PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 3: A61N 1/42	A1	(11) International Publication Number: WO 82/01135
		(43) International Publication Date: 15 April 1982 (15.04.82)

(21) International Application Number: PCT/SE80/00241

(22) International Filing Date: 3 October 1980 (03.10.80)

(71) Applicant; and
(72) Inventor: ROSENGART, Henning [SE/SE]; Ruilharvsgatan 2E, S-431 40 Mölndal (SE).

(74) Agents: ROTH, M. et al.; Göteborgs Patentbyrå AB, Box 5005, S-402 21 Göteborg (SE).

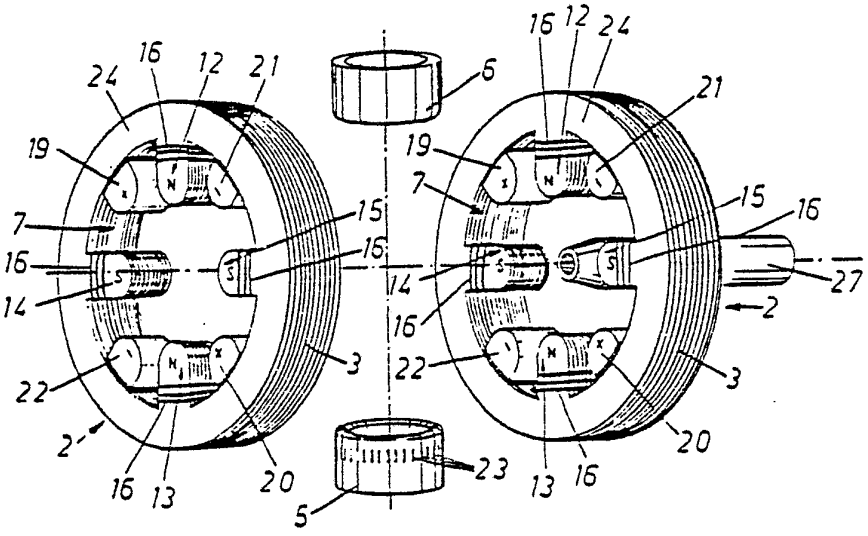
(81) Designated States: AT, AT (European patent), AU, BR, CH, CH (European patent), DE, DE (European patent), DK, FI, FR (European patent), GB, GB (European patent), JP, NL, NL (European patent), NO, SU, US.

Published
With international search report
In English translation (filed in Swedish)

(54) Title: ELECTROMEDICAL TREATMENT APPARATUS

(57) Abstract

Electromedical treatment apparatus for treatment of biological tissue. The treatment apparatus is foremost intended to accelerate the healing processes in injured or otherwise diseased body parts by hyperaemia, i.e. localized oversupply of blood and increased blood flow. This is achieved partly by that a magnetic field is applied transversely to the general longitudinal direction of the blood vessels in the body part that is to be treated, partly by an electric field applied transversely both to the general longitudinal direction of the blood vessels and to the flow of the magnetic field. In this way, the electrically charged particles included in the blood, the ions, are affected to carry out helixshaped, rotating movements, whereby the blood flow in the tissue increases. The electromedical treatment apparatus mostly consists of an electric field generator containing field electrodes (5, 6) and at least one lens system (2). The solenoids (3, 16) and the electrode elements (5, 6, 19-22) included in the treatment apparatus are supplied a regularly varying voltage which causes pulsating magnetic and electric fields. A magnetic and/or electric field suitable to each treatment situation and injury is generated in that the supply voltage can be adjusted by choice.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	KP	Democratic People's Republic of Korea
AU	Australia	LI	Liechtenstein
BR	Brazil	LU	Luxembourg
CF	Central African Republic	MC	Monaco
CG	Congo	MG	Madagascar
CH	Switzerland	MW	Malawi
CM	Cameroon	NL	Netherlands
DE	Germany, Federal Republic of	NO	Norway
DK	Denmark	RO	Romania
FI	Finland	SE	Sweden
FR	France	SN	Senegal
GA	Gabon	SU	Soviet Union
GB	United Kingdom	TD	Chad
HU	Hungary	TG	Togo
JP	Japan	US	United States of America

Electromedical treatment apparatus

The present invention refers to an electromedical treatment apparatus for treatment of biological tissue, preferably for speeding up the healing process in a part of a body as for example a leg or an arm, and of the kind that at least generates partly a magnetic and partly an electric field of force in a treatment zone, comprising an electric field generator adapted to generate an electric field of force directed essentially towards and at right angles to the blood-vessels of the object of treatment and within the treatment zone.

Background of the invention

A large part of the economic and personell resources todays medical service consume is used for treatment of patients with long lasting illness periods. As an example we can mention the treatment of fractures such as a fractured thigh bone, treatment of reumatism and patients with neurologic movement handicaps and long term therapy patients with slow-heating infected wounds etc. For this reason it is not least of economical value, but even for reducing personal suffering, of great importance to point out and use medical methods and equipment which speed up and support the healing processes.

It has been known for a long time that magnetic and electric fields affect biological tissue. Injuries and diseases have been treated with varying result. Magnetic and electrical fields have been applied against the diseased or wounded body part and then one has hoped for the best. An example of this kind of treatment apparatus is described in the American patent No. 3,915,151. It is primarilly adapted for treatment of broken bones and uses preferably flat coils for generation of a magnetic field whose flow is arranged longitudinally with the treatment object,i.e. parallel to a leg or an arm. Besides a magnetic field is in one embodiment an electrostatic field introduced. This is achieved by two

diametrically opposite electrodes, to which a voltage with relatively high potential difference is supplied. An electric field is hereby achieved which flow through the treatment object eccentially at a right angles to the flow of the magnetic field. By supplying a voltage, whose amlitude fluctuate regularly, the electrically charged particles in the treatment area are brought into an oscillating movement. Due to the magnetic and electric fields flow directions, the charged particles oscillate only at right angles to the skeletal structure and thus perpendicular to the main blood flow of the treatment object. The venous bloodflow, i.e. the blood flow toward the heart, is thereby not affected by this treatment apparatus.

Characteristics and objects of the invention

The object of the present invention is to accelarate the healing process in biological tissue by bringing the electrically charged particles in the actual tissue into a helixformed movement which support the metabolism in the tissue and increase the volume of the blood flow. Further objects are that with the invention treat reumatics and patients with circulatory disturbances as well as to prevent thrombusis developing. Also patients with neurological disturbances and diseases such as neurologically caused movement disturbances should further be treated with success. The invention should also be easy and safe to use and in the future reduce the resource needs within the medical service. This is achieved by a magnetic field generator, incorporating at least one solenoid, arranged to generate a magnetic field with a regularly varying field strength in the treatment zone, which field in the treatment zone is directed substantially tranvsversely partly to the electric field and partly to the main blood vessels of the treatment object and that at least one magnetic lens system and one electric lens system is arranged to cooperate and to homogenize as well as concentrate the magnetic field generated by the solenoid in the treatment zone.

Description of the drawings

The invention will here below be described in an embodiment with reference to the attached drawings.

Fig. 1 shows a sideview in perspective of the electromedical treatm apparatus,
fig. 2 shows a vertical section through the invention,
fig. 3 shows an electrical circuit diagram of the invention,
fig. 4 shows the design of a lenssystem,
fig. 5 shows some examples of particle paths in force fields.

Description of the embodiment

In fig. 1 is shown schematically a sideview of the electromedical treatment apparatus 1 according to the invention. The parts includes are mainly two ringshaped lenssystems 2 coaxially arranged horizontally and at some distance from one another. Each lenssystem 2 is at its circumference equipped with a solenoid 3. These solenoids 3 are electrically connected in series and form together a magnetic field generator 4. Between the lenssystem 2 is a lower and an upper field electrode 5, 6 arranged in a way, that an imaginary central axis in each field electrode 5, 6 coincides with each other. The hypothetical central axis of the field electrodes 5, 6 interseets the hypothetical central axis of the lenssystem 2 perpendicular and at essentially the same distance from each lenssystem 2. The lenssystems 2 and the field electrodes 5, 6 are arranged in a way that each of them can manually be adjusted in horizontal resp. vertical line between each other. This arrangement results in that the center of the treatment apparatus 1 i.e. the treatment zone between the lenssystem 2 and the field electrodes 5, 6 can be adjusted to a larger or a smaller size and in this way be adapted to the size of the object to be treated, for example it can be made smaller if an object such as an ankle is to be treated, or larger when a femur is to be treated.

Each of the lenssystems 2 included in the treatment apparatus 1 consists essentially of a ringshaped core 7,

built up of transformer core sheets 8. These sheet metal lamina, of for example silicon albyed iron, are in a conventional way isolated from each other and tightly packed in the longitudinal axial direction of the lenssystem 2. In the defined inner space of each ringshaped core 7 is arranged one magnetic and one electric lens 9 resp. 10. The elements 12-15, 19-22 included in each lens 9, 10 can either be attached at the inner surface of the ringformed core 7 or in another way freely be arranged inside the ringformed core 7.

At the circumference of the lenssystem 2, i.e. at the surface directed off center of the ringformed core 7, is arranged a solenoid 3. The solenoid 3 consists of an isolated copper coiling whose wire diameter is adjusted to the maximum current which is to be introduced to the solenoid 3. To keep the coils of the solenoids 3 in place two side pieces 24 of dielectric material are arranged at each side surfaces of the lenssystem 2. In the intention to maintain a strong enough magnetic field of force a number of wireing turns may be necessary. Both of the solenoids 3 included in the treatment apparatus are electrically connected in series whereby a homogenous magnetic field is maintained in the treatment zone.

The magnetic lens 9 arranged in the lenssystem 2 is of the so called square pole type and contains four lens elements 12-15 each of which forms a magnetic pole. The preferably cylindrical shaped lenselements 12-15, which for example can be punched in the same material as the ringshaped core 7, are located symmetrically along the inner surface of the core 7 in such a way that the two lens elements 12, 13 which forms the north poles and the two lens elements 14, 15 which forms the south poles are arranged in pairs diametrically opposite each other. The lens elements 12-15 are, at inward the center of the magnetic lense 9 turned part, hyperbolically formed. Hereby a more homogenous magnetic field of force in the center of the magnetlense 9 is maintained. Around each lense element 12-15 are arranged solenoids 16 in

such a manner that one in each solenoid 16 hypothetical central axis coincide within one and the same point in the center of the lenssystem 2.

The solenoids 16 are connected electrically in a way that two diametrically arranged lenselements 14, 15 work as south poles and the other two as north poles. The solenoids 16 included in the magnetic lens 9 can be electrically connected in series and connected to a voltage unit 17. The main purpose of the magnetic lense 9 is to converge electrically charged particles which are in or pass through the magnetic lens 9. Its function should, however, be seen in relation to other included parts of the electromedical treatment apparatus 1.

Also the electric lens 10 included in the lenssystem 2 is of the so called square pole type, i.e. also this has four lenselements here called leans electrodes 19-22. Each lens electrode 19-22 consists of an electrically conducting material, for example copper or the like, and is essentially rod-shaped. The surface turned toward the center of the lens system 2 is preferably hyperbolically shaped in the purpose to maintain the desired field distribution. The lens electrodes 19-22 are symmetrically arranged inside the ring-shaped core 7 of the lenssystems 2, in such a way that the two lens electrodes 19-20 with positive potential and the two lens electrodes 21-22 with negative potential are arranged in pairs diametrically opposite each others. The lens electrodes 19-22 that are electrically insulated from the ring shaped core 7 with insulators 25 are advisable arranged displaced with an angle of 45° relative to the lenselements 12-15 contained in the magnetic lens 9. The lens electrodes 21-22 that have a negative potential are connected and wired to the negative terminal of the voltage unit 17 and the lenselectrodes 19-20 that have positive potential are connected and wired to the positive terminal of the voltage unit 17. The above described electrical lens 10 dierges the electrically charged particles that pass through its central section.

In the middle of the electromedical treatment apparatus 1, i.e. in its treatment zone, is arranged an electric field of force directed against the magnetic flow. This electrical field of force is generated by an upper and a lower field electrode 6, 5, constituting an electrical field generator 26. The upper field electrode 6 consists of a ringshaped pipe of metal whereon the pipe end turned toward the treatment zone is hyperbolically shaped. This upper field electrode 6 is supplied with a positive potential, which results in that the flow of the electrical field is directed downwards and cooperates with the gravitational force intended for the electrically charged ions.

The lower field electrode 5 consists in the same way as the upper field electrode 6 of metal and is formed as a ring-shaped pipe. A grid 23 is arranged at its inner edge. This grid 23 consists of bands or rods of tungsten or molybden and are arranged in the upper part of the lower field electrod 5. The upper edges of the grid 23 are formed with a sharp eggshaped, profile and directed toward the upper field electrode 6. Hereby an electric field is obtained, whose flow is focussed toward the inner part of the lower field electrode 5. This results in that a more concentrated field distribution is obtained in the treatment zone.

As is shown in fig. 3 and 4 are all solenoids 16 arranged at the lens elements 12-15, connected in series and all lens electrodes 19, 20 with positive potential are connected together and wired to the positive terminal of the voltage unit 7. The lens electrodes 21, 22 are in a related way connected to the negative terminal of the voltage unit 17. One and the same voltage unit 17 supply the entire treatment apparatus 1 with its electrical energy. The voltage consists of a half-wave rectified sinus voltage that never passes zero. The frequency with which the voltage varies has been chosen to 66 Hz, but can naturally vary between for example 20-100 Hz. Also the amplitude of the voltage is freely adjustable. The voltage to the solenoids 3, 16 can either be

positive or negative. It is of course thinkable to separate the purely electrical system from the electromagnetical system and thereby supply the solenoids 3, 16 on the one hand and the lens electrodes 19-22 and field electrodes 5, 6 on the outer hand with voltages whose parameter values differ. It is, however, desirable that the voltage to both systems can vary in accordance to amplitude, frequency and polarity.

In another embodiment can for example a pipe or a nozzle 27 for gas or liquid additive can be arranged at one or both ends of the electromadical apparatu 1, i.e. coaxially with an imaginary central axis through the lens system 2. Through this pipe or nozzle 27, electrically charged particles possibly mixed with one or more medically active substances, can be supplied to the treatment zone via the one or both lens systems 2.

Short theoretical ideal magnetohydrodynamical background

The function of the invention is based upon generally accepted physical and chemical laws as well as upon new discoveries within the medical research. The theoretical basis is among others collected from the magnetohydrodynamics and the plasmaphysics by Jackson "Classical Electrodynamics" and the vacuumgaselectronphysics and by Lyman Spitzen, Princeton University. What connects to the medical discoveries reference is made to for example Medicine and Biology, No. 3, 1969.

Plasmawaves are high frequency oscillations and must be separated from oscillations of lower frequency, so called magnetohydrodynamic waves, which result in transportation of the media without charge separation. At low requency the media is contemplated as one (electrons and ions are assumed as one media) conducting media and the movement current in Ampere's law are neglected. This is "magnetohydrodynamics" and is valid among other things for liquids. By means of the laws of Ohm and Maxwell the magnetic diffusion time, the magnetic pressure, the flowspeed of the liquids and the

movement speed of the charged particles in the liquid can be calculated. How the electromedical treatment apparatus is to be constructed to affect the flow of the blood and the ions in the cells and muscle fibres will be shown at th end.

In a perfectly conducting liquid, e.g. blood, the changes caused in the magnetic field are directly proportional to the movement of the liquid. For the magnetic flow, that passes through a zone of a sealed circuit (e.g. the bloodflow) the movement of the liquid must be constant. If not, according to Faraday's law of induction an electromotive force in the circuit will occur. But a perfectly conductive flow cannot maintain an electric field and because of this the electromotive force will disappear. This results in that the force, which influenced a charged particle in the zone, has ceased and the velocity of the flow in the zone decreases.

If an electric field is applied to the zone, the total force, that affects the charged particle, will be the sum of the force from the applied field and the Lorentz-force $E^x = E + V \times B$. This force vanishes in a perfect conductor and secures that the magnetic flow remains, i.e. "freezes" in the media.

If the field is not homogeneous in the liquid, but changes over a distance "L", the speed at which the field changes, will be proportional to the speed at which the liquid flows i.e.

$\frac{dB}{dt} \sim vB/L$, or if the field has finite resistivity,

$$\eta \Rightarrow \frac{dB}{dt} \sim \eta\, B/L^2$$

Through solution of this equation, the time can be achieved, which is necessary for the field to drive into the

conducting liquid.

$$t \sim L^2 / \eta$$

Where:
E = electrical intensity of field
V = velocity
B = magnetic intensity of field
x
E = force
η = resistivity

Fig. 5a-c shows paths of charged particles in different fields of force according to accepted laws of nature. E, B and W represent electric field, magnetic field resp. mechanical force. In fig. 5a is shown the movement path of a positive particle in a magnetic field directed "away from the viewer". In fig. 5b is shown the movement path of a negative particle in a magnetic field directed "toward the viewer". Finally is in fig. 5c shown how a negatively charged particle perform a helix-shaped movement in two, against each other, perpendicular fields. A magnetic field B directed toward the viewer and an electric field E directed upward (as shown by arrows). It is among other things this movement that is achieved by the present invention.

Function of the invention

Our blood, as is known, contains a number of different elements and substances. The most common ions, the so called anions and cathions are potassium-, sodium-, chloride-, calcium-, iron-, sulphate and phosphate ions. When an ion is a particle whose resultant charge is either positive or negative, it is influenced by electric, electrostatic and magnetic fields. If the ion passes or is in one of these fields movement energy is transmitted to it, whereby it starts to move. The mobility or movement velocity of the ion depends among other factors on the viscosity of the

surrounding substance. Also the ability of the ion to bring with it other particles in the substance affect the mobility. Convection movements in the substance and density gradients can to some extent also affect the movement of the ion.

In a number of injuries and diseases it has been advantageous to use a treatment that causes hyperaemia, i.e. localized oversupply of blood and increased throughflow of blood. This has so far been achieved by means of physiotherapy, whereby mainly different forms of heating apparatus have been used, such as heating lamps and hing frequency techniques. The increased blood flow which has been achieved in this way, assists the transportation of e.g. nutritional elements, proteins and oxygen to the cells and undissolved products from them. This metabolism supports the healing processes. A substantial drawback during treatment with heating lamps is that the infrared radiation can only pass through a few millimeters in the skin and thereby only affects the body surface.

The electromedical treatment apparatus according to the invention is effective also on deeper lying tissue. This is due to that all positive or negative charged particles in an electric or magnetic field are affected and that these particles are spread in all parts of the tissue.

The electromagnetic radiation is intended to affect the bioelectrical potentials on the cellular plane of the organism - cell membranes and mitochondria etc. - but naturally also will affect water distribution in the organism depending on the special structure of the watermolecules. Other organic molecules with dipole characteristics will probably also be affected.

When voltage is supplied the treatment apparatus generates on the one hand a magnetic field with a substantially horizontal flow and on the other hand an electric field whose flow is directed transversally to the magnetic flow.

Due to the electric and magnetic lens systems, the magnetic and electric flow will be concentrated in the center of the treatment apparatus, i.e. in its treatment zone. If charged particles, for example the ions in the blood plasma, are supplied in this area they are influenced to move in a determined pattern. The movement velocity of the ions is influenced by the strength of the magnetic and electric fields and bring with them uncharged particles in their immediate surroundings. The strength of the fields is by choice djustable and can, regarding the strength of the magnetic field, reach for example 2000 Gauss. Both the strength of the magnetic and electric fields vary at the rate of the pulse frequency of the introduced voltage. A pulsefrequency of 66 Hz has been shown to coincide with the biological activity of the body but can, when needed, be adjusted between 20-80 Hz.

By locating the relevant bodypart, for example an arm or a leg, in the treatment apparatus substantially perpendicular to both the magnetic and electric field and through that both lens systems transmits force components to the ions in the bodypart, the ions are applied into a helixformed movement in the direction of the length of the blood vessels (see fig. 5c). When substantially all charge particles receive an equal movement component and each charged particle to a greater or lesser extent brings with it other, uncharged closely lying particles, an uncreased flow through of blood in the vessels is obtained.

The energy transferred to the ion results in a movement which in short can be described in the following way. A positively charged particle that approaches a magnetic field will curve and rotate counter-clockwise seen in the view of the direction of the flow of the magnetic field. If an electric field is applied perpendicular to the magnetic field and the flow of the electric field is directed upward, the positively charged particle will accelerate on the right side of the magnetic field and slow down on the left. If the particle is negatively charged, the relationship will be the

opposite. The final movement path will be helixshaped, i.e. screwformed, with a constant pitch. This is visualized in fig. 5c.

With that the charged particles start to move and thereby bring with them close lying particles, an advantageous increase of the blood throughflow is obtained in the treated tissue. Also an analgesic, i.e. pain reducing, effect can be shown. Pain depends on lack of oxygen in the tissues or of an collection of pain substances. An increase of the blood flow gives increased oxygen supply and supports the removal of the pain substances.

Since also the central nervous system works by means of electrically charged particles which among others pass in and out of the nerve cells and in this way transmit information, to for example the muscles, also neurologically caused wounds or diseases can be treated with the electro-medical treatment apparatus according to the invention. An example of this is that certain types of handicaps, such as neurologically caused movement restrictions, can be treated.

A large part of diceases of older persons stem from the circulatory system and its peripheries. Within this dicease area it is difficult to produce adequate medicine because the sideeffects on other organs increase, especially so on older persons. There exists therefore a clear need for an alternative technique that limits its affect on the cellular plane to the diseased organ.

Many persons suffer from so called de liming of the skeleton when they get older. This greatly increases the risks of fractures, where femur breakage is a common injury. The treatment period for this type of injury can be very long and consume a large part of medical service resources. With the electromedical treatment apparatus according to the invention a quicker healing is achieved when treating these femur breaks. It has been shown that calcium ions can be forced to wander back into the skeleton whereby a delimed

skeleton can be regenerated. In this way bone fractures also can be prevented.

The healing of leg wounds, burns and slow-healing, infected sores can also be speeded up with the treatment apparatus according to the invention. This can for example be carried out by that a medically active substance such as active iodine, or antibiotics in mist form, is supplied to the treatment zone by acceleration from one or both of the lens systems 2 via for example a nozzle 27. This is also the case with hyperbar oxygentherapy. A bombardment of the wound with the medically active substances can thereby be achieved. Due to this method of treatment the otherwise developing resistant infection causes can be avoided.

C L A I M S

1. Electromedical treatment apparatus (1) for treatment of biological tissue, preferably for accelerating the healing processes in a body part such as for example a leg or an arm, and of the kind that at least generates on one hand a magnetic and on the other hand an electric field in a treatment zone, incorporating an electric field generator (26) arranged to generate an electric field directed substantially perpendicular to the main blood vessels of the treatment object in the treatment zone,
c h a r a c t e r i z e d t h e r e b y, that a magnetic field generator (4), incorporating at least one solenoid (3) is arranged to generate a magnetic field with regularly varying field strength in the treatment zone, which field in the treatment zone is directed substantially transversely partly to the electric field and partly to the main blood vessels of the treatment object and that at least one magnetic lens system (13-16) and one electric lens system (19-22) is arranged to cooperate and homogenize as well as concentrate the magnetic field generated by the solenoid (3) in the treatment zone.

2. Electromedical treatment apparatus according to claim 1,
c h a r a c t e r i z e d t h e r e b y, that the upper field electrode (6) of the electric field generator (26) is connected to the positive terminal of the voltage unit (17) and that the lower field electrode (5) of the electric field generator (26) is connected to the negative terminal of the voltage unit (17) whereby the electrical field generator (26) is arranged to generate an electric field which cooperates with the earth gravity concerning electrically charged particles.

3. Electromedical treatment apparatus according to anyone of claims 1 or 2,
c h a r a c t e r i z e d t h e r e b y, that directly adjacent to the treatment zone there is arranged at least

one lens system (2), mainly consisting of an electric lens (10) arranged to diverge charged particles in the treatment zone and a magnetic lens (9), arranged to converge charged particles in the treatment zone.

4. Electromedical treatment apparatus according to anyone of claims 1-3,
c h a r a c t e r i z e d t h e r e b y, that directly adjacent to the treatment zone there is arranged at least one lens system (2), mainly consisting of an electric lens (10) and a magnetic lens (9), and which lens system (2) is arranged to converge medically active substances such as for example hyperbaroxygen or active iodine supplied to the treatment zone.

5. Electromedical treatment apparatus according to anyone of claims 1-4,
c h a r a c t e r i z e d t h e r e b y, that at least one nozzle/jet (27) is arranged substantially coaxially with the lens system (2) at one or both of the lens systems (2) and arranged to supply the treatment zone with charged particles and/or medically active substance.

6. Electromedical treatment apparatus according to anyone of claims 1-5,
c h a r a c t e r i z e d t h e r e b y, that the field electrodes (5, 6) are mainly tube-shaped and have ends falling the treatment zone which are hyperbolically formed.

7. Electromedical treatment apparatus according to anyone of claims 1-6,.
c h a r a c t e r i z e d t h e r e b y, that the solenoids (3, 16) forming part of the lens system (2) are electrically connected in series and arranged for power supply from a voltage unit (17).

8. Electromedical treatment apparatus according to anyone of claims 1-7,
c h a r a c t e r i z e d t h e r e b y, that the field

electrodes (5, 6) are tube-formed with the ends facing each other being rounded (hyperbolic).

9. Electromedical treatment apparatus according to anyone of claims 1-8,
c h a r a c t e r i z e d t h e r e b y, that in one of the field electrodes (5, 6) there is arranged a grid (23) for concentrating the electric field.

10. Electromedical treatment apparatus according to claim 9,
c h a r a c t e r i z e d t h e r e b y, that the grid (23) is provided with of rods or consist of a band of molybdenum or tungsten.

FIG. 1

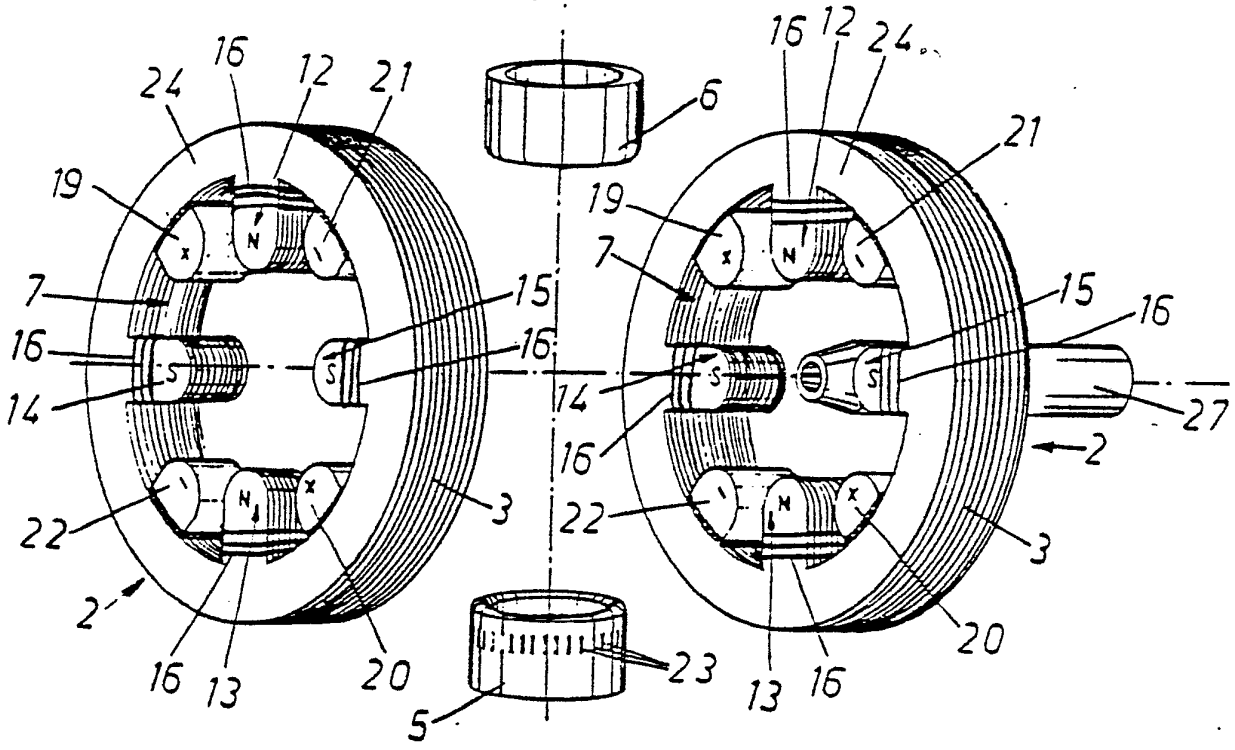


FIG. 2

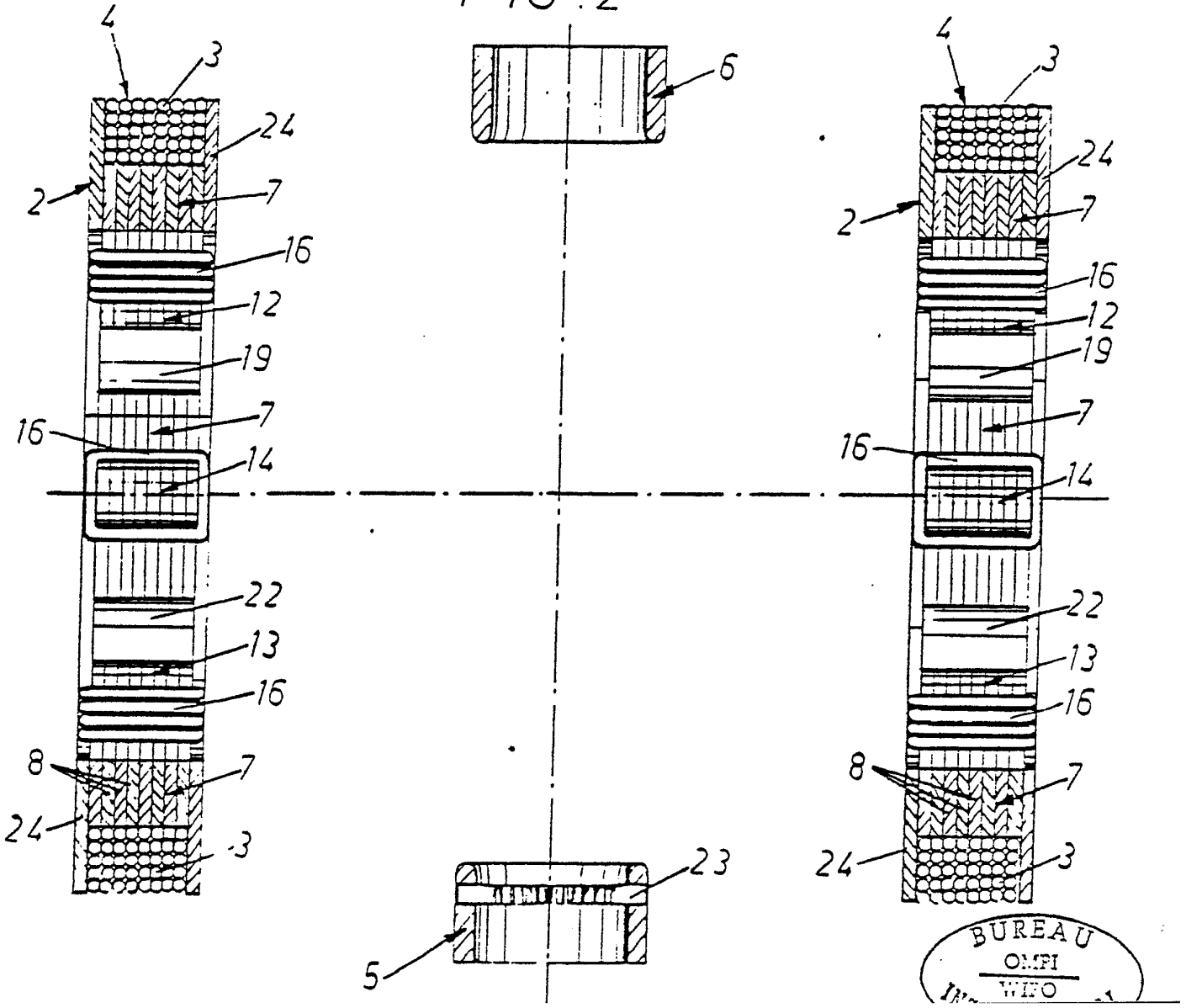


FIG 3

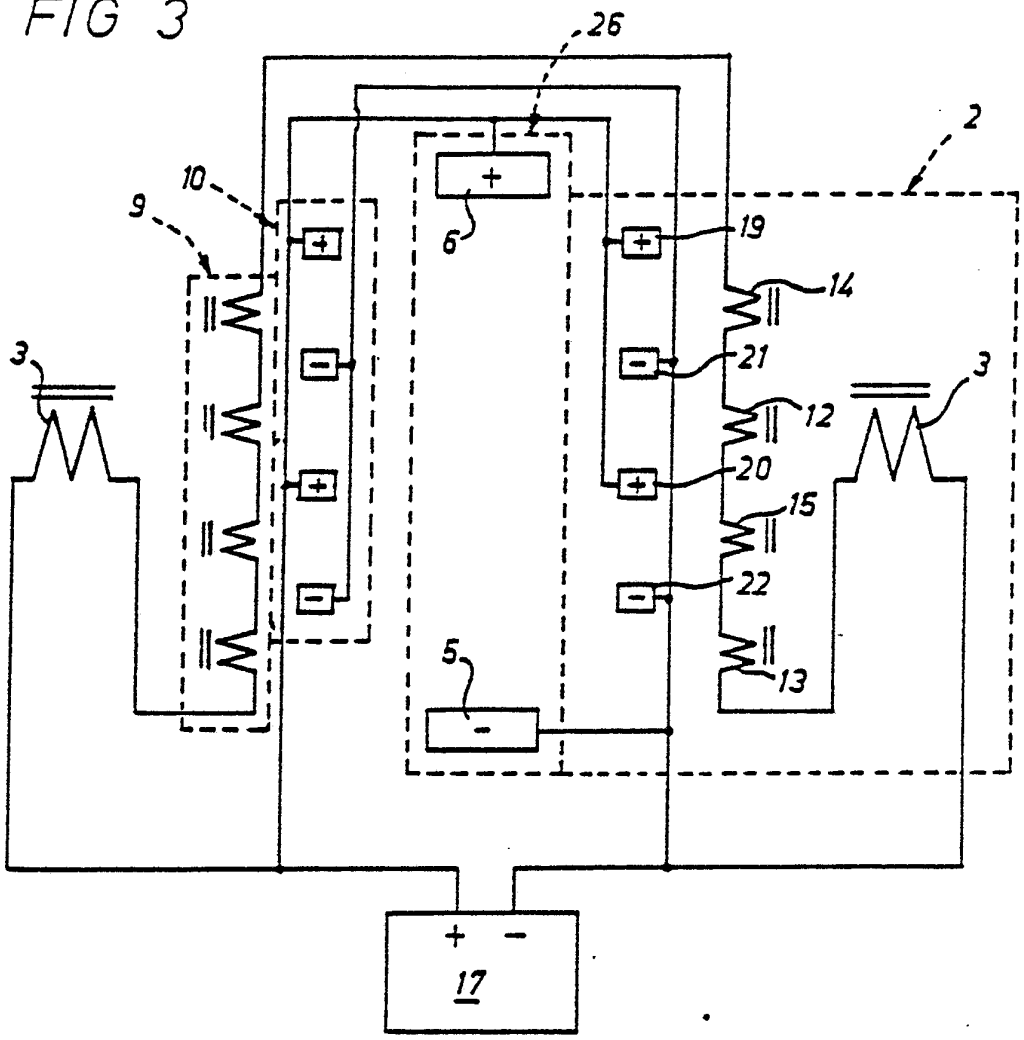


FIG 4

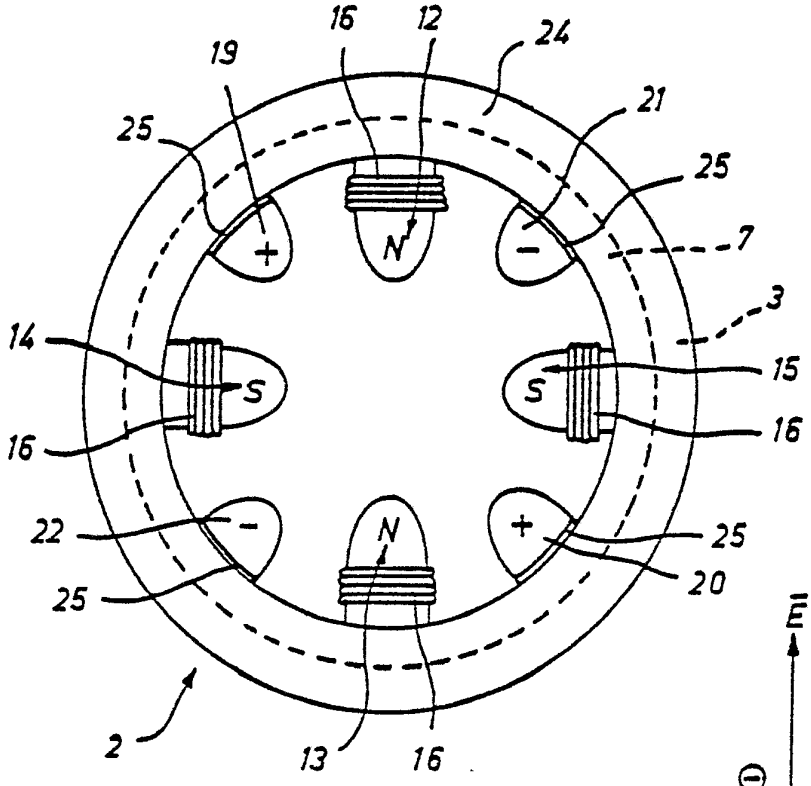


FIG 5a

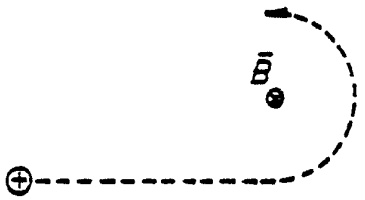


FIG 5b

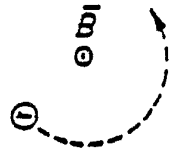
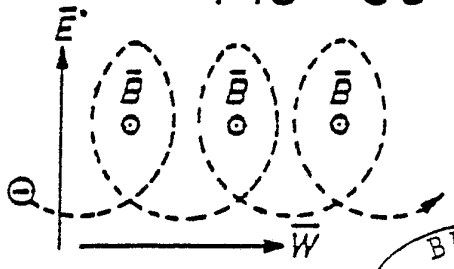


FIG 5c



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE80/00241

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC 3

A 61 N 1/42

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 3	A 61 N 1/00,/02,/40,/42, H 01 F 7/06,/20
US Cl	128:1.3,1.5, 419R,419F, 420-424
National Cl	21g:24/01, 27

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category [6]	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	US, A, 3 915 151 published 1975, October 28, W Kraus	
A	GB, A, 871 672 published 1961, June 28, H Nemec	

* Special categories of cited documents: [15]

"A" document defining the general state of the art

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

"L" document cited for special reason other than those referred to in the other categories

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

"P" document published prior to the international filing date but on or after the priority date claimed

"T" later document published on or 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

IV. CERTIFICATION

Date of the Actual Completion of the International Search [1]	Date of Mailing of this International Search Report [2]
1981-05-13	1981 -05- 15
International Searching Authority [1]	Signature of Authorized Officer [20]
	Göran Magnusson