An electrosurgical vein stripper

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The invention relates to a vein stripper comprising a probe and a coagulation and cutting unit, with the coagulation and cutting unit comprising at least two electrodes and a face opening through which the probe can be guided.

Vein strippers are known from the field of surgery.

SU 1 498 473 A1 discloses a vein stripper which is connected with a probe. The vein stripper comprises a ring knife with a nose, with the nose having an opening with an electrode situated therein. The ring knife is arranged as a further electrode. During the vein stripping, the tissue around the vein is cut by the ring knife. The grasping of venous side branches is indicated by an increased mechanical resistance. The venous side branch can be cut through with the cutting edge of the nose by turning the vein stripper and can be coagulated with the electrode by means of high-frequency currents. The disadvantageous aspect in a vein stripper according to SU 1 498 473 A1 is that smaller venous side branches are severed without any noticeable increase in the mechanical resistance and are not coagulated. The further disadvantageous aspect is that the venous side branches can only be coagulated when they are recognized shortly before the severing. If a venous side branch has been recognized and has already been cut, the required position of the vein stripper for coagulation can no longer be found. This relates both to the position in the longitudinal direction of the vein stripper as well as the angle of rotation to be set. The coagulation represents a complex and protracted procedure. A further disadvantage of the vein stripper according to SU 1 498 473 A1 is that due to the stresses during the vein stripping, hemorrhages will also occur in veins in the ambient tissue, whereby said veins are not coagulated. A further disadvantageous aspect in the vein stripper according to SU 1 498 473 A1 is that inadvertent injuries to the ambient tissue may occur as a result of the sharp cutting edge of the ring knife.

It is therefore the object of the present invention to provide a vein stripper of the kind mentioned above which eliminates these disadvantages and ensures the coagulation of nearly all venous side branches.

It is a further object of the present invention to provide a vein stripper of the kind mentioned above which also coagulates injured veins in the ambient tissue.

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It is a further object of the invention to provide a vein stripper of the kind mentioned above in which the impairment to the ambient tissue by inadvertent cuts is kept low.

It is further an object of the invention to provide a vein stripper of the kind mentioned above which ensures the cutting and coagulation in one working step.

This is achieved in accordance with the invention in such a way that at least two of the at least two electrodes are arranged adjacently over the circumference of the coagulation and cutting unit, which circumference is situated in the region of the face opening.

This embodiment comes with the advantage that it can be used in conjunction with current vein strippers. It comes with the further advantage that a blood-dry strip channel is achieved, as a result of which the use of pressure bandages is not mandatory. Moreover, the traumatizing of the ambient tissue is substantially prevented by the vein stripper in accordance with the invention. This leads to the further advantage that the operation with the vein stripper in accordance with the invention can be performed throughout the whole year and not only in the cold season.

The invention further relates to a vein stripper with a probe and a coagulation and cutting unit, with the coagulation and cutting unit comprising at least one electrode and a face opening through which the probe can be guided.

It is the object of the present invention to present a vein stripper of the kind mentioned above which remedies the disadvantages as mentioned above, ensures the coagulation of nearly all venous side branches, also coagulates injured veins in the ambient tissue, keeps the impairment to the ambient tissue by inadvertent cuts low, ensures the cutting and coagulation in one working step and comes with a simple and secure design.

This is achieved in accordance with the invention in such a way that the probe is arranged at least along a region of its length as an electrode.

This embodiment comes with the advantage that due to the spatial separation of the electrodes the likelihood of a short is especially low. A blood-dry strip channel is also achieved with this vein stripper in accordance with the invention, thus ensuring that the use of pressure bandages is no longer mandatory. Moreover, the traumatizing of the ambient tissue is substantially prevented.

This leads to the further advantage that the operation with the vein stripper in accordance with the invention can be performed throughout the whole year and not only in the cold season.

In a further development of the invention it can be provided that at least one of the at least one electrode is arranged adjacently over the circumference of the coagulation and cutting unit, which circumference is situated in the region of the face opening. In this way the coagulation can be ensured in all directions around the opening.

According to a further embodiment of the invention it can be provided that at least one of the electrodes is provided with an annular arrangement. As a result of the annular arrangement the enclosure of the opening by the electrode can be ensured.

According to another embodiment of the invention it can be provided that at least one of the electrodes is provided with a spiral configuration. The spiral configuration allows enclosing the opening with an electrode several times.

In a further embodiment of the invention it can be provided that at least one of the electrodes comprises interruptions. Other electrodes can be guided by the interruptions, thus allowing the electrodes to be arranged in one plane.

In a further embodiment of the invention it can be provided that at least one of the electrodes comprises fan-shaped fingers. The fan-shaped fingers allow considerably enlarging the region in which the coagulation and cutting takes place, thus considerably improving the security of the coagulation of all venous side branches.

It can be provided for in a further development of the invention that one end of the probe can be connected with the coagulation and cutting unit by means of a holding apparatus arranged on the coagulation and cutting unit or by means of a concluding piece or the like. As a result of the connection with the probe, the vein stripper in accordance with the invention can be used like a conventional vein stripper, thus reducing the likelihood of operating errors.

According to another embodiment of the invention it can be provided that the probe is fixed to the coagulation and cutting unit. Operating errors can be substantially excluded by fixing the probe to the coagulation and cutting device.

According to a further embodiment of the invention it can be provided that the coagulation and cutting device comprises a displacement device, in particular a shaft or the like, and that the probe is configured as a guide probe. The coagulation and cutting unit can be moved by the probe through the displacement device, with the probe not being moved simultaneously and only being used as a guide means. In this way the vein can be cut out first and the venous side branches can be coagulated and only then can the vein be removed. In this way it is not necessary that the coagulation and cutting unit receives the vein, so that the dimensions of the coagulation and cutting unit can be kept small.

It can be provided in a further development of the invention that the coagulation and cutting unit comprises a drive apparatus, with the same being automatically movable along the probe. No displacement device is required any more as a result of the drive apparatus, thus ensuring that the movement about a curved probe can be performed more easily.

It can be provided in a further embodiment of the invention that the coagulation and cutting unit comprises at least one further electrode, especially at least three further electrodes. As a result of the further electrodes it is possible to enlarge the region in which the cutting and/or coagulation is performed. This increases the security that all venous side branches are coagulated.

According to a further embodiment of the invention it can be provided that the at least one further electrode is arranged on the wall surface of the coagulation and cutting unit. The attachment of the at least one further electrode to the wall surface of the coagulation and cutting unit increases the coagulation region after the severing of the venous side branch and thus increases the security that all venous side branches are coagulated.

It can be provided for in a further development of the invention that the electrodes are arranged at difference distances from the respectively adjacent electrodes. By choosing difference distances it is possible to achieve different activity regions between two electrodes.

According to another arrangement of the invention it can be provided that at least one of the electrodes is connected with a resistor or the like. Different activity regions can be achieved through the connection with a resistor or the like.

In a further embodiment of the invention it can be provided that the coagulation and cutting unit comprises a basic body which is aligned along a longitudinal axis and the at least two of the at

least two electrodes are attached to a first face side of the basic body. The electrodes can be fastened to the basic body. By attaching the electrodes to a first face side it is ensured that venous side branches reach the activity region of the electrodes before they tear off.

According to a further embodiment of the invention it can be provided that the coagulation and cutting unit comprises two electrodes which are arranged in a substantially annular fashion, with the axes of symmetry of the annular electrodes extending substantially parallel with respect to each other and with the surfaces which are each opened by the annular electrodes substantially overlapping each other when viewed in the axial direction of the axes of symmetry. This embodiment ensures a simple construction of the coagulation and cutting unit. It is not necessary to configure the probe as an electrode.

It can be provided for in a further development of the invention that the at least one further electrode is provided with an annular arrangement whose axis of symmetry extends substantially parallel to the axes of symmetry of the two other annular electrodes, with the surface which is opened up by the at least one further annular electrode and the surfaces which are opened up by the two other annular electrodes substantially overlapping each other when viewed in the axial direction of the axes of symmetry. The security in the coagulation of all venous side branches can be improved by using at least three annular electrodes.

In accordance with another embodiment of the invention it can be provided that the axes of symmetry of the annular electrodes extend substantially parallel to the longitudinal axis of the basic body. This embodiment allows achieving a rotationally symmetrical effect of the electrodes, so that its effect is not changed by any inadvertent rotation of the coagulation and cutting unit.

According to a further embodiment of the invention it can be provided that the annular electrodes lie in one and the same plane extending substantially normal to the longitudinal axis of the basic body. As a result of this embodiment the cutting effect of the coagulation and cutting unit can be improved in particular, as a result of which an only very low tensile force is required for coagulation and cutting.

In accordance with a further embodiment of the invention it can be provided that the basic body encloses a substantially cylindrical space. This leads to the advantage that the coagulation and cutting unit can be placed closely around the vein. Moreover, the second face side of the basic

body can be placed on the end of a conventional vein stripper and can thus be pulled with the same over the vein, with venous side branches being severed by the coagulation and cutting unit.

In a further development of the invention it can be provided that the basic body is provided with at least one web aligned in the longitudinal axis of the basic body. This allows the vein which arches in the region of the basic body by the tension to expand sufficiently without clogging the basic body, as a result of which the coagulation and cutting unit can be provided with a configuration of merely a low length.

According to another embodiment of the invention it can be provided that the basic body comprises the holding apparatus for receiving and fixing the end of the probe in the region of its second face side. A separate closure of the vein stripper is thus no longer required. This arrangement comes with the additional advantage that the use of the coagulation and cutting unit in the wrong direction is excluded, thus reducing the likelihood of an error during operation.

According to a further embodiment of the invention it can be provided that the basic body comprises the holding apparatus for receiving and fixing the end of the probe on its second face side. The overall length of the coagulation and cutting unit can be reduced by arranging the holding apparatus on the second face side.

In a further embodiment of the invention it can be provided that the holding apparatus allows an interlocking connection between the end of the probe and the basic body. It is ensured through the interlocking configuration of the connection that the connection is not detached inadvertently.

In a further development of the invention it can be provided that the holding apparatus comprises a slot incorporated in the side wall of the basic body for inserting the probe as well as a recess for receiving the end of the probe. The recess comprises a web at its side facing the first face side of the basic body which narrows the same. This arrangement allows a simple and secure connection between the probe and the basic body.

According to a further embodiment of the invention it can be provided that the recess comprises an extension on its side facing the first face side of the basic body. The permanence of the connection can be improved by the extension.

In a further development of the invention it can be provided that electric lines for connecting the electrodes with a power supply source are guided in a centric fashion out of the basic body on the second face side of the basic body. This configuration allows moving the coagulation and cutting unit by means of the electric lines without any tilting moment.

According to another embodiment of the invention it can be provided that the holding apparatus comprises two contacts which are electrically conductively connected with the electrodes and that the electric lines are guided within the probe for connecting the electrodes with an electric power source and are connected with further contacts situated at the end of the probe, with the electric conductive connection between the annular electrodes and the power supply source occurring by means of the contacts and the further contacts when receiving and fixing the probe in the holding apparatus. As a result, it is not necessary to provide any separate cables for connecting the electrodes with the power supply source because the connection is made through the probe.

In a further development of the invention it can be provided that a drainage tube is arranged on the coagulation and cutting unit. In this way the drainage tube can be introduced into the stripping channel in one step with the stripping.

In this connection it can be provided in a further development of the invention that a drainage tube fastening apparatus is arranged on the face side of the coagulation and cutting unit which is opposite of the opening. When using the vein stripper in accordance with the invention for two vein pieces, the drainage tube situated in the strip channel after the first vein piece can be cut off and a further drainage tube can be fastened again on the coagulation and cutting unit.

According to a further embodiment of the invention it can be provided that a longitudinal slitting apparatus is provided. The vein stripper in accordance with the invention can be guided about the vein by the longitudinal slitting apparatus, with the vein only being removed from the strip channel after the vein stripping. This leads to the advantage that the vein can remain in the stretched position during the stripping.

According to a further embodiment of the invention it can be provided that the longitudinal slitting apparatus comprises a slot electrode for monopolar cutting, a slot electrode for bipolar cutting or a mechanical blade. A secure slitting of the vein in the longitudinal direction can be ensured by each of these three embodiments.

According to a further embodiment of the invention it can be provided that the longitudinal slitting apparatus can be latched together with the probe, especially with a groove or the like. The secure slitting of the vein in the longitudinal direction can be ensured with this embodiment.

It can be provided for in a further embodiment of the invention that the longitudinal slitting apparatus can be fixed in the holding apparatus and comprises a further holding apparatus for receiving and fixing the end of the probe. This arrangement allows a modular configuration of the coagulation and cutting unit and the longitudinal slitting apparatus.

It can be provided for in a further development of the invention that in the region of at least one of the electrodes at least one outlet opening for the outlet of an ionizable gas, especially argon, is provided. Coagulation occurs already before the electrodes by the ionizable gas. The likelihood is thus reduced that encrustations or the like stick to one of the electrodes and are torn open during the movement of the vein stripper. The ionizable gas is supplied via a gas supply line.

In this connection it can be provided according to a further embodiment of the invention that the at least one outlet opening is joined to a gas connection on the second face side of the basic body. The gas supply line and the electric lines can be guided in parallel and optionally in a common tube.

It can be provided for in a further embodiment of the invention that at least one suction opening is provided. The smoke produced during the coagulation can be sucked off by means of the suction opening and can be removed by means of a suction line.

In this connection it can be provided for in a further development of the invention that the at least one suction opening is arranged in the holding apparatus. This configuration ensures that the suction opening can be configured independent of the coagulation and cutting unit, thus ensuring a favorable suction.

It can be provided for in a further embodiment of the invention that the at least one suction opening is joined to a suction connection on the second face side of the basic body. This ensures that the electric lines, the suction line and optionally the gas supply line can be guided in parallel and can optionally be arranged in a common tube.

It can be provided for in a further development of the invention that an annular ultrasonic resonator is arranged in the region of the electrodes. The ultrasonic resonator can be arranged as a cutting unit and the electrodes as a coagulation unit, thus separating the cutting process and the coagulation process and thus allowing them to be set and controlled independent from one another in a very simple manner.

The invention is now explained in closer detail by reference to the enclosed drawings showing especially preferred embodiments, wherein:

Fig. 1a shows a vein with side branches in the connective tissue in a section view;

Fig. 1b shows a sectional view of the exposed vein according to fig. 1a with the probe and its end and handle guided through said vein;

Fig. 1c shows a sectional view of the vein according to fig. 1a with bulging during the stripping process;

Fig. 2a shows a sectional view of a vein in the connective tissue with threaded electrodes;

Fig. 2b shows an illustration of an arrangement of the electrodes relative to the vein;

Fig. 3a shows a side view of the electrodes in two different planes;

Fig. 3b shows a side view of a further arrangement of the electrodes in two different planes;

Fig. 3c shows a side view of the electrodes in the same plane;

Fig. 3d shows a further possible arrangement of the electrodes in a top view;

Fig. 4a shows a coagulation and cutting unit of a vein stripper in accordance with the invention in a side view;

Fig. 4b shows a side view of a vein stripper in accordance with the invention, with the coagulation and cutting unit having a cylindrical basic body;

Fig. 4c shows a side view of a vein stripper in accordance with the invention, with the coagulation and cutting unit having two webs;

Fig. 4d shows a side view of a vein stripper in accordance with the invention, with the coagulation and cutting unit having two webs and a holding apparatus;

Fig. 4e shows a sectional view of the holding apparatus of the coagulation and cutting unit and the probe according to fig. 4d;

Fig. 4f shows a sectional view of a vein stripper in accordance with the invention, with the coagulation and cutting unit comprising a holding apparatus with contacts and with electric leads being guided in the probe, as well as a handle provided with contacts.

Fig. 4g shows a vein stripper in accordance with the invention, with the coagulation and cutting unit comprising a displacement device;

Fig. 4h shows a vein stripper in accordance with the invention, with the coagulation and cutting unit comprising a drive device;

Fig. 4i shows a vein stripper in accordance with the invention, with the coagulation and cutting unit comprising a displacement device and the probe being arranged as an electrode;

Fig. 4j shows a vein stripper in accordance with the invention, with the probe being arranged as an electrode;

Fig. 4k shows a vein stripper in accordance with the invention, with the coagulation and cutting unit comprising a drive device and the probe being arranged as an electrode;

Fig. 5a shows a further coagulation and cutting unit of a vein stripper in accordance with the invention in a partial sectional view;

Fig. 5b shows the side view of a coagulation and cutting unit according to fig. 5a in a sectional view;

Fig. 5c shows the top view of the coagulation and cutting unit according to fig. 5a;

Fig. 5d shows the front view of the coagulation and cutting unit according to fig. 5a;

Fig. 5e shows the sectional side view of a further embodiment of the coagulation and cutting unit with a longitudinal slitting apparatus;

Fig. 5f shows the sectional side view of a further embodiment of the coagulation and cutting unit with a longitudinal slitting apparatus and a further holding apparatus;

Fig. 6a shows an embodiment of the electrodes in accordance with the invention with sectional interruptions;

Fig. 6b shows a further embodiment of the electrodes in accordance with the invention which are arranged in the shape of a spiral;

Fig. 6c shows a further embodiment of the electrodes in accordance with the invention which comprise fan-like fingers;

Fig. 7 shows an oblique view of a further embodiment of a vein stripper in accordance with the invention with outlet openings;

Fig. 8 shows an oblique view of a further embodiment of a vein stripper in accordance with the invention with suction openings;

Fig. 9a shows an oblique view of a further embodiment of a vein stripper in accordance with the invention with outlet openings and suction openings;

Fig. 9b shows a side view of the vein stripper according to fig. 9a;

Fig. 9c shows a top view of the vein stripper according to fig. 9a;

Fig. 9d shows a sectional view along the line AA in fig. 9b;

Fig. 9e shows a sectional view along the line BB in fig. 9c;

Fig. 10 shows an oblique view of another embodiment of a vein stripper in accordance with the invention with an ultrasonic resonator and suction openings;

The present invention relates to techniques of electrosurgery and high-frequency surgery and especially to the coagulation and cutting of biological material or tissue by means of high-frequency current flowing through the tissue. The effects on the biological material at low-frequency currents are the electrolytic effect and the Faraday effect. These two effects are not desirable in electrosurgery because they can lead on the one hand to electrolytic damage and on the other hand to undesirable muscular contractions. For this reason only high-frequency currents with frequencies from approx. 300 kHz are used in electrosurgery. At such frequencies there is no ion displacement in the tissue and muscular contractions no longer occur. A heating of the tissue is achieved through the thermal effect. This can be used for coagulating or cutting the tissue.

During the coagulation in which the tissue is heated to approx. 100°C, the intra- and extra-cellular liquid evaporates. The tissue shrinks as a result, with the cell membranes remaining intact, however. Hemorrhages can thus be stopped with a high degree of success. During the cutting, the tissue is abruptly heated to temperatures which are slightly above 100°C, so that the cell membranes rupture in an explosive fashion. This allows performing precise cuts in the tissue.

Two techniques of electrosurgery are obtained from the shaping of the electrodes for connection with the high-frequency power supply source. In the monopolar technique a large-surface so-called neutral electrode is attached to the patient's body. The size of the electrode ensures that only very low current densities occur in the region, thus leading to only very low or negligible heating. The heating occurs in the region of the active electrode which is provided with an acute configuration and causes considerable current densities in the tissue in this region. In bipolar technique the two electrodes are situated very close to each other and are integrated in one unit, if possible. The current only flows in the closely defined tissue region between the two electrodes.

The vein stripper in accordance with the invention relates to the bipolar technique for coagulating and cutting organic material.

It is often necessary in the case of vascular or venous diseases to remove a certain section 102 of a vein 100 (fig. 1a to 1c).

For this purpose the connective tissue 105 is cut in the upper region 103 which is closer to the heart and is adjacent to the section 102 and in the lower region 104 which is further from the heart, the vein 100 is severed and the two ends of the section 102 of the vein 100 to be removed are exposed.

In a next step the probe 100 of a vein stripper is introduced into the section 102 of vein 100 to be removed.

An end piece 111 is attached to probe 110 in the lower region 103, which end piece prevents the slippage of the vein 100 from the probe 110. The probe 110 is then pulled by means of a handle 112 attached to the upper end of the probe 110 through the connective tissue 105 by entraining the section 102 to be removed and pulled out in the upper region 103 in the pulling direction as indicated by arrow 113.

As is indicated in fig. 1c, a bulging of the vein 100 and an increased formation of folds in the vein wall occur in the region 114 upstream of the end piece 111. The disadvantageous aspect in this method is that the venous side branches 101 which open into the vein 100 are torn off during this process. This causes substantial bleeding and leads to longer hospital stays with subsequent bandaging and the need to rest the treated body part.

The vein stripper in accordance with the invention allows eliminating this disadvantage. This is achieved in such a way that the venous side arms 101 are not torn out of the connective tissue 105 with the vein 100 or are not torn off when pulling out the vein section 102. Instead, they are previously sealed with the presented unit and are severed from vein 100.

This occurs by the aforementioned electrosurgical coagulation or cutting of the venous side branches 101 in the region of their opening into vein 100.

For this purpose the vein stripper in accordance with the invention comprises a coagulation and cutting unit 1 which according to a first embodiment of the vein stripper in accordance with the invention is arranged with at least two electrodes 3, 4, 5 which can be substantially annular in shape. According to another embodiment of the vein stripper in accordance with the invention, the probe 110 is arranged as electrode 3, 4, 5 and the coagulation and cutting unit 1 is provided

with at least one electrode 3, 4, 5, with the vein stripper in accordance with the invention having again at least two electrodes 3, 4, 5.

As a result of the annular arrangement of the electrodes 3, 4, 5 they can be threaded over the vein 100.

This produces a generally annular region which encloses the vein 100 (which is referred to hereinafter as the activity region 6), in which the biological material which encloses the vein 100 can be coagulated or cut. As a result, the venous side branches 101 can be severed from the vein 100 in the region of their opening into vein 100 (fig. 2). It is thus possible on the one hand to sever the venous side branches 101 directly. On the other hand, it is sufficient to produce a coagulation of the venous side branches 101. They are thus sealed off and are cleanly severed at the coagulated place during the subsequent extraction of the section 102 of vein 100 to be removed without producing any relevant bleeding.

The optimal radius of the electrodes 3, 4, 5 is based on the physiological conditions. They are determined by the diameter of the vein 100. On the other hand, the diameter of the electrodes 3, 4, 5 should be kept as small as possible in order to ensure that as little as possible of the ambient connective tissue 105 is injured. In this respect the annular configuration of the electrodes 3, 4, 5 is especially advantageous in vein stripping because the electrodes 3, 4, 5 can be placed especially closely on the vein 100. Other configurations of the electrodes 3, 4, 5 are possible, e.g. as closed loops of rectangular layout, etc. Such electrodes 3, 4, 5 shall apply as substantially annular electrodes 3, 4, 5 within the terms of the invention.

For the purpose of slipping the substantially annular electrodes 3, 4, 5 over the vein 100 they are arranged in such a way that the axes of symmetry 3', 4', 5' of the electrodes 3, 4, 5 extend substantially parallel to the central line 100' of the vein 100 (fig. 2b). The axes of symmetry 3', 4', 5' of the electrodes 3, 4, 5 thus extend substantially parallel with respect to each other. Furthermore, the surfaces which are each opened by the electrodes 3, 4, 5 overlap when they are seen in the axial direction of the axes of symmetry 3', 4', 5'. This overlapping can be complete or only partial, depending on the configuration of the individual electrodes 3, 4, 5.

This obviously also applies to electrodes 3, 4, 5 where no precise axes of symmetry 3', 4', 5' can be defined, which comprise convexities or the like for example.

The arrangement of the substantially annular electrodes 3, 4, 5 can occur in any case in analogy to the arrangement outlined in fig. 2b.

The precise arrangement of the electrodes 3, 4, 5 influences the position and extension of the activity region 6, i.e. the region in which the thermal effects on the tissue are the highest. The activity region 6 is defined by the region in which the current density between the electrodes 3, 4, 5 is the highest.

The form and the structure of the activity region 6 are naturally also dependent on other factors, especially the used current and voltage intensities. Different methods of coagulation such as soft coagulation, forced coagulation and spray coagulation can be set by choosing the initial voltages.

Figs. 3a to 3d show a number of possible advantageous arrangements of the electrodes 3, 4, 5 and the activity regions 6 arising from these arrangements.

The activity regions 6 are each indicated by the broken lines. They are obtained as intersecting lines between the edge surface of the three-dimensional, substantially annular activity region 6 and the plane of projection which is indicated by the plane 6'. The activity region 6 defined by the annular electrodes 3, 4, 5 is in any case a three-dimensional, approximately annular area. Generally, the activity region 6 can be defined as a torus, with a circular or even elliptical or rectangular layout.

Fig. 3a shows an arrangement in which two electrodes 3, 4 are situated in two different planes which are spaced from each other and are substantially parallel. This leads to an activity region 6 for the bipolar coagulation and cutting which is situated between the two electrodes 3, 4, as indicated. With this arrangement a venous side branch 101 is grasped at first by the electrode 4 when moving the two electrodes 3, 4 in the pulling direction 113. Only when there is further pulling will the side branch 101 be bent into the activity region 6 and be coagulated or cut there.

In this case it is appropriate to provide a separate protective sleeve 115 which prevents that the vein 100 per se is severed.

Fig. 3b shows an arrangement with two electrodes 3, 4, 5 of different diameters which are again situated in two spaced planes. The indicated activity region 6 leads to cutting or coagulating the

venous side branch 101 already at an earlier point, i.e. in the case of a slight pull. A protective sleeve 115 can be provided in this case too.

In the arrangement as shown in fig. 3c, the two electrodes 3, 4 are situated in the same plane. An activity region 6 is thus obtained which extends in a non-substantial way over the edge formed by the inner electrode 4 and the outer electrode 3. As a result, the vein 100 per se is not situated in the activity region 6. During the movement in the pulling direction 113 the venous side branches 101 are severed already prior to and especially during the contact with one of the two electrodes 3, 4. This facilitates the forward cutting, because the activity region is situated in the pulling direction 113. A protective sleeve 115 is not necessary here. It can still be ensured by the fixing of the two electrodes 3, 4 that also the inner electrode 4 is not led too close towards vein 100.

Other arrangements of the electrodes 3, 4, 5 are obviously also possible. For example, fig. 3d shows an arrangement in which the activity region 6 is limited to the region in which the two electrodes 3, 4 come closest to each other. This is advantageous for very selective devices for example in which the surgeon can precisely define the place of coagulation by turning the coagulation and cutting unit 1. In other arrangements it is also possible to provide further electrodes 5 in addition to the two electrodes 3, 4, as a result of which the coagulation region can be changed, and in particular enlarged.

The electrodes 3, 4, 5 can be carried in the presented coagulation and cutting unit 1 by a longitudinal basic body 2.

Figs. 4a to 4k show advantageous embodiments of the vein stripper in accordance with the invention. For this purpose the electrodes 3, 4, 5 can be attached to the first face side 2a of the basic body 2 in such a way that the axes of symmetry 3', 4' of the electrodes 3, 4, 5 extend substantially parallel to the longitudinal axis 2' of the basic body 2. As a result of this arrangement it is ensured that when the basic body 2 is moved in the illustrated manner or in the pulling direction 113 along the vein 100 or its central line 100', the electrodes 3, 4, 5 will be aligned in the aforementioned manner (especially figs. 3a to 3d) relative to vein 100.

The basic body 2 as illustrated in fig. 4a is formed in the form of a web having a handle 7. The electrodes 3, 4, 5 are situated in the illustrated embodiment (in analogy to the arrangement shown in fig. 3c) in one and the same plane which extends substantially normal to the

longitudinal axis 2' of the basic body 2. Configurations of the electrodes 3, 4, 5 according to figs. 3a, 3b, 3d or the like are possible.

The electrodes 3, 4, 5 are connected via electric leads 3a, 4a with a power supply source 37, which is shown in fig. 4f for example.

The basic body 2 as illustrated in fig. 4b has a substantially cylindrical shape. Annular electrodes 3, 4, 5 are attached to the first face side 2a of the basic body 2, which electrodes 3, 4, 5 are connected on their part via electric lines 3a, 4a with the power supply source 37. The axes of symmetry 3', 4' of the electrodes 3, 4, 5 also extend substantially parallel to the longitudinal axis 2' of the basic body 2.

The cylindrical shape allows slipping the coagulation and cutting unit 1 over the vein 100. The cylindrical shape of the basic body 2 as shown in fig. 4b allows further that the coagulation and cutting unit 1 can be guided along the vein 100.

At the same time, the basic body 2 is configured on its second face side 2b in such a way that it can be placed on a conventional end piece 111 of a vein stripper.

During the vein stripping, it is thus possible, after slipping the coagulation and cutting unit 1 over the exposed end of the section 102 of vein 100 to be removed in the region 103 (cf. fig. 1b) and after threading the probe 110 into the vein 100 in the known manner, to attach an end piece 111 to the probe 110 and to pull out the vein in the pulling direction 113.

In contrast to known methods, all venous side branches 101 are cut off and coagulated in this process by the coagulation and cutting unit 1 in accordance with the invention before said side branches can tear off with the aforementioned disadvantages.

The fact is especially advantageous in connection with the described embodiment that the coagulation and cutting unit 1 can be used with conventional vein strippers.

Fig. 4c shows a further embodiment in which the basic body 2 is arranged merely by means of two webs 20a, 20b and the face-side rings 21a, 21b. Appropriately, the electric leads 3a, 4a are guided over the webs 20a, 20b. An embodiment with merely one web 20a is obviously also possible.

This form of the basic body 2 ensures that the substantially cylindrical envelope which is created by the basic body 2 is nearly wholly passable in contrast to the embodiment shown in fig. 3b.

This is advantageous in vein stripping in connection with the formation of folds as described above. The withdrawal of the vein 100 from the connective tissue 105 leads in the region 114 upstream of the end piece 111 regularly to a bulging of the vein 100. The embodiment as shown in fig. 4c allows the vein to expand in a sufficient way and over the cylindrical space as encompassed by the basic body 2. In comparison with the embodiment with an enclosed cylinder, this configuration allows providing a much shorter basic body 2 without the bulging of the vein 100 leading to any blockages of the basic body 2.

Conventional vein strippers can be used in this case too.

Intermediate forms are also possible which are situated from a constructional viewpoint between the embodiments shown in fig. 4b and fig. 4c. It is possible for example to merely provide a number of larger recesses in the cylindrical jacket surface of the basic body 2. The coagulation and cutting unit 1 can thus be optimized in this way with respect to length and stiffness. A necessary precondition for the use of the coagulation and cutting unit 1 for the stripping of veins is merely that the bulging of the vein 100 in the region 114 does not extend in the pulling direction 113 before the electrodes 3, 4, 5. In this case it would no longer be possible to securely coagulate and cut the side branches 101.

In the illustration of fig. 4d a holding apparatus 8 is attached to the second face side 2b of the basic body 2. It is used for receiving and fixing the end 110a of a probe 110. As a result, the end piece 111 is integrated in the basic body 2. Handling is thus simplified even further, since it is not necessary to attach any separate end piece 111. After threading the probe 110 through the exposed vein 100, merely the coagulation and cutting unit 1 in accordance with the invention is slipped over the vein 100 and the end 110a of the probe 110 is fixed to the basic body 2 or the holding apparatus 8.

The holding apparatus 8 is preferably similarly arranged for this purpose like known end pieces 111 of conventional vein strippers. In particular, it comprises a slot 8a through which the probe 110 can be inserted. It further comprises a recess 8b for receiving the end 110a of the probe 110 and a web 8c which prevents a slippage through of the end 110a (fig. 4e).

The illustrated embodiment facilitates the operation during the vein stripping; it can be prevented in particular that the basic body 2 is slipped over the vein 100 in the wrong direction.

The embodiment as shown in fig. 4f offers the connection of the electrodes 3, 4, 5 to the power supply source 37 via the probe 110. A separate cable is no longer necessary which either needs to be guided through the vein 100 prior to vein stripping or needs to be entrained during the extraction of the vein 100 through the connective tissue 105.

It can be provided for this purpose that the holding apparatus 8 comprises two contacts 9a, 9b which are electrically conductively connected with the electrodes 3, 4, 5. A special probe 110' is further provided into which two electric lines 3a and 4a are molten. The probe 110' also comprises two contacts 10a, 10b at its end 110a'. After threading the probe 110' through the vein 100, the coagulation and cutting unit 1 is connected with the end 110a' of the probe 110' in a similar manner as shown in the embodiment as shown in fig. 4d. The contact is made in this case however between the contacts 9a, 9b and 10a, 10b, as a result of which the annular electrodes 3, 4, 5 are connected via the probe 110' with the power supply source 37.

Preferably, the probe 110' is provided at both ends 110a' and 110b' with electrodes 10a, 10b and a handle 112' is further provided, which produces an electric connection to the electric leads 3a, 4a in an analogous manner. The handle 112' also comprises electrodes in this case which are connected with the leads leading to the power supply source 37. Vein stripping is especially simple in this last described embodiment. After threading the probe 110' through the vein 100 and after the placement of the coagulation and cutting unit 1 and the handle 112' on both ends 110a' and 110b', which handle is connected with the power supply source 37, the electrodes 3,4, 5 are connected with the power supply source 37 via the handle 112' and the probe 110'. The vein 100 can thus be extracted, with all venous side branches 101 being severed by the electrodes 3, 4, 5 with a high degree of certainty.

The vein stripper in accordance with fig. 4g corresponds to the one shown in fig. 4a, with the probe 110 being introduced into the vein 100 prior to stripping in order to guide the coagulation and cutting unit 1. It can thus be prevented that the vein 100 is severed, so that the vein stripper according to fig. 4g in accordance with the invention also comprises a probe. The guidance of the coagulation and cutting unit 1 is ensured by the guide ring 2d, thus ensuring that the coagulation and cutting unit 1 is guided around the vein.

Fig. 4h shows a vein stripper in accordance with the invention which comprises a drive apparatus 22. It can comprise wheels 22 or the like in particular. Due to the drive apparatus 22, the coagulation and cutting unit 1 can move along the probe 110 and thus sever the vein 100 from the connective tissue 105 and the venous side branches 101. No additional thrusting and/or pulling apparatuses are necessary in this embodiment.

The vein strippers in accordance with the invention and according to figs. 4g and 4h come with the advantage that the vein 100 can be severed in a first step from the connective tissue 105 and the venous side branches 101 and only in a second step will the vein 100 be removed. It is thus no longer necessary that the coagulation and cutting unit 1 comprises regions for receiving the already stripped vein 100, because the same remains unchanged in the body, thus leading to small overall sizes for the vein strippers in accordance with the invention.

In the vein strippers 1 according to the invention and according to figs. 4i to 4k the probe 110" is arranged as an electrode 4. One electrode 3 on the coagulation and cutting unit 1 is thus already sufficient for achieving the cutting and coagulation effect. As a result of the substantially annular arrangement of the electrode 3 on the coagulation and cutting unit 1 it is ensured that the cutting and coagulation can occur in all directions. In order to improve the properties of the coagulation and cutting unit 1, further electrodes 5 can also be provided in the embodiments according to figs. 4i to 4k.

In the embodiments in which the probe 110, 110', 110" can be moved jointly with the coagulation and cutting unit 1 during the stripping, the probe 110, 110', 110" can also be integrally connected with the coagulation and cutting unit 1.

It has been seen that during the operation the vein stripper mostly needs to be pulled back several times by a bit. This can occur by pulling the electric leads 3a, 4a which are connected to the electrodes 3, 4, 5 or a cable enclosing the same when the leads 3a, 4a or the cable are led out at the second face surfaces 2b of the basic body 2. If the cable is fastened in an eccentric way to the basic body 2, a tilting of the coagulation and cutting unit 1 can occur in the channel. The leads 3a, 4a are therefore led away from the second face surfaces 2b of the basic body 2 in a further advantageous embodiment as shown in figs. 5a to 5d.
The coagulation and cutting unit 1 as shown in figs. 5a to 5d comprises several further electrodes 5 in the region of the first face surface 2a of the basic body 2, which further electrodes

substantially overlap with the electrodes 3, 4. In particular, their axes of symmetry 5' extend substantially parallel to the axes of symmetry 3', 4' of the other electrodes 3, 4. The surfaces opened by the electrodes 3, 4, 5 substantially overlap each other when viewing in the axial direction of the axes of symmetry 3', 4', 5.

As is shown in the drawing, the further electrodes 5 can be attached to the outer wall surface 2c of the basic body 2 or also to the inner wall surface.

It is obvious that further electrodes can be provided directly on the first face surface 2a of the basic body 2.

By using several electrodes 3, 4, 5 further activity regions 6 are obtained in which the severed venous side branches 101 can be coagulated in addition. This is especially advantageous for controlling the hemorrhage, because by a repeated coagulation of the already severed open end of a vein branch it is possible to achieve the best possible hemorrhage stoppage. This is often necessary in the case of very thick or also very thin or brittle vein branches in which otherwise occasional hemorrhages might occur again. If the coagulation and cutting unit 1 is provided with additional electrodes 5 on the side surfaces 2c of the basic body 2, the ends of the problematic venous side branches 101 are automatically coagulated several times, thus achieving a complete stoppage of the hemorrhage.

The additional ring electrodes 5 can be placed via separate lines on a specific potential or be connected with the other electrodes 3, 4, 5. The first case offers the possibility of separately setting the difference in potential for all activity regions 6. In the latter case all electrodes 3, 4, 5 can advantageously be supplied via the two lines 3a, 4a. The electrodes 3, 4, 5 of the coagulation and cutting unit 1 as shown in figs. 5a to 5d are all connected via lines 3a, 4a and alternatingly have the polarities of the line 3a and line 4a.

Different differences in potential between the electrodes 3, 4, 5 can be achieved by different distances between the electrodes 3, 4, 5 and/or by the connection of at least one of the electrodes 3, 4, 5 with a resistor or the like. Suitable resistors are in addition to ohmic resistors especially reactive impedances.

The basic body 2 is arranged by means of a single wide web 20a, thus providing sufficient space for the formation of folds of the vein wall.

In the region of the second face surface 2b the basic body 2 comprises a slot 8a provided in the side wall 2c as well as a recess 8b, with the recess 8b being narrowed by a web 8c on its side facing the first face side 2b of the basic body 2. It is used as a holding apparatus 8 for receiving and fixing the end 11a of a probe 110. The illustrated holding apparatus 8 in which the recess 8b comprises an extension 8d on its side facing the first face side 2b of the basic body 2 allows a simple interlocking connection between the basic body 2 and the head-like end 110a of the probe 110. After the insertion of the probe 110 or its end 110a into the region of the slot 8a or the recess 8b, the end 110a of the probe can be fixed by withdrawal in the pulling direction 113 in the extension 8d.

By providing the holding apparatus 8 in the side wall 2c, the leads 3a, 4a can be guided away from the second face surface 2b in a centric manner. The coagulation and cutting unit 1 can thus be pulled back and forth in the vein channel very easily by the leads 3a, 4a and the probe 110.

Especially in the case that the leads 3a, 4a are guided within the probe 110' there is the possibility to fix an additional drainage tube 36 to the second face surface 2b, as is shown in fig. 4f. Said drainage tube or redon tube 36 is usually introduced into the strip channel after the completed extraction of the vein in order to absorb additional tissue liquid. The provision of a coagulation and cutting unit 1 with a fixed redon tube 36 facilitates the introduction of said tube 36, because the redon tube 36 is introduced automatically into the vein channel with the removal of the vein 100. On the other hand, the vein stripper in accordance with the invention can be pulled back and forth in the vein channel by the redon or drainage tube 36 in the case that the leads 3a, 4a are guided within the probe 110' and the basic body can no longer be withdrawn by leads 3a, 4a. The fixing of the drainage tube 36 can occur in different ways by welding or clamping for example. Advantageously, a separate holding apparatus 35 is provided on the basic body 2 by means of which the drainage tube 36 can be fixed. This offers the possibility of performing the operation on one leg, leaving the first redon tube 36 in the first vein channel, fixing a further redon tube 36 with the holding apparatus 35 on the basic body 2 and repeating the operation on the second leg. In other embodiments of the vein stripper in accordance with the invention the leads 3a, 4a can be guided within the redon tube 36.

Fig. 5e shows the side view of a further embodiment of the coagulation and cutting unit 1 with a longitudinal slitting apparatus 25, shown in a sectional view. It comprises the longitudinal slitting apparatus 25 in addition to the embodiment according to figs. 5a to 5d.

The longitudinal slitting apparatus 25 is used for slitting open the vein 100 during the stripping in the longitudinal direction. The slit region of the vein 100 can be guided about the second face side 2b of the coagulation and cutting unit 1. That is why the coagulation and cutting unit 1 can be pulled with the probe 110, 110', 110" through the stripping channel, with the vein 100 remaining in the strip channel and being removed from the strip channel only after a further step. When removing the vein 100, a redon tube can be introduced into the strip channel. In this procedure it is not necessary that the vein stripper in accordance with the invention needs to receive the already stripped region of vein 100, thus allowing smaller overall sizes of the vein stripper to be achieved.

The longitudinal slitting of the vein 100 can occur by means of a mechanical blade or by means of a slitting electrode. Cutting can occur in bipolar or monopolar fashion with the slitting electrode. In the case of a bipolar arrangement of the slitting electrode one of the further electrodes 5 can be used as a counter-electrode. In the case of a monopolar slitting electrode the required output for the cutting and coagulation of the vein 100 and the longitudinal slitting can be set independent of each other.

In the embodiment according to fig. 5e the longitudinal slitting apparatus 25 is connected with the coagulation and cutting unit 1. This allows connecting the slitting electrode with one of the electric leads 3a, 4a. The provision of a separate electric line has proven to be advantageous especially in the case of a monopolar slitting electrode.

The longitudinal slitting of the vein 100 is especially ensured in cases when the longitudinal slitting apparatus 25 is connected both with the coagulation and cutting unit 1 as well as with the probe 110, 110', 110". It can be provided for this purpose that the probe 110, 110', 110" comprises a groove or the like into which the longitudinal slitting apparatus 25 can be latched.

According to another embodiment of the vein stripper in accordance with the invention which is shown in fig. 5f, the longitudinal slitting apparatus 25 can be fixed in the holding apparatus 8 by means of a nose 38a and comprise a further holding apparatus 38 for receiving and fixing the end 110a, 110a', 110b' of the probe 110, 110', 110". In this embodiment the longitudinal slitting apparatus 25 can be introduced between the probe 110, 110', 110" and the holding apparatus 8 of the coagulation and cutting unit 1, thus leading to a modular arrangement. This configuration of

the longitudinal slitting apparatus 25 can be connected integrally with the coagulation and cutting unit 1.

As a result of the arrangement of the electrodes 3, 4, 5, the shown embodiments lead to the consequence that the activity region 6 extends substantially over the entire circumference of the basic body. This property can also be achieved with a plurality of further electrode shapes.

For example, the electrodes 3, 4, 5 can be provided with interruptions in sections, as indicated in fig. 6a. This offers the additional possibility to extend the electrodes 3, 4, 5 in a spiral fashion. Fig. 6b shows the coagulation and cutting unit 1, in which two of the electrodes 3, 4, 5 are extended in a spiral way over a longer region of the basic body 2. A larger activity region 6 is thus obtained.

In the embodiment as shown in fig. 6c the electrodes 3, 4, 5 comprise fan-like fingers 10. This also leads to the possibility to enlarge the activity region 6.

In addition to the stripping of veins 100, the vein stripper in accordance with the invention can also be used for stripping other tube- and/or pipe-like tissue parts or the like. For example, a section of an esophagus could be stripped with the vein stripper in accordance with the invention.

The vein stripper as shown in fig. 7 comprises outlet openings 30 for an ionizable gas, with the use of argon being provided in particular as the ionizable gas. The outlet openings 30 are preferably arranged around the entire circumference of the vein stripper in accordance with the invention. It is possible to provide a plurality of outlet openings 30 or a substantially ring-like outlet opening. It has proven to be advantageous to provide the electrodes 3, 4, 5 with the same polarity with the outlet openings 30, with the electrodes 3, 4, 5 of the other polarity being arranged adjacent to the electrodes 3, 4, 5 with the outlet openings 30.

It may occur in the vein stripper in accordance with the invention when no ionizable gas is used that the coagulated crust of one of the side branches will stick to the electrode 3, 4, 5 and the crust will break open through the movement of the vein stripper and the side branch will begin to hemorrhage again. A complete coagulation of the side branches can be achieved by pulling the vein stripper through several times even without using ionizable gas.

When ionizable gas is used, it flows out of the outlet openings 30 and forms a gas cushion via the electrode 3, 4, 5 with the outlet openings 30. When the gas cushion touches one of the electrodes 3, 4, 5 with another polarity, then the gas ionizes and becomes conductive, with the gas heating up and becoming plasma-like. The tissue contacting the gas cushion is coagulated by the same. There is no direct contact of the tissue with one of the electrodes 3, 4, 5 and therefore the crusts cannot stick to the electrodes 3, 4, 5.

In order to ensure that the coagulation occurs by the heat of the plasma-like ionized gas and not directly on the electrodes 3, 4, 5, the electrodes 3, 4, 5 with the outlet openings 30 can be offset to the rear relative to the adjacent electrodes 3, 4, 5, thus ensuring the formation of the gas cushion of plasma-like gas via the electrodes 3, 4, 5 with the outlet openings 30. Said gas cushion which can be annular in particular produces the coagulation and simultaneously prevents the direct contact of the tissue to be coagulated with the electrodes 3, 4, 5.

If the gas cushion has direct contact with only one of the electrodes 3, 4, 5, the contact with one of the electrodes 3, 4, 5 with another polarity can also occur indirectly via the tissue. The gas between the electrode 3, 4, 5 with the outlet openings 30 and the body tissue will ionize, with the gas heating up again and becoming plasma-like, as a result of which the tissue will coagulate. This case can occur in particular when the gas pressure is very low, the edges of the adjacent electrodes are soiled and/or much bodily liquid impinges upon the surfaces of the electrodes 3, 4, 5.

When the electrodes 3, 4, 5 are offset to the rear only slightly, it can be ensured that in the event of failure of the gas stream the tissue to be coagulated comes into direct contact with the electrodes 3, 4, 5 and there is a coagulation as in a vein stripper in accordance with the invention without support by ionizable gas.

The vein stripper in accordance with the invention and in accordance with fig. 8 comprises two suction openings 40 in the region of the holding apparatus 8 by means of which the smoke produced during coagulation can be removed. Another number of suction openings 40 can also be provided in other embodiments. The arrangement of the suction opening 40 in the region of the holding apparatus 8 comes with the advantage that the configuration of the electrodes 3, 4, 5 can occur independent of the configuration of the suction openings 40. The immediate removal of smoke after its production can be ensured by the suction openings 40.

.The suction openings 40 can also be arranged in the web 20a.

Figs. 9a to 9e show a further embodiment of the vein stripper in accordance with the invention which comprises outlet openings 30 and suction openings 40.

The sectional views as shown in figs. 9d and 9e show that one of the electrodes 3, 4, 5 comprises a tubular region 11. The tubular region comprises a large contact surface, thus improving the conductive connection between the tubular region 11 and the tissue.

Figs. 9d and 9e show further that the outlet openings 30 are connected to a gas connection 32 by means of a gas conduit 31. The gas connection 32 can be arranged on the second face side 2b of the basic body 2. The gas supply line can then be guided parallel to the electric leads 3a, 4a or be connected to the same.

The suction openings 40 are connected with the suction connection 42 by means of suction bores 41, which connection is preferably also arranged on the second face side 2b of the basic body 2. A suction line can then also be guided parallel to the electric lines 3a, 4a or be connected with the same. The electric leads 3a, 4a, the gas supply line and the suction line can be guided in a common tube or the like.

An annular ultrasonic resonator 50 is arranged in the region of the electrodes 3, 4, 5 in the embodiment of the vein stripper in accordance with the invention as shown in fig. 10, which resonator is arranged as a cutting unit. The electrodes 3, 4, 5 form the coagulation unit. The cutting process and the coagulation process are realized differently in this arrangement, thus enabling a separate control of the two processes in a very simple manner.

A longitudinal slitting apparatus 25 can also be provided in the embodiments according to figs. 7 to 10. Furthermore, the ultrasonic resonator 50 and/or the suction opening 40 and/or the outlet openings 30 can be provided in all embodiments.

CLAIMS:

1. A vein stripper with a probe and a coagulation and cutting unit, with the coagulation and cutting unit having at least two electrodes and an opening on the face side through which the probe can be guided, characterized in that at least two of the at least two electrodes (3, 4, 5) are adjacently arranged over the circumference of the coagulation and cutting unit (1) situated in the region of the opening on the face side.

2. A vein stripper with a probe and a coagulation and cutting unit, with the coagulation and cutting unit having at least one electrode and an opening on the face side through which the probe can be guided, characterized in that the probe (110, 110', 110") is arranged as an electrode (3, 4, 5) at least along a section of its length.

3. A vein stripper as claimed in claim 2, characterized in that at least one of the at least one electrode (3, 4, 5) of the coagulation and cutting unit is arranged in the region of the circumference of the coagulation and cutting unit situated in the region of the opening on the face side.

4. A vein stripper as claimed in one of the claims 1 to 3, characterized in that at least one of the electrodes (3, 4, 5) is provided with a ring-like arrangement.

5. A vein stripper as claimed in one of the claims 1 to 4, characterized in that at least one of the electrodes (3, 4, 5) is provided with a spiral arrangement.

6. A vein stripper as claimed in one of the claims 1 to 5, characterized in that at least one of the electrodes (3, 4, 5) has interruptions.

7. A vein stripper as claimed in one of the claims 1 to 6, characterized in that at least one of the electrodes (3, 4, 5) comprises fan-like fingers (10).

8. A vein stripper as claimed in one of the claims 1 to 7, characterized in that one end (110a, 110a', 110b') of the probe (110, 110', 110") can be connected with the coagulation and cutting unit (1) by means of a holding apparatus (8) attached to the coagulation and

cutting unit (1) or by means of an end piece (111) or the like.

9. A vein stripper as claimed in claim 8, characterized in that the probe (110, 110', 110") is fastened to the coagulation and cutting unit (1).

10. A vein stripper as claimed in one of the claims 1 to 9, characterized in that the coagulation and cutting unit (1) comprises a displacement device, especially a shaft (2) or the like, and that the probe is arranged as a guide probe (110, 110', 110").

11. A vein stripper as claimed in one of the claims 1 to 10, characterized in that the coagulation and cutting unit (1) comprises a drive apparatus (22), with the same being automatically movable along the probe (110, 110', 110").

12. A vein stripper as claimed in one of the claims 1 to 11, characterized in that the coagulation and cutting unit (1) comprises at least one further electrode (5), especially at least three further electrodes (5).

13. A vein stripper as claimed in claim 12, characterized in that at least one further electrode (5) is arranged on the wall surface (2c) of the coagulation and cutting unit (1).

14. A vein stripper as claimed in claim 12 or 13, characterized in that the electrodes (3, 4, 5) are arranged with different spaces from the respectively adjacent electrodes (3, 4, 5).

15. A vein stripper as claimed in one of the preceding claims, characterized in that at least one of the electrodes (3, 4, 5) is connected to a resistor or the like.

16. A vein stripper as claimed in one of the claims 1 to 15, characterized in that the coagulation and cutting unit (1) comprises a basic body (2) aligned along a longitudinal axis (2') and the at least two of the at least two electrodes (3, 4, 5) are attached to a first face side (2a) of the basic body (2).

17. A vein stripper as claimed in one of the claims 1 to 16, characterized in that the coagulation and cutting unit (1) comprises two substantially annularly configured electrodes (3, 4), with the axes of symmetry (3', 4') of the annular electrodes (3, 4) extend substantially parallel with respect to each other and with the surfaces which are

each opened by the annular electrodes (3, 4) substantially overlapping each other when viewed in the axial direction of the axes of symmetry (3', 4').

18. A vein stripper as claimed in claim 17, characterized in that the at least one further electrode (5) is arranged in an annular way, whose axis of symmetry (3', 4') extends substantially parallel with respect to axes of symmetry (3', 4') of the other two annular electrodes (3, 4), with the surface which is opened by the at least one further annular electrode (5) and the surfaces which are opened by the two other annular electrodes (3, 4) substantially overlapping each other when viewed in the axial direction of the axes of symmetry (3', 4', 5').

19. A vein stripper as claimed in claim 17 or 18, characterized in that the axes of symmetry (3', 4') of the annular electrodes (3, 4) extend substantially parallel to the longitudinal axis (2') of the basic body (2).

20. A vein stripper as claimed in claim 17, 18 or 19, characterized in that the annular electrodes (3, 4) are situated in one and the same plane extending substantially normal to the longitudinal axis (2') of the basic body (2).

21. A vein stripper as claimed in one of the claims 16 to 20, characterized in that the basic body (2) encloses a substantially cylindrical space.

22. A vein stripper as claimed in one of the claims 16 to 21, characterized in that the basic body (2) is provided with at least one web (20a) aligned in the longitudinal axis (2') of the basic body (2).

23. A vein stripper as claimed in one of the claims 16 to 22, characterized in that the basic body (2) comprises in the region of its second face side (2b) the holding apparatus (8) for receiving and fixing the end (110, 110a', 110b') of the probe (110, 110', 110").

24. A vein stripper as claimed in claim 23, characterized in that the basic body (2) comprises on its second face side (2b) the holding apparatus (8) for receiving and fixing the end (110, 110a', 110b') of the probe (110, 110', 110").

25. A vein stripper as claimed in one of the claims 8 to 24, characterized in that the holding apparatus (8) allows an interlocking connection between the end (110, 110a', 110b') of the probe (110, 110', 110") and the basic body (2).

26. A vein stripper as claimed in one of the claims 16 to 25, characterized in that the holding apparatus (8) comprises a slot (8a) incorporated in the side wall (2c) of the basic body (2) for inserting the probe (110, 110', 110") as well as a recess (8b) for receiving the end (110a, 110a', 110b') of the probe (110, 110', 110"), with the recess (8b) being narrowed by a web (8c) on its side facing the first face side (2a) of the basic body (2).

27. A vein stripper as claimed in claim 26, characterized in that the recess (8b) comprises an extension (8d) on its side facing the first face side (2a) of the basic body (2).

28. A vein stripper as claimed in one of the claims 16 to 27, characterized in that electric leads (3a, 4a) for connecting the electrodes (3, 4, 5) with a power supply source (37) are guided in a centric fashion out of the basic body on the second face side (2b) of the basic body (2).

29. A vein stripper as claimed in one of the claims 8 to 28, characterized in that the holding apparatus (8) comprises two contacts (9a, 9b) which are electrically conductively connected with the electrodes (3, 4, 5) and that the electric lines (3a, 4a) are guided within the probe (110, 110', 110") for connecting the electrodes (3, 4, 5) with an electric power source (37) and are connected with further contacts (10a, 10b) situated at the end (110a, 110a', 110b') of the probe (110, 110', 110"), with the electric conductive connection between the annular electrodes (3, 4, 5) and the power supply source (37) occurring by means of the contacts (9a, 9b) and the further contacts (10a, 10b) when receiving and fixing the probe (110, 110', 110") in the holding apparatus (8).

30. A vein stripper as claimed in one of the preceding claims, characterized in that a drainage tube is arranged on the coagulation and cutting unit (1).

31. A vein stripper as claimed in claim 30, characterized in that a drainage tube fastening apparatus is arranged on the face side (2b) of the coagulation and cutting unit (1) which is opposite of the opening.

32. A vein stripper as claimed in one of the claims 1 to 31, characterized in that a longitudinal slitting apparatus (25) is provided.

33. A vein stripper as claimed in claim 22, characterized in that the longitudinal slitting apparatus (25) comprises a slitting electrode for monopolar cutting, a slitting electrode for bipolar cutting or a mechanical blade.

34. A vein stripper as claimed in claim 32 or 33, characterized in that the longitudinal slitting apparatus (25) is connected with the coagulation and cutting unit (1) and that optionally the slitting electrode is connected with the electric leads (3a, 4a) or a further electric lead.

35. A vein stripper as claimed in claim 34, characterized in that the longitudinal slitting apparatus (25) can be latched together with a probe (110, 110', 110"), in particular a groove or the like of the probe (110, 110', 110").

36. A vein stripper as claimed in claim 32 or 33, characterized in that the longitudinal slitting apparatus (25) can be fixed in the holding apparatus (8) and comprises a further holding apparatus (38) for receiving and fixing the end (110a, 110a', 110b') of the probe (110, 110', 110").

37. A vein stripper as claimed in one of the claims 1 to 36, characterized in that at least one outlet opening (30) for the outlet of an ionizable gas, in particular argon, is provided in the region of at least one of the electrodes (3, 4, 5).

38. A vein stripper as claimed in claim 37, characterized in that the at least one outlet opening (30) is connected with a gas connection (32) on the second face side (2b) of the basic body (2).

39. A vein stripper as claimed in one of the claims 1 to 38, characterized in that at least one suction opening (40) is provided.

40. A vein stripper as claimed in claim 39, characterized in that the at least one suction opening (40) is arranged in the holding apparatus (8).

41. A vein stripper as claimed in claim 39 or 40, characterized in that the at least one suction opening (40) is connected with the suction connection (42) on the second face side (2b) of the basic body (2).

42. A vein stripper as claimed in one of the claims 1 to 41, characterized in that a ring-like ultrasonic resonator (50) is arranged in the region of the electrodes (3, 4, 5).