United States Patent

[11] 3,626,926

[72] Inventors **Mikhail Ilich Kuzin**
Leninsky prospekt, 60/9, kv. 76;
Samvel Artushovich Agasarian, 3
Parkovaya ulitsa, 33, kv. 35; Vladimir
Davydovich Zhukovsky, Sadovaya-
Samotechnaya ulitsa, 7, kv. 6; Nikolai
Alexeevich Volkov, 3 Parkovaya ulitsa, 46,
korpus 2, kv. 57; Vladimir Iosifovich
Sachkov, Podsosensky pereulok, 18, kv. 6.;
Isaak Zakharovich Rukhovets, 6 proezd
Mariinoi Roschi, 28/30, kv. 3.; Nikolai
Mitrofanovich Liventsev, Novodevichy
proezd, 2, kv. 115; Boris Ivanovich
Panfilov, 2 Frunzenskaya ulitsa, 10, kv. 34,
all of Moscow, U.S.S.R.

[21] Appl. No. **717,127**
[22] Filed **Mar. 29, 1968**
[45] Patented **Dec. 14, 1971**

[54] **APPARATUS FOR CONTROLLED INHIBITION OF THE CENTRAL NERVOUS SYSTEM IN MAN OR ANIMAL, MOSTLY FOR ELECTRONARCOSIS**
1 Claim, 2 Drawing Figs.

[52] **U.S. Cl.** ..... **128/1 C,** 128/419 R
[51] **Int. Cl.** **A61n 1/08,** A61n 1/34
[50] **Field of Search** 128/1, 1.03, 419, 420, 421, 422

[56] **References Cited**

UNITED STATES PATENTS

2,622,601	12/1952	Nemec	128/422
2,771,554	11/1956	Gratzl	128/421

FOREIGN PATENTS

148,156	1/1961	U.S.S.R.	128/1.03

OTHER REFERENCES

Buchsbaum, " Electronics World," Vol. 70, no. 3, Sept. 1963, pp. 27–29

Primary Examiner—William E. Kamm
Attorney—Waters, Roditi and Schwartz

ABSTRACT: An apparatus is provided for controlled inhibition of the central nervous system of humans and animals, mostly for electronarcosis. The apparatus comprises a pair of electrodes adapted for controlled application of current to a patient and at least two alternators coupled to the electrodes and adapted for generating different frequency currents capable of applying interferential currents to the patient. Each alternator has a respective voltage amplifier and power amplifier and a power supply unit is provided for the alternators. Connected to the outputs of the voltage amplifiers is an electromechanically operated current regulator for controlling the degree and intensity of the inhibition applied to the electrodes and thus to the central nervous system.

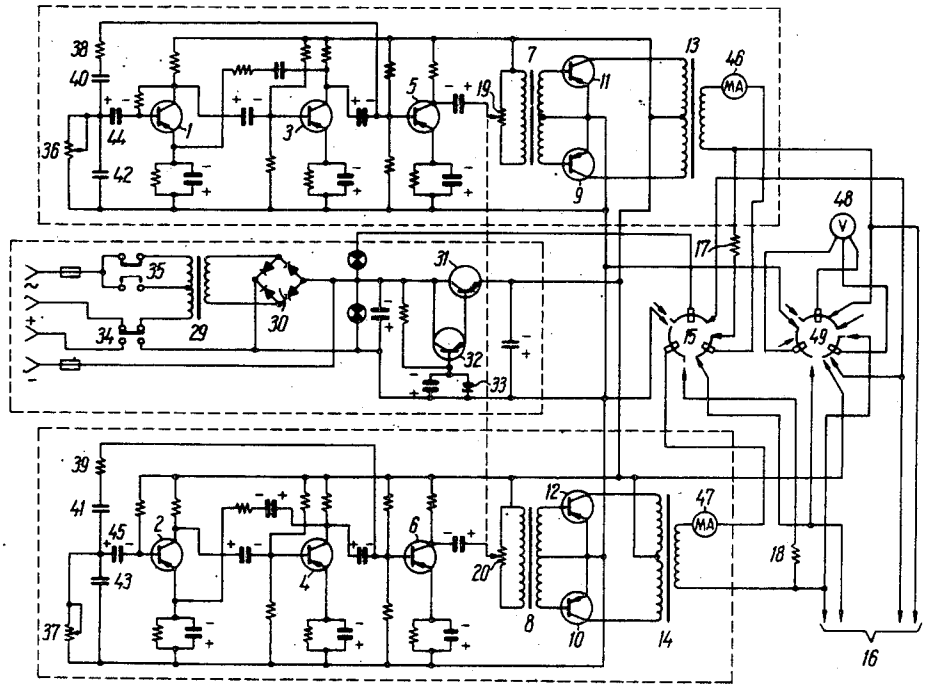
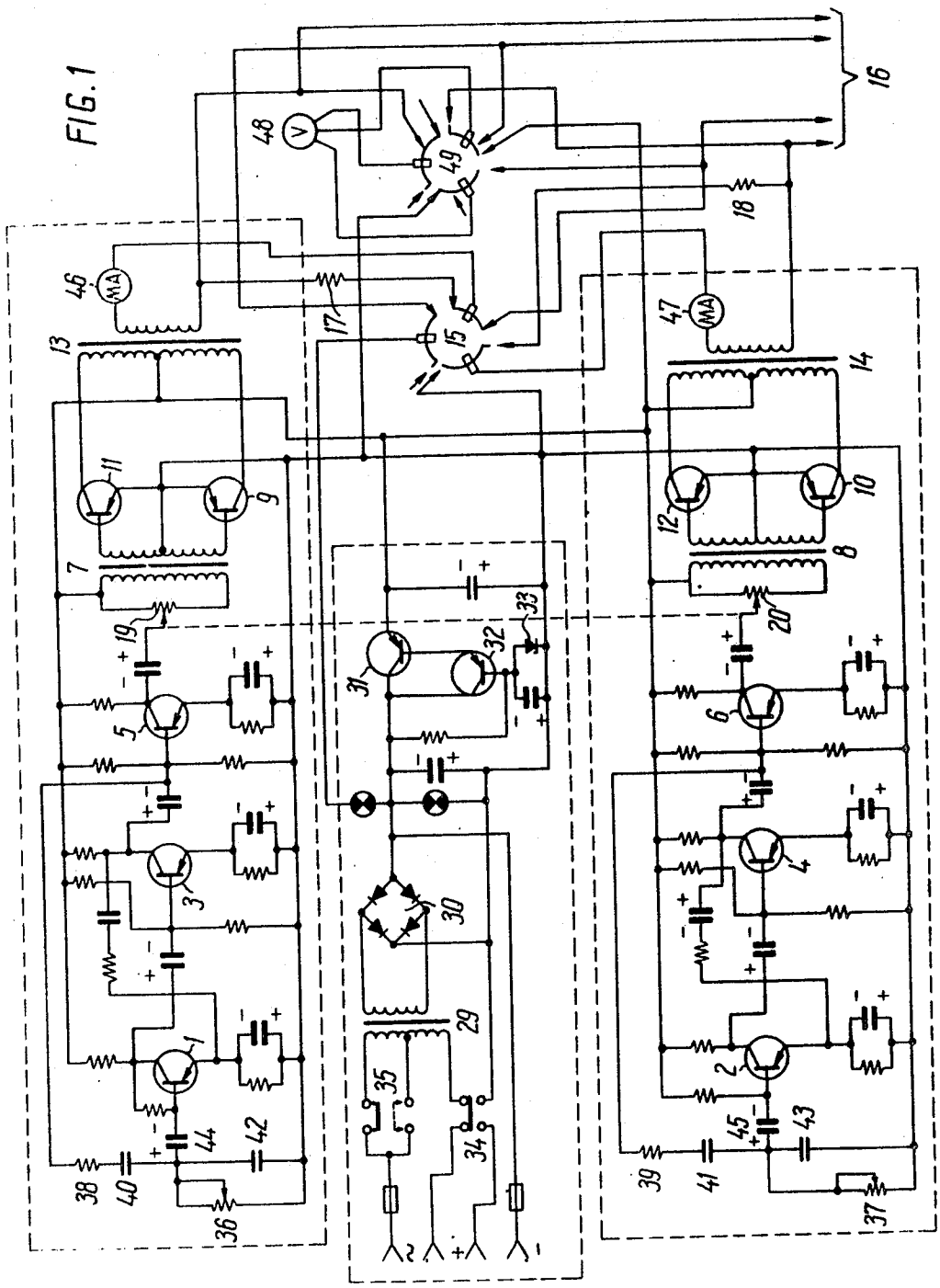


FIG. 1


16
48
V
49
18
46
MA
17
15
47
MA
13
14
11
9
10
12
8
7
19
20
33
32
31
5
6
3
4
30
29
1
2
35
34
44
42
45
43
38
40
36
39
41
37

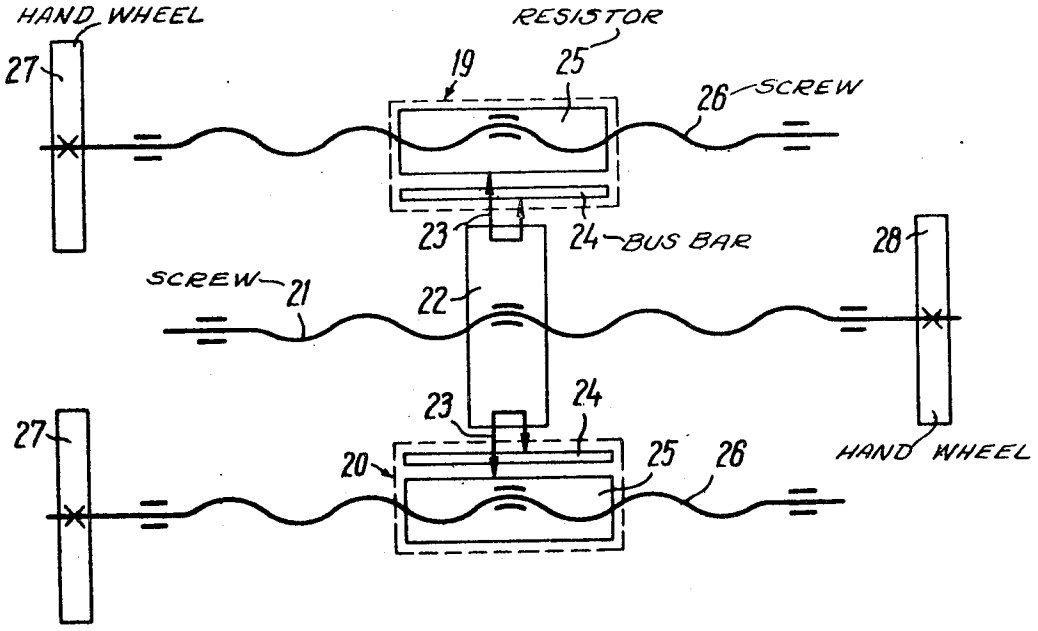

HAND WHEEL
RESISTOR
27
19
25
26
SCREW
23
24
BUS BAR
28
SCREW
21
22
23
24
27
20
25
26
HAND WHEEL

FIG. 2

APPARATUS FOR CONTROLLED INHIBITION OF THE CENTRAL NERVOUS SYSTEM IN MAN OR ANIMAL, MOSTLY FOR ELECTRONARCOSIS

The present invention relates generally to electrically-operated medical apparatus and equipment used in anesthesiological practice and more particularly to apparatus for a controlled inhibition of the central nervous system both in man and in animals mostly for electronarcosis.

Known in the art is apparatus for a controlled inhibition of the central nervous system used for example in electronarcosis are now employed in medical practice, said apparatus operating by virtue of the effect of electric current on the human or animal's organism, i.e., interferential current, which current is generated by an alternator of sinusoidal current at a frequency of from 700 to 1,500 c.p.s.

However, when applying electronarcosis with the aforesaid apparatus, current flowing through the superficial tissues of the patient in the place of application of electrodes, is liable to inflict pain and cause a considerable drift in haemodynamical indications which limits the application of said apparatus to the framework of an experiment, and precluding its use in clinical practice.

Attempts have likewise been made as an experiment to effect a controlled inhibition of the central nervous system of the human organism by means of interferential currents which attempts have yielded good results, on which account necessity has arisen in the development of an apparatus making use of said interferential currents.

It is a primary object of the present invention to eliminate the disadvantages mentioned above.

It is a specific and particular object of the present invention to provide an apparatus for a controlled inhibition of the central nervous system in man or animal, principally for electronarcosis, by way of effecting the patient's organism with interferential currents, said apparatus making it possible to obtain current at a frequency suitable for applying electronarcosis not within the apparatus itself but directly inside the object to be treated.

Said object is accomplished, according to the invention, due to the fact that the apparatus for a controlled inhibition of the central nervous system in man or animal, mostly for electronarcosis, by means of interferential currents affecting the patient's organism, comprises at least two alternators connected to the power supply unit, each of said alternators being provided with a voltage amplifier and a power amplifier, and an electromechanically operated current regulator connected at the outputs of said voltage amplifiers to control the degree and intensity of the inhibition applied.

The aforesaid electromechanically operated current regulator may be made in effect as at least two operatively interconnected potentiometers capable of being controlled either simultaneously or separately, each of said potentiometers being connected at the output of the voltage amplifier of the respective alternator. To precheck the possible degree or intensity of the inhibition applied, an electrically equivalent mockup of the patient's head is connected at the output of each of said power amplifiers through a changeover switch.

Furthermore, it is practicable that the power supply unit incorporate a device capable of voltage stabilizing and protecting the apparatus against short circuiting.

A main advantageous feature of the herein-disclosed apparatus resides in the fact that its operation involves currents which are much less of a irritant to the skin and tissues in nervous receptors and lying immediately under the applied electrodes, as compared to the pulses arising from said currents in the bulk of tissues.

Furthermore, the electromechanically operated regulator provided for in the apparatus helps maintain the equality of current flowing through the object treated both during the static operation and with the intensity of inhibiting action being stepped up as required making it possible to prevent a considerable decrease of the interferential current amplitude which inevitably occurs when the equality of currents is disturbed.

Moreover, the maintenance of the equality of current flowing through the object treated is a necessary condition for ensuring smooth regulation, making it possible to prevent convulsive contraction of muscles and even occasional spasms of the patient's muscles, and other undesirable phenomena due to the irritant effect of current.

In order that the invention may be clearly understood and readily carried into effect the same will now become apparent from a consideration of a more full description of the apparatus for a controlled inhibition of the nervous system in man or animal, read in connection with and by the aid of the accompanying drawings, wherein:

FIG. 1 is a schematic circuit diagram of the apparatus as disclosed in the present invention; and

FIG. 2 is a skeleton diagram of the electromechanically operated current regulator employed by the apparatus of FIG. 1.

As can be particularly evident from FIG. 1, the apparatus disclosed herein comprises two mutually-independent alternators based upon transistors 1, 2, 3 and 4, voltage amplifiers connected respectively to said alternators and using transistors 5 and 6, correspondingly, and power amplifiers, incorporating input transformers 7 and 8, transistors 9, 10, 11 and 12, and output transformers 13 and 14, respectively.

The output transformers 13 and 14 can be connected via a changeover switch 15 either to electrodes 16 applied to the patient or to mockup electrical equivalents thereof made as resistors 17 and 18 serving to precheck an attainable degree and intensity of the inhibition applied to the central nervous system of the patient being treated.

Provided at the output of each of the voltage amplifiers are operatively-interconnected potentiometers 19 and 20 which constitute part of the electromechanically-operated current regulator. The latter effects a synchronous and reasonably smooth regulation of the currents delivered from the voltage amplifiers and, apart from this, allows an individual and separate current regulation in each of said voltage amplifiers.

As it can be seen from FIG. 2, said electromechanically-operated current regulator comprises a motion screw 21, whereby a crossmember 22 is free to travel, said crossmember carrying contact springs 23 which are in contact with bus bars 24 and resistors 25. The contact springs 23, bus bars 24 and resistors 25 all are component parts of the aforesaid potentiometers 19 and 20. When separately regulating the current in the voltage amplifiers, the resistors 25 are caused to travel by the motion screws 26, for which purpose provision is made at the ends of the motion screws 21 and 26 for handwheels 27 and 28, respectively.

The power supply units of the alternators comprise a power transformer 29 (FIG. 1), a rectifier 30, a voltage stabilizing device based upon transistors 31, 32 and upon a silicon voltage stabilizing tube (stabilitron) 33, and a changeover switch 34, whereby the apparatus can be power-supplied both from an AC network and from storage batteries.

According to the invention the apparatus for a controlled inhibition of the nervous system operates as follows.

Mains voltage (127 or 220 volts) is fed via the changeover switch 35 to the primary winding of the power transformer 29, whereas a low voltage stepped-down to a necessary magnitude, is delivered from the secondary winding thereof to impress upon the rectifier 30. Next the rectified voltage is filtered and stabilized by means of the transistors 31, 32 and the voltage stabilizing tube 33 and is delivered to the alternators. Part of the voltage amplified by the transistors 1, 2, 3, and 4 is fed through a phasing circuit composed of resistors 36, 37, 38, 39 and capacitors 40, 41, 42, 43, 44, 45, to impress upon the bases of the transistors 1 and 2. As a result, electrical oscillations are induced in both of the alternators at a frequency dependent on the parameters of said phasing circuit, said frequency being alterable within a certain range through the use of the variable resistors 36 and 37.

The voltage generated by the alternators is then magnified by the voltage amplifiers and is fed via the electromechanically-operated current regulator to the power amplifiers, the

magnitude of the currents produced by the alternators being checked by means of milliammeters **46** and **47**.

In the event the electrodes **16** become short-circuited, the voltage stabilizing device in the power supply unit stops feeding the alternators with voltage which results in a drop of generation so that the apparatus is protected against possible damage and the patient is prevented from burns.

To check the voltage effective across the electrodes **16** and the output of the power supply unit, a voltmeter **48** is provided connectable to the aforesaid circuits via a changeover switch **49**.

The apparatus described hereinabove can be utilized not only for applying electronarcosis but also in some other fields of medical practice such as treatment of neuromuscular system with interferential currents, effecting the "electrosleep" therapy procedures, and the like.

What is claimed is:

1. Apparatus for controlled inhibition of the central nervous system of human or animal patients mostly for electronarcosis, said apparatus comprising: a pair of electrodes adapted for controlled application of current to a patient; at least two alternators coupled to the electrodes and adapted for generating current different in frequency and capable of affecting the patient's organism with interferential currents such that the current passing through the patient corresponds in frequency to the difference of the frequencies of said alternators; a voltage amplifier and power amplifier connected between each said alternator and said electrodes; a power supply unit for said alternators; electromechanically-operated regulator means connected to said alternators through the intermediary of said voltage amplifiers respectively for simultaneous, synchronous or separate selective control of the current passing through the patient, wherein said electromechanically operated current regulator means comprises at least two operatively associated potentiometers, each connected to one of each of said alternators through the intermediary of said voltage amplifiers respectively, and means for selectively regulating the potentiometers either separately or simultaneously.

* * * * *