ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 1, Issue 9, December 2014

Muscle Stimulation

Mayank Lokhande

Introduction to Muscle Stimulation

Electronic muscle stimulation (EMS), also known as neuromuscular electrical stimulation (NMES) or electromyostimulation is the elicitation of muscle contraction using electric impulses. EMS has received increasing attention in the last few years, because it has the potential to serve as: a strength training tool for healthy subjects and athletes; a rehabilitation and preventive tool for partially or totally immobilized patients a testing tool for evaluating the neural and/or muscular function in vivo; a post-exercise recovery tool for athletes. The impulses are generated by a device and delivered through electrodes on the skin in direct proximity to the muscles to be stimulated. The impulses mimic the action potential coming from the central nervous system, causing the muscles to contract. The electrodes are generally pads that adhere to the skin. Electrical muscle stimulation, or EMS, is the use of electrical impulses to cause muscles to contract. EMS has long been used in physical therapy, and research has shown that it can help strengthen and tone muscles, though only to a certain extent. However, manufacturers' claims that EMS devices promote weight loss or fat loss have never been proven. Indications Neuromuscular stimulation should be used only under medical supervision for adjunctive therapy in the treatment of medical diseases and conditions. Neuromuscular Stimulation (N.M.E.S) is the application of an electrical stimulus for use in muscle rehabilitation.An electrical stimulus is passed from the device to an electrode that is placed on the skin over the motor point of a targeted muscle or muscle group. This stimulation results in a muscle contraction. By assisting patients to fully contract a muscle or muscle group, N.M.E.S can move a patient more quickly towards normal function and the resumption of their normal activities.

Muscle Stimulation is indicated for use in

- The retardation or prevention of disuse atrophy (wasting of muscle due to lack of use)
- Muscle re-education, such as after surgery or trauma Relaxation of a muscle spasm
- Prevention of deep Venous Thrombosis (blood clots due to inactivity) immediately after surgery
- Maintaining or increasing the range of motion
- Increasing local blood flow

A wide range of neurological and orthopedic diagnoses will benefit from the use of Muscle Stimulator.

Some of the most common uses include

- Rehabilitation after knee surgery
- Traumatic injury
- Shoulder rehabilitation
- CVA (stroke)

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 1, Issue 9, December 2014

Muscle Stimulators are user friendly and safe to be used by the patient at home. It therefore offers the patient a self-management option -- a desirable aspect of any treatment program since this has been shown to increase patient compliance and response to treatment.

After the initial cost of purchasing a Muscle Stimulators device, the replacement of batteries and electrodes are the main running costs. In long-standing cases of pain, this is cheaper than regular prescriptions for analgesics.

The precautions and contradictions associated with Muscle Stimulator are few and largely based on common sense. In addition, side-effects are minimal (i.e. skin irritation)

The application of a Muscle Stimulation device requires Proper patient selection, electrode placement, parameters selection and patient education contributes to the successful use of these devices.

Function

EMS works by simulating the natural process of exercising muscles. When you want to move your arm, for example, your brain sends electrical impulses down the spinal cord and out through nerve pathways to reach the proper muscles for the job. Those impulses stimulate the muscles, causing them to contract, and your arm moves just like you wanted it to. With EMS, however, the impulses come from electrodes attached to the skin over the muscle, not from your brain. The electrodes deliver impulses--tiny electric shocks, really--and the muscles contract.

DO THE ELECTRONIC MUSCLE EXERCISERS WORK?

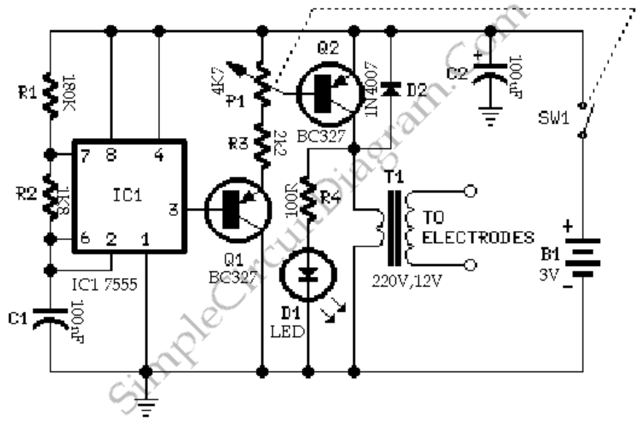
Electric muscle stimulation, or EMS, most often used for therapeutic rehabilitation purposes, is the process of using low current electrical impulses to stimulate muscles and cause them to contract. In physical therapy or sports medicine practices, EMS is often used to help retrain injured or atrophied muscles. According to the FDA, while EMS devices may be able to temporarily firm and tone a muscle.

Working

Here is a circuit that stimulates nerves of that part of your body where electrodes are aid in removing cellulites. The system comprises two units: muscular stimulator the circuit of the muscular stimulator. IC 7555 is wired as an a stable multi vibrator to generate about 80Hz pulses. The output of IC1 is fed to transistor T1, whose emitter is further connected to the base of transistor T2 through R3 and VR1. The collector of transistor T2 is connected to one end of the secondary winding of transformer X1. The other end of the secondary winding of the transformer is connected to ground. When IC1 oscillates, transformer X1 is driven by the pulse frequencies generated to produce high voltage at its primary terminals. Separate electrodes are connected to each end of the primary winding of transformer X1. Diode 1N4007 (D1) protects transistor T2 against high-voltage pulses generated by the transformer. Using potmeter VR1 you can control the intensity of current sensing at the electrodes. The brightness level of LED1 indicates the amplitude of the pulses. If you want to increase the intensity level, replace the 1.8-kilo-ohm resistor with 5.6 kilo-ohms or higher value up to 10 kilo-ohms. X1 is a small mains transformer with 220V primary to 12V, 100/150mA secondary. It must be reverse connected, i.e., connect the secondary winding to the collector of T2 and ground, and primary winding to the output electrodes. The output voltage is about 60V but the output current is so small that there is no threat of electric shock. Electrodes are made of small, thin gauge metallic plates measuring about 2.5×2.5 cm2 in size. Use flexible wires *Fig. 1: Muscular stimulator circuit* attached. It is useful to relieve headache and muscular pain and revive frozen muscles that impair

iJCEM
International Journal of Core Engineering & Management
ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 1, Issue 9, December 2014

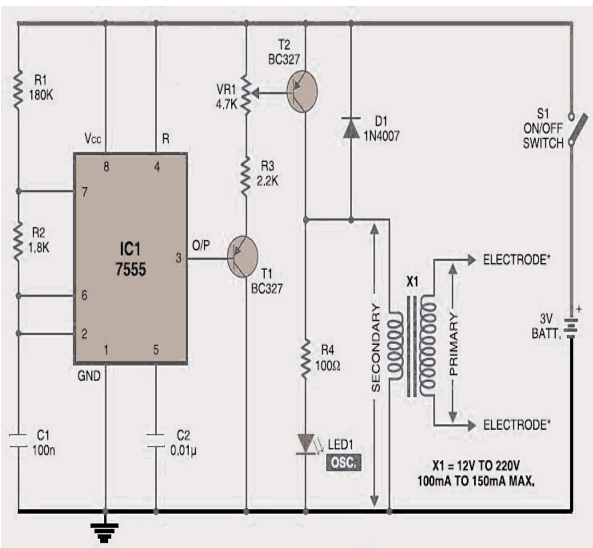
movement. Though it provides muscles stimulation and invigoration.



Components

- IC 7555
- Resistor R1(180k)
- Resistor R2(1.8k)
- Resistor R3 (2.2k)
- Resistor R4 (100 ohm)
- Capacitor C1 (100n)
- Capacitor C2(.01*u*)
- Variable resistor(4.7k)
- Transistor *T1 (BC327)*
- Transistor *T2 (BC327)*
- Diode *D1 (1N4007)*
- Transformer X1 (12 to 220v ,100mv to 15o mA max)
- LED
- Electrodes
- Battery (3v)
- Switch S1

Diagram



Theory

EMS causes adaptation, i.e. training, of muscle fibers.Because of the characteristics of skeletal muscle fibers, different types of fibers can be activated to differing degrees by different types of EMS, and the modifications induced depend on the pattern of EMS activity. These patterns, referred to as protocols or programs, will cause a different response from contraction of different fiber types. Some programs will improve fatigue resistance, i.e. endurance, others will increase force production.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 1, Issue 9, December 2014

THE USES OF AN ELECTRONIC MUSCLE STIMULATION MACHINE

Electronic muscle stimulation, or EMS, machines use low-voltage pulses to stimulate motor nerves that cause muscles to contract. Medical facilities use these machines to treat pain, relax and strengthen muscles, and increase blood circulation.

Range of Motion

EMS machines are often beneficial for people who suffer a reduced range of motion in their shoulders, knees or backs because of fractures or operations. The EMS therapy helps stimulate muscles and either maintain or increase the amount of movement in the affected areas.

Muscle Disuse Atrophy and Muscle Reeducation

When you do not use certain muscles for long periods of time, they can lose tone and begin to atrophy. The electrical stimulation of EMS machines can help to contract and strengthen muscles to prevent disuse atrophy. When muscles have begun to atrophy, EMS in conjunction with exercise may help speed the strengthening of atrophied muscles.

Blood Circulation

The medical device company Ib3Health reports on its website that the rhythmic muscle contractions triggered by EMS machines can be helpful in increasing blood circulation. As blood circulation improves, areas that are swollen or tender may begin to improve. In addition, the machines are sometimes beneficial after surgery to stimulate calf muscles and prevent venous thrombosis .

Things You Need to Know About Electronic Muscle Stimulation

1. Understanding the Basics

Electronic muscle stimulation (EMS) uses small electrical charges to zap muscles and make them contract and relax automatically. Pads that contain electrodes, connected by wires to a small control unit, are attached to the body and deliver the charges. The theory is that this helps heal damaged muscles and helps strengthen normal muscles without active exercise.

2. Medical Uses of EMS

EMS is often used in rehabilitation following surgery or injury. Muscles quickly lose their strength and tone when they are not used. EMS helps patients who can't move around during recovery regain some muscle tone. Because EMS causes muscles to contract and relax without the patient's own effort, it keeps the injured muscles active. It's a kind of "heal as you sleep" method. For pain control, doctors and physical therapists may use a similar device, known as a TENS (Transcutaneous Electrical Nerve Stimulator) unit.

Uses

EMS can be used both as a training, therapeutic, and cosmetic tool.

In medicine EMS is used for rehabilitation purposes, for instance in Physical therapy in the prevention of disuse muscle atrophy which can occur for example after musculoskeletal injuries, such as damage to bones, joints, muscles, ligaments and tendons. However, this should not be confused with TENS (Transcutaneous Electrical Nerve Stimulator): the use of electric current in pain therapy.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 1, Issue 9, December 2014

Because of the effect that strengthened and toned muscles have on appearance (a stronger muscle has larger cross-section), EMS is also used by a niche of practitioners for aesthetics goals. The FDA rejects certification of devices that claim weight reduction. EMS devices cause a calorie burning that is marginal at best: calories are burnt in significant amount only when most of the body is involved in physical exercise: several muscles, the heart and the respiratory system are all engaged at once.However, some authors imply that EMS can lead to exercise, since a person toning his/her muscles with electrical stimulation is more likely afterwards to participate in sporting activities as the body is ready, fit, willing and able to take on physical activity. In EMS training few muscular groups are targeted at the same time, for specific training goals.The effectiveness of the devices for sport training has been debated.

Benefits

Doctors and physical therapists regularly use EMS to treat people who have suffered a loss of muscle function, such as from a stroke, spinal cord injury or other nerve damage, or who are unable to exercise certain muscles because of injury or surgery. Because EMS simulates natural muscle activity--muscles contract when the impulses are applied and relax when they aren't--it can help maintain tone and strength in muscles that would otherwise "atrophy," or waste away from lack of use. Another common use of EMS is to relieve muscle spasms.

Caution

Heart patients and pregnant women should not use this device. Also, do not attach electrodes to burns, cuts, wounds or any injury. Consult your physician before using this circuit.

References

- ✓ *www.wikipidia.com*
- ✓ *www.electronicsforu.com*
- ✓ *www.engineeargarage.com*
- ✓ *www.slideshare.net*
- ✓ *www.youtube.com*
- ✓ *www.projectsof8051.com*
- ✓ *www.ieeexplore.ieee.org*