

Development portable hair removal applies PET (Pause¹⁰⁻⁹⁰ and Energy²⁰⁻⁴⁰ Trigger¹⁻⁷) function

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Abstract— For pulse trigger way and the energy injection rate according to PET (Pause¹⁰⁻⁹⁰ Energy²⁰⁻⁴⁰ Trigger¹⁻⁷) function, indeed, human body condition, period of dormancy in this research about this back correctly adjustment possible and designed harmless micro carrying along style hair exclusion so that can design and manufacture and run special quality examination and Xenon flash lamp to crawl in human body. Because creating individual's skin model to do stable treatment by light transmission way by skin impedance and measure, must embody treatment special quality of most suitable that draw skin color, energy, wave length, approximately, transmission time, pulse delay etc. and want. Specially, saved standard of war treatment pulse modeling by skin impedance, and manufacture pulse modeling system of most suitable by skin subordinate, and embody suitable treatment pulse. Specially, embody as could do root of a hair exclusion being emitted in pulse form using multi wave length of 560nm, 590nm, 640nm, 755nm and embodied clinical data. If become research repletion furthermore little more, is seen that can approximate in commercialization.

Index Terms— Pause¹⁰⁻⁹⁰ Energy²⁰⁻⁴⁰ Trigger¹⁻⁷, Xenon flash lamp, pulse trigger, multi wave length

I. INTRODUCTION

Interest for human body regulation cap is converged by change of Well-being concept by age. Also, by demand enlargement that individual wants manufacture of headgear directly by universal awareness of correction of deformities culture, by method for regulation cap permanently, root of a hair exclusion is becoming interest. Basically, light occurrence treatment method is not single wave length

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unlike laser. Treatment way of new concept is appearing taking advantage of prognostication that emitted light of complex wave length. While this method investigates disease that laser wishes to treat, it is treating whole skin to store. 500nm's filter leaches conclusion of state examinations fewer than all 590nm and emit 590 - 1200nms' light. IPL's variable is skin style, energy, wave length, and investigation time. Usually, energy is more, curative effect is good. If use doing filter so that short cast may appear controlling conclusion of state examination, is better. If short wave length is included much, possibility that damage occurs in skin is much and permeability interacts mainly on the surface on enemy plane. Energy is enough for this reason and 515 - each pulse width, time, delay time between pulse etc. should be regulated as variable 1200nms' wave length should be formed.

Have better set and use suitable energy suitably. However, case that do feedback which is different from anticipation if try treatment is appeared. Specially, face is red and because there is vasodilatation, light of wave length of daytime is more effect. However, must raise energy to regulate and come deeply at this time by light of high wave length because must come deeply to do manufacture of headgear. If energy rises, skin treats because light regulates so that time that appear is prolonged because worry to hurt grows. Doing so that cast of little more high wave length may appear, and regulate so that cast appears for longer time. Therefore, curative effect is dropped some than people who people who color is dark have light color anyway. Because variable that IPL treatment must regulate than other laser treatment is much, use is not easy.

In fact, Oriental need 1 ~ 2 weeks' priority action in general and can go through inconvenience which after action need after surgical operation. Specially, hair changes according as heredity enemy, environmental leading person and age increases, and difference by individual is big. Also, hair classification benevolent person to skin temperature, the poor-quality paper made of mulberry bark amount, the water amount, skin PH, hair color, neutralization ability etc.

By foreign enemy habitat factor, blood stream, the sweating amount etc. Eactly measurement difficult.

Hair actuality ph value does not exist in dry. Only, could not but treat for hair color (white, black color, brown) back that is optical classification system. Do variety with Pulsed Lighting way to do function variously for light treatment, back for regulation cap exclusion for hair exclusion to coloring matter treatment, vein treatment that use to capillary vessel extension symptoms and so on, skin aging and peaceful slumber flushing etc. That treat pimple bacterium and so on. In this experiment portable - micro hair exclusion exclusive use system design and embody . Daytime reduces damage to wave length in hair. Also, can reduce damage to formation that energy space adjustment is available and do not want. Is safe to treatment and so on that is the South Korea which course coloring matter composure by melanin cell is worried. Parameter (energy density, pulse time, pulse width, delay time) of most suitable variously adjustment possible techniques embody.

This research is FET (Fause¹⁰⁻⁹⁰, Energy²⁰⁻⁴⁰ Trigger¹⁻⁷) function. That is, the energy injection rate to pick up 1 - 7 step pulse trigger way and 20 - 40 according to human body condition, for period of dormancies of 10 - 90 step back correctly adjustment possible. Produced harmless micro carrying along style root of a hair exclusion radical in human body. Special quality examination and xenon flash lamp etc. did an experiment through driving gear. Light transmission way of most suitable has advantage that can penetrate brightness directly in part disease. Can not overlook point that there is difference in ability photo-electricity month by diverse color of horn character department which is head of a family outside part of hair and treatment according to various patient can be inappropriate.

Because creating individual's hair model to do stable treatment by storehouse transmission way by hair impedance and measure, must embody treatment special quality of most suitable that draw color, energy, wave length 1,000,000 hours, pulse delay etc. and want. Specially, save standard of war treatment pulse modeling by hair impedance, and embodied suitable treatment pulse through pulse modeling of most suitable by hair subordinate. Specially, embody as could do root of a hair exclusion being emitted in pulse form using multi wave length of 560nm, 590nm, 640nm, 755nm and embodied clinical data.

II. VIRTUE REARCH

Each Body surface is hair of about 500 full blooms. Hair is acting important role in human body. But, as society is progressed, face had gotten into troublesome existence for one side. While hair is

snazzy for women from past, much sensitivity were the matter that is used. Also, that body that hair is less gets good feeling nowadays man as well as woman handle that case hair completely increase. Injury by stimulation or impact, these injury that hair is enemy everyday is lightening quantity degree of grow-able disease for cause. Hair of a person is becoming atrophy and is not sensitive so much so that is connected by living body defensive measure. Role of one hair is that assimilate so that to do not to absorb sun's ray in interior of the body absorbing sun's ray. Hair is more to white man usually and develop long. Hair is divided by young rice plant (hair shaft) and root of a hair root and young rice plant is hair that produce on the skin surface, and root of a hair is part on skin lower part. Part that is protecting root of a hair in skin blanket, or speak that is hair follicle. Speak that radices part of root of a hair is hairball (hair bulb) and it is known that cavernous part of the lower part is nipple. Body surface is hair of about 500 full blooms. Hair is acting important role in human body. But, as society is progressed, face had gotten into troublesome existence for one side.

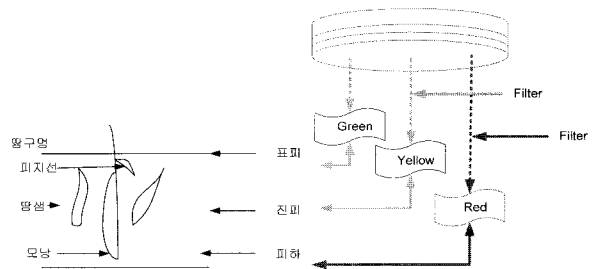


Fig. 1 Filter processing by wave length

Injury by stimulation or impact, these injury that hair is enemy everyday is lightening quantity degree of grow-able disease for cause. Hair of a person is becoming atrophy and is not sensitive so much so that is connected by living body defensive measure. Role of one hair is that assimilate so that to do not to absorb sun's ray in interior of the body absorbing sun's ray. Hair is more to white man usually and develop long. Certain person that have vein or sensitivity in nipple and is justly over in cell nutritive substance send . Mother cell splits and turn on snapping body surface to upper in blanket growing delivering esteemed daughter from nipple for origination of hair.

$$r = \frac{R}{R + G + B}, g = \frac{G}{R + G + B}, b = \frac{B}{R + G + B} \text{ ----(1)}$$

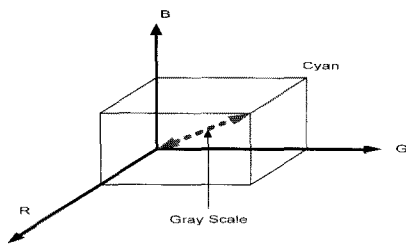


Fig. 2 RGB color cube

Nipple is melanin creation cell that decide hair shade also. Even if is cut even if greased hair or a hair that sebaceous glands heat pregnant woman is not destroyed falls, is grown again. Structure between young rice plant is consisted of three floor if examine section between young rice plant. It is urination, cortex. Urination (cuticle) is coating in state that pile up whole hair from radices part to scale state on thin cell wall of semitransparent certain ingredient. Role of urination is introspection for water, alcohol, rattan that live that parturient canal does not turn white specially that protect hair main frame (cortex) from physical, chemical stimulation. The other side, alkali has weak propensity. Hair can keep shine and beautiful head wave when is coated close by urination.

If urination of that haunt overly is damaged by head or strong medicine etc., hair is damaged too on the whole. Cortex makes of soft protein to staple of hair, nature of hair in certain cortex floor, indeed, elasticity or that is stiff, blandness is decided. There is elasticity that can lift heft of about 100 gram with hair one piece. Cortex also includes much melanin coloring matter granule. Hair color according to a race is due to melanin pigmentary amount that the other speaks in front, and it melanin creation cell does not the function properly and because coloring matter is not formed that gray. Being consisted of protein transfer according to thickness of hair change. Hair is less than that do not grow again that once growth stopped also doing not grow always. Is repeating schedule cycle that is occurrence, growth, depilation, occurrence.

It is known that this cycle of hair is cycle. Hair cycle ordinary, classify by growth, deterioration, decline. Hairball that certain person is new because cell is split of growth process is made, and hair begins to grow in blanket. Because hair that growth 2 grows in blanket turns on the skin surface, nipple of the growth sun reaches and ingests esteemed daughter from capillar vessel in subcutaneous tissue as time long and thickly. Time that certain person stops cellular polarization, and begin depilation ready retrogression time retrogression time la be and do. Root of a hair rises on and mother's milk degree is trembled from hairball. Cycle of growth according to region or age of human's hair becomes different.

Embryo's forerunner is covered with this hair as that one time hair refers to short and thin hair of baby which begin to come into being from embryo. There is seldom coloring matter as thin and soft hair that turn after second down life that increase.

Adult's hair, eyebrows, eyelashes, mustache, armpit and lewd woman's hair is all radiceses. Degree that soft hairs are replaced by radices receives effect of little man and internal secretion institution by heredity red. Research for human body hair had been studied much and take advantage of technology for hair and color and state, hair model base encoding, research of imagination living things and so on is progressing. There are method to find out depth degree of hair using stereo picture two-dimensional case and method to utilize general skin model.

$$R(x, y) = b(r(x, y), g(x, y)) \text{ -----(2)}$$

$$R(x, y) = \frac{1}{2\pi\sigma_r\sigma_g} e^{-\frac{1}{2}\left(\left(\frac{r(x,y)-m_r}{\sigma_r}\right)^2 + \left(\frac{g(x,y)-m_g}{\sigma_g}\right)^2\right)} \text{ -----(3)}$$

That include color information and brightness ingredient and use color revision information in collar above zero brightness ingredient process that do rule need. Can express space by r, g with rule way in figure 3. If express so, is subtracted effect by brightness at burn entry, and number of color ingredient has advantage that the calculation amount decreases as is different decreasing. If analyze hair color information in some conditions from fixed color space, can know that color occurrence frequency for hair sack is massed laying stress on specification area. Color value of pixel that have value such as hair color to draw hair area color in input collar above zero therefore high do. Method that area of any color does as daytime has probability value is very expedient.

III. HAREWARE DESIGN

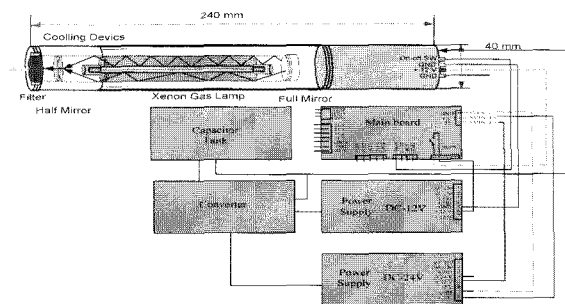


Fig. 5 Serial Type(Pause¹⁰⁻⁹⁰ Energy²⁰⁻⁴⁰ Trigger¹⁻⁷)

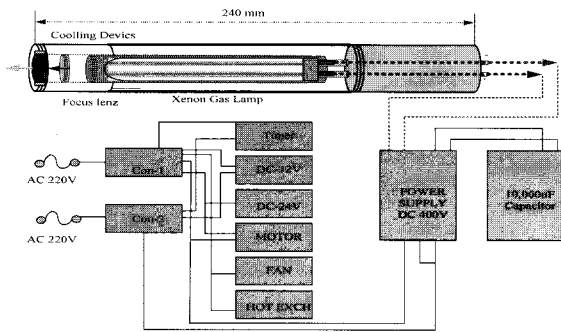


Fig. 6 Parral Type(Pause¹⁰⁻⁹⁰ Energy²⁰⁻⁴⁰ Trigger¹⁻⁷)

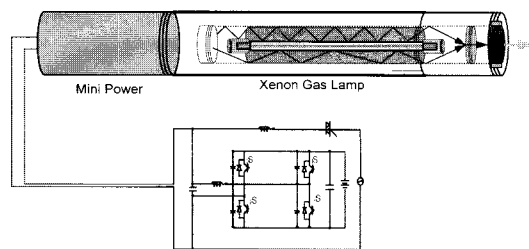


Fig. 7 DC/ AC Link interface(Pause¹⁰⁻⁹⁰ Energy²⁰⁻⁴⁰ Trigger¹⁻⁷)

Can use by AC 220V and become independent dc power by system specifications that manufacture system that manufacture. By whipping protection basis insulation and reinforcement ground connection, wavelength that increase about Xenon gas, electric shock 560nm ~ 1200nm be. Output unit J/cm², output century 20J/ ~ 45J/ cm², Pulse width 0.5ms ~ 15ms, Pulse 1 ~ 3Hz be. Cooling way is my circulation air-cooling, and temperature is 5 - 45°C, and product size 240 (W) that increase × 40 (D) mm, weight 300g be. Action principle does ZVS (Zero Voltage Switching) action in inverter.

The first of transformer of this charger is threaded to charger. The second transmits electric power because is threaded and close up the first to the second that is threaded in root of a hair exclusion mourning when charge in root of a hair exclusion mourning. Battery is connected by multiple on C both end. Current controller and Unitrode company's UC3875 that status change and spiritual enlightenment order of switch element control mean value of transformer primary current decide. Subordinate voltage and load current are controlled by digital by ATMEL company's AT90C8535. 3 charge way according to one way to control subordinate voltage and load current is decided. Constant voltage charge is mode to fix voltage per cell according to battery's discharge state by 2.4 - 2.5 [V] and charges during 10-20 hours.

Because excessive current can pass at charge early, establish limitation current in Battery regular 10-50 [%] extent must limit current. This charger establishes charge voltage by 57-60 [V] and limitation current is available set by 20-50 [A]. Charging current decides according to Battery proper form by way that power failure kind charge keeps charging current as is fixed.

Battery must watch well charge situation because there is danger of polar plate's damage and so on by unmeasured gas occurrence at overcharge. If monad voltage rise so, must finish charge. In this charger charging current by 20-50 [A] charge completion voltage by 57-60 [V] establishment possible. If voltage per cell get into 2.1 [V] degrees, do current to become minimum current if voltage per cell get into 2.6 [V] degrees beginning to reduce size of current. Maximum current is decided according to Battery's proper form. It is known that ratio of maximum current and minimum current is the taper rate. If the taper rate is small, charge time is shortened and there is end point that danger of battery's temperature upswing is. If the taper rate is high, while Battery temperature invincible danger is less, but there is shortcoming that charge time is prolonged. Control transformer primary voltage to control dc output voltage and current and transformer primary voltage is controlled by status change.

Separation style transformer, Transformer should be possible separation in this charger and the first, the second is detached and approximates when charge and forms transformer usually.

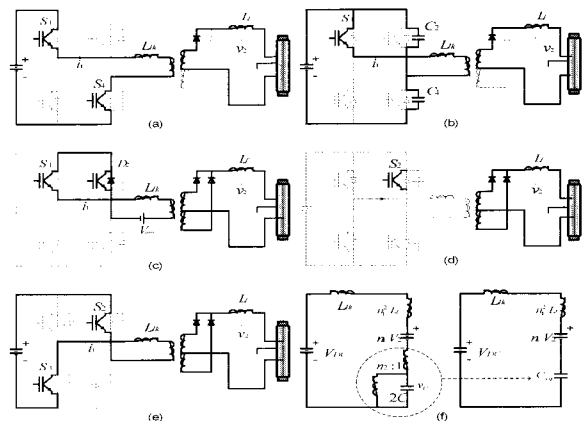


Fig.9 . Action mode

Used high frequency ac from TC of inverter and design power to transmit electric power by Battery. High frequency interchange breeds by high frequency inverter. Inverter circuit composed by IGBT with figure 2. Output of this inverter is delivered in load side through transformer. Transformer core the first puts to charger because separating 1, 2 cars and the

second puts in root of a hair exclusion flag side and did to use approaching at charge. Load current of designed striation four pulse modeling systems is controlled by dc/dc converter. Full bridge inverter of dc/dc converter is consisted by control system hardware enemy who figure 6 embodies concretely of center.

Right side pole of this inverter acts by ZVS and middle pole acts by ZCS. Right side pole of inverter by L_{lk} , C_2 , C_4 relationship help ZVS action and real situation pole by assistance inning by help ZCS action do. Left side pole is used with assistance and is acted passively according to transformer the first current. If the first current is positive direction, DA3 is, and if is backward, DA1 becomes on. ZVS or ZCS does to reduce greatly switching damage of switching element and can heighten action frequency. Voltage of inverter that act by ZV-ZCS are controlled by status change (phase-shift). Unitrode company's UC3879 of status change and spiritual enlightenment order of switch element decides. Make level direct current because there are diode stoppage circuit and filter inductor to the second of transformer. Striation four pulse modeling systems can be used in skin excessive expense laser of constant current system basically. Pulse current check and user justice current (piecewise linear) waveform check are available. Controller of striation four pulse modeling systems is consisted with fig 6. Is divided at current control with current order occurrence department greatly. Current order occurrence department receives issue number of a periodical in high position system through series communication though was composed laying stress on microprocessor.

Digital current order that is given by CPU is made by analog through D/A converter. Current controller is consisted of analog controller and Unitrode company's UC3879. Comparison and compensation with current order and actuality current do in analog controller and UC3879 controls PWM accordingly. Action state of skin excessive expense laser is transmitted by high position computer through series communication. Used high frequency ac from power to transmit electric power by skin excessive expense laser tube. Inverter circuit composed by IGBT with figure 6. Output of this inverter is passed in load side through transformer. If heighten frequency to heighten action frequency to shorten size of transformer, switching damage grows.

This research used clean bright atmosphere voltage/marks of honor kind (ZV-ZCS : Zero Voltage and Zero Current Switching) technology to reduce switching damage. Because both end voltage of on/off city switch element of switch element are "0" in ZVS, electric power damage decreases and on/off of flowing

current consists in "" state on switch element in ZCS and electric power damage at switching decreases. Inverter generates interchange via process such as fig 7. Figure 7 of mode 1 S1 be, military strength is early state to 2 roads supplied section in transformer the first S4 element is lighted. Mode2 of S4 to resonance section that is begun by common S4's ZVS off consist . If voltage of B point arrive on top portion advance guard of dc, S4's ZVS off is completed. Practical equivalent circuit is same with pic that picture omits part for conveniences sake by assistance inning. After current becomes "0" by step that remove current that mode3 of passes to transformer the first by Reset voltage by assistance inning, S1 becomes ZCS off if put out S1. Assistance transformer the second is linked in dc through DA3 and D2 for this section and dc voltage are approved adversely to the first through assistance transformer. If current turns on S2 in passing Mode 3 interval by D2, ZVS on two consists. Mode 4 of transformer the first current pass and free-wheel through the second do section that know be. Mode 5 of S3 section that do layer ZCS on be. During this section primary current by current that have and increase and flow to Df1 in the second circuit slant by Df2 move .

IV. EXPERIMENT RESULT

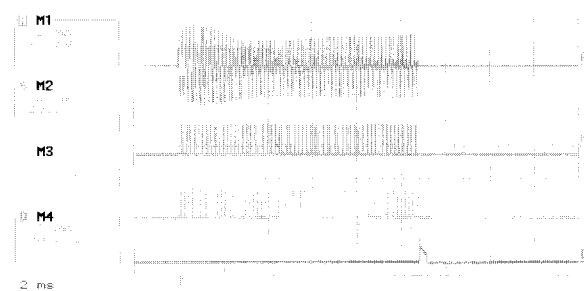


Fig. 10 . Inverter output current

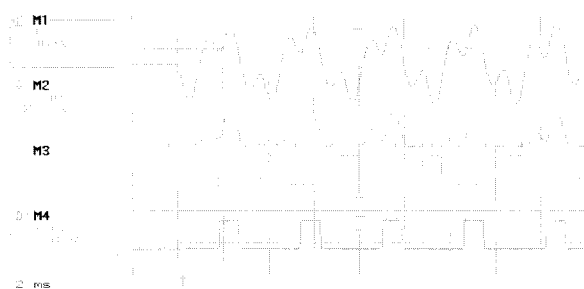


Fig. 11 . Inverter output voltage & control signal

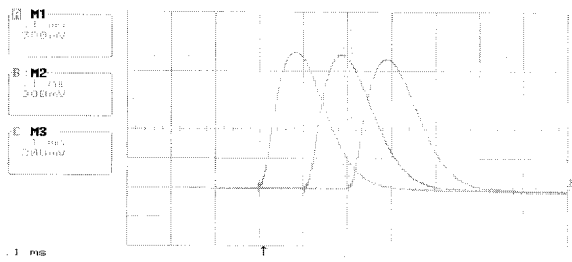


Fig. 12. Repeat PPS

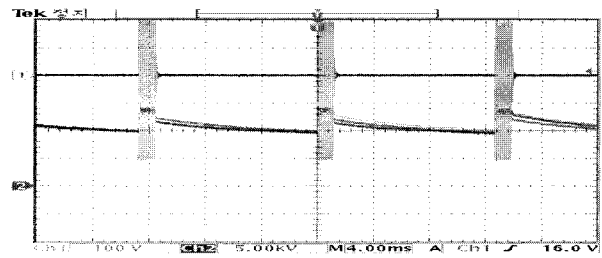


Fig. 17 Existing small high voltage tube terminal output (C102 2 series connections 4)

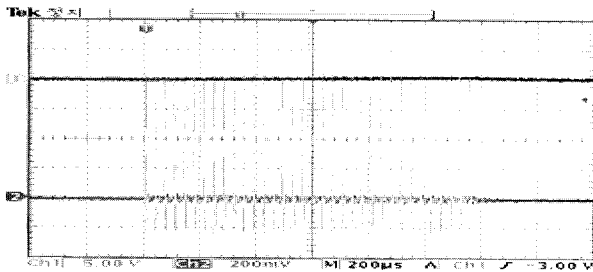


Fig. 13. S_pulse 10W Ch1: coil 1 Ch2: coil 2 current

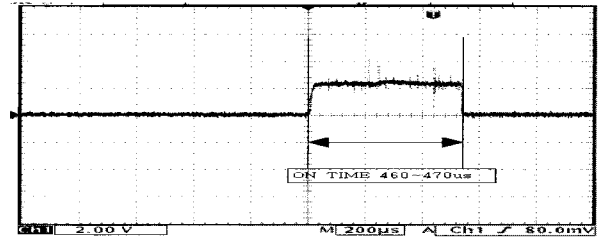


Fig. 18. pulse 70W 450-470 uS

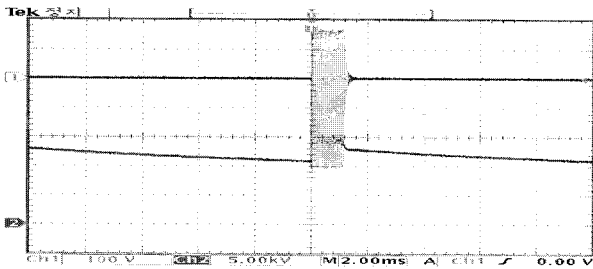


Fig. 14. Existing small high voltage tube terminal output

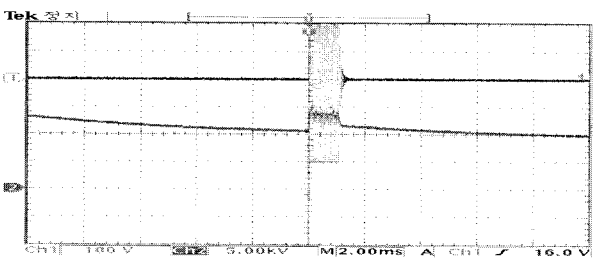


Fig. 15 Existing small high voltage tube terminal output

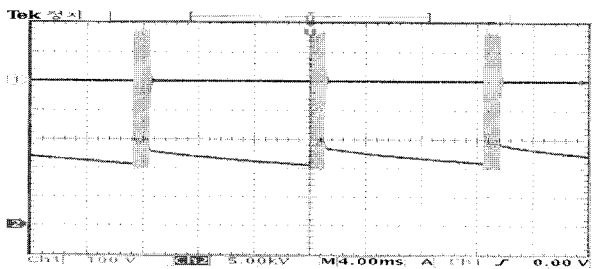


Fig. 16 Existing small high voltage tube terminal output

First, if refer system that propose, use by cast which leisure appears in specification whipping by fixed power control. Striation four pulse modeling systems that propose are high frequency, it is thing for various output by choice of grass bridge control system of repeat style that is. Is way that can treat entirely different skin disease at the same time without side effect breed light (515 - 1200nm) of wave length periodically in strong pulse form.

But, embodied treatment pulse by possible complexion by Software as well as by hardware so that system that see can embody pulse to improve this perfectly being knowing problem according to skin color by skin color. But, embodied treatment pulse by possible complexion by Software wear as well as by hardware so that system that see can embody pulse to improve this perfectly being knowing problem according to complexion by complexion. This way displays effect that as well as coloring matter disease of peaceful slumber hectic, vein sex disease of capillar vessel extension symptoms and so on and freckles or liver spot etc. is gotten better by cast of complex wave length if repeat about 5th to space 3~4 week clinically having various kinds excellent, pore that increase shrinks and as fine wrinkles decrease, face whole skin that skin becomes bouncy rejuvenates.

Basis specification that propose in this research and manufacture is as following. Do condenser CD91A 1000uF/400V, timer 5T3PF AC220V refrigerator circulating pump la steamed rice used for brewing rice wine another thing motor (MP-20R), AC 220V 20 W SMPS, DC power -5V, GND, -12V, -24V, LCD screen MT508SV3CN, high tension occurrence chapter, transformer .If arrange by semi-conductor

performance, is same with lower part.

Working voltage is AC 220V 60HZ, protection about electric shock is 1 danger B type, Wavelength : 560nm, 590nm, 640nm, 755nm, output unit J/cm², century of output 20J/ cm²~45J/ cm², pulse 0.5ms~ 15ms, Pulse count 1Hz~3Hz that increase, cooling way is circulation water-cooling, environment temperature room temperature 5 - 45°C displaying Pulse using multi-waveform storehouse examine. Fig 9 displays Miss Fire detection, fig 10 is Miss Fire detection waveform, fig 11 detects pulse occurrence circuit that act water Flow detection pulse information in oscilloscope. Fig 12 tube both end output, fig 13 tube both end output appear.

Added panel, and because Set1 uses installation Filter 560nm if explain Panel, being function mode to give encouragement of skin, Set2 function mode, Set3 that give encouragement of skin using installation filter 590nm function mode that give encouragement of skin using installation filter 640nm by give that function mode using installation filter 755nm stimulation of skin Set4 act can. A controls century military expedition of Fluence, Energy by ^ v and mark the state, B is Pulse counter, Number of times of energy output apply (make in Reset - initialization 0000 states) indication and C applies appliance in ready state that Ready can emit investigation beam.

When display, display in on state necessarily. Ready can select and use when establish again output adjustment. Finally, important thing may arranged and refer treatment pulse result that is human body in treatise next term from fig 15 to 19 as treatment pulse mode privately.

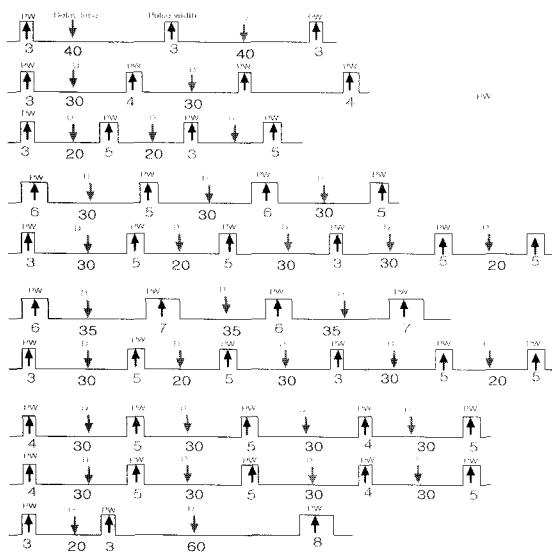


Fig. 19. Hair root removal therapeutic pulse

V. CONCLUSION

First, storehouse investigation pulse modeling system has advantage that can irradiate mineral ore directly in part war by storehouse transmission treatment way of most suitable through skin and there is difference in ability photo-electricity month by diverse complexion of horn character department which is head of a family outside part of skin.

To standpoint that treatment can be inappropriate according to various patient does fixed measuring by storehouse investigation way by skin impedance in research, it is method to use skin impedance way and color information through skin area abstraction and Correct. That is, after search each color ingredient that ingredient of HIS and YIQ that use color information corresponds to skin color in an experiment though is most universal, because creating automatically individual's skin model through view-data who receive result according to patient's skin model area detection as result that use color information and measure, investigated model and special quality of most suitable that draw skin color, energy, wave length 1,000,000,000,004 hours, pulse delay etc. and want. Second, it is thing to save standard of war treatment pulse modeling by skin impedance. Design and manufactured storehouse investigation pulse modeling system of most suitable by skin subordinate.

Physiognomy of figure 15 is treatment pulse mode for black in 3 pulse kind as treatment pulse by complexion, and middle is yellow race treatment pulse mode, and soft is white man treatment pulse mode. Fig 16 is treatment pulse mode by blood clotting disorder, physiognomy is black treatment pulse mode, and soft is white man treatment pulse mode that is yellow. Fig 17 is treatment pulse mode by skin refreshing, physiognomy is black treatment pulse mode, and soft is white man treatment pulse mode that is yellow.

Physiognomy of fig 18 is pulse mode for black in 3 pulse kind as treatment pulse for regulation cap, and middle is yellow race pulse mode, and soft is white man pulse mode. Fig 19 is expressing energy input per treatment pulse lastly by the most important thing. Clinical demonstration about this research embodied by help of hospital with company. Will contain presence at a sickbed picture in detail in dissertation next term, and see that there is large sense that manufactured striation four pulse modeling systems, and embody correct treatment pulse model in complexion, and construct suitable treatment pulse database by skin collar fit in domestic real condition in this research.

Designed pulse trigger way and the energy injection rate according to FET (False¹⁰⁻⁹⁰, Energy²⁰⁻⁴⁰ Trigger¹⁻⁷) function, indeed, human body condition, pause etc.,

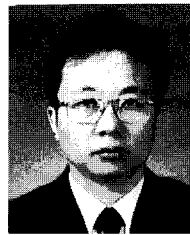
so that adjustment can be available and design harmless micro carrying along style root of a hair exclusion flag in human body and manufacture and run special quality examination and Xenon flash lamp correctly.

Advantage that storehouse transmission way of most suitable can penetrate brightness directly in part war in store communicative ability by horn character department's diverse skin color which is branch or head of a family outside part of skin difference be and can not overlook point that treatment according to various patient can be inappropriate. Because creating individual's skin model to do stable treatment by storehouse investigation way by skin impedance and measure, must embody treatment special quality of most suitable that draw skin color, energy, pulse delay etc. and want. Specially, saved standard of war treatment pulse modeling by skin impedance, and manufacture pulse modeling system of most suitable by skin subordinate, and embody suitable treatment pulse.

Specially, embody as could do root of a hair exclusion being emitted in pulse form using 560nm, 590nm, 640nm, 755nm's multi waveform and embodied clinical data. If become research repletion furthermore little more, is seen that can approximate in land of Supreme Happiness.

REFERENCES

- [1] Dierickx CC, Grossman MC, Farinelli WA, Anderson RR. Permanent hair removal by normal-mode ruby laser. *Arch Dermatol* 1998;13:837-69.
- [2] Lou WW, Quintanna AT, Geronemus RG. Prospective of hair reduction by diode laser (800 nm) with long term follow-up. *Dermatol Surg* 2000;26:428-432.
- [3] Goldberg DJ, Samady JA. Evaluation of a long term Q-switched Nd:YAG laser for hair removal. *Dermatol Surg* 2000;26:109-113.
- [4] Bencini PL, Luci A, Galimberti M, Ferranti G. Long-term epilation with long-pulse neodymium: YAG laser. *Dermatol Surg* 1999; 25:175-178.
- [5] Stratigos AJ. A review of laser systems and light sources for hair removal. *Med Surg Dermatol* 1998;5:103-6.
- [6] Goldberg DJ. Unwanted hair: Evaluation and treatment with lasers and high source technology. *Adv Dermatol* 1999;14:115-
- [7] Winston KR. Hair and neurosurgery. *Neurosurgery* 1992;31:320-
- [8] Bell RM, Bell PM. The OR—home of the surgeon. In: Lawrence PE, editor. *Essentials of general surgery*. Baltimore: Williams & Wilkins; 1988. p. 28-37.
- [9] Montes LF, Wilborn WH. Anatomical location of normal skin flora. *Arch Derm* 1970;101:145-59.
- [10] Goldberg DJ, Silapunt S. Hair removal using a long-pulsed Nd: YAG laser: Comparison at fluence of 50, 80 and 100 J/cm². *Dermatol Surg* 2001;27:434-6.
- [11] 김휘영(2008), 특허등록번호 10-0876840 휴대용 제모관리기, 특허청
- [12] 김휘영(2008), 특허등록번호 10-0801376 광 펄스를 이용한 휴대용 제모기, 특허청
- [13] Kim W-Y. Long pulse generation technology of solid-state laser adopting a new real time multi discharge method. *Optics & laser technology* 2002, 34: 203-207



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