

# Design of Epitaxy Style Magnetic Curer and Special Quality Embodiment for Nerve Luman Nature Disease Treatment

Lee, Jung Sook (Dongju College, Dept of Occupational Therapy)\*  
Kim, Whi Young (Dongju College, Dept of Biomedical Engineering)\*\*

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## Abstract

Result that study to serve to apply epitaxy style magnet nerve curer in nerve human nature disease treatment is as following. Designed probe actually with special quality research about coil probe of magnet curer firstly. Impose and revealed all drives about treatment probe embodying power device using MOSFET that is electric power element secondly. Could receive energy value that is proportional in number to close with actuality coil value by manufacture about treatment coil probe by third and come out. This could embody treatment pulse by disease, and saved pulse form and so on by damping pulse form through a special quality experiment variously specially. High amplitude treatment pulse(great strong) maximizes curative effect at short time and will be bought that demand is magnified greatly at the future in this research.

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Keywords: magnet nerve curer, magneto-therapy, pulse forming, damping, MOSFET

## I . Introduction

Magnetic curer changes number of flux linkage degree by current if

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\* Professor, Depart of Occupational Theraphy, Dongju College, jslee@dongju.ac.kr

\*\* Professor, Depart of Biomedical Engineering, Dongju College, ndyag@dongju.ac.kr

electro-motive force is derived to magnetic circuit by current change of magnetic circuit and flowing current changes to circuit. Electromotive force happens to myself circuit for direction that disturb these change. Principle of faraday, neuman, lenz is that induced emf relationship relation by current's change is formed in magnetic circuit in Come on. Lattice and magnetic induction phenomenon that do flux linkage to circuit. Act because do so that may emit magnetic field from outside by lacteal gland rule, and therefore is long-lived than usual subordinate because electric power does not have exhausted part directly basically and there is big advantage in preservation repair aspect. Magnetic probe present in van every country practical use research is gone general coil probe real condition that utilization is being magnified gradually be. Because magnetic curer treatment probe's drive changes greatly do voltage, peak of current of main circuit to magnetic field discharge by coil departure, drive circuit that satisfy coil probe booting and magnetic discharge is required. Also, action frequency of magnetic coil probe circuit must decide considering flowing energy efficiency in coil, in action frequency 1.5MHz when is Open ferrite core probe, union efficiency becomes more than 90%. Therefore, coil probe's drive can know that high frequency voltage more than action frequency 1.5MHz are need. Most fan shape power amplifier is used but is stood face to face by switching type of inverter by conversion efficiency daytime to present coil probe's drive circuit. But ordinary PWM inverter can not be acted in frequency more than 1.5MHz by switching devices' switching loss. High frequency switching is presenting action analysis by induction about possible zero switching inverter by coil probe drive in this research.

First, could save condition of booting and discharge by get equivalent circuit and apply this to inverter and do action analysis after coil probe's discharge whole curriculum discharge. Also, could establish zero switching inverter's design guide for coil probe drive on the basis of this result, and confirmed action special quality through an experiment. Also, serve to supply necessary entire membership voluntarily to do commercial power to act interchange for control in off-line mode by input voltage and designed assistance power and stoppage circuit. Also, apply high frequency high tension that pass over Probe starting voltage to lacteal gland coil winding

that is established on probe's interior. Flowing current is abandoned before high frequency that have high frequency self-discipline by high-frequency current to coil. Probe produces magnetic being thought by this ago. Power failure union style E grade discharge by ago of lacteal gland coil's axis by high frequency high tension that pass over coil probe starting voltage is begun and is ordered by electromagnetic induction type H discharge by challenge clerk in charge electron Sign of the Cock of right angle direction and coil probe acts. Magnetic coil probe's starting inning must accommodate next time condition, when approve high frequency high tension that need at circuit format, coil discharge starting that can get high effectiveness is in high frequency action to induction coil my voltage, current stress at constraint, coil booting by my schedule voltage be and get rated power be able to must. Also, remove instability by magnetic coil's paternity resistance special quality, must do coil probe to do stability starting discharge.

## II . Coil probe special quality of magnetic curer

Because magnetic curer is been behind than learning field of other rain, but enters recently, research is progressing in various pathology field. Specially, is consisting through effort of biologist and biophysicist and clinician etc. As a result, new devices and medicine technology are invented as long as hide on essence. Artificial magnetic curer is various kinds, but curer type that can receive head of a family rem in analog(CMF), variableness style(VMF), pulse style(PMF) is pulse style magnetic curer field. It is proved that produce objective result more much vividly and fast than changeable field without that pulse style(that include that magnetize) runs out. Is lower about adaptation that pulse impacts, but after all organism methods arrive rhythmically, pulsation impacts being active more physically, have specific character and simultaneity that can give enough encouragement to Biosystem after change setting of "Biotropic parameters"(frequency, pulse form, porosity etc.) parameters. Pulse impacts influence in physical strength

tractive force, and pulse force causes clear change in organism(its average ability that there is no change). Fairly time of progress takes here. If explain biology effect of high position pulse magnetic curer(HPMT), stimulation(PMT) (MS) that magnetic curer is charged with pulse magneto treatment or self-examination although think as suitable terminology of "High Pulse Magnetic Theraphy" usually call.

HPMT is pulse during long wave high-amplitude(greatly great of traditional magneto-therapy) short time. Base in effect material important discoveries that magnetize with purpose that conduce medicine treatment and diagnostic, and ampere etc.. show interaction from electric field and a magnetic field visually. M in 1831. The 1st scientist who Faraday stated rule of electromagnetic induction that certify that each alteration of a magnetic field begins electric field, and explained magneto stimulation effect is A. It was D. rsonval(1896), beer(1902) and S. Thompson(1910). Back studied following future affair, and received MS patients someone's brain or retina field. R. By Bickford and B. Fremming(1965) sends by pulsation to stimulate an animal and person's frame muscle, and M. J. Rs and used magnetic field. Polson(1982) was first investigator who recorded motor response of irritated muscle by a magnetic field of peripheral device nerves. Finally, a barked animal and his colleagues(1985) made stimulant that wear enhanced radiation self-examination for commerce by 1st, and embodied curer that can provoke to stimulate cerebrum cortex and draw muscle. If flowing current changes in coil, guided electro-motive force is as following in coil that inside that pass each coil that close changes and shuts by Faradays law Come on.

$$\frac{emf}{N} = - \frac{d\psi}{dt} \text{-----(1)}$$

Here, N are number of times that wash whole, and it can be premised that each coil shares a common magnetic field. If express to mathematical expression, is as following.

$$emf = - \frac{d(N\psi)}{dt} \text{-----(2)}$$

$N\psi$  is proportional in flowing current in coil and the comparison good hand is going to depend on form that coil shuts. In L

$$N\psi = LI \text{ -----(3)}$$

If can express comparison good hand L by inductance, and display electro-motive force by inductance and current, is as following.

$$emf = -L \frac{di}{dt} \text{ -----(4)}$$

If current passes to leading wire, magnetic field happens around. Line of magnetic force that pass this section is known as magnetic flux.

Figure 1. Series epitaxy way

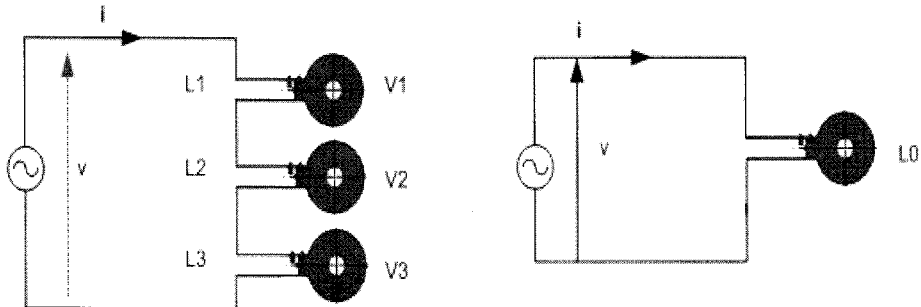
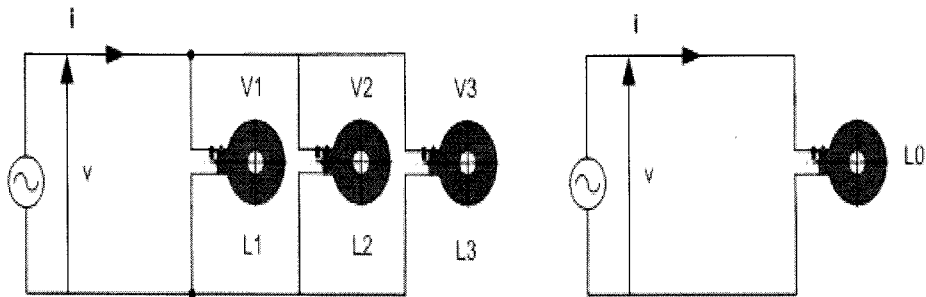


Figure 2. Parallel epitaxy way



Picture is arranging in way 5 by series connection way.

$$\begin{aligned}
 V &= V_1 + V_2 + V_3 = L_1 \frac{di}{dt} + L_2 \frac{di}{dt} + L_3 \frac{di}{dt} \\
 &= (L_1 + L_2 + L_3) \frac{di}{dt} = L \frac{di}{dt} \\
 L_0 &= L_1 + L_2 + L_3
 \end{aligned}
 \tag{5}$$

$$\begin{aligned}
 L_0 &= \frac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}} = \frac{L_1 L_2 L_3}{L_1 + L_2 + L_3} \\
 \frac{1}{L} &= \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}
 \end{aligned}
 \tag{6}$$

Parallel connection way can arrange by next time way.

$$i = \frac{L_1 L_2 L_3}{L_1 + L_2 + L_3} \tag{7}$$

$$i = I_m \sin wt \tag{8}$$

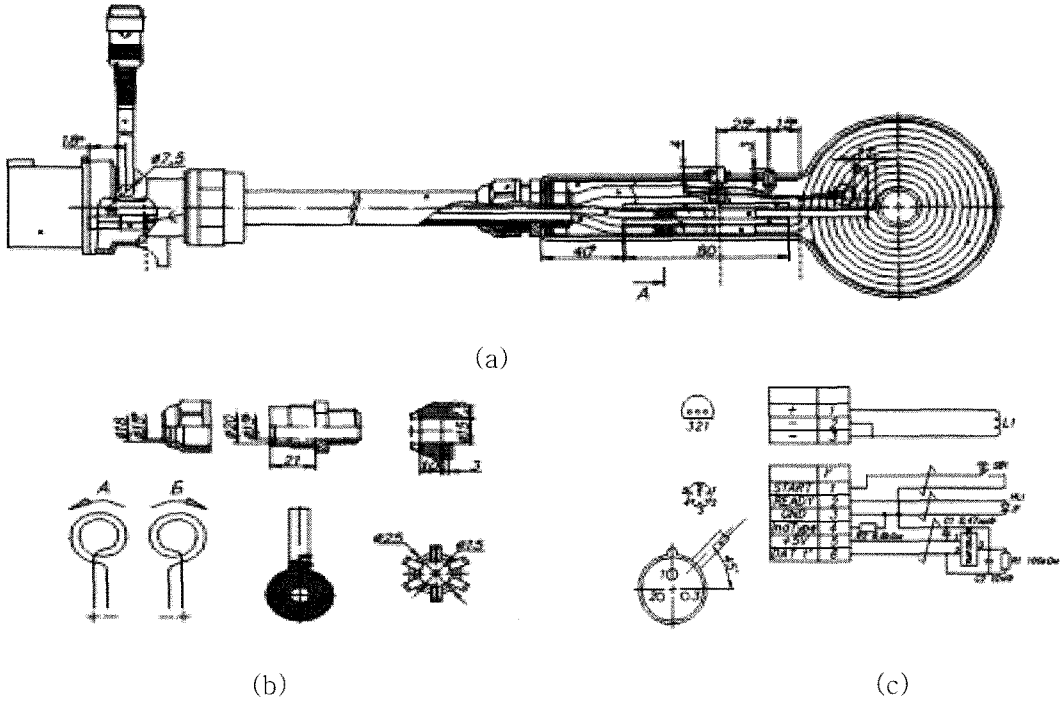
$$v = L \frac{di}{dt} = L \frac{di}{dt} (I_m \sin wt) \tag{9}$$

$$= wL I_m \cos wt = wL I_m \sin (wt + 90^\circ)$$

$$XL = wL = 2\pi fL \tag{10}$$

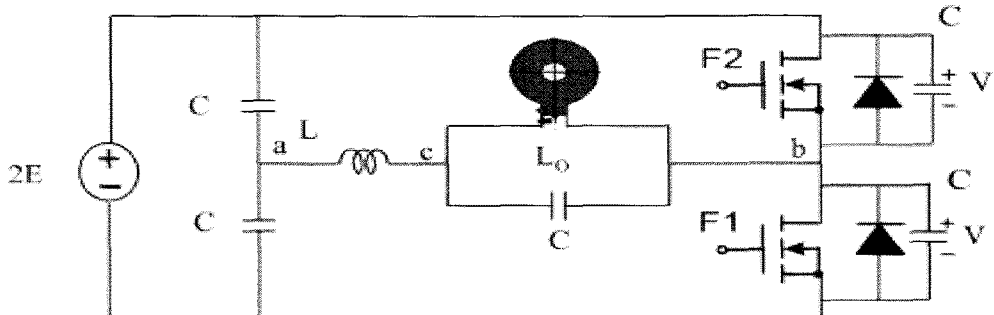
As can know in front way, in inductance voltage current status  $90^\circ$  go first. Figure 3 is archetype type treatment probe that manufacture actually.

Figure 3. Treatment coil Probe that manufacture actually



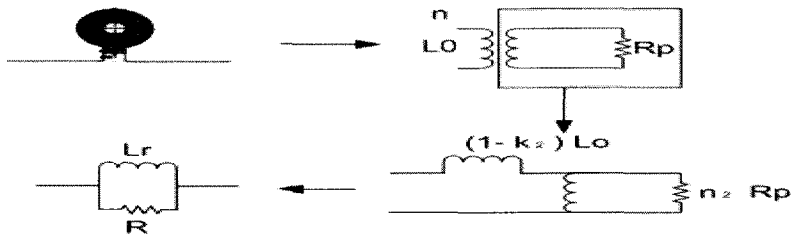
### III. Power Department Design and Special Quality of Magnetic Curer

Figure 4. Zero voltage switching inverter driver circuit



Circuit of figure 4 is half bridged inverter that compose and composes serial resonant circuit as capacitor C that connect by multiple to induction coil  $L_0$  and L that connect by series. Do to approve high frequency high voltage more than coil probe departure voltage on induction coil both end to resonant circuit in going of coil probe of magnetic curer and operate coil probe. After operation, coil probe's impedance changes greatly, do not give unmeasured voltage current stress to circuit because voltage current's amplitude decreases and stability discharge by coil probe's proper form electric power can act. That magnetic curer discharge circuit operates coil probe by that approve high frequency high voltage to induction coil discharge until this begin coil probe can handle without subordinate, and can assume as pure resistance as equivalence after discharge. Coefficient of coupling with induction coil and discharge is K, and discharge's resistance is  $R_p$ , and if digit of induction coil's winding is known as n, coil probe and induction coil can mark to equivalence society that resistance that is  $R_p$  to n:1's leactor transformer is joined in figure 4.

Figure 5. Induction coil coil and coil probe's equivalence circuit



If impedance  $Z_L$  of induction coil's both end b c, switching angular frequency is known as  $\omega_s$ , is marked by next time way.

$$Z_L = R_1 + j \omega_s L_1 \text{-----(11)}$$

$$= \frac{\omega_s n^2 R_p k^4 L_0^2}{n^4 R_p^2 + k^4 L_0^2 \omega_s^2} + j \left( \omega_s (1 - k^2) L_0 + \frac{\omega_s n^4 R_p^2 k^2 L_0}{n^4 R_p^2 + k^4 L_0^2 \omega_s^2} \right) \text{-----(12)}$$



$$R_1 = \frac{w_s^2 n^2 R_p k^4 L_o^2}{n^4 R_p^2 + k^4 L_o^2 w_s^2} \text{-----(13)}$$

$$L_1 = (1 - k^2) L_o + \frac{n^4 R_p^2 k^2 L_o}{n^4 R_p^2 + k^4 L_o^2 w_s^2} \text{-----(14)}$$

Here analysis because do addition summer period as is easy inverter impedance ZL if change resistance R and inductance Lr that connect parallel conversion next mark.

$$\frac{1}{Z_L} = \frac{1}{R} + \frac{1}{j\omega_s L_r} \text{-----(15)}$$

$$= \frac{1}{R_1 + j\omega_s L_1}$$

$$R = R_1 + \frac{w_s^2 L_1}{R_1} \quad L_r = L_1 + \frac{R_1^2}{w_s^2 L_1} \text{-----(16)}$$

Via this conversion, is given together coming figure 4 by treatment coil probe's equivalence inring. Is and expressed resonant circuit whole reactance X frequency characteristic before discharge opening by coil probe starting inring. Reactance X grows rapidly in parallel resonant frequency fox neighborhood, and amount to 0 in serial resonant frequency frx. Here, parallel resonance frequency fox and serial resonant frequency frx

$$fox = \frac{1}{2\pi} \sqrt{\frac{1}{CL_o}} \text{-----(17)}$$

$$frx = \frac{1}{2\pi} \sqrt{\frac{1}{C} \left( \frac{1}{L_o} + \frac{1}{L} \right)} \text{-----(18)}$$

Is marked. Also, at coil probe action after discharge opening parallel resonant frequency fo and series resonant frequency fr

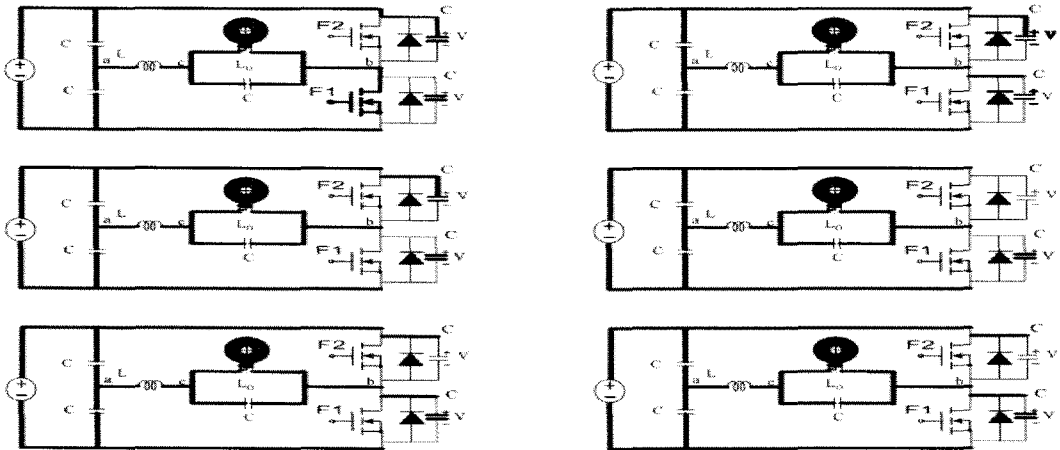
$$f_o = \frac{1}{2\pi} \sqrt{\frac{1}{CLr} - \frac{1}{(2CR)^2}} \text{-----(19)}$$

$$f_r = \frac{1}{2\pi} \sqrt{\frac{1}{C} \left( \frac{1}{Lr} + \frac{1}{L} \right) - \frac{1}{(2CR)^2}} \text{-----(20)}$$

Switing frequency  $f_s$  establishes higher than serial resonant frequency  $f_r$  to this circuit. Because load is inductivity impedance, if quantity switched becomes off, resonance current  $i$  passes continuously by reactance energy accumulated among dead time period. Behave switch parasitic capacitance  $C_{ds1}$ ,  $C_{ds2}$  relationship insect discharge by this current and realize zero switching. Is same with figure 5 by each mode equivalence inning of these circuit. Here,  $V_{gs1}$ ,  $V_{gs2}$  switch Q1, voltage between Q2's gate-sauce,  $V_{ds1}$ ,  $V_{ds2}$  switch Q1, voltage between Q2's drain-sauce,  $V_{ab}$  resonarce current that a, voltage between b,  $i$  pass to inductance  $L$  be. Q1, Q2 by gate voltage  $V_{gs1}$ ,  $V_{gs2}$  of square wave quantity switch off that is dead another thing if is done during  $T_d$  mutually all, off if is done and gate voltage  $V_{gs1}$  amounts to zero switch Q1 turn-off while is done and because switch Q1's parasitic capacitance  $C_{ds1}$  is charged by resonarce current  $I$ , switch both end voltage  $V_{ds1}$  increases directly between  $T_c$  during time switch Q2 because parasitic capacitance  $C_{ds2}$  is discharged the both end voltage  $V_{ds2}$  directly decrease. If both end voltage  $V_{ds2}$  amounts to zero after  $T_c$  passage during current time, because switch Q2's parasite diode D2 is spiritually enlightened, both end voltage  $V_{ds2}$  is become clamp by 0 voltage. Approving voltage that come to gate voltage  $V_{gs2}$  between  $T_a$  during time that this parasite diode D2 is been spiritually enlightened switch Q2 to do Teonon zero voltage switching actions come true and zero voltage switching actions are come true equally about switch Q1. If try voltage by action analysis, lacteal gland of current, analysis of because do a, b both end voltage equivalence Tuesday to rural districts of square wave for conveniences sake compose. If switching frequency approximates in series resonance frequency, impedance of series resonance circuit can be smallest in switching frequency and ignore that have big impedance relatively in wide-band more than double of switching frequency. That is, can do square

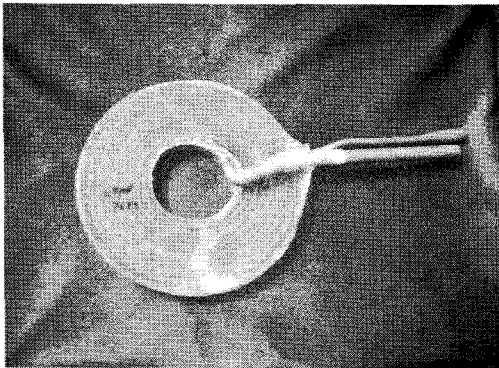
wave ashes equivalence Tuesday by circuit that have sinewave's power considering fundamental wave ingredient changing Fourier.

Figure 6. Each mode action circuit



#### IV. Experiment result

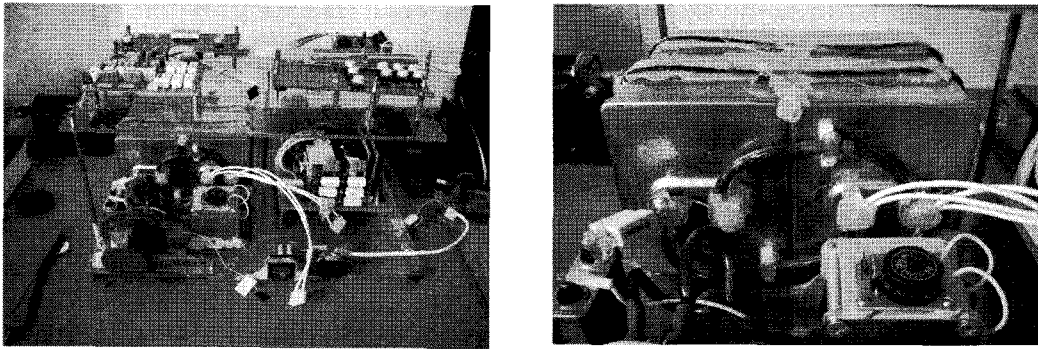
Figure 7. System manufacture( devices )



As explain in figure 4 schematic diagrams, as going alternately because is successive without sending pulse style current to coil probe, could send

pulse style current and confirm action waveform by scope. Converter current Pulse forming waveform is sending and display pulse style current creating pulse style current from other electric power element again moment waveform comes during period of dormancy send once pulse style current by coil probe and is waveform. Figure 7, 8 is displaying waveform that is imposed to voltage waveform and current, coil probe

Figure 8. System manufacture(Units)



imposed every moment on switching element. Is confirming output waveform to 9 i that is displayed by coil current that get thin picture 9 to 14. This way does to operate coil probe approving high frequency old book kind more than coil probe starting voltage on both end that is induction to resonant circuit at action of coil probe of magnetic curer by half bridge inverter way to compose serial resonant circuit composing as capacitor that connect by multiple to induction coil and L that connect by series, and because coil probe's impedance changes greatly after action, amplitude of voltage current decreases. Until stability action by proper form electric power is possible to coil probe and discharge is begun that magnetic curer discharge circuit acts coil probe by that approve high frequency high voltage to induction coil, can handle as coil probe no-load that increase, and can assume as pure resistance as equivalence after discharge.

Figure 9. Each mode action circuit

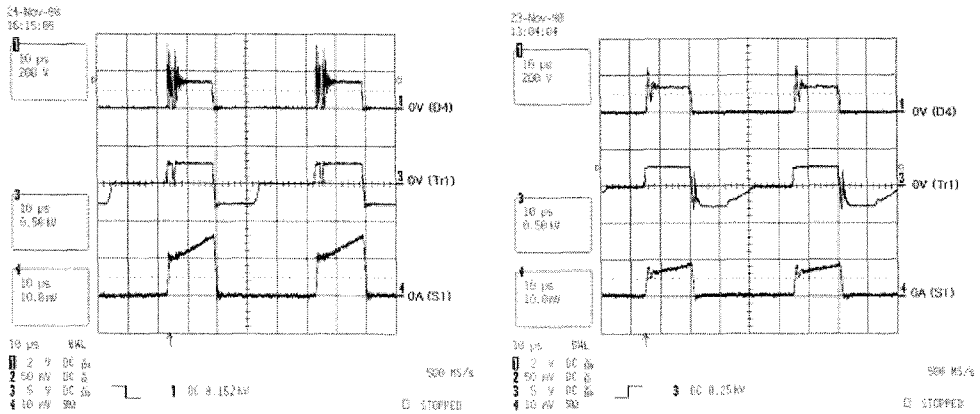


Figure 10. Each mode o action circuit

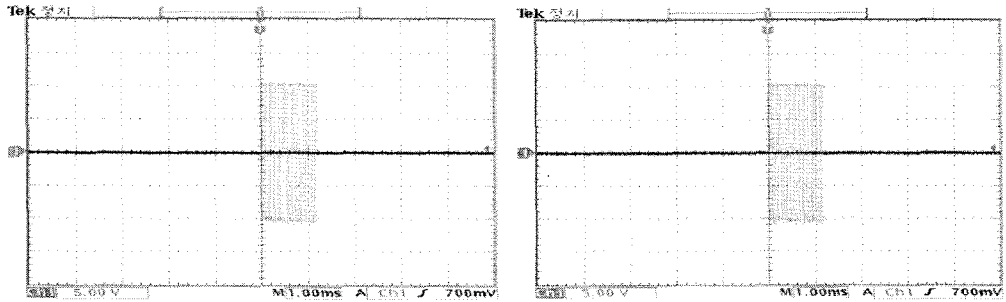


Figure 11. Mode 1, 2 coil probe output waveform

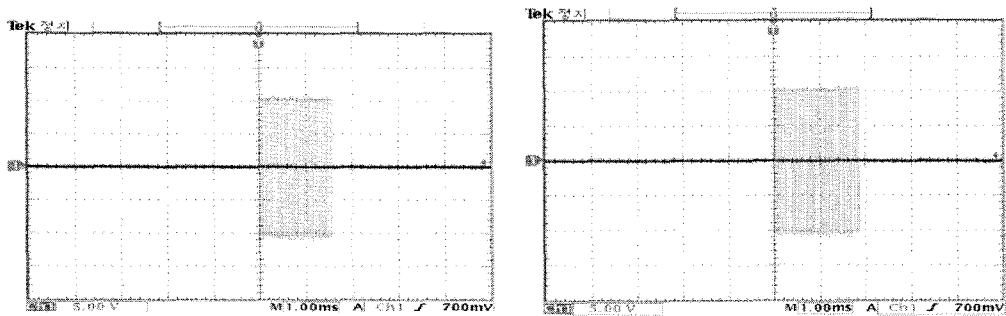


Figure 12. Mode 3, 4 coil probe output waveform

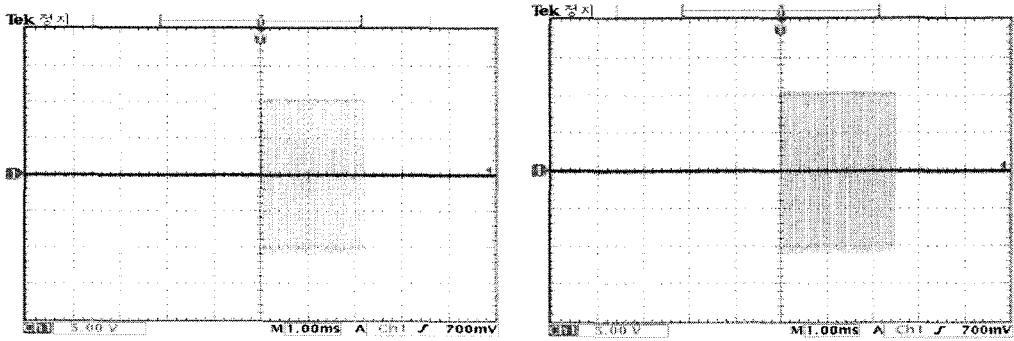


Figure 13. Mode 5, 6 coil probe output waveform

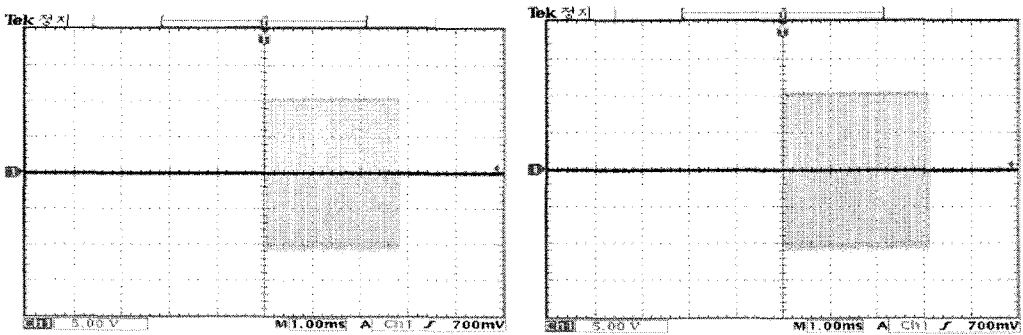
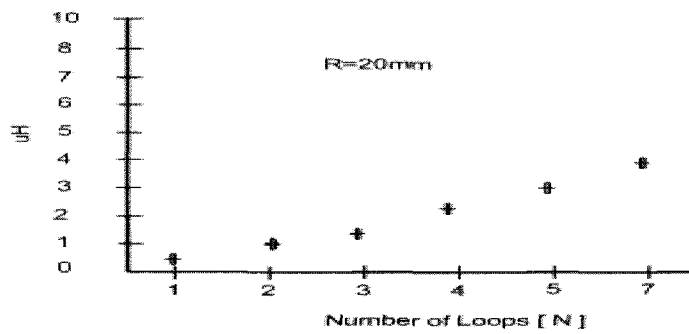
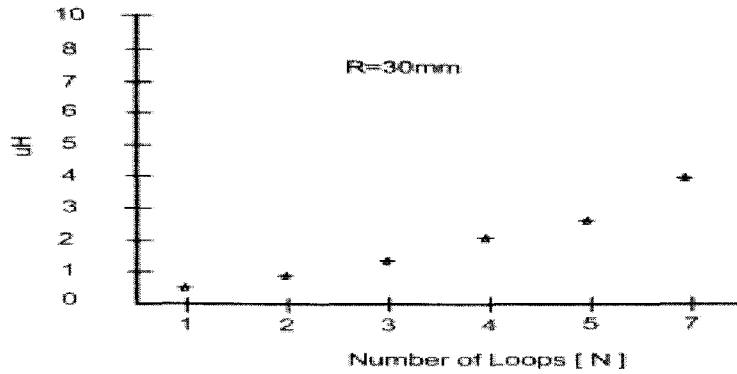
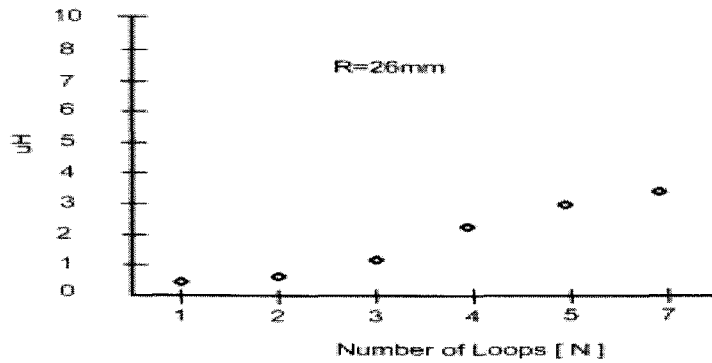


Figure 14. Energy by coil probe radius





## V. Conclusion

All nerve stimulation system is mounting that treat pulse style current that is charged to capacitor by way that spill life of telling kind in patient's body flowing coil probe current. That introduce in this research gouge coil probe of magnetic curer priority in modes and firstly and designed probe actually with Korea special quality research. Impose and revealed Korea power drive gouging coil probe embodying power supply using MOSFET that is electric power element secondly. Could receive energy value that is proportional in number to close with actuality coil value by manufacture about coil probe by third and come out. This could embody treatment pulse by war, and saved

pulse form and so on by damping pulse form through a special quality experiment variously specially. High amplitude width treatment pulse (traditional magneto-therapy of greatly great that strong) maximizes curative effect between predicted that demand is magnified greatly at the future in this research.



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## 신경인성 질환치료를 위한 적층형 자기치료기의 설계 및 특성구현

이정숙\* · 김휘영\*\*

### 국 문 요 약

적층형 자기신경 치료기를 신경인성 질환치료에 적용하기 위하여 연구한 결과, 첫째로 자기치료기의 코일프로브에 대한 특성연구와 실제로 프로브를 설계하였고, 둘째로 전력소자인 MOSFET를 사용하여 전원장치를 구현하여 치료프로브에 대한 전원구동을 가하여 시험하였고, 셋째로 치료코일 프로브에 대한 제작으로 실제 코일값과 감은 수에 비례하여 나오는 에너지 값을 얻을 수가 있었다. 이는 병변에 따른 치료펄스를 구현할 수 있고, 특히 특성실험을 통해 댐핑펄스 형태에 따른 펄스형태 등을 다양하게 구하게 되었다. 본 연구에서는 고진폭 치료펄스는 짧은 시간에 치료효과를 극대화하고 미래에는 수요가 크게 확대 될 것으로 사려 된다.

핵심주제어: 적층형 자기신경 치료기, *magneto-therapy*, 펄스포밍, 댐핑, *MOSFET*

\* 동주대학 작업치료과 교수

\*\* 동주대학 의료기공학과 교수