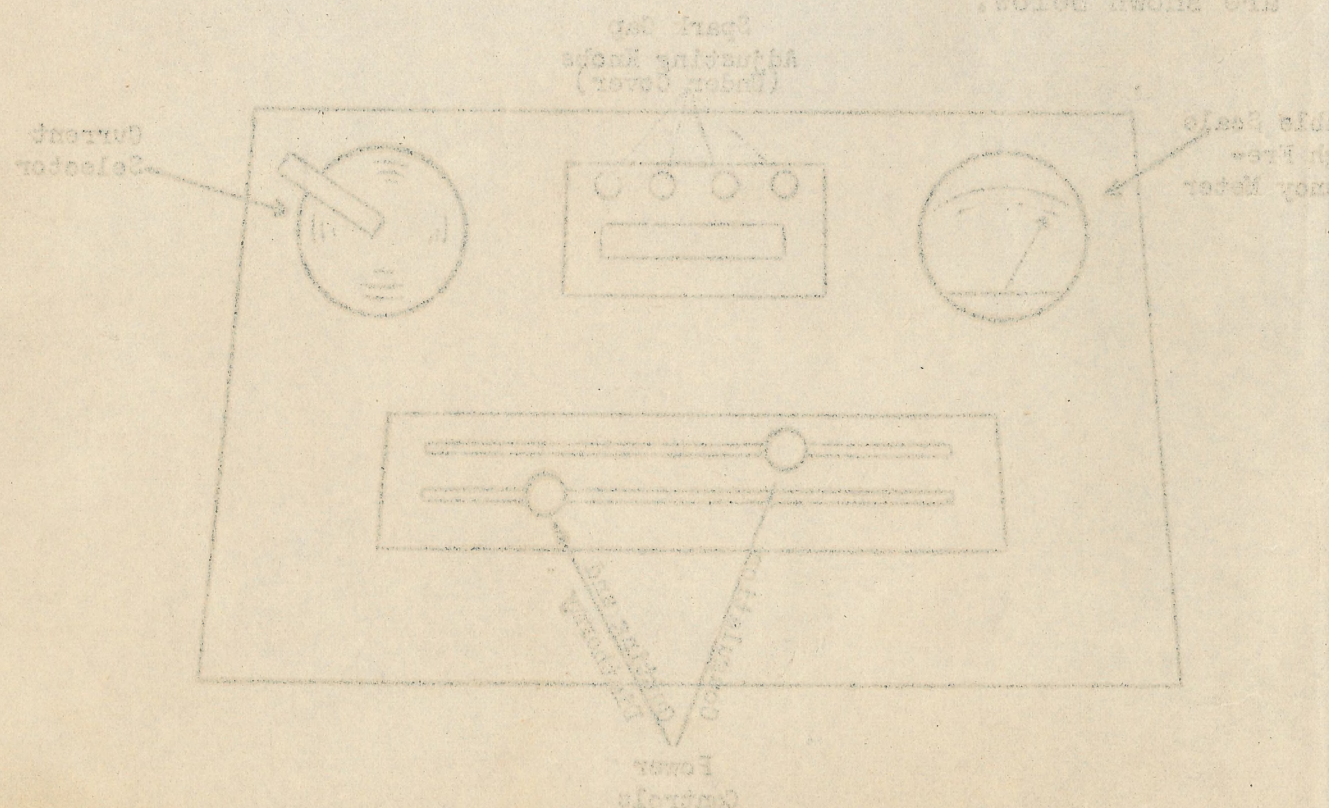
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The functions of the various controls on the top panel are shown below.



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 as illustrated. The section inserted in bracket should be fastened with set screw. If the instrument rack is too high for convenience with both straight sections in place, simply leave off one length, or both.

STERILIZABLE HANDLES are provided for the selector switch and the two power controls. When used for surgery these handles may be sterilized by boiling or auto-claving and inserted in openings in the power control levers and selector switch, thus permitting all necessary manipulations under aseptic conditions.

THE POWER CONTROLS - Two power controls are provided. The first one, (facing the cabinet) controls power of the cutting and medical diathermy currents. The second one controls the power of the coagulation current.

These power control levers, sliding over their graduated scale, provide a constant, unbroken range of power from zero to maximum output of the particular current being used. (See subsequent section for further details on power control.)

THE HIGH FREQUENCY CONNECTIONS - On the front panel are high frequency terminals of the "plug-in" type. When used for surgery (cutting or coagulation) the single connection marked "PATIENT" is for the inactive (indifferent) electrode. The three terminals marked "ELECTRODE" are for active (operating) electrodes. These three active terminals all deliver the same current -- they are provided in multiple, so that up to three different operating instruments (required in certain operations) can be connected simultaneously and, while operating, the surgeon can simply pick up the instrument needed at the moment. The inactive electrode cord is equipped with a round plug; active electrode cords with square plugs so they can not be connected to wrong terminal.

When used for medical diathermy one cord is connected to the "PATIENT" terminal and the other to any one of the three terminals marked "ELECTRODE".

For auto-condensation, the pad or cushion is connected to the "PATIENT" terminal and the handle to any one of the "ELECTRODE" terminals.

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

At the left side of sub-cabinet is a small metal bracket which supports the sterilizable instrument rack.

In back of sub-cabinet is an open compartment for convenient storage of foot switch and supply cable.

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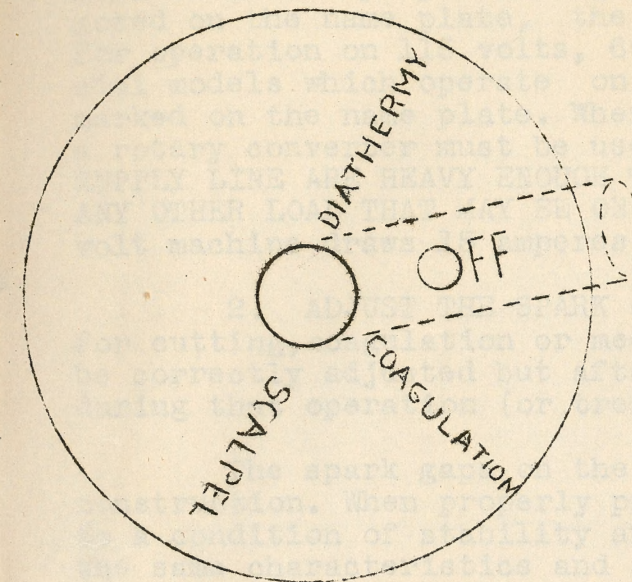
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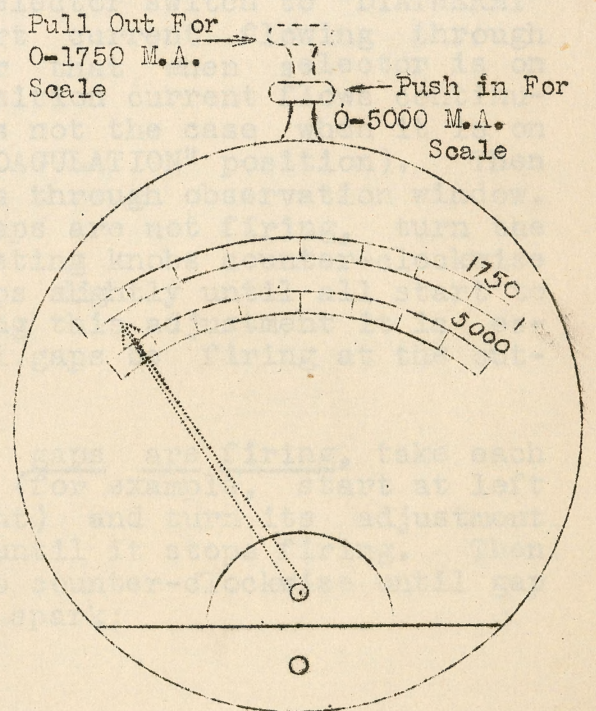


THE SELECTOR SWITCH
There are four stations on the selector switch -- an "OFF" position, and three active positions giving respectively, cutting, coagulation, and medical diathermy currents. At any point other than "OFF" position, the pilot light glows.

When selector switch is on the "DIATHERMY" position the machine is in operation immediately. The gaps will fire continuously, and a constant flow of diathermy current will be delivered to the outlet terminals.

When selector switch is on "SCALPEL" or "COAGULATION" position the supply current is turned onto the machine, the pilot light glows, but no high frequency current is generated until foot switch is depressed.

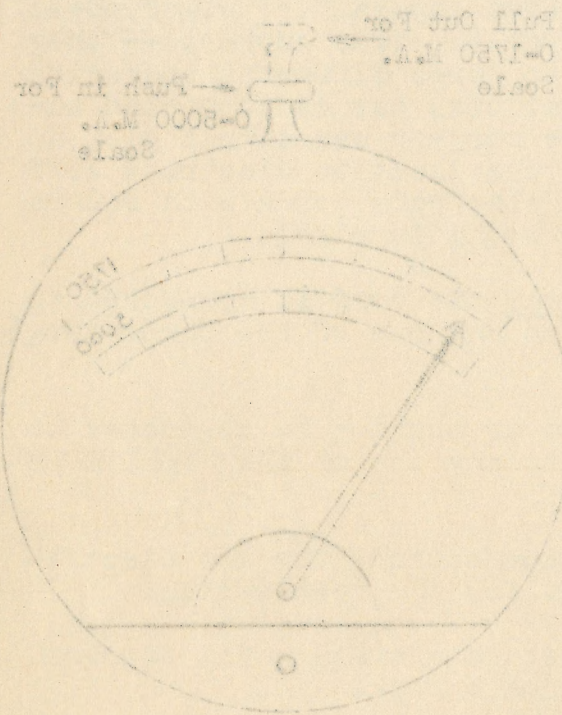
THE HIGH FREQUENCY METER
has two scales, one reading 0 to 5000 milliamperes, the other, 0 to 1750 milliamperes. The capacity of the meter, as well as the scale is shifted by means of the button located on back of meter. When this button is pushed in the meter reads up to 5000 milliamperes on the lower scale. When the button is pulled out, 0 to 1750 M.A. may be read on the upper scale. This meter is in the circuit at all times -- a reading will be secured whether the machine is used for medical diathermy, cutting or coagulation. As meter readings are of no value when the machine is used for cutting and coagulation, we suggest that when used for this service, the meter be removed to avoid possibility of damage in case of an accidental short circuit. Removing meter automatically short circuits the meter terminals so that current flow is not interrupted. If the meter is left in the circuit, BE SURE AND PUSH BUTTON IN so that the 0 to 5000 scale is in service.



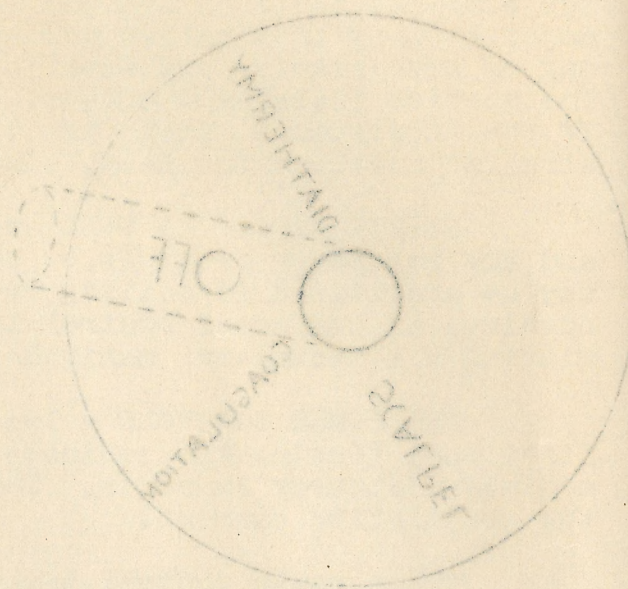
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TO PLACE MACHINE IN OPERATION

1. CONNECT SUPPLY CABLE. Be sure your electrical current is of the proper voltage and frequency. Unless otherwise noted on the name plate, the Universal Bovie Unit is designed for operation on 115 volts, 60 cycles, alternating current. Special models which operate on other alternating currents are so marked on the name 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 THAT MAY BE ON THE LINE AT THE SAME TIME. The 115 volt machine draws 15 amperes. The 230 volt machine, $7\frac{1}{2}$ amperes.

2. ADJUST THE SPARK GAPS. Whether the machine is used for cutting, coagulation or medical diathermy, the spark gaps must be correctly adjusted but after they are set, need not be touched during that operation (or treatment).

The spark gaps on the Bovie Unit are of a unique patented construction. When properly pre-set, the entire machine is brought to a condition of stability and will always generate currents of the same characteristics and strength, permitting accurate duplication of results. However, current quality is dependent on accurate spark gap adjustment and it is essential that this operation be properly performed.

There are four sparking surfaces on the gaps beneath the glass observation window. Each individual spark gap is adjusted with the small bakelite knob directly above it as follows:

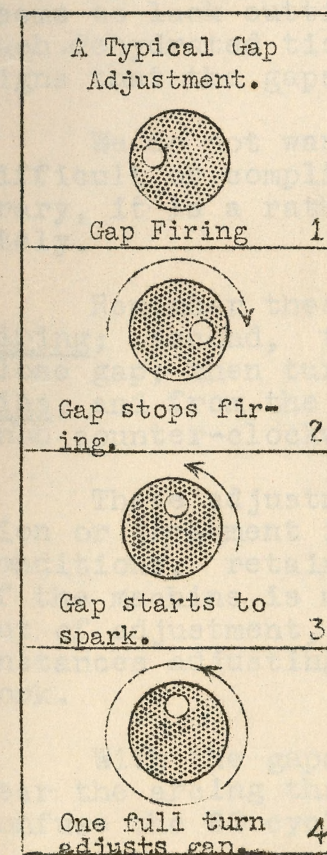
To adjust gaps, first move selector switch to "DIATHERMY"

position to start current flowing through gaps. (Remember that when selector is on "DIATHERMY" position current flows continuously, which is not the case when it is on "SCALPEL" or "COAGULATION" position). Then look at the gaps through observation window. If any of the gaps are not firing, turn the the proper adjusting knobs counter-clockwise and open the gaps slightly until all start to fire. In making this adjustment it is essential that all gaps be firing at the outset.

After all gaps are firing, take each individual gap (for example, start at left and work to right) and turn its adjustment knob clockwise until it stops firing. Then slowly turn knob counter-clockwise until gap first begins to spark;

THEN STOP.

Observe position of small white dot on knob and from the point where sparking first started, turn this knob counter-clockwise one full turn which will put that particular gap in proper adjustment.



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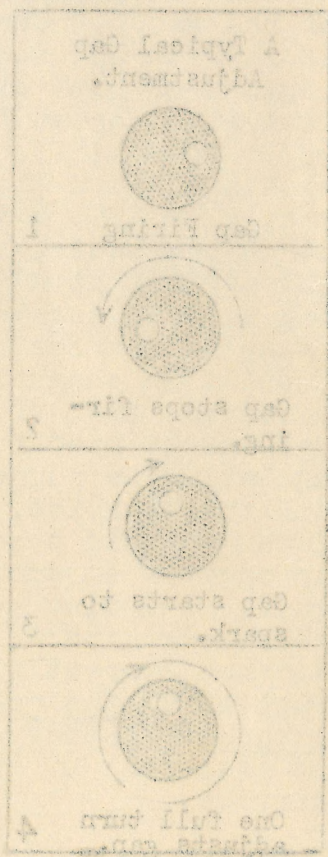
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It is important that observer's eye be lined up directly with sparking surface on the particular gap being adjusted. The arc that takes place is quite small and if viewed from even a moderate angle you will not be able to tell exactly the point at which firing first begins and from which the subsequent one turn adjustment must be made.

After first gap is correctly adjusted, proceed to the other gaps in turn until all are properly adjusted. In service, when adjusted correctly, intensity of the arc in each gap should appear about the same to the eye. If a particular gap seems to be firing with less intensity than the others it probably means that it has not been opened enough and should be completely re-adjusted in accordance with above instructions. If any one gap fires irregularly or sputters, it very likely means that that gap has been opened too wide and it should also be readjusted. We wish to caution once more, be sure and have the eye lined up with sparking surfaces when watching for the point where firing starts. This is the critical factor in the adjustment; it is essential that the gap be opened one full turn from the point where firing first starts -- from the place where you see the first continuous twinkle in the gap.

Due to intensity of the arc, the eye receives the impression that there is an appreciable separation of the sparking surfaces. As a matter of fact, however, the gap opening is only about one one-thousandth of an inch and this opening must be accurately established to secure currents of proper quality.

Gap adjustment is the most important point in starting out to use the machine. Satisfactory functioning, particularly of the cutting current, depends on accurate gap adjustment. If the machine seems to lack cutting power, if it cuts slowly or if there is too much dehydrated tissue on edges of the wound, -- these are sure signs that the gaps are not in adjustment.

We do not want to give the impression that there is anything difficult or complicated about adjusting these gaps. On the contrary, it is a rather simple procedure -- but must be done accurately.

Remember these simple instructions -- first get all gaps to firing; second, taking one gap at a time, turn knob clockwise and close gap; then turn knob counter-clockwise until sparking first begins, and from the point where the gap first starts to fire, turn knob counter-clockwise one full turn. Do this on all four gaps.

These adjustments should be made each time before an operation or treatment is started. While the gaps will, under ordinary conditions, retain their adjustments over quite a period of time, if the machine is moved around a great deal they may get slightly out of adjustment, and as a matter of safety we recommend in all instances adjusting the gaps carefully each time before starting to work.

With the gaps properly adjusted you should hardly be able to hear the arcing that takes place when current is turned on. (Don't confuse the 60 cycle transformer hum with the high pitched hissing

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note of the arc). If the gaps are open too wide, or if they are adjusted improperly so that one of them takes most of the load, there will be a decided sputtering in that one gap (or all gaps, if all are open too much). You can both see and hear the sputtering which has something of a crackling sound. A single sputter at rare intervals is of no consequence, but if heard often or continuously, the gap should be correctly adjusted.

With the gaps properly pre-set in accordance with the above instructions, you will always be able to duplicate the results from the machine. For specific types of surgery, you know in advance where to set the power controls for the cutting and coagulation current -- on medical diathermy you will know approximately the amount of current that will be delivered under equivalent conditions. This matter of gap adjustment is one that should be carefully studied and thoroughly mastered, for the satisfactory performance of the machine is largely dependent on this being properly done.

IF UNABLE TO MAKE GAPS FIRE

1. Make sure machine is connected to correct current supply and that the supply line is not "dead" because of burnt out fuses or other reasons.

2. Occasionally some uninformed persons will close one or more gaps several turns or open them up a number of turns, in which case it may appear impossible to get the gaps to fire.

If this occurs the thing to do is first, close all gaps completely by turning adjustment knobs clockwise until resistance is felt and further motion arrested. This may require anywhere from two or three to twenty 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 open one gap until it starts firing. This will require from eight to fifteen counter-clockwise turns. Then open the other three 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.

With the supply cable connected and gaps properly adjusted, the machine is ready for service.

WHEN USED FOR ELECTRO-SURGERY

When the Universal Bovie is used for surgery, several other preparatory steps must be carried out:

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With these parts sterilized and prepared for the operation the following steps must also be carried out;

1. CONNECT FOOT SWITCH.
2. CONNECT INDIFFERENT ELECTRODE, using a cord with clip on one end and round plug on other. Insert plug in terminal marked "PATIENT". Clip fastens onto metal plate. (See subsequent section for further information on applying indifferent electrode).
3. INSERT STERILIZABLE HANDLES in openings in the two power control levers and selector switch. Turn handle two or three clockwise turns to lock it in place.
4. INSERT OPERATING ELECTRODES IN HANDLE. To do this, unscrew to release chuck, insert electrode and tighten chuck carefully.
5. INSTALL STERILIZABLE INSTRUMENT RACK as illustrated. If instrument rack is too high for convenience with both straight sections in place, simply leave off one length or both.
6. CONNECT OPERATING ELECTRODE HANDLES. One, two, or three handles may be connected as required. The three terminals marked "ELECTRODE" all deliver the same current. Lay operating electrode handles with their instruments in place on the sterilizable instrument rack.

With the connections made, the power controls must be adjusted before you are ready to proceed with the operation. This is covered at length in the following.

POWER CONTROL SETTINGS

With the spark gaps properly adjusted, the generating circuits are brought to a stabilized condition which permits presetting power controls with assurance that for any given power setting the same current strength will be delivered at all times. This is a highly important feature as it permits duplication of power and results from day to day.

The amount of power needed for any given work involves several variables so that experience and familiarity with the machine will, in the end, be of more value than any arbitrary figures we may set. The following, however, will serve as a guide and with minor variations the power settings shown will work out satisfactorily in practice.

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FOR PROSTATIC RESECTION experience has shown the following power settings to be approximately correct:

- 28 Fr. McCARTHY ELECTROTOME -cutting 80 to 90
coagulation 65 to 75
- 24 Fr. McCARTHY ELECTROTOME -cutting 70 to 80
coagulation 55 to 65

These approximate settings may vary slightly, depending on your line voltage. In general, it is desirable to use the lowest power that will accomplish the desired results. Excessive power tends to carbonize the sheath and destroy loops. The less power used, the longer your loops and sheaths will last. We therefore suggest that you experiment with your particular conditions and work out, to your own satisfaction, the power settings that give the best results in your hands, with your line voltage and with your own instrument. Also, the power required will vary somewhat with the nature of the gland being resected. The fibroses require more power than malignancies or hypertrophies.

On the coagulation current, for light bleeding and oozing, considerably less power may prove entirely satisfactory and is desirable to use as it prolongs the life of loops and sheaths. On the other hand, in the presence of profuse bleeding -- real spurters -- considerable power is required. One prominent Resectionist uses a low power setting (around 45 to 50) for normal bleeding and oozing -- advances the power to about 65 or 70 when a real spurter is encountered -- and then reduces it again after the large bleeders are sealed.

CUTTING POWER REQUIRED FOR GENERAL SURGERY depends on:

- A. Nature of tissue being sectioned. Fatty tissue or heavy cartilage requires more power for a given depth of incision than skin or muscle tissue. Skin requires slightly more power than muscle.
- B. Depth of incision. A deep incision (with 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 smaller blade requires the least power. Slightly greater power is required in order for the large blade, small needle and large needle. Loop electrodes, used for "scalping out" bits of tissue, require moderately heavy power settings.

When selecting cutting current power setting, a good general rule is to use the lowest power which cuts freely and rapidly to the desired depth. Only experience on the part of each indi-

FOR PROSTATIC RESECTION experience has shown the following power settings to be approximately correct:

28 Fr. MCCARTHY ELECTROTOME - cutting 30 to 35
coagulation 25 to 28

24 Fr. MCCARTHY ELECTROTOME - cutting 20 to 25
coagulation 15 to 20

These approximate settings may vary slightly, depending on your line voltage. In general, it is desirable to use the lowest power that will accomplish the desired results. Excessive power tends to carbonize the sheath and destroy loops. The less power used, the longer your loops and sheaths will last. We therefore suggest that you experiment with your particular conditions and work out, to your own satisfaction, the power settings that give the best results in your hands, with your line voltage and with your own instrument. Also, the power required will vary somewhat with the nature of the gland being resected. The fibroids require more power than malignancies or hyperplasia.

On the coagulation current, for light bleeding and coagulating, considerably less power may prove entirely satisfactory and is desirable to use as it prolongs the life of loops and sheaths. On the other hand, in the presence of profuse bleeding -- real spurters -- considerable power is required. One prominent Resectant uses a low power setting (around 45 to 50) for normal bleeding and coagulating -- advances the power to about 65 or 70 when a real spurter is encountered -- and then reduces it again after the large bleeders are sealed.

CUTTING POWER REQUIRED FOR GENERAL SURGERY depends on:

A. Nature of tissue being sectioned. Fatty tissue or heavy cartilage requires more power for a given depth of incision than skin or muscle tissue. Skin requires slightly more power than muscle.

B. Depth of incision. A deep incision (with 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 smaller blade requires the least power. Slightly greater power is required in order for the large blade, small needle and large needle. Loop electrodes, used for "scalping out" bits of tissue, require moderately heavy power settings.

When selecting cutting current power setting, a good general rule is to use the lowest power which cuts freely and rapidly to the desired depth. Only experience on the part of each indi-

vidual surgeon will determine the power required for each class of work under his particular conditions, but the following will serve as a guide in starting out.

A power setting of 40 to 45 will permit fairly rapid incisions through skin or muscle one-eighth to one-quarter inch deep.

Settings between 45 and 50 will make rapid incisions up to about one-half or three quarters inch deep.

With power settings of from 50 upward rapid incisions an inch or more in depth can be made.

Remember that fatty tissue or cartilage requires considerably more power. Also, that the different electrodes require slightly different power settings due to difference in thickness of the cutting edges.

When loop electrodes are used, power settings of 40 to 50 will scallop out small pieces of tissue; from 50 upward will be required for larger pieces.

Power of the cutting current is varied by moving the front lever (marked "SCALPEL & DIATHERMY") through the arbitrary scale graduated from 0 to 100. 0 gives practically no power, 100 gives the full output of the machine; intermediate points are in proportion, but with this type of power control, settings below 35 will give very little current.

The above information will be of value in starting out with the machine, but as each operator gains experience he will develop technique to suit his own conditions and will become accustomed to making a certain type of incision with a given power setting. Experiments on meat as outlined later are of value to the beginner.

NOTE: Electrical 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.

to make use of the following table for each class of work. The table is arranged in such a way that the power settings can be determined for any given tissue and for any given electrode.

A power setting of 50 will usually be sufficient for most tissues. If a higher power is required, the power setting should be increased in steps of 10 until the desired effect is obtained.

Settings between 40 and 50 will make rapid incisions in most tissues. Settings above 50 will make deeper incisions and are used for cutting through muscle and bone.

For power settings of from 50 upward rapid incisions can be made in most tissues. Settings above 60 are used for cutting through muscle and bone.

Settings above 60 are used for cutting through muscle and bone. Settings above 70 are used for cutting through muscle and bone.

Settings above 70 are used for cutting through muscle and bone. Settings above 80 are used for cutting through muscle and bone.

Settings above 80 are used for cutting through muscle and bone. Settings above 90 are used for cutting through muscle and bone.

Settings above 90 are used for cutting through muscle and bone. Settings above 100 are used for cutting through muscle and bone.

Settings above 100 are used for cutting through muscle and bone. Settings above 110 are used for cutting through muscle and bone.

POWER SETTINGS FOR ELECTRO-COAGULATION AND DESICCATION

For this work current is applied by different methods through electrodes of various 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 tissue by the current passing from the electrode.

ELECTRO-DESICCATION is a procedure similar to electro-coagulation except that 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.

These two methods of application produce exactly the same effect on tissue - namely - the cells so treated are de-hydrated, 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.

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 destructions 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.

MONOPOLAR DESICCATION -- Very light -- 30 to 35
 Light -- 35 to 45
 Medium -- 45 to 60
 Heavy -- 60 upward

BIPOLAR COAGULATION -- Very light -- 15 to 20
 Light -- 20 to 30
 Medium -- 30 to 45
 Heavy -- 45 upward

Power of the coagulation current is varied by moving the second lever through the arbitrary scale, graduated from 0 to 100. 0 gives practically no power, 100 gives the full output of the machine; intermediate points are in proportion but the current will not begin to manifest itself until the control is advanced to 15 or 20. Current strength with a setting less than 15 is too little for any practical application.

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 covered in a subsequent section. In general, however, a power setting of around 35 (bipolar method) will prove adequate if only small amounts of tissue are picked up in the clamp and around 40 if larger clamps are used and larger bits of tissue picked up.

MEDICAL DIATHERMY

When the Universal Bovie Unit is used for medical diathermy the spark gaps must be adjusted in accordance with detailed instructions in a preceding section. A unique feature of this machine -- an important advantage never incorporated in any previous diathermy unit -- is that the spark gaps play no part in the control of current strength. The gaps are preset before treatment is started and thereafter power is controlled by the front lever marked "SCALPEL OR DIATHERMY". Moving this lever through its arbitrary scale graduated from 0 to 100 varies the power of the diathermy current from 0 up to the maximum output of this circuit.

To use the machine for medical diathermy the spark gaps should first be adjusted and the selector switch returned to the "OFF" position. The high frequency meter should be in place and the scale properly set (on 0-5000 M.A. if a heavy treatment is to be given or on 0-1750 M.A. if light treatment).

Both power controls should be placed at the zero position--the extreme left on the scale.

UNIVERSAL BOVIE UNIT --
 1. Turn selector switch to "DIATHERMY" position.
 2. Turn power control knob to "0" position.
 3. Turn "PATIENT" terminal to "ELECTRODE" position.

DIATHERMY POSITION --
 1. Turn selector switch to "DIATHERMY" position.
 2. Turn power control knob to "0" position.
 3. Turn "PATIENT" terminal to "ELECTRODE" position.

Power of the diathermy current is varied by moving the selector switch to the "DIATHERMY" position. The power control knob is graduated from 0 to 100. The "PATIENT" terminal is connected to the "ELECTRODE" terminal. The handle is connected to any one of the three terminals marked "ELECTRODE". Current is gradually stepped up to the maximum desired by moving the power control lever through its graduated scale.

For any practical application, the selector switch should be moved to the "DIATHERMY" position before the power control knob is turned.

The electro-diathermy unit is a very compact and portable unit. It is designed for use in the office or hospital. The unit is powered by a standard 110 volt AC line. The power control knob is graduated from 0 to 100. The "PATIENT" terminal is connected to the "ELECTRODE" terminal. The handle is connected to any one of the three terminals marked "ELECTRODE". Current is gradually stepped up to the maximum desired by moving the power control lever through its graduated scale.

REPAIRS AND MAINTENANCE

When the Universal Bovie Unit is used for medical diathermy, the spark gaps must be adjusted in accordance with the instructions in the preceding section. A single feature of this unit is a special advantage. The power control knob is graduated from 0 to 100. The "PATIENT" terminal is connected to the "ELECTRODE" terminal. The handle is connected to any one of the three terminals marked "ELECTRODE". Current is gradually stepped up to the maximum desired by moving the power control lever through its graduated scale.

To use the Universal Bovie Unit for medical diathermy, the spark gaps must be adjusted in accordance with the instructions in the preceding section. A single feature of this unit is a special advantage. The power control knob is graduated from 0 to 100. The "PATIENT" terminal is connected to the "ELECTRODE" terminal. The handle is connected to any one of the three terminals marked "ELECTRODE". Current is gradually stepped up to the maximum desired by moving the power control lever through its graduated scale.

Both power controls should be placed at the same position. The selector switch should be moved to the "DIATHERMY" position before the power control knob is turned.

Using any of the conventional methods, the diathermy electrodes are put in place on the patient's skin. One electrode is connected to the "PATIENT" terminal on the Universal Bovie -- the other to any one of the three terminals marked "ELECTRODE". These three terminals all deliver the same current.

The selector switch is moved to the "DIATHERMY" position and the current is turned onto the electrodes by moving the front power control to the right through its graduated scale. The power control should be stepped up slowly and steadily -- allowing several minutes to work up to maximum power -- and when the desired amount of milliamperage is recorded, power control is left in that position till treatment is finished.

FOR AUTO-CONDENSATION the procedure is the same as above. The auto-condensation pad or cushion is connected to the "PATIENT" terminal. The handle is connected to any one of the three terminals marked "ELECTRODE". Current is gradually stepped up to the maximum desired by moving the power control lever through its graduated scale.

SERVICE NOTES

The only thing on the Bovie Unit that will ever need special attention is the spark gaps which will require reconditioning after about 500 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 footswitch 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.

THE LIEBEL-FLARSHEIM CO.
 303 West Third Street
 Cincinnati, Ohio

INSTRUCTIONS FOR USING THE BRAASCH-BUMPUS PUNCH

WITH THE

UNIVERSAL BOVIE ELECTRO-SURGICAL UNIT

With the Braasch-Bumpus Punch, the segment of tissue engaged in the fenestrum of the sheath is rendered ischemic by coagulation with a multi-needle electrode before excision with a 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 medical diathermy current is used. For sealing bleeders with the fulgurating electrode, the coagulation current is used.

Under normal conditions, the medical diathermy current on Universal Bovie is not under foot switch control and as this is most desirable when using the Braasch-Bumpus Punch, we furnish a special supply cable which enables the operator to control both the medical diathermy and coagulation currents with the foot treadle. (If you want this special supply cable write us for details, giving serial number of your Universal Bovie.)

This special supply cable has a foot switch connection built into the cable where the foot switch is attached. The regular foot switch terminals on the back of the machine are short circuited with a short circuiting plug which is also furnished.

With the "Foot Switch" terminals on the machine short circuited and the special supply cable attached with the foot switch connected to it, both the medical diathermy and coagulation currents can be controlled with the foot treadle, changing from one to another with the "Current Selector" as required.

Setting of the controls on the machine are as follows:

Scalpel or Diathermy Current Power	-- 90
Coagulation Current Power	-- 45

The indifferent electrode is connected to the "Patient" terminal. The multi-needle electrode is connected to any 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 the foot switch is pressed, therefore the electrode not in use should be laid at some point on the instrument stand where the operator or an assistant cannot accidentally contact its tip and get a high frequency burn. Also,

INSTRUCTIONS FOR USING THE BRASCH-BUMPUS FUNCH

WITH THE

UNIVERSAL BOVIE ELECTRO-SURGICAL UNIT

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

For preliminary coagulation with the multi-needle electrode, the medical diathermy current is used. For sealing bleeding with the fulgurating electrode, the coagulation current is used.

Under normal conditions, the medical diathermy current on Universal Bovie is not under foot switch control and as this is most desirable when using the Brasch-Bumpus Funch, we furnish a special supply cable which enables the operator to control both the medical diathermy and coagulation currents with the foot treadle. (If you want this special supply cable write us for details, giving serial number of your Universal Bovie.)

This special supply cable has a foot switch connection built into the cable where the foot switch is attached. The rear foot switch terminals on the back of the machine are short circuited with a short circuiting plug which is also furnished.

With the "Foot Switch" terminals on the machine short circuited and the special supply cable attached with the foot switch connected to it, both the medical diathermy and coagulation currents can be controlled with the foot treadle, changing from one to another with the "Current Selector" as required.

Setting of the controls on the machine are as follows:

Scalpel or Diathermy Current Power -- 90
Coagulation Current Power -- 45

The indifferent electrode is connected to the "Patient" terminal. The multi-needle electrode is connected to any 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 the foot switch is pressed, therefore the electrode not in use should be laid at some point 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 short circuit 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, the current selector switch turned onto the "Medical Diathermy" setting, and current applied by pressing the foot switch. From four to eight 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 a 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.

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

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Cincinnati, Ohio

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If uncontrolled bleeding from individual vessels is observed, it may be stopped by applying the "Coagulation" current through the single-pointed infusing electrode.

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PHIA.

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—THORACIC SURGERY—

1. MATSON, RALPH C. - "Cauterization of Adhesions in Artificial Pneumothorax by the Jacobaeus-Unverricht Method of Closed Pneumolysis". American Review of Tuberculosis, March, 1929
2. MATSON, RALPH C. - "Operative Collapse Therapy in the Treatment of Pulmonary Tuberculosis". Western Journal of Surgery, November, 1930
3. MOORE, JULIAN A. - "Closed Intrapleural Pneumolysis as an Adjunct to Artificial Pneumothorax Therapy of Pulmonary Tuberculosis". Southern Medical Journal, November, 1932
4. FORSEE, J. H. - "Closed Intrapleural Pneumolysis in the Artificial Pneumothorax Treatment of Pulmonary Tuberculosis". Journal of Thoracic Surgery, February, 1933

—UROLOGY—

1. DAVIS, T. M. - "Prostate Operations". Journal A.M.A., December 5, 1931
2. DAVIS, T. M. - "Prostatic Resection". International Surgical Digest, January, 1932
3. ALCOCK, N.G. - "Ten Months Experience with Transurethral Prostatic Resection". Journal of Urology, Nov., 1932
4. RANDALL, ALEXANDER - "The Pathology of Bladder Neck Obstructions". Journal of Urology, November, 1932
5. BUMPUS, H. C. - "Results Five Years After Transurethral Treatment of Benign Prostatic Obstructions". Journal of Urology, November, 1932
6. DAY, ROBERT V. - "Endoscopic Resection of the Prostate". Journal of Urology, November, 1932
7. STIRLING, W. C. - "Transurethral Resection of the Prostate". Virginia Medical Monthly, April, 1932
8. KRETSCHMER, H.S. - "Treatment of Prostatic Obstructions with the Electric Resectoscope". Illinois Medical Journal, September, 1932
9. BOYD, M.L. and BAILEY, M. K. - "Transurethral Prostatic Resection in Benign Prostate Hypertrophy". Piedmont Hospital Bulletin, September, 1932
10. FOLSOM, A.I. - "My Personal Experience with Transurethral Prostatic Resection". Urologic & Cutaneous Review March, 1932

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BIBLIOGRAPHY

—GENERAL AND GYNECOLOGICAL SURGERY—

1. BARTLETT and BARTLETT - "Thyroidectomy Technique of Today". Surgery, Gynecology & Obstetrics, April, 1931
2. MOCK, H.E. - "Electro-Surgery in Thyroidectomy". Journal A.M.A., May 3, 1930
3. KELLY, HOWARD A. - "Electro-Surgery". Surgery, Gynecology & Obstetrics, February 15, 1931
4. HYAMS, M. N. - "Conization of Cervix". Archives of Physical Therapy, April, 1930
5. WALLACE, W. J. - "Conization of the Cervix with Electric Scalpel". Oklahoma State Medical Journal, April, 1932
6. WALKER, R. B. - "Treatment of Chronic Endo-Cervicitis by Surgical Endothermy". N.J. State Med. Journal, May, 1930
7. YOUNG, HUGH H. - "Electro-Hemostasis in Place of Ligatures". Surgery, Gynecology & Obstetrics, July, 1932
8. NICKELSEN, DONALD - "The Electric Scalpel in Cancer Surgery". Medical Sentinel, January, 1927
9. WYETH, GEO. A. - "Electro-Surgery in Malignant Disease". International Journal of Medicine & Surgery, Sept. 1930
10. TROWBRIDGE, EDW. H. - "The Use of the Electro-Surgical Knife in Major Operations". International Journal of Medicine and Surgery, October, 1929
11. GROFF, SUTTON H. - "Radical Electro-Surgical Masectomy". American Journal of Surgery, January, 1932
12. ANDERSON, JOHN - "Cutting Currents". American Journal of Physical Therapy, June, 1930
13. LILIENTHAL, HOWARD - "The Electro-Surgical Unit as an Aid in General Surgery". Surgery, Gynecology & Obstetrics, February 15, 1931
14. WARD, GRANT E. - "Electro-Surgery in Non-Malignant Conditions". International Journal of Medicine & Surgery, September, 1930
15. ELLIS, JOHN D. - "Rate of Healing of Electro-Surgical Wounds". Journal A.M.A., January 3, 1931

—NEURO-SURGERY—

1. CUSHING, HARVEY AND BOVIE, W. T. - "Electro-Surgery as an Aid in the Removal of Intra-Cranial Tumors". Surgery, Gynecology & Obstetrics, December, 1928
2. ELSBERG, CHAS. A. - "Surgery of Infiltrating Tumors of The Brain". Surgery, Gynecology & Obstetrics, June, 1929
3. SACHS, ERNEST - "The Electro-Surgical Unit as an Aid to the Neurological Surgeon". Surgery, Gynecology & Obstetrics, February 15, 1931
4. DAVIS, LOYAL - "The Use of Electro-Surgery in Neurological Surgery". American Journal of Surgery, August, 1930