(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 September 2014 (18.09.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/143476 A1

(51) International Patent Classification:
A61B 18/14 (2006.01) *A61B 18/12* (2006.01)

(21) International Application Number:
PCT/US2014/015923

(22) International Filing Date:
12 February 2014 (12.02.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/787,731 15 March 2013 (15.03.2013) US
61/902,933 12 November 2013 (12.11.2013) US

(71) Applicant: **GYRUS ACMI, INC. (D/B/A OLYMPUS SURGICAL TECHNOLOGIES AMERICA)** [US/US]; 136 Turnpike Rd., Southborough, MA 01772 (US).

(72) Inventors: **BATCHELOR, Kester J.**; 2933 Cambridge Lane, Mound, MN 55364 (US). **MOE, Riyad**; 301 W. Third St., Waunakee, WI 53597 (US).

(74) Agents: **PURSLEY, Kristen L.** et al.; The Dobrusin Law Firm, P.C., 29 W. Lawrence Street, Suite 210, Pontiac, MI 48342 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,

[Continued on next page]

(54) Title: ELECTROSURGICAL INSTRUMENT

(57) Abstract: An electrosurgical instrument comprising a first arm (12) carrying at least a first electrode (18) and optionally a second and third electrode (18, 20), and a second arm (14) opposing the first arm, the second arm carrying one of a nonconductor element (22) or one or more conductive elements.

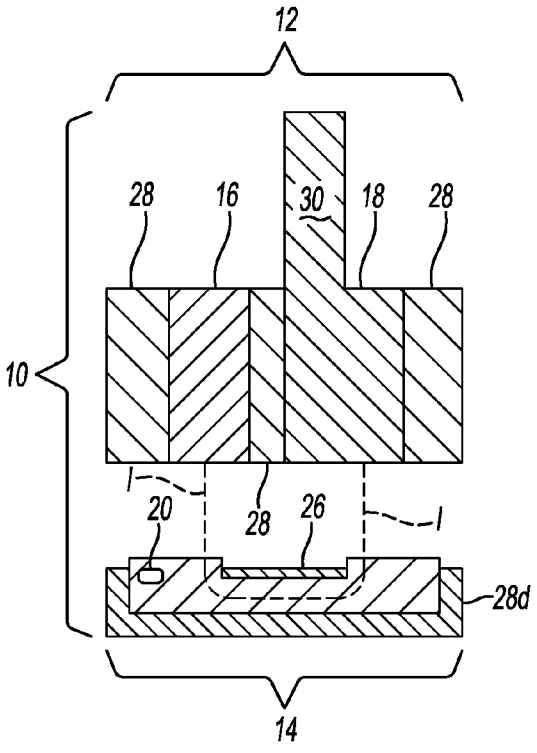


Fig-3

WO 2014/143476 A1

KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

ELECTROSURGICAL INSTRUMENT

FIELD

[0001] The present teachings generally relate to electrosurgical instrument tip arrangements for use in both bipolar and combination monopolar/bipolar devices. More specifically, the present teachings address the arrangement of multi-electrode electrosurgical tip designs.

BACKGROUND

[0002] Typically, electrosurgical instruments have stand-alone monopolar capabilities or bipolar capabilities. Combination devices that can be utilized in both monopolar and bipolar mode have also been developed. Based upon the operational needs of each type of device, different electrosurgical device tip designs are generally utilized for each of stand-alone monopolar, bipolar, or combination monopolar/bipolar devices.

[0003] Some examples of such electrosurgical instrument tip arrangements may be found in U.S. Patent Nos. 5,403,312; 6,030,384; 6,113,596; 6,458,128; 6,926,716; and 7,604,635, all of which are incorporated by reference herein for all purposes. It would be desirable to have an electrosurgical device tip design that provides improved function for a stand-alone bipolar device and may also be utilized for a combination monopolar/bipolar device. It would be further beneficial to have an electrosurgical device that may be used in open surgery as forceps and may be used for electrical cutting and/or hemostasis.

SUMMARY

[0004] The present teachings meet one or more of the needs identified herein by providing an electrosurgical instrument comprising a first arm carrying a first and second electrode and an optional third electrode, wherein the first and second electrode are optionally two integrally formed discrete conductors. The instrument may further include a second arm opposing the first arm, the second arm carrying one of a nonconductor element or one or more conductive elements. Only one of the first electrode, second electrode, third electrode, or one or more conductive elements may pass energy in a monopolar mode and at least two of the first electrode, second electrode, or one or more conductive elements may pass energy in a bipolar mode.

[0005] In another embodiment of the present teachings, the instrument may comprise a first arm carrying a first and second electrode and an optional third electrode and a second arm opposing the first arm, the second arm carrying one or more electrodes. The first arm, the

second arm or both may include a plurality of electrodes free of direct contact with one another but in electrical connectivity with one another to pass energy in a monopolar mode and at least two of the first electrode, second electrode, or one or more electrodes of the second arm pass energy in a bipolar mode.

[0006] Another possible embodiment of the present teachings comprises an electrosurgical instrument comprising a first arm carrying a first and second electrode and a second arm opposing the first arm, the second arm carrying a conductive element. The conductive element may be a floating electrode so that a preferential path is created for energy flow from one or more of the first and second electrode via the floating electrode in bipolar mode.

[0007] Yet another embodiment addressed by the present teachings includes an electrosurgical instrument comprising a first arm carrying a first electrode and a second arm opposing the first arm, the second arm carrying a second electrode. Only one of the first electrode or second electrode may pass energy in a monopolar mode and both of the first electrode and second electrode may pass energy in a bipolar mode.

[0008] Another embodiment addressed by the teachings herein includes an electrosurgical instrument comprising a first arm carrying a first electrode and a second arm opposing the first arm, the second arm carrying a second electrode. At least a portion of one or more of the first electrode and second electrode may pass energy in a monopolar mode and at least a portion of one or more of the first electrode and second electrode may pass energy in a bipolar mode. At least a portion of one or more of the first electrode and second electrode passes energy in monopolar mode and extends from a spine or side edge of at least one of the first or second arms.

[0009] The teachings herein further provide for an electrosurgical instrument comprising a first arm carrying a first electrode, a second arm opposing the first arm, the second arm carrying a second electrode, a third electrode, and optionally one or more additional electrodes. The first electrode and second electrode may pass energy in a monopolar mode and at least two of the first electrode, third electrode, or one or more additional electrodes may pass energy in a bipolar mode.

[0010] The teachings herein provide for electrosurgical instrument tip arrangements that may be utilized in both bipolar and combination monopolar/bipolar devices. The teachings herein further provide for electrosurgical instrument tip arrangements that may be used in open surgery as forceps and may be used for electrical cutting and/or hemostasis. The teachings herein also provide for tip arrangements including a plurality of electrodes and insulating

portions for facilitating improved energy flow depending upon the need for cutting or hemostasis and the monopolar or bipolar nature of the energy facilitated through the tips.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Fig. 1 shows an illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0012] Fig. 2 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0013] Fig. 3 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0014] Fig. 4a shows a cross-sectional view of the tip arrangement of Fig. 2 when contacting a tissue sample.

[0015] Fig. 4b shows a cross-sectional view of the tip arrangement of Fig. 3 when contacting a tissue sample.

[0016] Fig. 5a shows an illustrative example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the present teachings.

[0017] Fig. 5b shows an additional illustrative example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the present teachings.

[0018] Fig. 6a shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0019] Fig. 6b shows an additional illustrative example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the present teachings.

[0020] Fig. 6c shows an additional illustrative example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the present teachings.

[0021] Fig. 7 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0022] Fig. 8a shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0023] Fig. 8b shows an additional illustrative example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the present teachings.

[0024] Fig. 8c shows an additional illustrative example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the present teachings.

[0025] Fig. 9 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0026] Fig. 10 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0027] Fig. 11a shows an example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the teachings in the prior art.

[0028] Fig. 11b shows an example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the teachings in the prior art.

[0029] Fig. 12a shows an example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the teachings in the prior art.

[0030] Fig. 12b shows an example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the teachings in the prior art.

[0031] Fig. 13 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0032] Fig. 14 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0033] Fig. 15 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0034] Fig. 16 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0035] Fig. 17 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0036] Fig. 18 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0037] Fig. 19 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0038] Fig. 20 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0039] Fig. 21a shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0040] Fig. 21b shows an additional illustrative example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the present teachings.

[0041] Fig. 22a shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0042] Fig. 22b shows an additional illustrative example of a tip arrangement and electrical circuit of an electrosurgical instrument in accordance with the present teachings.

[0043] Fig. 23 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0044] Fig. 24 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0045] Fig. 25 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0046] Fig. 26 shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0047] Fig. 27a shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

[0048] Fig. 27b shows an additional illustrative example of a tip arrangement of an electrosurgical instrument in accordance with the present teachings.

DETAILED DESCRIPTION

[0049] This application claims the benefit of the filing date of U.S. Provisional Application Serial No. 61/787,731 filed March 15, 2013, and U.S. Provisional Application No. 61/902,933, filed November 12, 2013 the contents of these applications being hereby incorporated by reference for all purposes.

[0050] The explanations and illustrations presented herein are intended to acquaint others skilled in the art with the teachings, its principles, and its practical application. Those skilled in the art may adapt and apply the teachings in its numerous forms, as may be best suited to the requirements of a particular use. Accordingly, the specific embodiments of the present teachings as set forth are not intended as being exhaustive or limiting of the teachings. The scope of the teachings should, therefore, be determined not with reference to the above description, but should instead be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. The disclosures of all articles and references, including patent applications and publications, are incorporated by reference for all purposes. Other combinations are also possible as will be gleaned from the following claims, which are also hereby incorporated by reference into this written description.

[0051] The present teachings are directed toward electrosurgical instrument tip arrangements. The tips are generally those associated with electrosurgical forceps. The electrosurgical instruments upon which the tips are located may be any device that may be used

by a surgeon to perform a surgical procedure. The electrosurgical device may be used to cut, perform hemostasis, coagulate, desiccate, fulgurate, electrocauterize, or any combination thereof. The electrosurgical instrument tips may be integrated with any device that includes bipolar capabilities or both bipolar capabilities and monopolar capabilities. The electrosurgical instrument tips are preferably utilized in either open or laparoscopic surgery as opposed to solely laparoscopic procedures.

[0052] The instrument tips may be utilized in combination monopolar/bipolar devices. When in a monopolar configuration (e.g., when included in a combination monopolar/bipolar device) one or more of the plurality of electrodes may receive power through the device and a return electrode may be located at another location outside of any hand-held portion of the electrosurgical instrument. Alternatively, two or more electrodes may be integrally formed or in electrical connectivity with one another to function as monopolar electrode. A monopolar configuration may be desired to cut tissue, apply power to a large area, or a combination thereof. Any use of the instrument tips described herein in monopolar mode may be for the purpose of dissection, less delicate procedures, less localized electrosurgery, or both when compared to bipolar electrosurgery.

[0053] The instrument tip when in a bipolar configuration (e.g., as part of a stand-alone bipolar device or as part of a combination monopolar/bipolar device) may be arranged such that one of a plurality of electrodes receives power and that power transfers to a second adjacent and/or opposing electrode creating a path for the power that is relatively short when compared to the path in the monopolar configuration. In a preferred bipolar configuration, the instrument tip may include two electrodes on a first surface and one electrode (e.g., one conductive portion) on an opposing second surface. In yet another preferred bipolar configuration, the instrument tip may include a first bipolar electrode on a first surface and a second bipolar electrode on a second opposing surface. The surfaces may be configured as forceps including first and second arms such that a first arm carries the first surface and a second arm carries the second surface. One or more electrodes or any other conductive portion may be located in opposing relationship with one or more additional electrodes or conductive portions. One or more electrodes may be located on non-opposing (e.g., outside edge) surfaces of the arms of the instrument tip. It is understood that conductive portions may be electrodes or may simply be conductive in nature and not operating as an electrode.

[0054] The instrument tips may be forceps instrument tips. The forceps may be any forceps that may be used to grip, hold, squeeze, or a combination thereof one or more objects. The forceps may include one or more finger grips (i.e., configured like scissors) that may be used to

move the forceps so that they may be used to grip one or more objects. The forceps may be free of finger grips and be actuated by direct pressure being applied to opposing sides of the forceps so that the forceps close and grip an object. The forceps include the first and second arms.

[0055] Each arm may include one or more surfaces that form the instrument tip arrangements described herein. As mentioned above, the instrument tips may be configured in one or more electrosurgical configurations (e.g., a monopolar configuration, bipolar configuration, or a combination of both). In addition to the arrangement of the tip surfaces as described herein, the tips may include teeth, serrations, mouse teeth, free of teeth (i.e., smooth), or any combination thereof. The instrument tips may include a plurality of conductive portions which may include one or more electrodes and one or more insulating portions. Preferably, the tip region includes insulation on the non-contact portions of the arms so that electrosurgical energy is not transferred through incidental contact. The arms may include an active portion (e.g., a conductive portion) and an inactive portion (e.g., an insulated portion).

[0056] The active portion may be any portion of the device that may be used to apply power or facilitate the flow of energy. The active portion may be the same portion as the electrodes on the surfaces of the arms. Thus, for example, when tissue is grasped between the first and second surfaces (e.g., contact portions) of the arms, power may be supplied to the tissue through this contact portion. Energy may thus flow through one or more of the first and second surfaces and into and/or onto the tissue. The active portions may be substantially surrounded by inactive portions or portions that are insulated. The inactive portion may be any portion that does not supply power, that is insulated, or both. The inactive portion may be any portion that may transfer power through incidental contact. For example, an outside portion of the arms may be coated with an insulating material so that if the arms accidentally contact tissue proximate to the tissue of interest the proximate tissue is not subjected to a transfer of power. The inactive portion and the active portion may be made of different materials, coated with different materials, or both.

[0057] The arms may be made of any material that may be used to grip, hold, squeeze, or a combination thereof and provide monopolar power, bipolar power, or a combination of both to a desired location. The arms may be made of one material and at least a portion of the tip region of each arm may include or be coated with one or more materials that may be insulating. At least a portion of the tip region of one or both of the arms may include a conductive material. The conductive material may be formed as a coating having a higher conductivity than a base material. The conductivity of a given portion of the arm may have a higher or lower conductivity

than an adjacent portion of the arm. The one or more arms may include one or more materials along the length of the arm. For example, the arms may be entirely made of stainless steel. Preferably, each arm includes two or more materials. For example, the arms may have a base material of stainless steel and at least a portion of the arms may be coated with an insulating material such as silicone or polytetrafluoroethylene (PTFE). The arms may include any material that is safe for use in a surgical procedure, and preferably an electrosurgical procedure. The arms may include metals, plastics, polymers, elastomers, gold, silver, copper, titanium, aluminum, iron based metals, stainless steel, silicone, polytetrafluoroethylene (PTFE), insulating polymers, rubber, or a combination thereof. Preferably, each arm is substantially coated with an insulating material except for a contact region where an arm directly contacts a second arm. The arms may be coated in regions where the user contacts the arms. The arms may have an active portion and a passive portion. For example, the active portion may be a metal that extends through the arms and is used to provide monopolar energy, bipolar energy, gripping capabilities, holding capabilities, squeezing capabilities, or a combination thereof. The passive portion may be a portion that houses the active portion. The passive portion may be a housing.

[0058] The arms may be located within a housing. The housing may be any device that may include one or more arms and be gripped by a user during use. The housing may provide for electrical connection, mechanical connection or a combination thereof between two or more arms. The housing may be a pivot point so that the two arms may be moved when the housing is compressed. The housing may substantially surround the arms so that only the tip region including the tip portions extends out of the housing and is exposed. The housing may surround an outer surface of the arms and an inner surface of the arms may be exposed. The housing may be electrically connected to a power source and provide power to each of the arms. The housing may be electrically insulating. The housing may include one or more activation buttons, one or more printed circuit boards and associated controls, one or more monopolar electrodes, one or more bipolar electrodes, one or more shields, one or more channels, or a combination thereof.

[0059] The monopolar electrode may be any device that may be used to apply monopolar power during a procedure. The monopolar electrode may be a separate piece that when activated may be used to supply monopolar power. A monopolar electrode may be formed on only one arm. A monopolar electrode may be formed on both arms. The monopolar electrode may be located on or adjacent an inner edge surface of an arm of the device. The monopolar electrode may be located on or adjacent an outer edge surface of the arm of the device. The monopolar electrode may operate in monopolar mode upon receiving monopolar energy. A

portion of the monopolar electrode may also operate as part of a bipolar electrode system. The monopolar electrode may be located on one surface of one arm along with a second electrode. The monopolar electrode may be used for electrically cutting.

[0060] One or more of the electrodes (e.g., the first, second, third, fourth or any additional electrode) may be made of the same material as one or both of the arms. Preferably, the arms and the one or more electrodes are made of different materials. The one or more electrodes may be made of one material. Preferably, the one or more electrodes include two or more materials. The one or more electrodes may be formed of two or more integrally formed electrodes (e.g., discrete conductors) having a joint formed therebetween. In one embodiment, one of the two integrally formed electrodes may allow for better thermal dissipation while the other allows for reduced thermal dissipation. The one or more electrodes may be made of stainless steel, copper, silver, titanium, a metal, a surgical steel, a metal with good thermal dissipation properties, a metal with reduced thermal dissipation properties, or a combination thereof. The one or more electrodes (or a portion thereof) may include a coating. The coating may be any coating that provides insulating properties, provides improved thermal dissipation, prevents corrosion, or a combination thereof. The coating may be a polymer, an elastomer, silicone, polytetrafluoroethylene (PTFE), the like, or a combination thereof. The coating may extend over substantially the entirety of the one or more electrodes except for the active region of the one or more electrodes. The one or more electrodes may include one or more electrode insulators.

[0061] Any electrode insulator may be formed of a material that may insulate all or a portion of the active portions of the arms. The electrode insulator may prevent undesired contact of tissue with the electrode when the electrosurgical device is in use. The electrode insulator may prevent power from being transferred from one or both of the arms to the one or more electrodes.

[0062] A first electrode may be located on a first surface which is formed on the first arm. The first electrode may be located along an inner surface of the first arm. The first electrode may extend from one or more outside surfaces of the first arm. The first electrode (or any of the electrodes) may be located along the inner surface of the first arm and may also extend from an outside surface of the first arm. The first arm and first surface may include a first and second electrode. The second electrode may extend from an outside surface of the first arm. The second electrode (or any of the electrodes) may be located along the inner surface of the first arm and may also extend from an outside surface of the first arm. The second electrode may be substantially free of any direct contact (e.g., direct physical contact as opposed electrical

contact) with the first electrode. The first and second electrodes (or any combination of electrodes) may be integrally formed discrete conductors which may have a joint formed therebetween. The first and second electrodes (or any combination of electrodes) may be in electrical communication with one another for operating together as an electrode. One or more of the first and second electrode may be a bipolar electrode. One or more of the first and second electrode may be a monopolar electrode. One or more of the first and second electrode may function as both a monopolar electrode and a bipolar electrode. The first and second electrodes may be located adjacent each other for forming the first surface. The first arm may also include a third electrode, which may also be located on the first surface of the first arm or may extend from an outside edge of the first arm. The third electrode may be adapted for operation in monopolar mode only, bipolar mode only, or may be adapted for both monopolar and bipolar use. Any of the first, second or third electrodes may include an insulating portion located adjacent one or more terminal edges of the electrode, whereby such insulating portion is located in between one or more electrodes. The size of the insulating portion between the one or more electrodes (e.g., the distance between the one or more electrodes) must be sufficiently large to prevent direct contact between the one or more electrodes. The size of the insulating portion between the one or more electrodes may be small enough so that power can flow from one electrode to another electrode, generally via a portion of tissue.

[0063] A second surface may oppose the first surface and may be located on the second arm. The second surface may include one or more conductive elements which may be an electrode. The second surface may also include an insulating portion. The insulating portion may be located adjacent the conductive element on at least one edge of the conductive element. The insulating portion may be located along at least two edges of the conductive element. The insulating portion may be located along at least three edges of the conductive element. Alternatively, the second surface may be substantially free of any conductive element. The second surface may consist essentially of an insulating portion. The conductive element on the second surface may be an electrode located along the inner surface of the second arm and may oppose one or more electrodes on the inner surface of the first arm. The conductive element may be an electrode located along an outside edge of the second arm. Two or more conductive elements may be located along the inner surface of the second arm and may also extend from an outside surface of the second arm. The conductive element may be an electrode that is adapted for operation in monopolar mode, bipolar mode, or both monopolar and bipolar mode.

[0064] The first arm may include a first electrode, which may operate in monopolar mode, bipolar mode, or both monopolar and bipolar mode. The first electrode may be located along an inner surface of the first arm, but a portion of the first electrode may also extend from one or more side edges of the arm or even a back edge (e.g., spine portion) of the arm. The first electrode may extend from multiple side edges of the first arm. The second arm may include a second electrode and energy may pass from the first electrode on the first arm to a second electrode on the second arm when used in bipolar mode. In the same arrangement, a switch may be activated so that only the first electrode passes energy when in monopolar mode (or alternatively only the second electrode passes energy in monopolar mode). The first arm may include a first electrode and the second arm may include an opposing second electrode such that both of the first and second electrodes are located along an inner surface portion of each of the first and second arms and both of the first and second electrodes include an extension portion extending from a side edge or back edge of each of the first arm and second arm. Energy may pass from the first electrode to the second electrode in bipolar mode. Each of the extension portions may pass energy in monopolar mode.

[0065] The first arm may include a first and second electrode. One or more of the first and second electrodes may operate in bipolar mode. One or more of the first and second electrodes may operate in monopolar mode. One or more of the first and second electrodes may operate in both bipolar and monopolar mode. The second arm may include only insulating material and may be substantially free of any conductive portion (e.g., electrode). The second arm may include one or more electrodes. The second arm may include a first and second electrode. The first arm may include a third electrode. The second arm may include a third electrode. Any electrode located on the first or second arm may be located on an inner surface of the arm or may be located (e.g., may extend from) an exterior surface of the arm which may be a side edge of the arm or a back edge (e.g., a spine portion) of the arm.

[0066] Any electrode may be formed of one material or of two or more materials. Two or more electrodes of the same or different material may also be integrally formed as two discrete conductors to act as a single electrode. The two or more materials may be selected based upon desired thermal dissipation of the electrode at different locations. As an example, a low thermal dissipation material may be utilized for the electrode through which energy flows during use of the device in monopolar mode. Such material would allow that portion of the electrode to heat thereby requiring less overall voltage. A high thermal dissipation material may be utilized for a second electrode. The two discrete conductors (low dissipation and high dissipation) may include a joint located therebetween. The joint may provide a thermal insulation function such

that the heating of the lower thermal dissipation material does not cause heating of the high thermal dissipation material. In one non-limiting example, the lower thermal dissipation material may include steel and the high thermal dissipation material may include copper and/or silver.

[0067] The concept of a joint between two or more electrodes in an effort to control heat and electricity transfer may also be utilized in electrodes formed of only one monolithic material. Such a joint may be formed by the shaping of the conductive materials. More specifically, one or more electrodes may be formed to have a "bottle-neck" feature where the material for forming the electrode is indented and adjacent to two or more lobes (see for example figures 26a and 26b). This indentation allows for thermal separation by allowing energy transfer but minimizing heat transfer between lobes. The joint may be in the form of a wave shaped ribbon which may be pressed into slot located along the tip. The joint may be formed as flat ribbon pressed into a slot with knobs. The slot along the tip may be filled with epoxy, putty, or filler to hold the ribbon in place.

[0068] In one embodiment, in the event that the conductive element is a floating electrode, the interaction between the first and second bipolar electrodes located along the inner surface of the first arm and the floating electrode may be such that energy flows through the first bipolar electrode, towards the floating electrode and back to the second bipolar electrode. During use, a tissue portion may be located between the first and second inner surfaces (e.g., between the first and second arms). Thus, energy may flow through the first bipolar electrode and then flow to any combination of onto the tissue, into the tissue, or through the tissue. If the instrument receives a tissue in between the first and second arm during use in bipolar mode, bipolar energy travels through at least a portion of the tissue when moving along an energy path between the first electrode, the floating electrode, and the second electrode. The second arm may include an insulation portion (as shown for example in Fig. 4b) so that bipolar energy travels through a larger portion of the tissue as compared to that of a second arm without the insulation portion.

[0069] A first and second electrode may be located on the first of two opposing arms and a third electrode may be located on the second of the two opposing arms. Alternatively, a first, second, and third electrode may be located on the first arm. A first electrode may be located on the first arm and a second electrode located on the second arm. Thus, tissue located in between the two opposing arms may electrically connect the arms, form an electrical bridge between the two arms, or both. In the event that the device is utilized in monopolar mode, the first arm may have a single monopolar electrode (which may the first, second, or third electrode) and the tissue contacted by that electrode may electrically connect the monopolar electrode with a return electrode, act as an electrical bridge between the monopolar electrode and the return

electrode, or both. One or more of the electrodes may be combined to form a single potential in monopolar mode. In the event that the device is a combination monopolar/bipolar device, the circuit may include a switch that switches between the monopolar configuration and the bipolar configuration. The switch may activate one of the bipolar electrodes and deactivate the return pad or vice versa, activate one bipolar electrode and deactivate the monopolar electrode or vice versa, deactivate one bipolar electrode and leave the electrode open (i.e., not powered), deactivate the monopolar electrode and leave the electrode open, deactivate both bipolar electrodes and activate the monopolar electrode and the return electrode or vice versa, or a combination thereof. The monopolar electrode (e.g., one of the first and second electrode), one or more of the bipolar electrodes (e.g., the first and second electrode), or a combination thereof may be connected to an alternating current power source, a direct current power source, or both. Preferably, the monopolar electrodes, the bipolar electrodes, or both are connected to an alternating current power source. The monopolar electrode, the bipolar electrodes, or both may complete a circuit when in contact with tissue.

[0070] The device tip arrangements as described herein are designed for improved function and interchangeability in a variety of device configurations. Each surface described may include specific materials having desired functions at selected locations to improve the function of the device. Such materials may be selected and located depending on the desired function of the device. For example, the second arm may carry a nonconductor element and be substantially free of any conductive surface, such that only the first arm includes conductive elements. Thus, the second arm may be free of any electrical connectivity and merely provides a compressive force during a surgical procedure. Alternatively, the second arm carries a conductive element. The conductive element on the second arm may act to improve the path of energy between the electrodes in bipolar mode. The conductive element may be a floating electrode so that a preferential path is created for energy flow from one or more of the first and second electrode and the location of the path is easily modified by location of the floating electrode. Thus the energy may flow between the first electrode to the second electrode via the floating electrode in bipolar mode. The energy may flow from only one of the first or second electrode to a return electrode remote from but in electrical communication with the first arm in monopolar mode.

[0071] One or more of the first and second arms may include insulated portions. The second arm may carry an insulation portion. This insulation portion may be located so that it extends the length of an energy path between the first and second electrode (see length (l) at Figs. 2 and 3). The first arm may include an insulation portion between the first and second

electrodes. The second arm may include an insulation portion that opposes the insulation portion between the first and second electrodes on the first arm.

[0072] Figure 1 shows an illustrative arrangement for an electrosurgical instrument tip 10. The tip 10 includes a first arm 12 and a second arm 14. The first arm 12 includes a first electrode 16. The first arm also includes a second electrode 18. The second arm 14 may be free of any electrode and may have only a non-conductive component 22 and no conductive component. The first arm 12 may also include insulating (non-conductive) portions 28a, 28b, and 28c, such that a first insulating portion 28a is located adjacent a terminating edge of the first electrode. A second insulating portion 28b may be located in between the first electrode and second electrode. A third insulating portion 28c may be located adjacent a terminating edge of the second electrode.

[0073] Alternatively, as shown in Fig. 2, the instrument tip 10 includes a first arm 12 and a second arm 14. The first arm 12 includes a first electrode 16. The first arm also includes a second electrode 18. The second arm 14 also includes an electrode 20 (e.g., a third electrode) which may be a floating electrode (e.g., may be free of any electrical connection with any electrode or ground) or may be fixed at one potential (e.g., electrically attached to the ground). The second arm may include one or more insulating (non-conductive) portions 28. The second arm includes a first insulating portion 28d which substantially surrounds the electrode 20 (e.g., the conductive portion) on the second arm on at least one, two, or three sides. The electrode 20 may instead be coplanar with the first insulating portion 28d or may extend beyond the surface of the first insulating portion. As in the embodiment shown at Fig. 1, The first arm 12 may also include insulating (non-conductive) portions 28a, 28b, and 28c, such that a first insulating portion 28a is located adjacent a terminating edge of the first electrode. A second insulating portion 28b may be located in between the first electrode and second electrode. A third insulating portion 28c may be located adjacent a terminating edge of the second electrode.

[0074] Fig. 3 illustrates an additional embodiment including a second insulating portion 26 located on the second arm. The addition of the second insulating portion 26 assists in directing energy from the first electrode 16 to the second electrode 18 via the third electrode 20 such that the flow of energy runs between the second insulating portion 26 and first insulating portion 28d of the second arm.

[0075] Fig. 4a depicts a cross-sectional view of an interface between the instrument tip 10 of Fig. 2 and a tissue sample 30. As shown, the path of energy 32 flows into the second electrode 18, through a portion of the tissue 30 toward the third electrode 20 and back to the first electrode 16.

[0076] Fig. 4b depicts an additional cross-sectional view of an interface between the instrument tip 10 of Fig. 3 and a tissue sample 30. In this embodiment, the inclusion of the second insulating portion 26 causes the path of energy 32 to extend further into the tissue 30 as the second insulating portion acts to guide the energy further toward the third electrode 20. The length of the second insulating portion 26 is also shown as longer than the length of the opposing insulating portion 28b, thus further extending the path of energy 32.

[0077] Fig. 5a displays an instrument tip 10 and associated electrical connections in use in bipolar mode. The first arm 12 includes a first electrode 16 and the second arm 14 includes a second electrode 18. A first extension portion 34 of the first electrode 16 extends from a side edge 36 of the first arm. When used in bipolar mode, the path of energy 32 moves between the first electrode and second electrode. The first and second electrodes are further connected via a circuit 38.

[0078] Fig 5b shows the instrument tip of Fig. 5a in use in monopolar mode. The first and second electrodes (16, 18) are present, however there is no energy flow between the first and second electrode. The path of energy 32 flows instead through the extension portion 34 of the first electrode, through tissue (not shown), to a remote ground pad 40.

[0079] Fig. 6a shows an instrument tip 10 including a first electrode 16 on the first arm 12 and a second electrode 18 on the second arm 14. Both of the first and second electrodes include an extension portion 34a, 34b extending from a terminating side edge 36a, 36b of the first arm and second arm respectively. In such an arrangement both the first and second electrodes have the capability of operating in monopolar mode.

[0080] As shown in Fig. 6b, the instrument tip of Fig. 6a may be connected via a circuit 38. When used in bipolar mode, the energy path 32 flows between the first electrode 16 and second electrode 18 and the first and second electrode are connected to an energy source (and one another) via the circuit 38. The first electrode 16 is connected to a power source via a first connector 17, and the second electrode 18 is connected to a power source via a second connector (e.g., a second connector that includes connector portions 19 and 23). A third connector 21 is available, but does not provide connectivity when the device is used in bipolar mode.

[0081] Fig. 6c shows the instrument tip of Figs. 6a and 6b in use in monopolar mode, whereby the circuit 38 no longer connects the first electrode 16 and second electrode 18. As shown, both first extension portions 34a, 34b of the first and second electrode are connected to a monopolar energy source and the energy path 32 flows through each extension portion, through tissue (not shown), to a remote ground pad 40. As shown, during use in monopolar

mode, the first and second electrodes are in electrical contact with one another such that a single monopolar energy supply can provide for use of both extensions portions. Similar to the bipolar configuration shown at Fig. 6b, the first electrode is connected to the power source via the first connector 17. However the second electrode is free of any connectivity to the power source via the second connector 19. However, the connector portion 23 that was part of the second connector in bipolar mode is connected to the power source and also now connected to the third connector 21 via a connector portion 25.

[0082] As shown for example in Fig. 7, the instrument tip 10 may include a first electrode 16 may include a first extension portion 34 and a second extension portion 35. One or both of the first and second extension portions may pass energy when in monopolar mode. The first electrode 16 may also pass energy in bipolar mode such that a bipolar energy path 32 flows between the first electrode 16 and second electrode 18.

[0083] A first extension portion 34a, 34b may extend from a spine portion 42 of the instrument tip 10 as shown in Figs. 8a-8c. Fig. 8a shows an exemplary instrument tip 10 including a first electrode 16 and second electrode 18, each including a first extension portion 34a, 34b extending from a spine portion 42 of the instrument tip. Fig. 8b shows the instrument tip of Fig. 8a when in use in bipolar mode. As shown, the energy path 32 from the circuit 38 flows between the first electrode 16 and the second electrode 18. Alternatively, as shown in Fig. 8c, in monopolar mode, the energy path 32 flows from one or more of the first extension portions 34a, 34b located on the spine portion 42 through tissue (not shown) to a ground pad 40. As shown, during use in monopolar mode, the first and second electrodes are in electrical contact with one another such that a single monopolar energy supply can provide for use of both extensions portions.

[0084] Alternatively, only one of the first or second electrode may include an extension portion that extends from a spine portion of the instrument tip. As shown for example at Fig. 9, the first electrode 16 includes an extension portion 34 extending from the spine portion 42 of the first arm 12 of the instrument tip 10. As shown the second arm 14 includes a second electrode 18, however the second electrode is free of any extension portion and thus may not be in receipt of any energy flow during use of the instrument tip in monopolar mode.

[0085] Fig. 10 depicts an alternative instrument tip arrangement wherein the first electrode 16 and second electrode 18 are both located on the first arm 12 of the instrument tip 10. The embodiment shown at Fig. 10 further includes a second arm 14 of the instrument tip that is free of any electrode. Both the first arm 12 and the second arm 14 are free of any electrode that passes energy in monopolar mode.

[0086] Specific examples of prior art tip arrangements for operating in both monopolar and bipolar mode are shown at Figs. 11a-11b and 12a-12b. As shown for example at Fig. 11a, the instrument tip 10 includes a first electrode 16 and second electrode whereby in bipolar mode the circuit 38 connects the first and second electrodes 16, 18 and remains unconnected to any ground pad 40. The first electrode 16 is connected to a power source via a first connector 17. The second electrode 18 is connected to a power source via a second connector formed of multiple connector portions 19, 23, 25. Additional connectors 21, 27 are not utilized in the circuit when in bipolar mode. However, as shown in Fig. 11b, the circuit 38 is arranged to both provide energy to the first electrode 16 and second electrode 18 and also connect via an energy path 32 to a ground pad 40 in monopolar mode. Additional connector 21 is connected to second connector 25 for forming a circuit that includes the ground pad 40. Additional connector 27 is also included in the circuit by connecting to second connector portion 19. Prior art instrument tip arrangements arranged to provide only monopolar or only bipolar functionality are shown at Figs. 12a and 12b. As shown for example in Fig. 12a, an energy path 32 is formed between the first electrode 16 and second electrode 18 when used in bipolar mode while the circuit 38 is free of any connection to a ground pad 40. However, in monopolar mode (as shown in Fig. 12b), the first arm 12 and second arm 14 are closed toward each other allowing for use of a portion of one or more of the first electrode 16 and second electrode in monopolar mode whereby the circuit 38 no longer connects the first electrode and second electrode, but rather forms and energy path 32 that includes the ground pad 40. These prior arrangements include first and second electrodes that are free of any portion that extends from the spine portion (e.g., a back edge of the arm) or an exterior side edge of the arm. Thus, the first and second electrodes are joined to form a common monopolar electrode that is blunt and free of any extension portion (e.g., blade).

[0087] The instrument tip may be arranged to include multiple distinct electrodes on one arm whereby one electrode passes energy only in bipolar mode and one passes energy only in monopolar mode. More specifically, as shown at Fig. 13, the first arm 12 includes a first electrode 16 and the second arm 14 includes the second electrode 18. The first arm further includes a third electrode 20 whereby the third electrode is free of any direct connection with the first electrode 16. The third electrode 20 is located along a spine portion 42 of the instrument tip 10 whereas the first electrode and second electrode are located along an inner surface portion 46a, 46b of each of the first arm and second arm. Fig. 14 depicts a similar instrument tip arrangement where both the first arm 12 and second arm 14 include multiple electrodes. Specifically, the second arm 14 includes a fourth electrode 48 located along a spine portion 42

of the instrument tip 10, similar in location to the third electrode 20 on the first arm 12. In a similar configuration, electrodes 20 and 48 are electrically connected via one or more wires (not shown). Thus electrodes 20 and 48 would act as a common monopolar electrode to produce a two sided scalpel, similar to that depicted in Fig. 8c. Fig. 15 depicts yet another instrument tip embodiment including more than two electrodes. The first arm 12 includes a first and second electrode 16, 18 located along the inner surface portion 46 of the instrument tip, separated by an insulation portion 28. The first arm also includes a third electrode 20 located along a spine portion 42 of the instrument tip. The first and second electrodes thus pass energy in bipolar mode whereas the third electrode 20 passes energy in monopolar mode. The second arm 14 is free of any conductive element.

[0088] Fig. 16 shows an instrument tip arrangement similar to that of Fig. 13. The first arm 12 includes a first electrode 16 and the second arm 14 includes the second electrode 18. The first arm further includes a third electrode 20 whereby the third electrode is free of any direct connection with the first electrode 16. The third electrode 20 is located so that it extends from both opposing terminating side edges 36a, 36b of the first arm 12 of instrument tip 10 to produce a two sided scalpel, whereas the first electrode and second electrode are located along an inner surface portion 46a, 46b of each of the first arm and second arm. Fig. 17 depicts an instrument tip arrangement similar to that of Fig. 16, however only the third electrode 20 extends from only one terminating side edge 36b of the first arm to produce a one sided scalpel.

[0089] Fig. 18 shows another embodiment similar to Fig. 15 where the first electrode 16 and second electrode 18 are located along the inner surface portion 46a of the first arm 12. However, the second arm includes a third electrode 20 located along the spine portion 42 of the instrument tip.

[0090] Fig. 19 shows an instrument tip arrangement including a first electrode 16 and second electrode 18 on first arm 12. The instrument tip 10 further includes a third electrode 20 (e.g., a conductive element) on the second arm 14 opposing the first and second electrode. A fourth electrode 48 is also included, being located along the spine portion 42 and utilized during use in monopolar mode. One or more insulation portions 28 may be included to assist in directing the energy path 32 during use of the instrument in bipolar mode. Fig. 20 depicts a similar arrangement to the instrument tip of Fig. 19, however the fourth electrode 48 is located on the spine portion 42 on the first arm 12. Fig. 21a is a combination of both Figs. 19 and 20 whereby both the first arm 12 and second arm 14 include an electrode (e.g., a fourth electrode 48 and fifth electrode 50) on each spine portion 42 of the instrument tip 10. In a similar configuration, electrodes 20 and 48 are electrically connected via one or more wires (not

shown). Thus electrodes 20 and 48 would act as a common monopolar electrode. Fig. 21b depicts the circuit connectivity of the tip arrangement of 21a. Two monopolar connector leads 32a are shown, one originating from each of the two monopolar electrodes 48, 50. Two bipolar connector leads 32b connect the power source to each of the first electrode 16 and second electrode 18.

[0091] One or more of the electrodes may be formed from more than one material. In one such embodiment, one or more of the electrodes may be formed from two discrete adjacent conductors including a thermal joint therebetween. As shown for example in Fig. 22a, the first electrode 16 is located on the first arm 12 and is formed from a first conductor 52 and a second adjacent conductor 54, thus forming a thermal joint 56 in between the two bonded conductors. The second conductor extends from the spine portion 42 of the instrument tip. The second arm 14 includes a second electrode 18 located along the inner surface 46 of the second arm. Thus the first conductor facilitates energy passage in bipolar mode while the second conductor facilitates energy passage in monopolar mode. Fig. 22b depicts the circuit connectivity of the tip arrangement of 22a. One monopolar connector lead 32a is shown originating from the monopolar electrode 54. Two bipolar connector leads 32b connect the power source to each of the first electrode 16 and second electrode 18.

[0092] Fig. 23 depicts a three electrode system where the first arm 12 includes a first electrode 16 and the second arm includes a second electrode 18 and a third electrode 20. A portion 16a of the first electrode is utilized when the device is in monopolar mode and a second portion 16b of the first electrode is utilized when the device is in bipolar mode. The energy path 32a in monopolar mode extends from each electrode or electrode portion 16a, 20 utilized for monopolar activity to the ground pad 40. The bipolar leads 32b extend from a power source to the electrodes or electrode portions 16b, 18 utilized when the device in bipolar mode.

[0093] Fig. 24 shows a similar embodiment to that of Figs. 22a and 22b, however in addition to the first arm 12 including a first electrode 16 being formed of multiple distinct conductors 52, 54, the first arm also includes a second standard electrode 18. Fig. 25 shows yet another alternative embodiment including both of the first arm 12 and second arm 14 including an electrode formed of a first and second conductor 52a, 52b, 54a, 54b having a thermal joint 56a, 56b therebetween (e.g., the first electrode 16 and second electrode 18 are each formed of multiple adjacent distinct conductors). Fig. 26 shows an embodiment similar to that of Figs. 22a-22b whereby one electrode (in the case the second electrode 18) is formed of multiple distinct conductors. As shown, the first arm 12 includes a first electrode 16 and the second arm 14 includes a second electrode 18, whereby the second electrode is formed of a first conductor 52

bonded to a second conductor 54 connected by a thermal joint 56. However, unlike Figs. 22a-22b, the embodiment of Fig. 26 includes an instrument tip arrangement where the second conductor 54 extends from an exterior side edge 36 of the second arm 14.

[0094] Figs. 27a and 27b depict a further embodiment whereby the shape of the conductor material creates a thermal joint configuration. Each of the first and second electrode 16, 18 are formed of a bottle-neck conductor 58a, 58b. Each bottle neck conductor includes a first conductor portion (e.g., lobes) 52a, 52b and a second conductor portion (e.g., lobes) 54a, 54b and an indented portion 60a, 60b in between the first and second conductor portions. Fig. 26a shows the opposing conductors when the first arm and second arm are in an open position. Fig. 26b shows the conductors in a closed position.

[0095] Any numerical values recited herein include all values from the lower value to the upper value in increments of one unit provided that there is a separation of at least 2 units between any lower value and any higher value. As an example, if it is stated that the amount of a component or a value of a process variable such as, for example, temperature, pressure, time and the like is, for example, from 1 to 90, preferably from 20 to 80, more preferably from 30 to 70, it is intended that values such as 15 to 85, 22 to 68, 43 to 51, 30 to 32 etc. are expressly enumerated in this specification. For values which are less than one, one unit is considered to be 0.0001, 0.001, 0.01 or 0.1 as appropriate. These are only examples of what is specifically intended and all possible combinations of numerical values between the lowest value and the highest value enumerated are to be considered to be expressly stated in this application in a similar manner.

[0096] Unless otherwise stated, all ranges include both endpoints and all numbers between the endpoints. The use of "about" or "approximately" in connection with a range applies to both ends of the range. Thus, "about 20 to 30" is intended to cover "about 20 to about 30", inclusive of at least the specified endpoints.

[0097] The disclosures of all articles and references, including patent applications and publications, are incorporated by reference for all purposes. The term "consisting essentially of" to describe a combination shall include the elements, ingredients, components or steps identified, and such other elements ingredients, components or steps that do not materially affect the basic and novel characteristics of the combination. The use of the terms "comprising" or "including" to describe combinations of elements, ingredients, components or steps herein also contemplates embodiments that consist essentially of the elements, ingredients, components or steps. By use of the term "may" herein, it is intended that any described attributes that "may" be included are optional.

[0098] Plural elements, ingredients, components or steps can be provided by a single integrated element, ingredient, component or step. Alternatively, a single integrated element, ingredient, component or step might be divided into separate plural elements, ingredients, components or steps. The disclosure of "a" or "one" to describe an element, ingredient, component or step is not intended to foreclose additional elements, ingredients, components or steps.

[0099] It is understood that the above description is intended to be illustrative and not restrictive. Many embodiments as well as many applications besides the examples provided will be apparent to those of skill in the art upon reading the above description. The scope of the teachings should, therefore, be determined not with reference to the above description, but should instead be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. The disclosures of all articles and references, including patent applications and publications, are incorporated by reference for all purposes. The omission in the following claims of any aspect of subject matter that is disclosed herein is not a disclaimer of such subject matter, nor should it be regarded that the inventors did not consider such subject matter to be part of the disclosed inventive subject matter.

CLAIMS

We claim:

Claim 1: An electrosurgical instrument comprising:

a. a first arm carrying a first and second electrode and an optional third electrode;
b. a second arm opposing the first arm, the second arm carrying one or more electrodes;

wherein the first arm, the second arm or both include a plurality of electrodes free of direct contact with one another but in electrical connectivity with one another to pass energy in a monopolar mode and at least two of the first electrode, second electrode, or one or more electrodes of the second arm pass energy in a bipolar mode.

Claim 2: An electrosurgical instrument comprising:

a. a first arm carrying a first and second electrode;
b. a second arm opposing the first arm, the second arm carrying a conductive element;

wherein the conductive element is a floating electrode so that a preferential path is created for energy flow from one or more of the first and second electrode via the floating electrode in bipolar mode.

Claim 3: An electrosurgical instrument comprising:

a. a first arm carrying a first electrode;
b. a second arm opposing the first arm, the second arm carrying a second electrode;

wherein at least a portion of one or more of the first electrode and second electrode passes energy in a monopolar mode and at least a portion of one or more of the first electrode and second electrode pass energy in a bipolar mode

wherein the at least a portion of one or more of the first electrode and second electrode that passes energy in monopolar mode extends from a spine or side edge of at least one of the first or second arms.

Claim 4: The electrosurgical instrument of any of the preceding claims, wherein the second arm carries an insulation portion.

Claim 5: The electrosurgical instrument of clam 4, wherein the insulation portion is located so that it extends at least the length of an energy path between the first and second electrode.

Claim 6: The electrosurgical instrument of any of the preceding claims, wherein the second arm includes an insulation portion that opposes an insulation portion between the first and second electrodes.

Claim 7: The electrosurgical instrument of any of the preceding claims, wherein the second arm includes a conductive element and an insulation portion located on an inner surface of the second arm so that bipolar energy travels through a larger portion of the tissue as compared to that of a second arm without the insulation portion.

Claim 8: The electrosurgical instrument of any of the preceding claims, wherein the first arm includes exactly two electrodes.

Claim 9: The electrosurgical instrument of any of the preceding claims, wherein the first arm includes exactly one electrode that passes energy in monopolar mode.

Claim 10: The electrosurgical instrument of any of the preceding claims, wherein only one monopolar electrode is electrically connected to an energy source.

Claim 11: An electrosurgical instrument comprising:

a. a first arm carrying a first electrode;
b. a second arm opposing the first arm, the second arm carrying a second electrode;
c. a third electrode, and optionally one or more additional electrodes;

wherein the first electrode and second electrode passes energy in a monopolar mode and at least two of the first electrode, third electrode, or one or more additional electrodes pass energy in a bipolar mode.

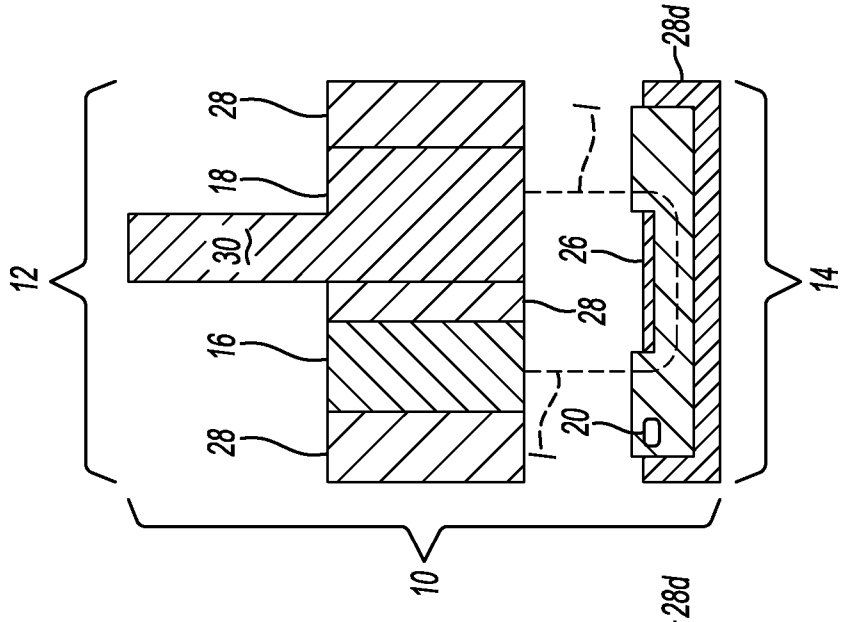


Fig-3

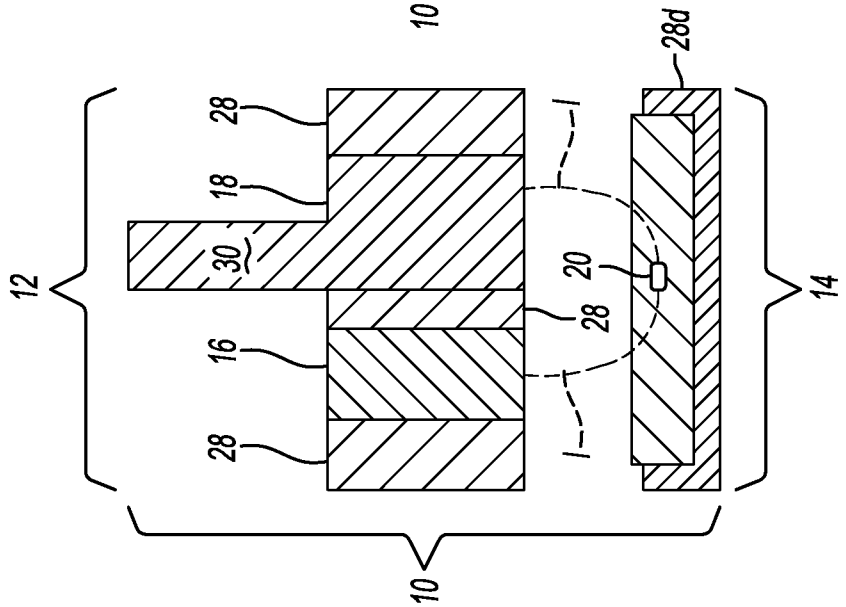


Fig-2

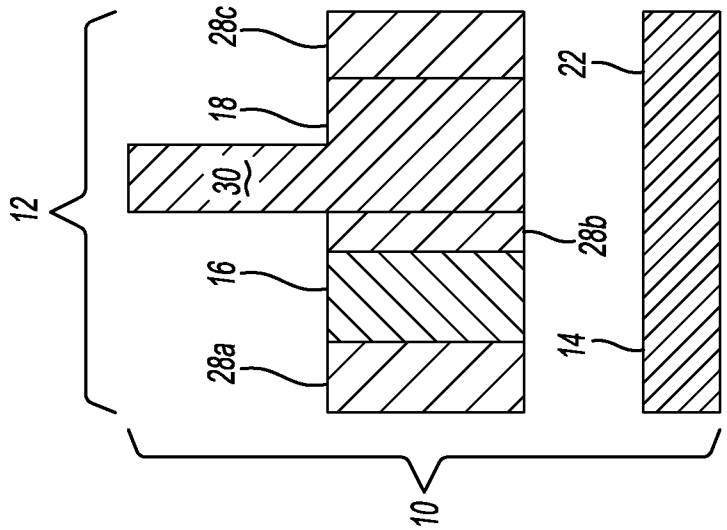


Fig-1

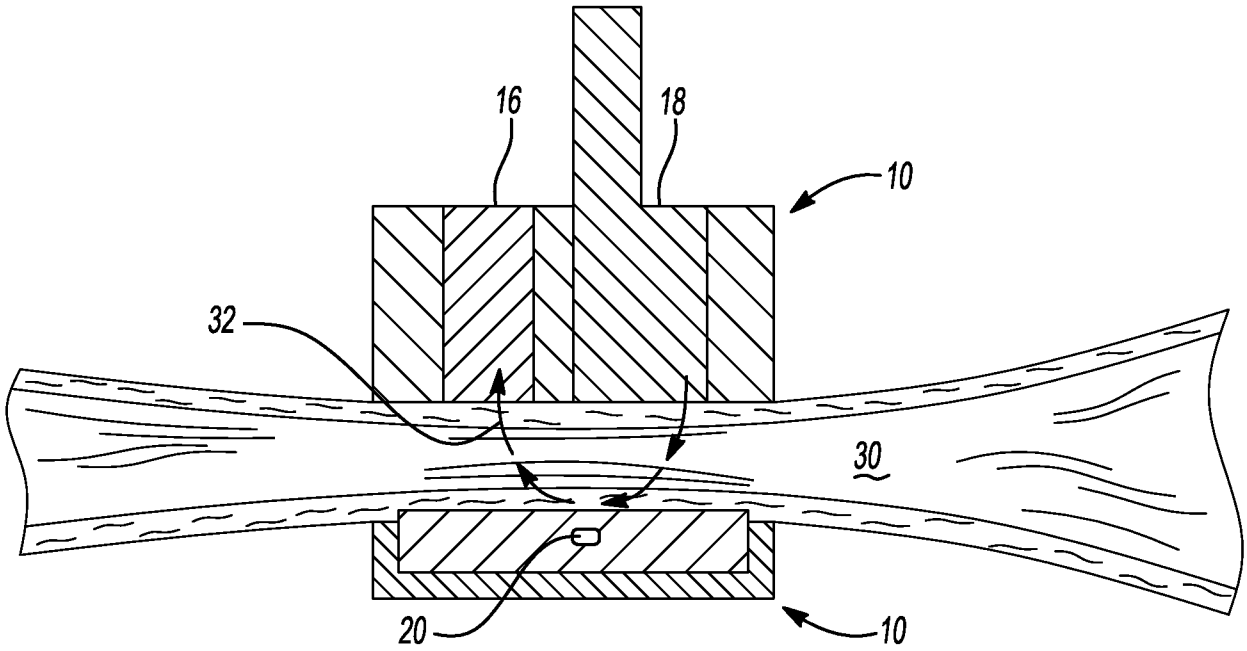


Fig-4a

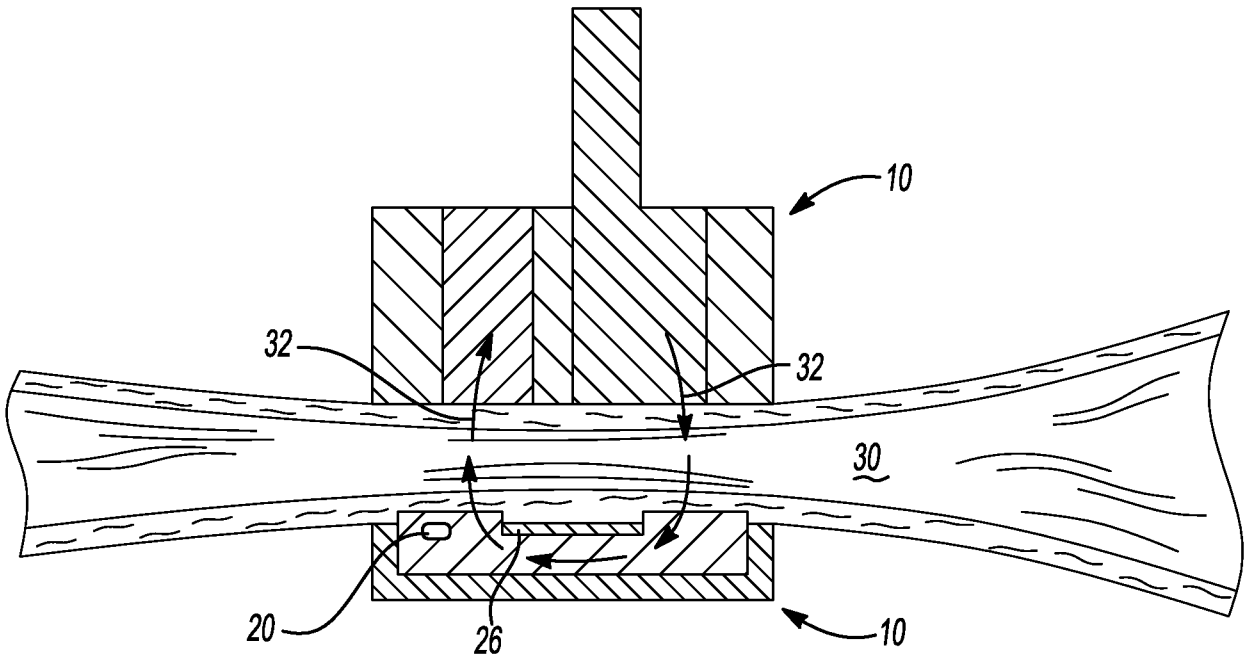


Fig-4b

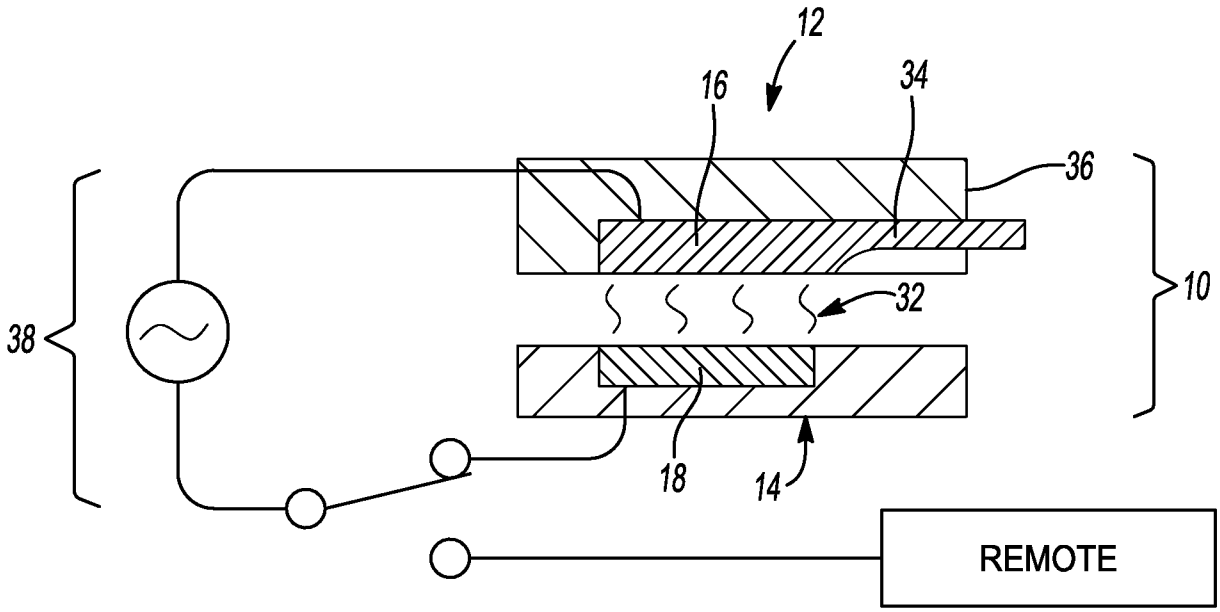


Fig-5a

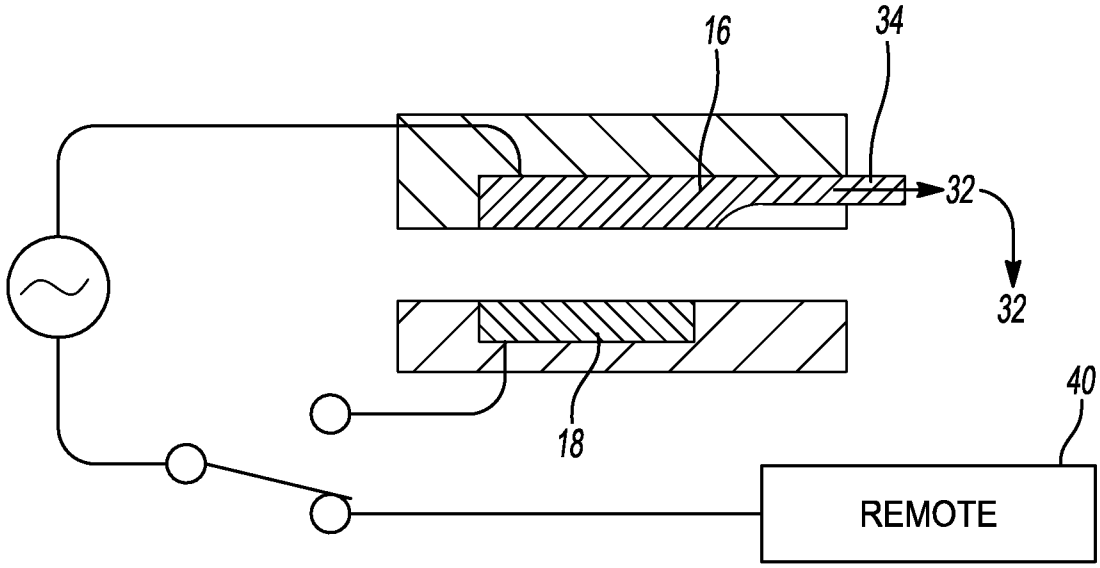


Fig-5b

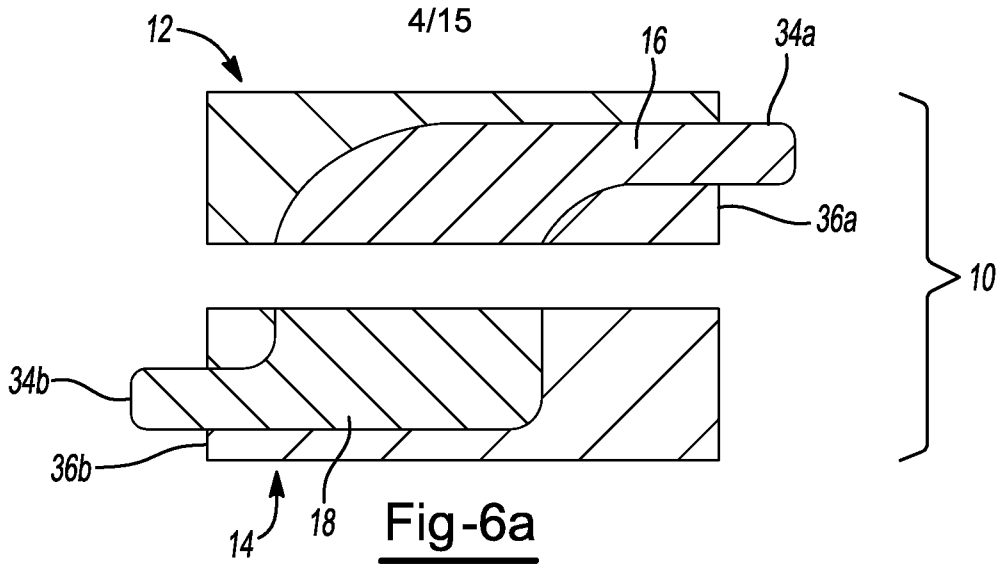


Fig-6a

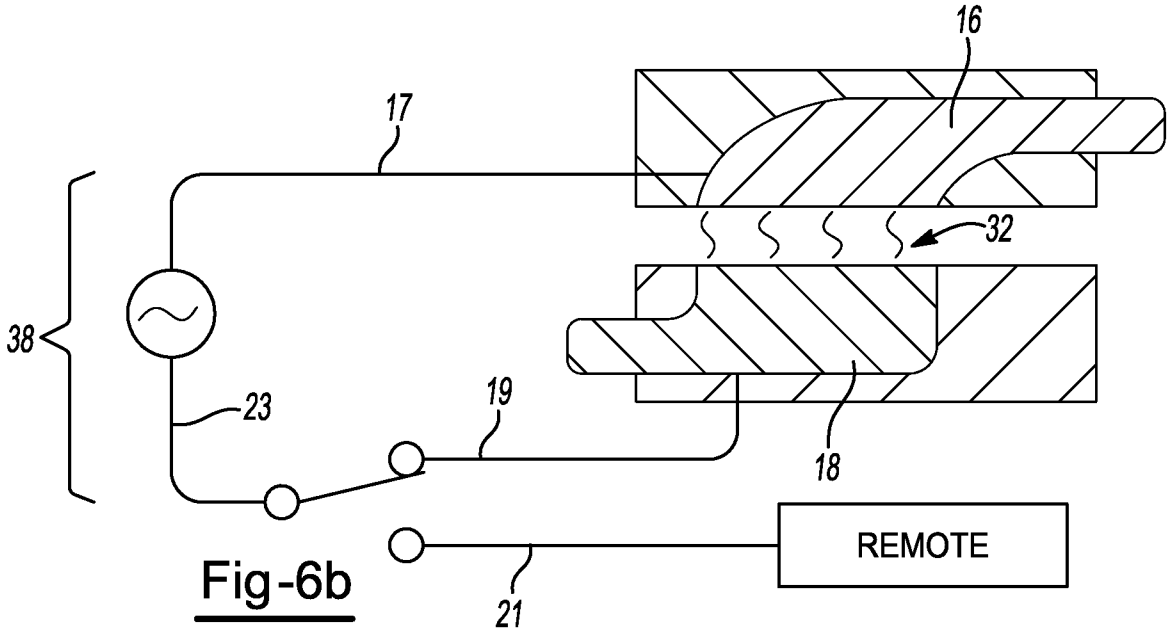


Fig-6b

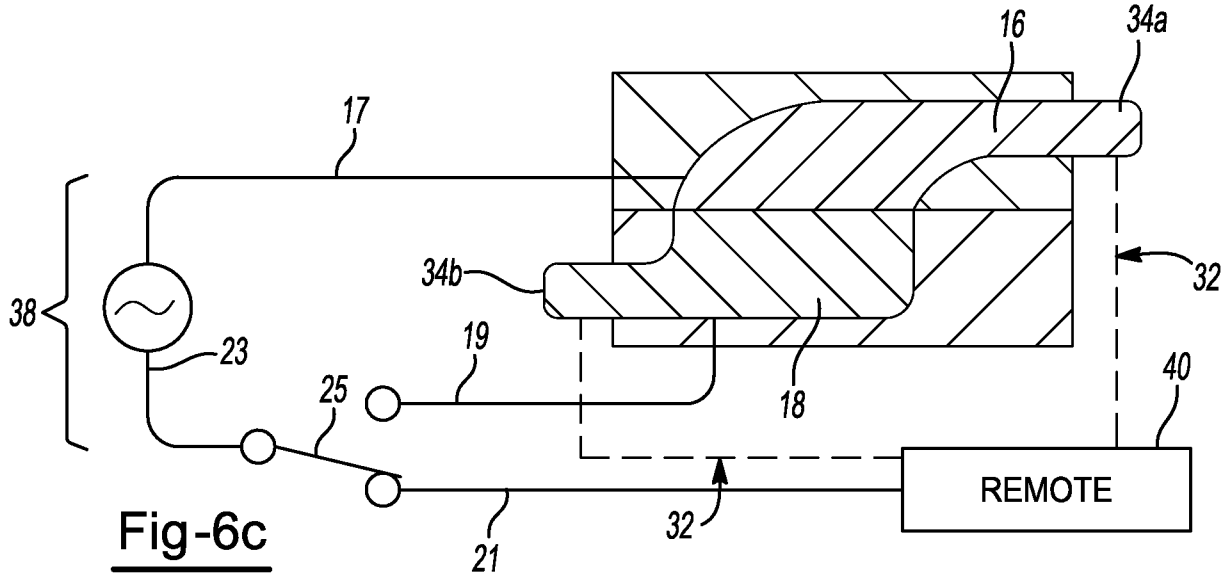


Fig-6c

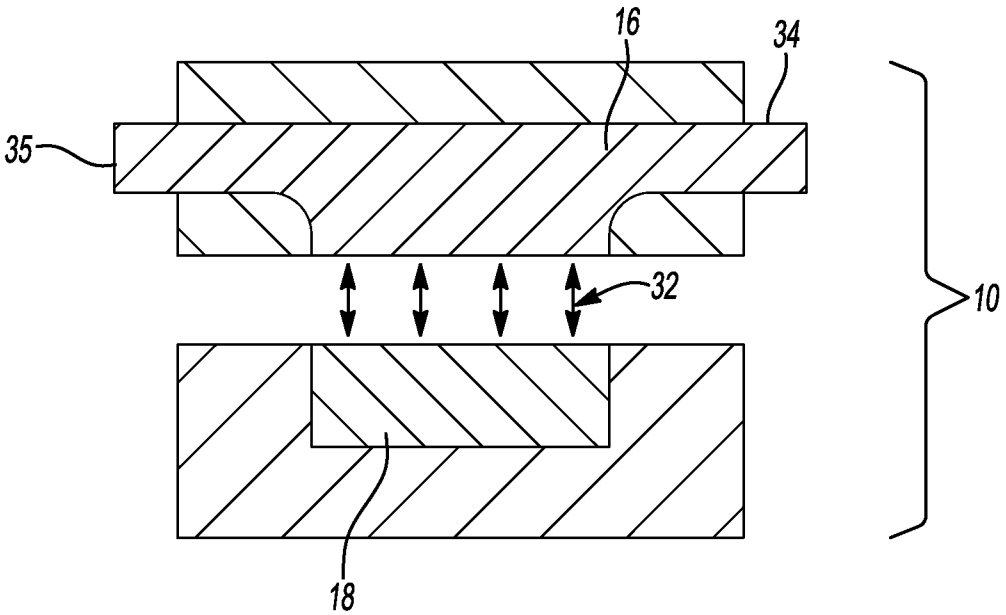


Fig-7

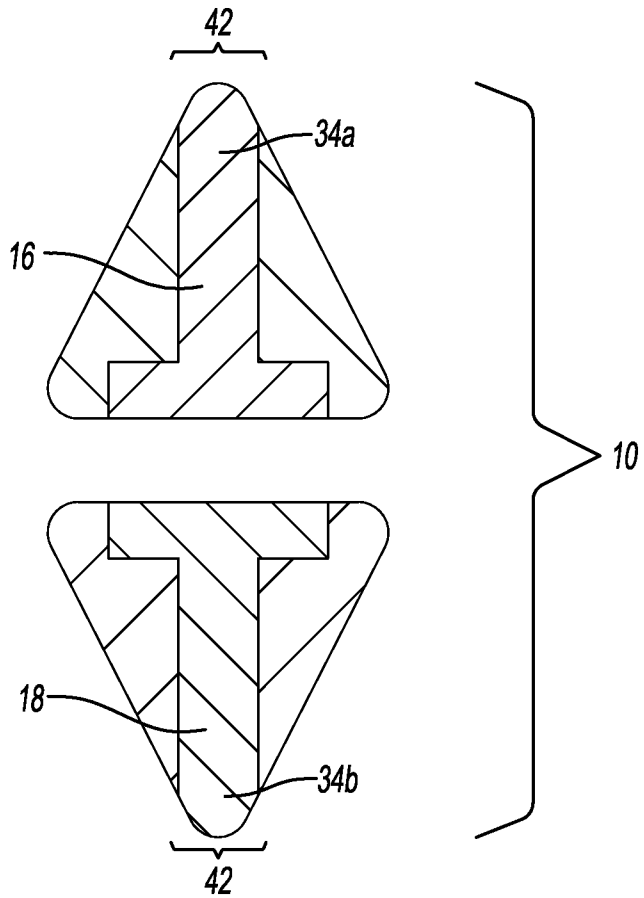


Fig-8a

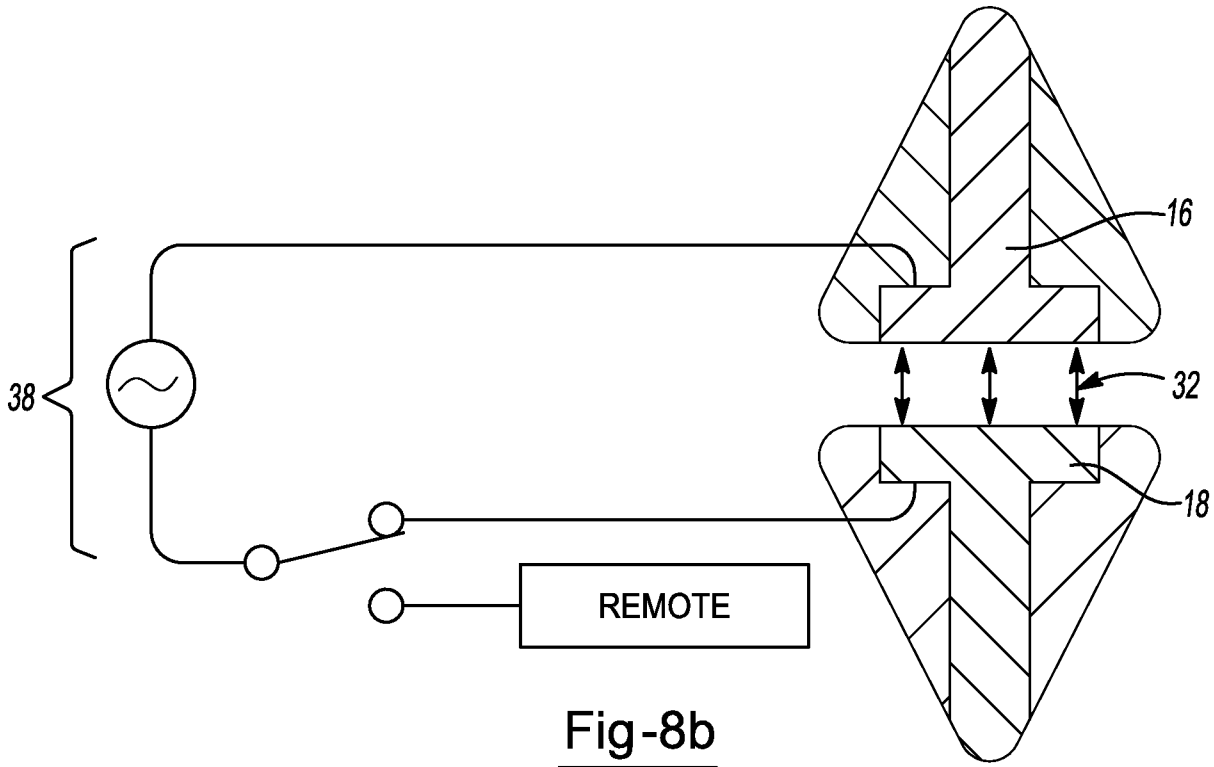


Fig-8b

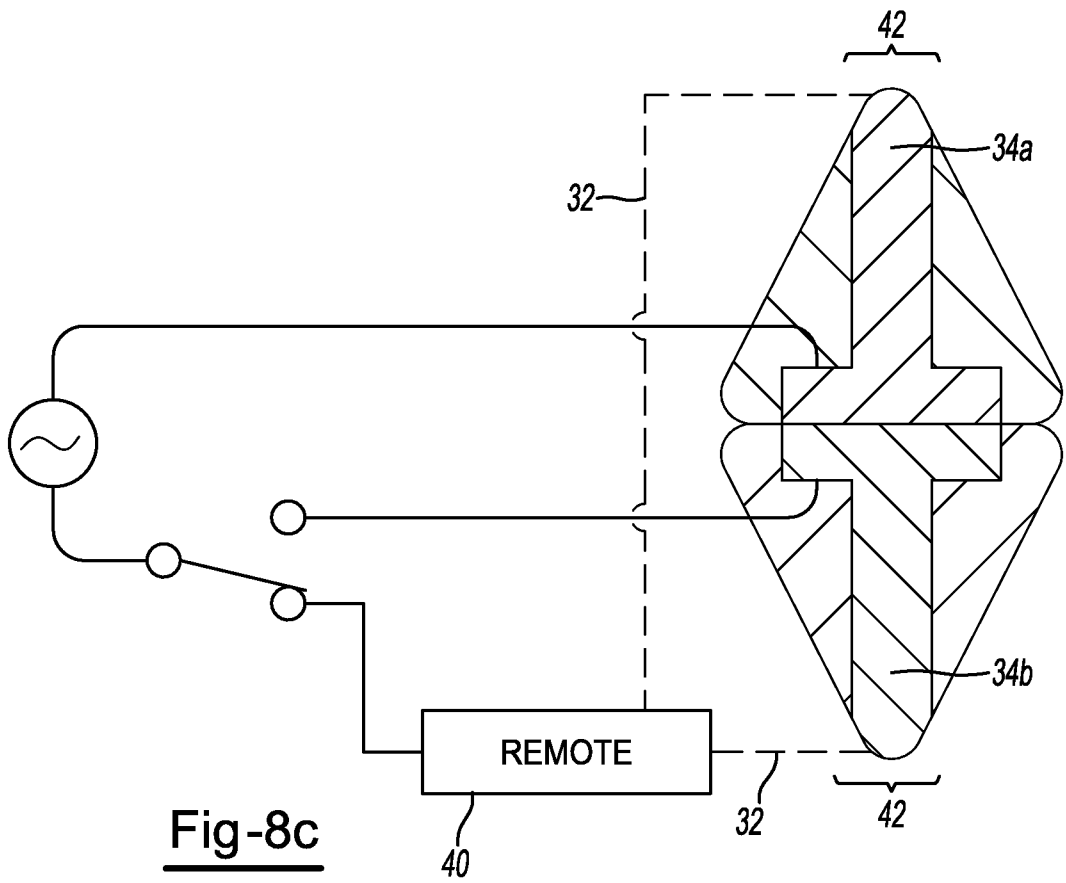


Fig-8c

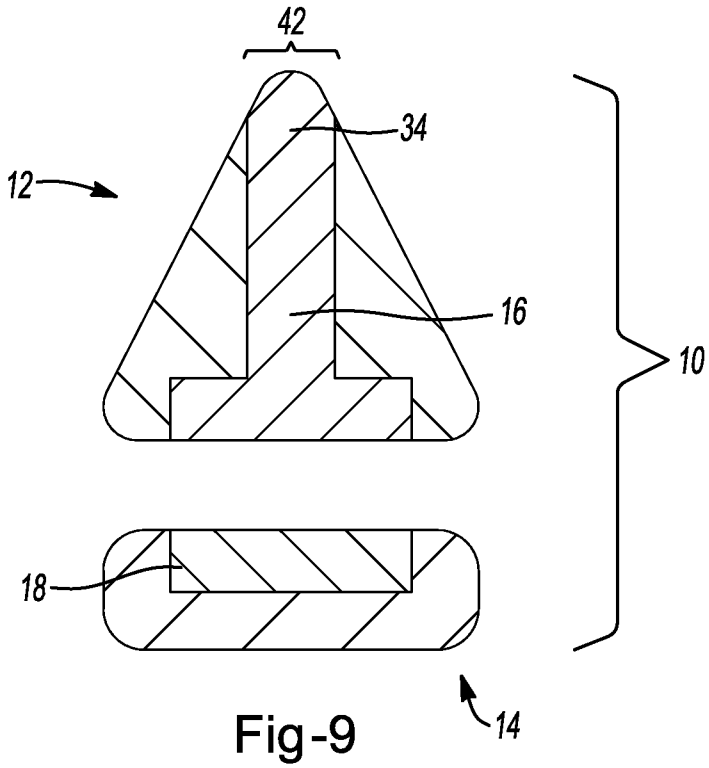


Fig-9

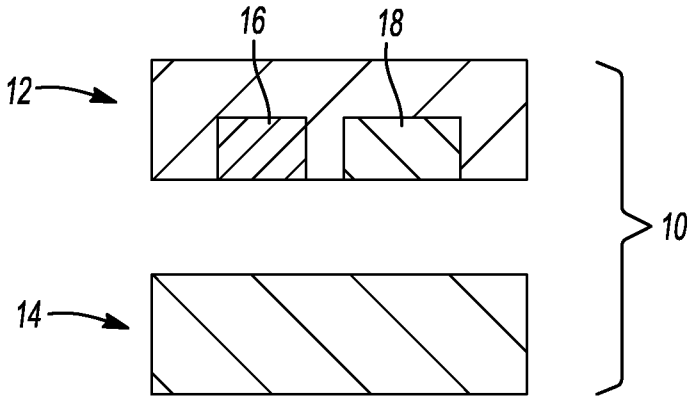


Fig-10

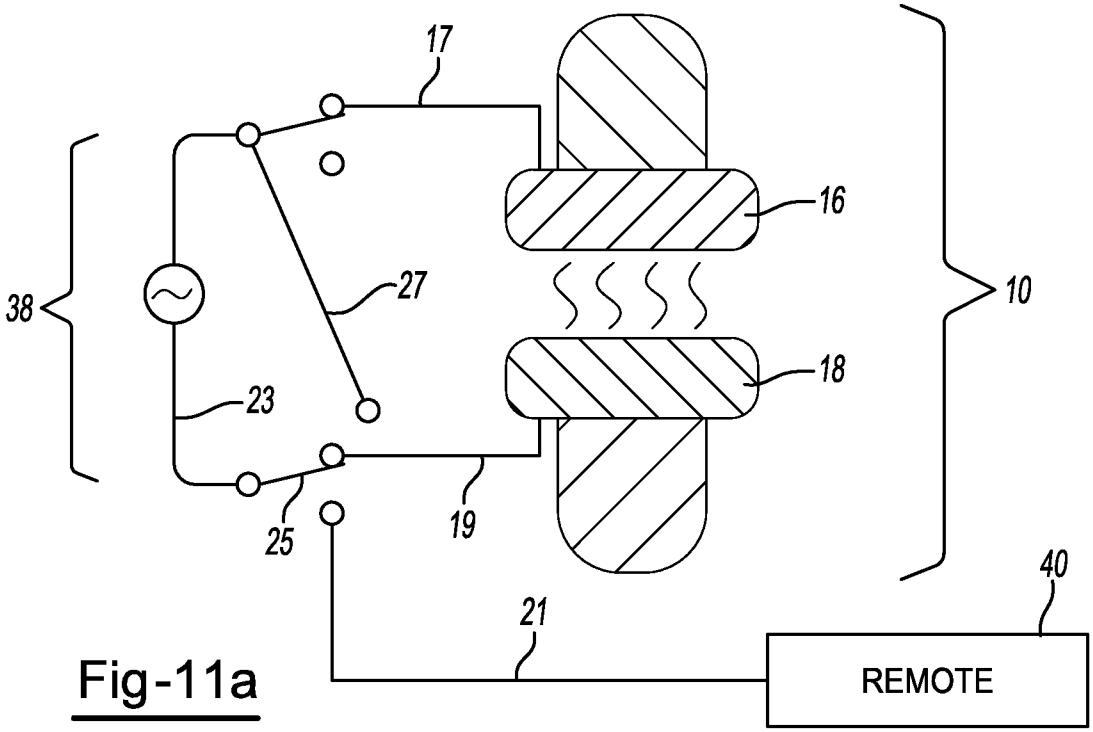


Fig-11a
PRIOR ART

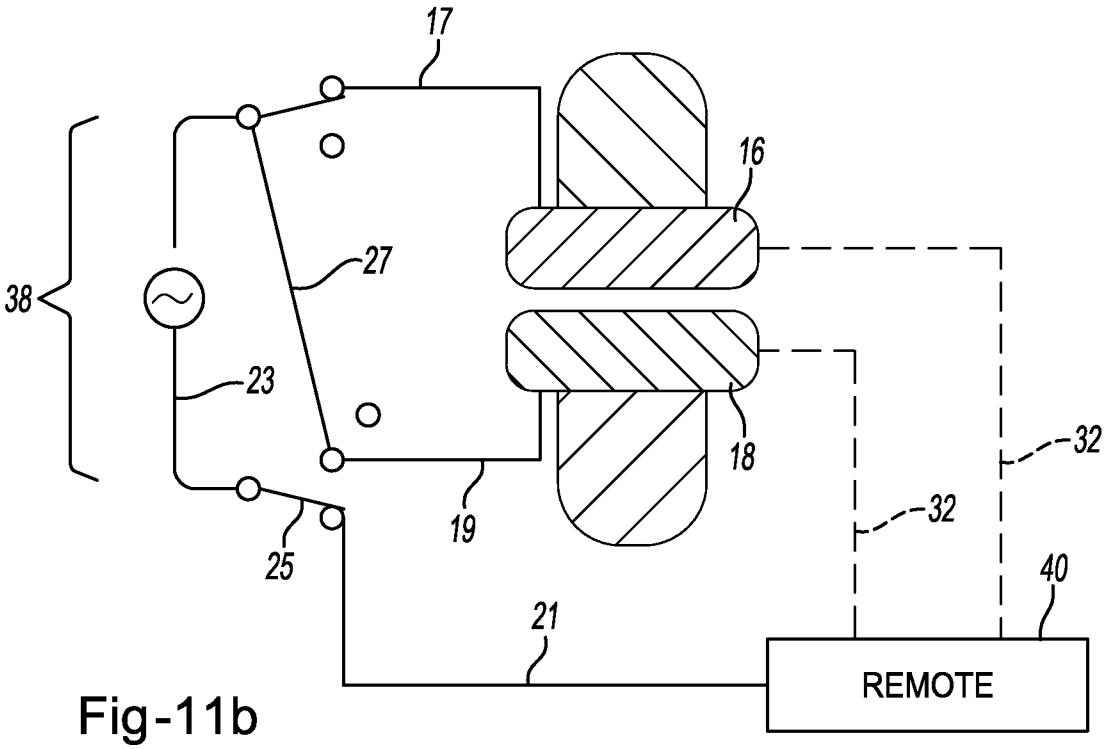


Fig-11b
PRIOR ART

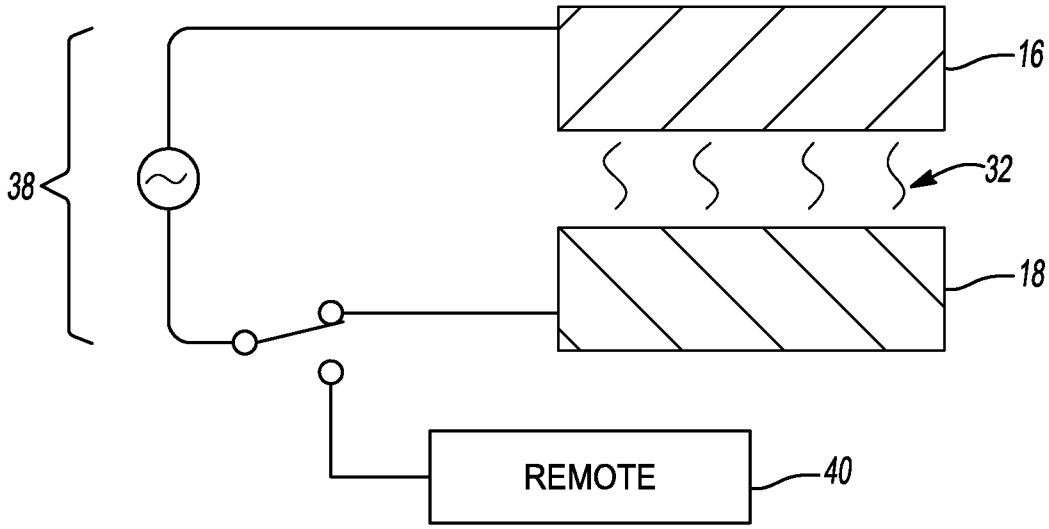


Fig-12a
PRIOR ART

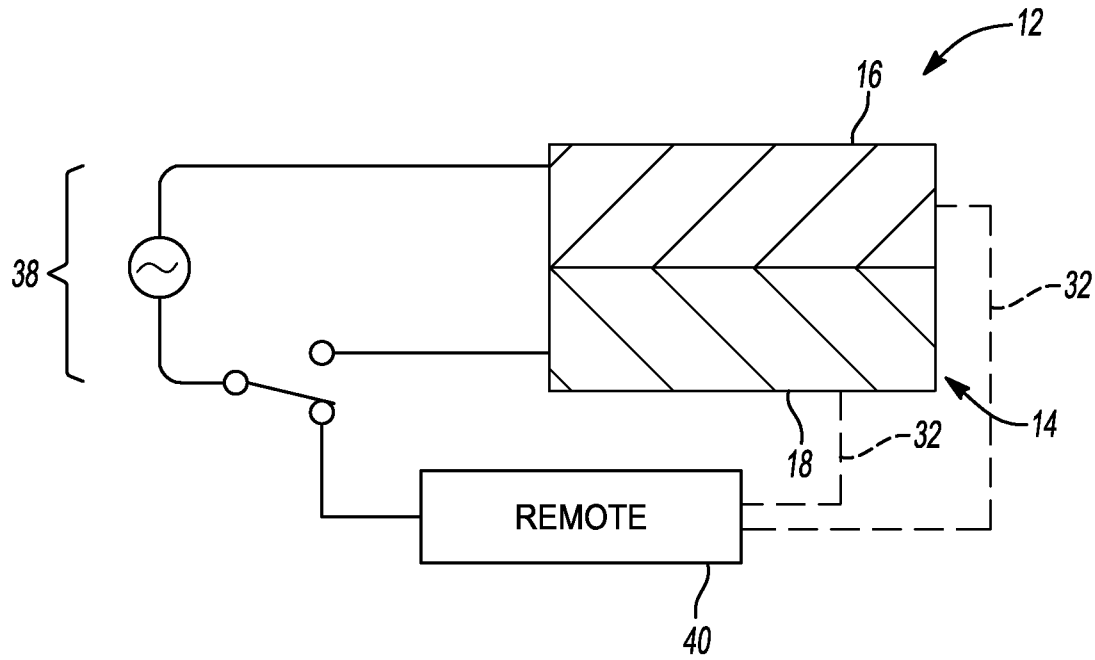


Fig-12b
PRIOR ART

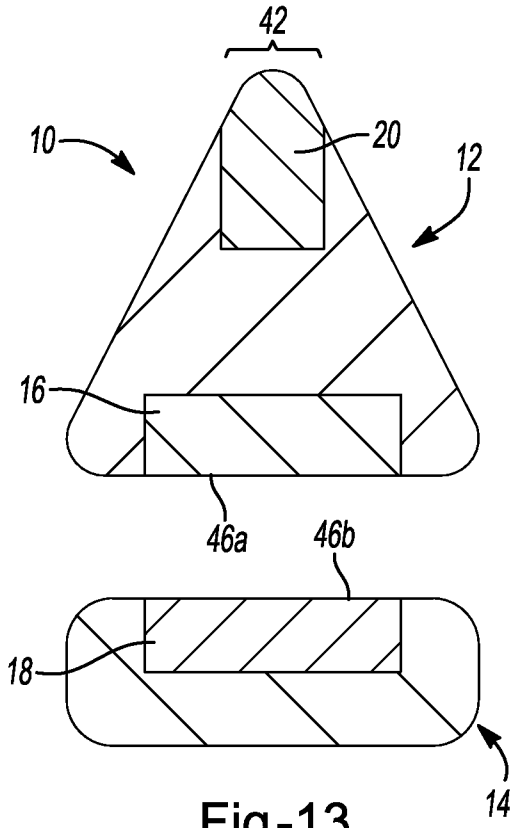


Fig-13

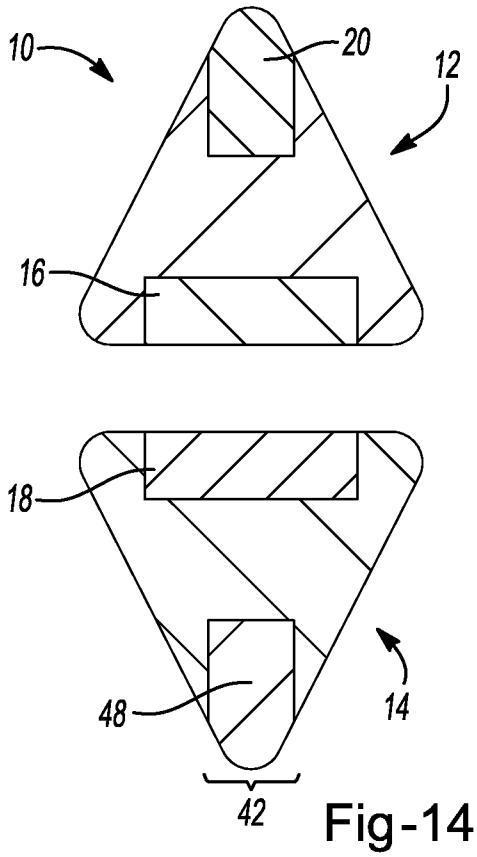


Fig-14

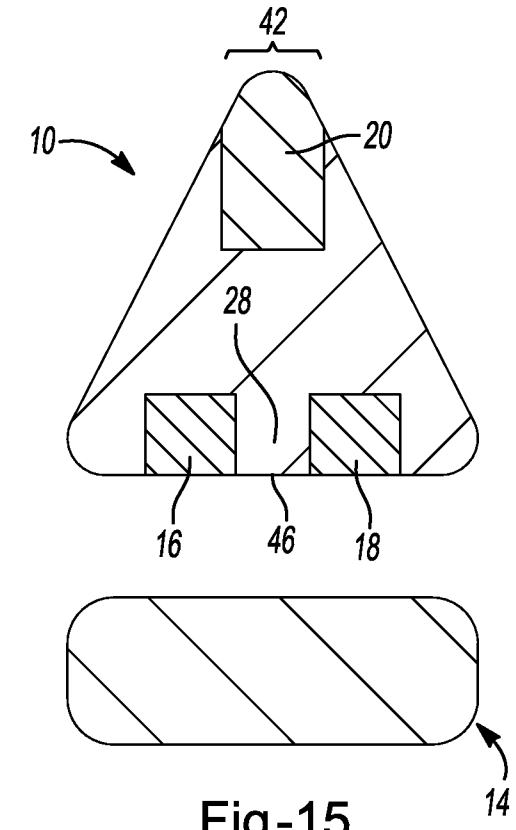


Fig-15

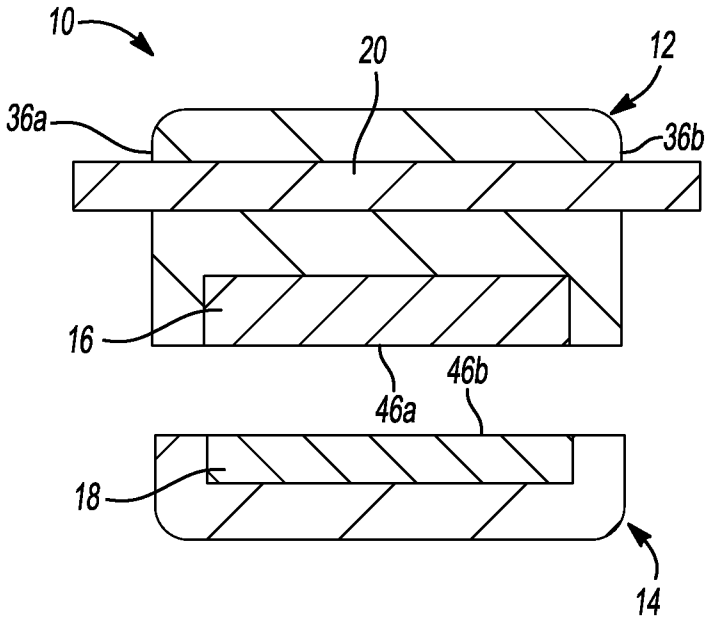


Fig-16

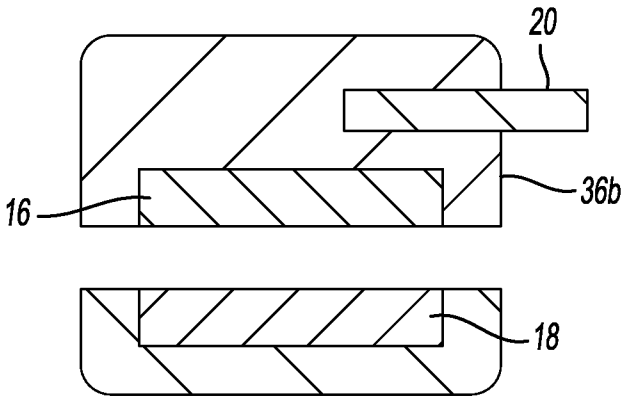


Fig-17

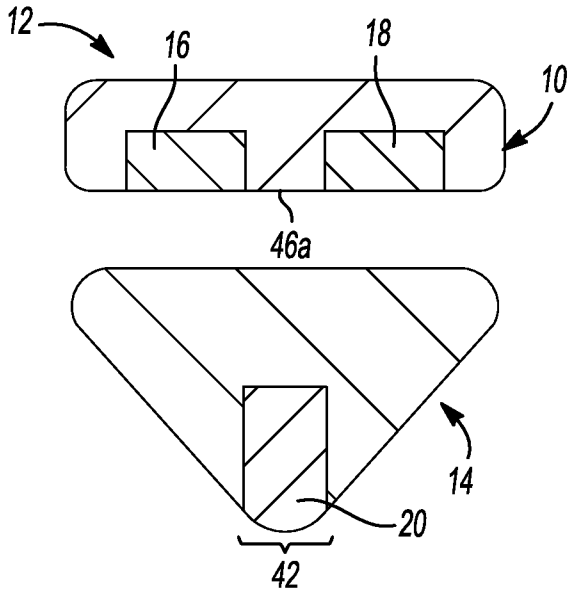


Fig-18

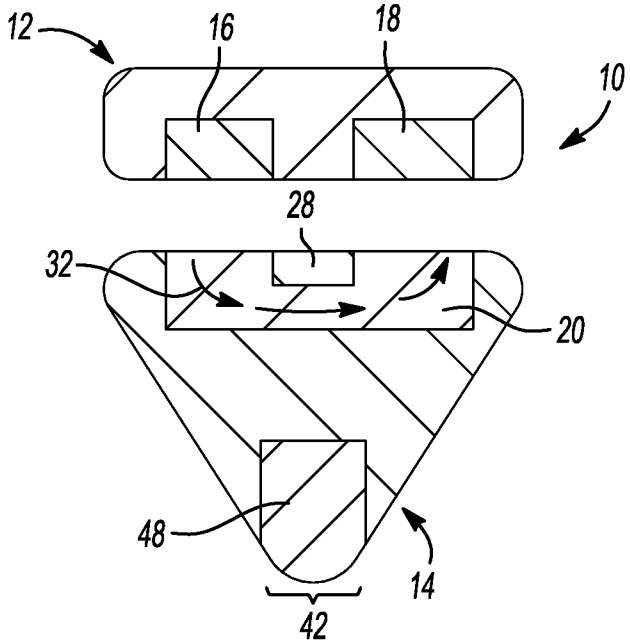


Fig-19

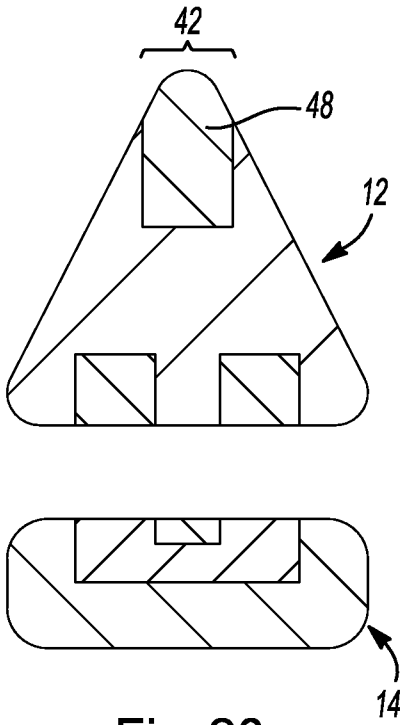


Fig-20

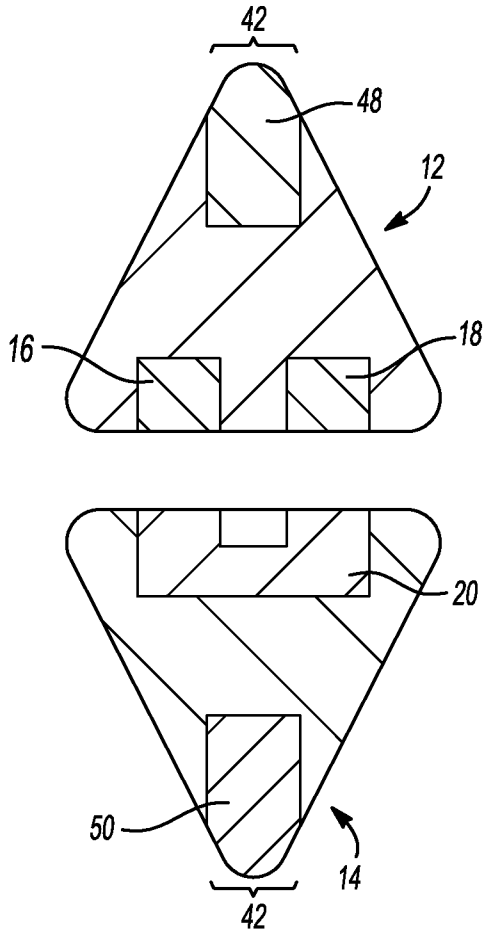


Fig-21a

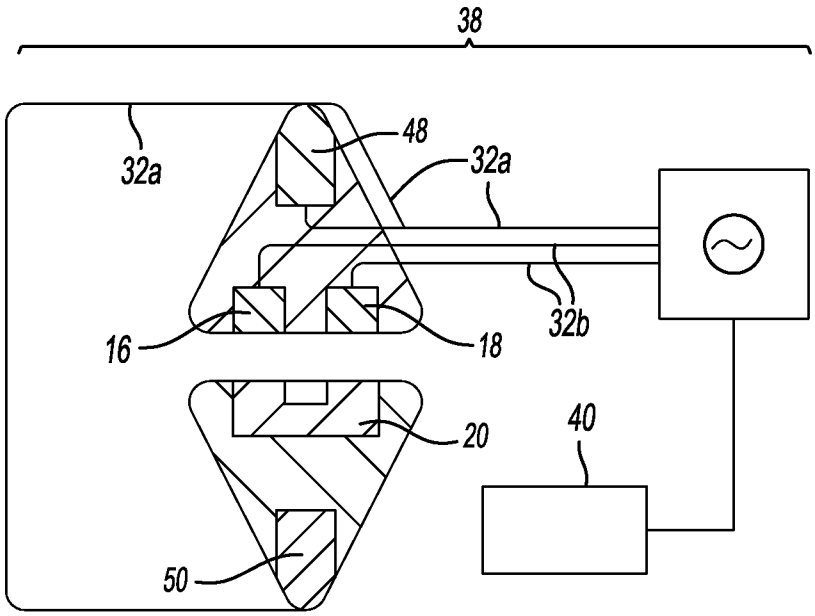


Fig-21b

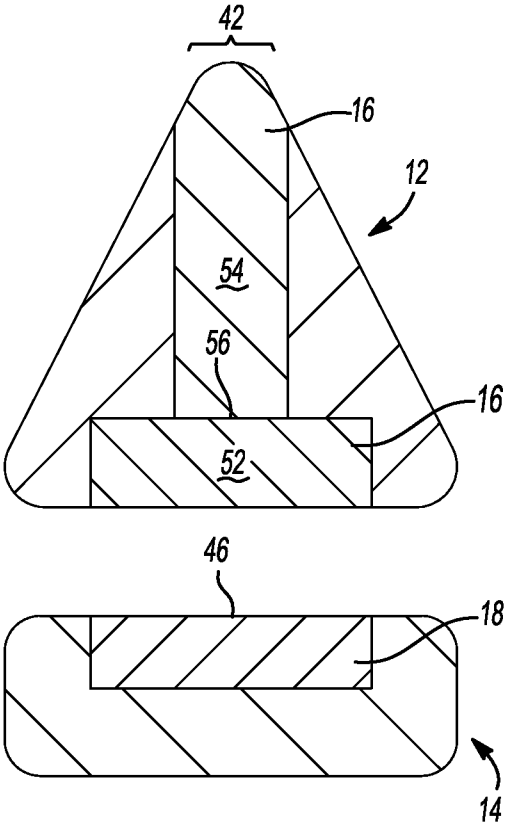


Fig-22a

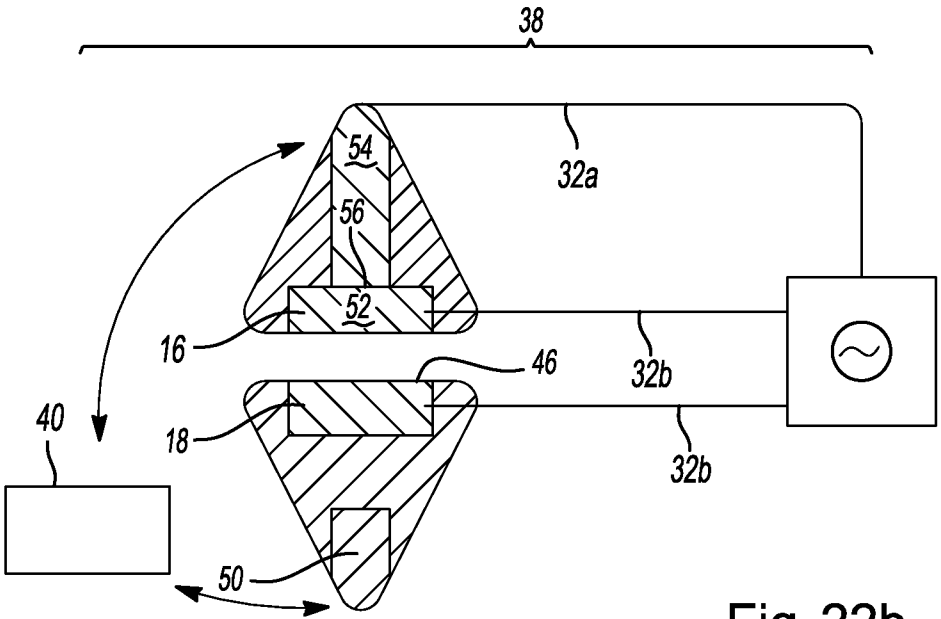


Fig-22b

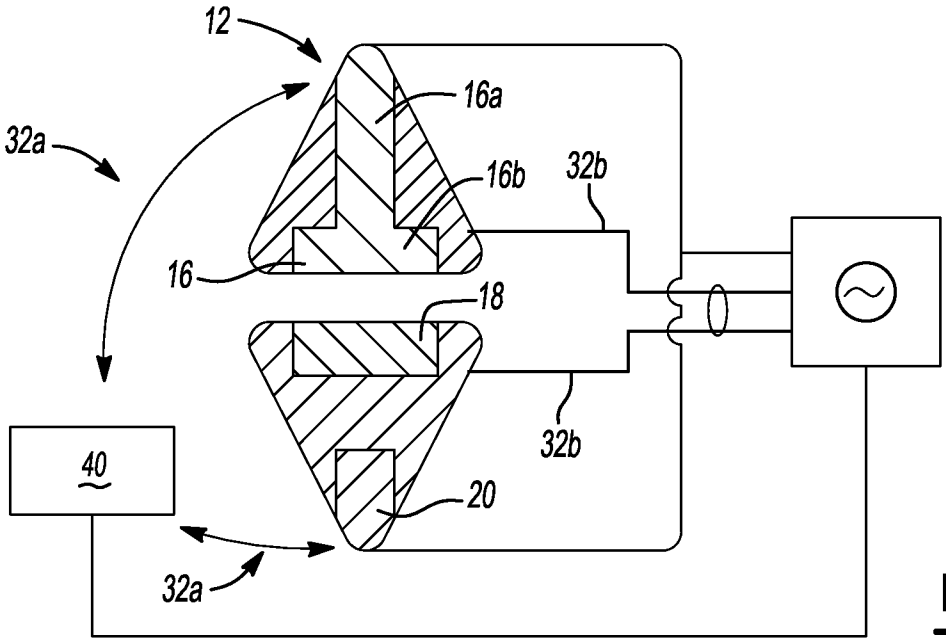


Fig-23

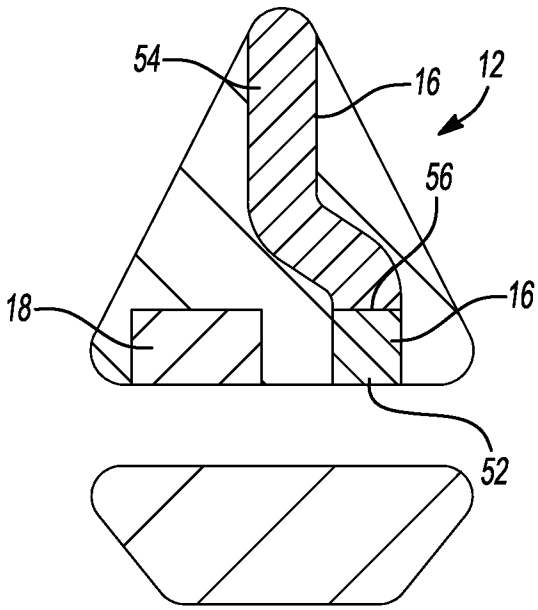


Fig-24

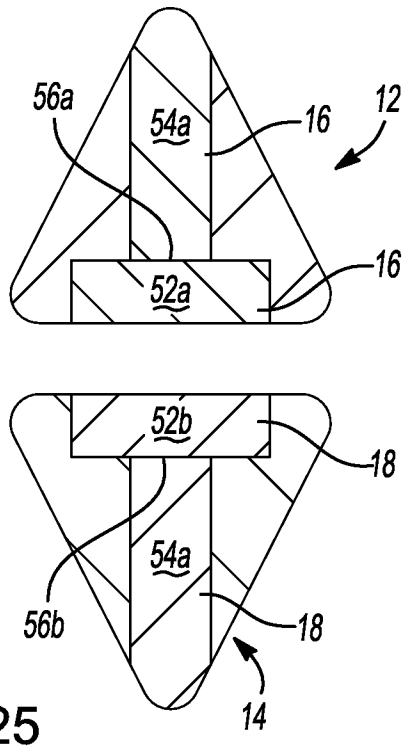


Fig-25

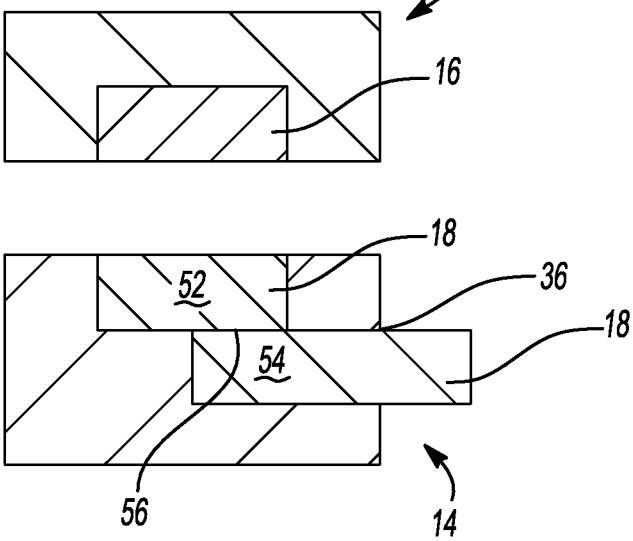


Fig-26

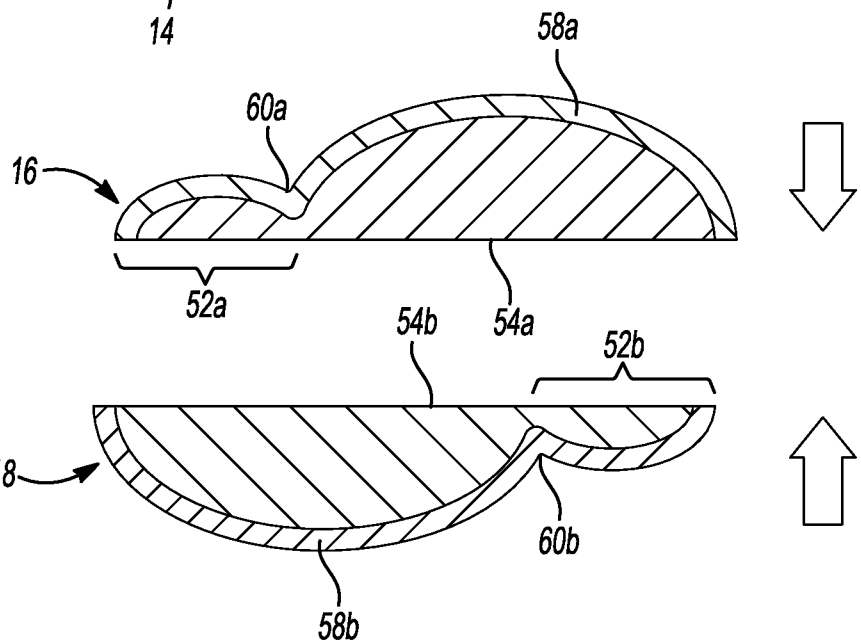


Fig-27a

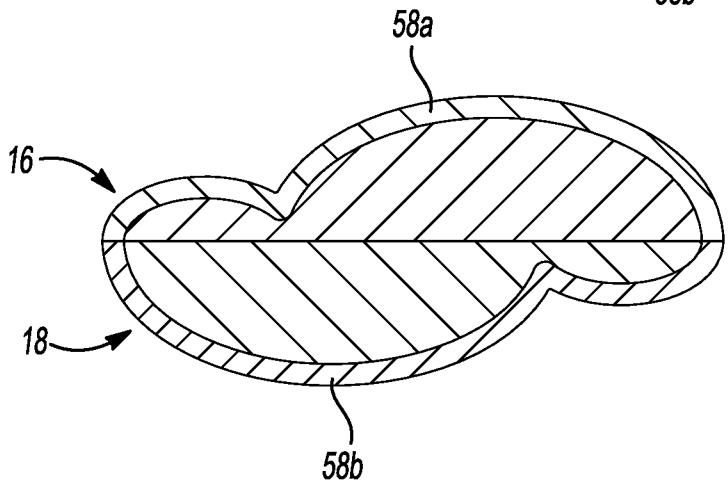


Fig-27b

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/015923

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B18/14 A61B18/12
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/150165 A1 (CONLEY BRIAN M [US] ET AL) 14 June 2012 (2012-06-14) abstract; figure 2 paragraphs [0005], [0032], [0067]	1-11
X	US 8 251 989 B1 (NEWTON DAVID [US] ET AL) 28 August 2012 (2012-08-28) the whole document	1-11
X	US 2010/228249 A1 (MOHR PAUL W [US] ET AL) 9 September 2010 (2010-09-09) the whole document	1-11
X	EP 1 977 706 A1 (TYCO HEALTHCARE [US]) 8 October 2008 (2008-10-08) the whole document	1-11

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 April 2014	02/05/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pereda Cubián, David

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/015923

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 810 629 A2 (SHERWOOD SERV AG [CH] COVIDIEN AG [CH]) 25 July 2007 (2007-07-25) the whole document	1-11
X	EP 1 530 952 A1 (SHERWOOD SERV AG [CH] COVIDIEN AG [CH]) 18 May 2005 (2005-05-18) the whole document	1-11
X	US 6 113 596 A (HOOVEN MICHAEL D [US] ET AL) 5 September 2000 (2000-09-05) cited in the application the whole document	1-11
X	US 5 207 691 A (NARDELLA PAUL C [US]) 4 May 1993 (1993-05-04) the whole document	1-11

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2014/015923

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012150165 A1	14-06-2012	EP 2648637 A1	16-10-2013
		US 2012150165 A1	14-06-2012
		WO 2012078278 A1	14-06-2012
US 8251989 B1	28-08-2012	US 8251989 B1	28-08-2012
		US 2012283720 A1	08-11-2012
US 2010228249 A1	09-09-2010	US 2010228249 A1	09-09-2010
		US 2013217967 A1	22-08-2013
EP 1977706 A1	08-10-2008	AU 2008201500 A1	23-10-2008
		CA 2627791 A1	03-10-2008
		EP 1977706 A1	08-10-2008
		JP 2008253782 A	23-10-2008
		US 2008249523 A1	09-10-2008
EP 1810629 A2	25-07-2007	AU 2007200272 A1	09-08-2007
		CA 2574937 A1	24-07-2007
		EP 1810629 A2	25-07-2007
		EP 2417926 A1	15-02-2012
		ES 2378899 T3	18-04-2012
		US 2007173810 A1	26-07-2007
		US 2009157073 A1	18-06-2009
		US 2009237169 A1	24-09-2009
EP 1530952 A1	18-05-2005	AU 2004231188 A1	02-06-2005
		AU 2010212496 A1	16-09-2010
		CA 2487579 A1	17-05-2005
		EP 1530952 A1	18-05-2005
		ES 2335759 T3	05-04-2010
		JP 4988909 B2	01-08-2012
		JP 5202788 B2	05-06-2013
		JP 5336551 B2	06-11-2013
		JP 2005144192 A	09-06-2005
		JP 2011005282 A	13-01-2011
		JP 2011212449 A	27-10-2011
		US 2005137590 A1	23-06-2005
		US 2008243120 A1	02-10-2008
		US 2011004209 A1	06-01-2011
		US 2013023874 A1	24-01-2013
		US 2014100569 A1	10-04-2014
US 6113596 A	05-09-2000	US 6113596 A	05-09-2000
		WO 9829044 A1	09-07-1998
US 5207691 A	04-05-1993	AT 154217 T	15-06-1997
		AU 659241 B2	11-05-1995
		CA 2122476 A1	13-05-1993
		DE 69220378 D1	17-07-1997
		DE 69220378 T2	15-01-1998
		EP 0610307 A1	17-08-1994
		JP 3221879 B2	22-10-2001
		JP H07502429 A	16-03-1995
		US 5207691 A	04-05-1993
		WO 9308741 A1	13-05-1993