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Treatment of arthritis with magnetic field therapy

**Abstract**

Process involves treating organs by applying a magnetic field by means of an annular coil surrounding the organ, the coil being energized by a pure DC voltage having a rectangular wave form pulsing at the rate of 1-30 CPS. The invention also includes an apparatus comprising a body support encompassed by an annular coil energized as above. The coil is mounted on a carriage running on tracks adjacent the body support.

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**References Cited** [\[Referenced By\]](#)

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**U.S. Patent Documents**

<a href="#">D345799</a>	Apr., 1994	Lamond et al.	
<a href="#">703989</a>	Jul., 1902	Burry.	
<a href="#">3915151</a>	Oct., 1975	Kraus	600/13.
<a href="#">4066065</a>	Jan., 1978	Kraus.	
<a href="#">4177796</a>	Dec., 1979	Franco-Vila.	
<a href="#">4266532</a>	May., 1981	Ryaby et al.	
<a href="#">4374516</a>	Feb., 1983	Harrison.	
<a href="#">4402309</a>	Sep., 1983	Harrison.	
<a href="#">4428366</a>	Jan., 1984	Findl et al.	
<a href="#">4584995</a>	Apr., 1986	Koeneman.	
<a href="#">4641633</a>	Feb., 1987	Delgado.	

<a href="#">4674482</a>	Jun., 1987	Waltonen et al.	
<a href="#">4738681</a>	Apr., 1988	Koeneman et al.	
<a href="#">4747400</a>	May., 1988	Koeneman et al.	
<a href="#">4750905</a>	Jun., 1988	Koeneman et al.	
<a href="#">4757804</a>	Jul., 1988	Griffith et al.	
<a href="#">4757809</a>	Jul., 1988	Koeneman et al.	
<a href="#">4818697</a>	Apr., 1989	Liboff et al.	
<a href="#">4895141</a>	Jan., 1990	Koeneman et al.	
<a href="#">4932951</a>	Jun., 1990	Liboff et al.	
<a href="#">4993413</a>	Feb., 1991	McLeod et al.	
<a href="#">5017185</a>	May., 1991	Baermann.	
<a href="#">5045050</a>	Sep., 1991	Liboff et al.	
<a href="#">5059298</a>	Oct., 1991	Liboff.	
<a href="#">5067940</a>	Nov., 1991	Liboff et al.	
<a href="#">5077934</a>	Jan., 1992	Liboff et al.	
<a href="#">5087336</a>	Feb., 1992	Liboff et al.	
<a href="#">5088976</a>	Feb., 1992	Liboff et al.	
<a href="#">5100373</a>	Mar., 1992	Liboff et al.	
<a href="#">5106361</a>	Apr., 1992	Liboff et al.	
<a href="#">5123898</a>	Jun., 1992	Liboff et al.	
<a href="#">5131904</a>	Jul., 1992	Markoll	600/14.
<a href="#">5143588</a>	Sep., 1992	Liboff et al.	
<a href="#">5156587</a>	Oct., 1992	Montone.	
<a href="#">5160591</a>	Nov., 1992	Liboff et al.	
<a href="#">5183456</a>	Feb., 1993	Liboff et al.	
<a href="#">5211622</a>	May., 1993	Liboff et al.	
<a href="#">5215633</a>	Jun., 1993	Liboff et al.	
<a href="#">5215642</a>	Jun., 1993	Liboff et al.	
<a href="#">5267939</a>	Dec., 1993	Liboff et al.	

<a href="#">5269745</a>	Dec., 1993	Liboff et al.	
<a href="#">5290409</a>	Mar., 1994	Liboff et al.	
<a href="#">5314400</a>	May., 1994	Tsyb et al.	
<a href="#">5316634</a>	May., 1994	McLeod.	
<a href="#">5318561</a>	Jun., 1994	McLeod et al.	
<a href="#">5453073</a>	Sep., 1995	Markoll	600/14.

#### **Foreign Patent Documents**

1150361	Jul., 1983	CA.
2591495	Jun., 1987	FR.
2843805	Apr., 1980	DE.
3517874	Nov., 1986	DE.
1639663	Apr., 1991	SU.
1736510	May., 1992	SU.
0741651	Dec., 1955	GB.

#### **Other References**

- The Bachelet General Magnet Co., article section by Emile Bachelet.  
 Turkish Journal of Sports Medicine, "Electromagnet Field Therapy of Sports Injuries," pp. 48-57, V. 26 No. 2 (1991).  
 The American Journal of Medical Electronics, "Biomagnetics--The Biological Effects of Magnetic Fields," Alexander, Harold S., Jul.-Sep. 1962, pp. 181-187.  
 Wilshires "I-ON-A-CO" the Short Road to Good Health, Feb. 1, 1927, pp. 1-31.  
 Canadian Medical Association Journal, Jun. 15, 1982, vol. 126, No. 12, pp. 1363, 1365, 1375.  
 The Journal of Orthopaedic and Sports Physical Therapy, "Magnetic Field Therapy--Does It Affect Soft Tissue?" Spring 1983, vol. 4/No. 4, pp. 241-246.  
 Atlas of Clinical Rheumatology, 1986, 1.2-7.14, Gower Medical Publishing.  
 Clinical Orthopaedics and Related Research, "Electrical Stimulation of Human Femoral Intertrochanteric Osteotomies," Marshall R. Urist, Dec. 1988, No. 237, pp. 256-263, J.B. Lippincott Co.  
 Physical Medicine and Rehabilitation, "Electromagnetic Treatment of Shoulder Periarthritis: A Randomized Controlled Trial of the Efficiency and Tolerance of Magnetotherapy," Arp. 1991, vol. 72, No. 5, pp. 284-287.  
 Monthly Journal of Pure and Applied Science, "Effect of Magnetic Field on Inflammation," 24 Jul. 1974, pp. 1411-1412.  
 Clinical Orthopaedics and Related Research, "The Electrical Stimulation of Tibial Osteotomies," Marshall R. Urist, Mar. 1993, No. 288, pp. 246-253.

NLM Reading Room Journal Collection, 1985--Present, National Library of Medicine, pp. 1-10.

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### *Parent Case Text*

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This application is a continuation of application Ser. No. 08/202,871, filed Feb. 28, 1994 now U.S. Pat. No. 5,453,073, which was a continuation of Ser. No. 07/867,446 filed Apr. 13, 1992 now abandoned, which was a division of Ser. No. 07/519,410.

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### *Claims*

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What is claimed is:

1. A process for treating an arthritic body organ including the step of subjecting the arthritic body organ to an electromagnetic field of under 20 Gauss and generated by an annular coil into which the arthritic body organ is placed, the coil being driven by a pulsed DC voltage having a rectangular wave form consisting of an abruptly rising and abruptly deteriorating current pulsing at the rate of 1-30 pulse bursts per second.
2. A treatment process as claimed in claim 1 wherein said body organ is an appendage and wherein the electromagnetic field and the flux lines thereof are oriented so that the lines travel along said appendage in a direction toward the distal end of the appendage, remote from the torso.
3. A treatment process as claimed in claim 1 wherein the electromagnetic field is about 12.5 Gauss.
4. A treatment process as claimed in claim 1 wherein the organ is no farther away from the source of the field than six inches.
5. A treatment process as claimed in claim 1 wherein the treatment is performed for about 30 minutes every 24-48 hours during the course of treatment.
6. A treatment process as claimed in claim 1 wherein the organ is disposed in the center space inside the coil and eccentric with respect to the central axis.

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### *Description*

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#### BACKGROUND OF THE INVENTION

##### 1. Field of the Invention

This invention relates to the treatment of all and any disease including painful, degenerative, injurious, or inflammatory conditions of the human musculoskeletal system or parts thereof, or other body organ systems or parts thereof affected by such conditions. More specifically, this invention relates to the application of a magnetic field to these systems or parts thereof to alter, arrest, or heal those said diseases and conditions, or relieve pain or other uncomfortable or unwanted sensations associated with these named diseases and conditions, and apparatus for delivering such magnetic field for the stated purpose. It is contemplated that the process and apparatus described herein may be beneficial in the treatment of cancer of various types and other diseases not specifically mentioned.

## 2. Description of Related Art including Information Disclosed under .sectn..sectn.1.97 to 1.99

It has been recognized in the prior art that the application of a magnetic field to diseased organs can in some way improve the condition. An example is disclosed in the Kraus patent 3,915,151 which discloses the idea of imparting a low frequency AC source to a wound toroid into which an ailing limb is inserted. The imparted voltage creates a changing magnetic field. This treatment is coupled in Kraus with a galvanic action by means of plates disposed on either sides of the limb.

A more recent patent, U.S. Pat. No. 4,537,181 to Shaloo et al, discloses treating a patient with a magnetic field created by rotating permanent magnets.

Other patents somewhat of interest to the present invention are U.S. Pat. No. 4,233,965 issued Nov. 18, 1980 and U.S. Pat. No. 4,758,429 issued Jul. 19, 1988.

## SUMMARY OF THE INVENTION

Under the present invention the target organ is subjected to an electromagnetic field driven by a pure DC voltage having an abruptly rising and abruptly deteriorating wave form at the rate of 1-30 cycles per second. The field at the target organ is of low intensity, preferably under 20 gauss, and the field lines are oriented, where the target organ is on an appendage, such that the flux lines travel toward the distal end of the appendage.

The effect of the treatment under the present invention is dramatic as will be demonstrated in examples hereunder. The exact mechanism by which the treatment derives its efficacy is not known but one explanation may be found in the uni-directional elongated (extended) prolongation and abruptly shortened repolarization theory: Directing a specific time frequency and wave form, of low amplitude magnetic field (flux) into and onto a target area of living tissue/organ in an almost axial arrangement for an extended specified length of time, allows (causes) the electron (ionic) flow to remain in either a plus or minus state. This action does stimulate the electrical potential. Thus a regeneration (repair) process is initiated by (during) which the cells (tissue/organs) are able to and will (better) more fully perform their intended genetic function(s).

The cells (tissue/organs) may therefore carry out their functions in a more appropriate

fashion and healthy physiological intended manner. The healing process, once stimulated, is henceforth maintained by nature of the permanently enhanced positive electron balance and healthy metabolic status.

In amplification of the above theory, I have concluded from a careful review of recent data concerning the intrinsic magnetic field strength of living individuals that all human beings possess measurable amounts of a magnetic field (MF). The data further indicates that most healthy people have a MF which ranges from X to Y gauss. Some human beings have extremely low MF levels: other human beings have extremely high MF levels, i.e. 4 to 5 times  $(X+Y/2)$ . Based on a correlation between healthy and morbid human beings, I postulate that further investigation should be initiated which might suggest that altered magnetic properties may represent the state of disease, that is, derangement of MF may correlate with disease.

The following specification represents a new approach based on the above theory.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Other features and objects of the invention will be clear from the following specification including the drawings, all of which disclose a non-limiting form of the invention. In the drawings:

FIG. 1 is a simplified perspective view of a wound toroid energized to develop an electromagnetic field as indicated by flux lines, shown treating a diseased hand;

FIG. 2 is a front end view with front of cover removed and showing the coil segments inside the toroid;

FIG. 3 is a graph showing the voltage flow vs. time as imparted to the toroid air coil to induce the magnetic field under the invention.

FIG. 4 is a perspective view of a table embodying an apparatus of the invention;

FIG. 5 is an enlarged front end view of the carriage showing the tracks in section;

FIG. 6 is an enlarged perspective view of the carriage for supporting the toroid; and

FIG. 7 is a sectional view taken on the line 7--7 of FIG. 6.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the invention involves the creation of an electromagnetic field F. This field is created by energizing a winding in a toroid T such that the field forms a three-dimensional donut in and about the toroid. The toroid T within its case contains a number of coil segments CS spaced by air gaps G as shown in FIG. 2. It is an important characteristic of the invention that the field not be greater than 20 gauss in the area of the diseased organ DO.

After much study, it has been found that it is important that voltage be supplied to the toroid winding in a pattern demonstrated in FIG. 3. The voltage supplied must

repeatedly build up steeply, hold, and then deteriorate steeply and so that there are thus created a series of spaced working plateaus p of pure DC current. It is preferred, therefore, that in the duty cycle the wave form of the pure DC voltage involved be virtually of rectangular shape with the abruptly rising r and abruptly falling d sides of the wave form comprising sides of a rectangle. In between two such duty cycles there is an off cycle.

As an additional characteristic, further study has indicated that it is important that the movement of the field along the diseased limb, for instance, be toward its distal end. Thus, for instance, when treating a patient's hand as shown, or knee, as the diseased organ, the magnetic lines of the field F in the area of the organ should move toward the end of the appendage remote from the torso. This is achieved by supplying voltage of proper polarity to the coil leads of the toroid T.

As shown in FIG. 2, the target diseased organ DO is supported to be in position eccentric to the central flux portion of the magnetic field within the toroid. This can be accomplished by a shapeable fiber support pillow SP of cotton or the like which need not completely surround the organ, hut should assist its proper positioning. Inside the toroid housing, as stated, are a series of circularly arranged arcuate segments, of wound coil CS. With respect to the size of the toroid, it is important that the distance between the organ and the windings be no greater than about six inches (6").

It has further been found, as a result of much experimentation, that the length of time intervals between the treatment periods and the length of the treatment periods themselves is important. Preferably the length of periods should be no greater than one-half hour and the frequency should be every 24 to 48 hours through the treatment period.

#### DESCRIPTION OF APPARATUS FOR TREATING ORGANS IN THE TORSO

The invention also has application, aside from treatment of the limbs, to diseased organs on the main part of the body, i.e., the torso. Equipment which has been used for such torso treatment is shown in the drawings, FIGS. 4 through 7.

FIG. 4 shows an apparatus useful in applying a magnetic field to the main part of the human body, i.e. the torso. It is generally designated 10 and is an all wood table comprising a plurality of support legs 12, a horizontal transitional surface 14 on which the patient may sit and then recline and prepare himself. The support surface 14 is preferably supported on a pair of end boards 16 which are supported by the legs and are notched as at 18 to support rails 20 which has between them a fabric support web 22.

Extending between the side board 16 and horizontally disposed at a level below the surface 14 is a coil support bed 24. Supported on the bed 24 are a pair of spaced parallel tracks 26 which may be in the form of boards having a rectangular cross section. A coil support carriage 28 is provided with a pair of side-by-side upward recesses 30 which fit slideably over the tracks 26.

Anti-friction means, such as plastic rollers 32, are mounted adjacent the upper wall of the recess 30 so that the carriage may easily move along the tracks. Preferably the upper sides of the carriage are formed with a circumferential lip 34. The toroid T, similar to

that disclosed in FIGS. 1 and 2, is equipped with downward flaring legs 36 which are received onto the carriage 28 to support the toroid.

In use, the patient reclines on the surface 14 and then, with the carriage 28 at one end of the tracks 26, the patient rolls onto the fabric support web 22 so that his body B is supported thereby. The carriage then moves along the tracks 26 until the toroid T, encompassing his body, is aligned with the diseased organ. The toroid is then energized for treatment as described above.

I have found that for treatment of the hand a toroid having an opening of 5 1/2" is preferable, an opening of 11" may be useful in treatment of the knee and for a treatment of the entire body, as in FIGS. 4 through 7, an opening of 22" is suitable for most patients.

## EXAMPLES

The following examples of treatment show results after indicated procedures, all within the scope of the invention as described above.

### Example 1

Patient #1 had severe arthritis of his right knee documented by Magnetic Resonance Imaging which demonstrated significant cartilaginous disease and cystic disease in his knee. He had this problem for more than one year and was a candidate for surgical treatment. He was unable to walk up and down steps and had constant and severe pain. After eighteen treatments with magnetic therapy (MT), as described herein, he had very dramatic and near complete resolution of the symptoms. A second and third M.R.I. study to be performed one and six months after the eighteenth treatment is scheduled.

### Example 2

Patient #2 had arthritis of the right knee with chronic effusions, cartilaginous disease of the medial and lateral meniscus with chronic pain on ambulation. Following eleven MT treatments, as described herein, complete resolution of his effusion and the pain associated with his arthritis were effected. Blinded Roentgenographic studies have demonstrated the resolution of effusion.

### Examples 3 and 4

Patients #3 and #4 had elbow epicondylitis, sub-acute but of more than six months and more than one year duration. One patient had hypothyroidism and the other patient had no underlying cause for the epicondylitis. Both patients responded dramatically after eighteen MT treatments, as described herein, i.e. they were able to resume pre-morbid housekeeping and professional activities fully and without pain or tenderness.

### Example 5

Patient #5 had severe flexor tendonitis of several years duration involving the second, third and fourth flexor tendons and osteoarthritis of the P.I.P. joints. The patient had severe and chronic pain, was unable to hold or grasp his golf clubs for several years. He

was not able to hold or carry a paper bag of groceries of minimal weight. After eighteen one-half hour sessions with MT, as described herein, this patient had complete resolution of his pain syndrome and stated that he "felt (his) hand actually younger looking" (patient's quote).

#### FURTHER EXAMPLES

Fifty joints were each treated eighteen times with magnetic therapy as described herein. Based on objective and subjective 112 variable parameters, a rating based on merit points was developed which provided an overall "Response" which was summarized by a blinded Chief Rheumatologist (Clinical Investigator). The following lists indicate the placement of all fifty joints in the Actively Treated Group and the Placebo Treated Group. It can be said that the Definite and Improved Groups demonstrated a significant betterment while the Slight and None Groups did not profit from the therapy.

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ACTIVE TREATED GROUP	PLACEBO TREATED GROUP
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Definite improvement			
= 18	Definite improvement	= 4	
Improved = 2	Improved = 2		
Slight improvement			
= 2	Slight improvement	= 3	
None = 1	None = 15		
TOTAL = 23	TOTAL = 24		

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50 patients were treated Actively and with Placebo.

47 patients completed the planned study without incident

1 patient with 2 joints was hospitalized due to pneumonia.

1 patient with 1 joint moved out of state.

Thus, it should be clear from the above examples that the invention herein disclosed has had dramatic results when used in its preferred form. It is envisioned that some changes within the patterns of the invention so far described are possible, the described characteristics being merely preferred.

Proof of the efficacy of the invention is available from more scientific indicies. As is well known, chromatin is the substance of chromosomes, the portion of the cell nucleus which plays a role in cell division. It is subdivided into euchromatin, the active portion, and heterochromatin, the inactive portion.

It has been demonstrated by electronmicroscopy that healthy synovium of patients under 70 years of age usually exhibits greater than 50% euchromatin and less than 50%

heterochromatin whereas patients with diseased synovial tissue usually demonstrate less than 50% euchromatin and greater than 50% heterochromatin. Repeated biopsy specimens of synovium in patients with arthritic disease, when examined under electronmicroscopy, demonstrated greater amounts of heterochromatin than euchromatin. These same patients underwent 12 to 18 treatments with magnetic field therapy and were re-biopsied. The relationship of euchromatin to heterochromatin was then noted to be reversed, i.e. the euchromatin was consistently greater than 50% and the heterochromatin was consistently less than 50.

As stated, the invention is susceptible of various changes and is not limited as described in the examples above. The invention may be, therefore, defined as having the scope of the following claim language or reasonable equivalents thereof.