



## Development Of Medical Therapeutic Apparatus "Electrosleep Supromed" And Its Technical Parameters

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### ABSTRACT

Electrosomni neurotherapy is a method based on which is the impact on the Central nervous system (CNS). Patient affects constant pulse current (rectangular), low frequency and small current. This pulse current specified parameters at impact of causes the patient's condition close to the physiological sleep. "Electrosomni Supromed" apparatus beneficially affects to the area of the brain and reaches sensitive nuclei of cranial nerves, pituitary, hypothalamus, reticular formation and other structures of the brain. This method is used in diseases on the basis of which is functional violations of CNS. Developed by the unit is designed to neuro-mental disease in Pediatrics, therapy, surgical practice, skin clinic, gynecology and in other cases where shown treatment unit "Electrosomni Supromed".

### Keywords:

pulse generator, output amplifier, electrode, current of additional constant component, pituitary gland, rectifier, patient current indicator, power supply.

### Introduction

Electrosomni neurotherapy is a method based on the effect on the central nervous system (CNS). The electrosleep device affects the area of the brain and reaches the sensitive nuclei of the cranial nerves, pituitary gland, hypothalamus, reticular formation and other brain structures.

This device is intended for the treatment of neuropsychiatric diseases in pediatrics, therapy, surgical practice, skin clinics, and gynecology.

The pulse current has a rectangular shape and the following parameters, frequency (1-160 Hz), current (up to 10 mA), and pulse duration (0.2-0.5 ms) when exposed, the current penetrates

through the openings of the orbits into the brain, spreading along the vessels and reaches the sensitive nuclei of the cranial nerves, pituitary gland, hypothalamus, reticular formation and other structures of the brain and induces in the patient a state close to physiological sleep.

### Main part

Currently, scientific achievements and results are widely applied and introduced in various areas of the national economy, including in the field of medicine. Electrosleep therapy is a method of neurotropic therapy based on the impact on the central nervous system (CNS) of the patient with a constant impulse current (preferably rectangular shape) of low frequency (1-160 Hz) and low force (up to 10 mA) with short duration pulses (0.2-0.5 ms). The impulse current of these parameters when exposed to the ocular-occipital technique causes a state close to the physiological sleep.

The action of the "Electroson Supromed" device consists of a reflex and direct, direct effect of the current on the brain regions. In this case, the current penetrates through the orifices of the eye sockets into the brain, spreads along the vessels and reaches the sensitive nuclei of the cranial nerves, the pituitary gland, the hypothalamus, the reticular formation and other structures of the brain.

Recent studies, summarizing many years of experience in the application of electrosleep, indicate that electro-therapy is indicated for almost all diseases, because any disease or pathological process in the body disrupt the functional state of the central nervous system, adaptive-adaptive mechanisms, corticovisceral relationships, which can be normalized using this method [1].

Currently, electrosleep therapy uses portable devices for one patient: "Electroson-4T", "Electroson-5" (ES-10-5) and a stationary "Electroson-3" device for simultaneous exposure to 4 patients. All of them are generators of voltage pulses of constant polarity and rectangular shape with a certain duration and adjustable frequency (up to 160 Hz). Two pairs of special electrodes are attached to the

apparatus, which are mounted on the patient in the form of a mask.

At present, the dominant approach is that in the case of the predominance of organic degenerative processes in the vessels and the brain region. With pronounced CNS excitation, an electrosleep with a pulse frequency of 5 to 20 Hz is prescribed. In diseases based on functional disorders of the central nervous system, there is a predominance of inhibitory processes or depression of sympathetic adrenal activity (neuroses, arterial hypertension, etc.), a pulse frequency of 60-120 Hz is used [4].

More promising is the principle of individual selection of the frequency of exposure based on the study of the frequency and energy components of the patient's encephalogram. There are also other approaches to individual selection of the frequency of the current when exposed to the patient. During the course, the adequately selected frequency, as a rule, does not change. The duration of the procedure varies from 30-40 to 60-90 min, depending on the characteristics of the patient's nervous system and the nature of the pathological process. The procedures are performed daily or every other day, 10-15 exposures are prescribed for the course [2].

The design of devices for the electric system allows to supplement the action of the pulsed current with a galvanic current - imposition of an additional constant component (ACCC). This circumstance makes it possible to enhance the irritant effect factor through the surface of the eyes and conduct drug electrophoresis. The so-called technique, combining electrophoresis with impulse currents with the action of the «Electroson Supromed» apparatus (electrospinore), is most justified for the administration of drugs of a tranquilizing or nootropic effect [3].

Electrosleep therapy also has a contraindication for individual intolerance to the current, acute pain of visceral origin, inflammatory eye diseases, high degree of nearsightedness, retinal detachment, eczema and dermatitis on the face skin, hysterical neurosis, epilepsy, the presence of metal objects in the brain and eyeball tissues, and with general contraindications for physiotherapy [5].

The developed device "Electroson Supromed" (Fig. 1) is designed for dosed effect on the cerebral cortex with a pulse current of rectangular shape. The device is intended for the treatment of diseases in the basis of pathogenesis of which lies the formation of stagnant foci of excitation and inhibition in the cortex of the cerebral hemispheres, as well as the disruption of normal correlate-subcortical regulation of the body's somatic functions. The device is used for the treatment of

neuropsychiatric diseases in pediatrics, therapy, surgical practice, skin clinic, gynecology and in other cases, when treatment with "Electroson Supromed" is indicated. The device is designed for operation under the following conditions:

- ambient air temperature from +10 to + 35 ° C,
- the relative humidity of the ambient air is up to 80% at a temperature of + 25 ° C.

The installation is up-to-date, easy to handle.

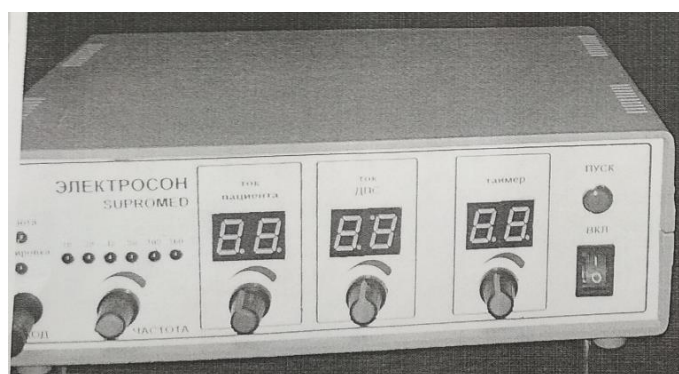


Fig.1. General view of the apparatus «ELEKTROSON-SUPROMED»

#### *Technical characteristics of the apparatus «ELEKTROSON-SUPROMED»*

- Pulse repetition rate: 10, 20, 40, 80,100 and 160 Hz. The relative error of frequency setting is not more than 20%;
- Pulse duration 0.5 ms  $\pm$  20%;
- The total duration of the front and cutoff of pulses is not more than 50  $\mu$ s;
- The impulse current at the output of the device is adjustable from zero to the maximum value. The maximum pulse current amplitude at the output of the apparatus is 10 mA  $\pm$  15% at a load of 5000  $\pm$  50  $\Omega$ ;
- The additional constant current component (ACCC) at the output of the device is adjustable from zero to the maximum value. The maximum value of the ACCC at the output of the apparatus is 0.5  $\pm$  0.1 mA at a load of 5000  $\pm$  50  $\Omega$ ;
- Pulsations in the chain of ACCC do not exceed 1% of the maximum value of ACCC;
- The time for setting the operating mode does not exceed 3 min;

- The device allows continuous operation for 8 hours;
- The device operates from an alternating current network of frequency 50  $\pm$  0.5 Hz with a nominal voltage of 220 V with a deviation of the mains voltage  $\pm$  10% of the nominal value;
- The power consumed by the apparatus from the network is not more than 20 W;
- For protection from electric shock, the device is made in class II, type BF;
- The device provides a protection device that excludes the possibility of supplying an output current in the event of a power failure when the handle "PATIENT TOP" is not set to the extreme left (zero) position or a sudden increase in the load current;
- The device has a procedural clock with the procedure time set from 1 to 64 minutes. in increments of 1 min. The completion of the procedure shows the indicator light;
- Monitoring of patient and ACCC current level is carried out by digital, dimensionless current indicators;

- Work on refusal not less than 1500 hours of conditionally continuous work.
- Average service life to write-off of at least 5 years;
- Overall dimensions of the machine are 260 x 200 x 100 mm;
- The weight of the apparatus without a set of electrodes is not more than 1.8 kg, with a set of electrodes not exceeding 3.5 kg.

### Device and operating principle of the device

The mains voltage  $\approx 220$  V is first reduced by a linear transformer to  $\approx 30$  V, rectified by the bridge rectifier circuit, stabilized by an integral stabilizer at +15 V and applied to a switching power supply that generates all the voltages required for the operation of the +65 and 5 V circuit diagrams.

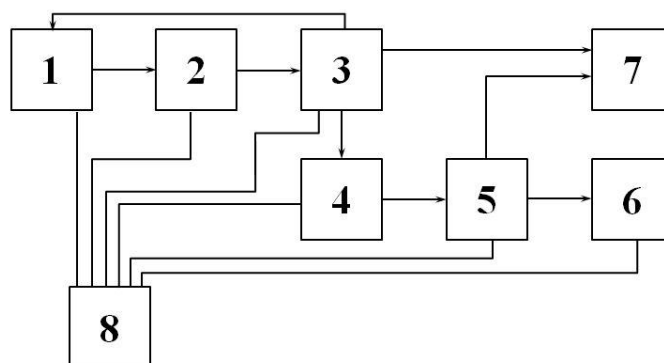


Fig.2. Functional diagram of the Electroson "SUPROMED":

1- pulse generator; 2-output amplifier; 3-patient chain protection system; 4- patient indicator; 5- additional constant component

The functional diagram of the apparatus (Fig. 1) consists of:

- a pulse generator on the PIC12F675 controller (1);
- the output amplifier (2);
- patient chain protection system (3);
- patient current indicator (4);
- the generator of an additional constant component of the patient's current (ACCC) (5);
- current indicator ACCC (6);
- Patient circuits (7);
- power supply unit (8).

The program of the generator controller (1) provides generation of pulses, the frequency of which is set by the "FREQUENCY" knob on the front panel of the device (Fig. 2). The frequency switching shows the corresponding luminous LEDs.

The output current of the device is provided by an output amplifier (2), the amplitude value of which is regulated by the handle "PATIENT CURRENT". The digital indicator of the patient current (4) shows the current level in dimensionless quantities.

generator (ACCC); 6 - indicator ACCC; 7 - patient circuit; 8 - patient block

An additional constant component of the patient's current is provided by the current generator of the ACCC (5). The current of the ACCC is combined with the impulse current of the patient and creates their "pedestal". The ACCC current provides a small galvanization. The current level of the ACCC is regulated by the handle "TOK ACCC". The digital indicator shows the level of the ACCC current.

The patient circuit protection system (3) blocks the current in the patient circuit when the unit is switched on with the "PATIENT TOP" and "TOK ACCC" regulators not moved to the extreme left (zero) position, and also with a sudden increase in current (with short-circuit of electrodes) on the patient. When the output current is blocked, the red "LOCK" LED lights up. The green LED "OPERATION" indicates that the unit is operating normally.

The patient's circuit consists of two pairs of temporo-occipital electrodes mounted in a rubber helmet worn on the patient's head and switching wires connecting the electrodes to the output connector of the "EXIT" device.

The power unit of the device provides double protection of the patient from mains voltage. The mains voltage  $\pm 220$  V is first reduced by a linear transformer to  $\pm 30$  V, rectified by the bridge rectifier circuit, stabilized by an integral stabilizer at + 15 V and applied to a switching

power supply that generates all the voltages necessary for the operation of the +65 and 5V circuit diagrams.

To obtain a physiological effect, the current is used between the thresholds of perception and pain sensation (Fig. 3).

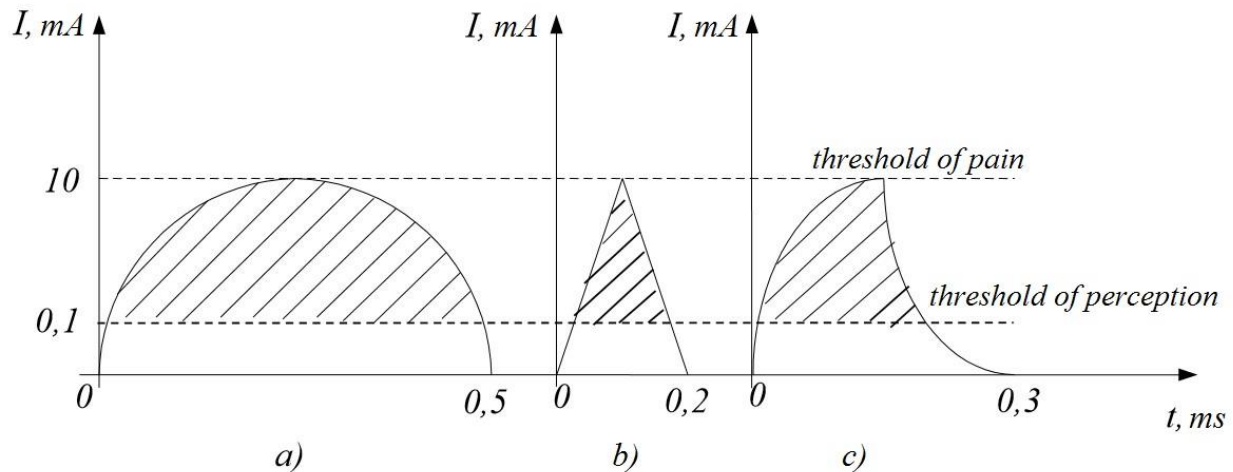


Fig. 3. Schematic representation of sinusoidal (a), tetanizing (b), exponential (c) currents (the coverage area is shaded)

#### Indications and contraindications

Electrosleep can be prescribed in the following pathologies:

- arterial hypertension I-II degree;
- hypotension;
- Nervous disorders;
- hormonal disorders;
- Peptic ulcer of the digestive tract;
- rheumatoid arthritis;
- cardiac ischemia;
- bronchial asthma;
- Some dermatoses (eczema, psoriasis, atopic dermatitis);
- stuttering;
- trauma to the skull, brain.

Contraindications to the procedure are:

- myopia is more than 5 diopters;
- inflammatory diseases of the eyes and eyelids;
- immature cataract;
- dermatitis or eczema of the face;
- Inflammation of the meninges;
- heart failure of II and more degree;
- intolerance to current;
- the presence of a foreign body in the eyes;

- presence of metal fragments in the cavity of the middle ear, soft tissues of the head or bones of the skull

#### Conclusion

After acquainting and studying the technical characteristics of the above-mentioned Electroson apparatus and studying the methods of treating neuropsychological diseases, together with the Supramed company, a more modern device is put into sleep state with a 15% improvement in efficiency, and also a deep immersion system sleep. This apparatus is approved by medical institutions and, after receiving a positive response, will be subsequently introduced into the republican health care system.

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