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METHOD AND DEVICE FOR INCREASING, ON ALTERNATING CURRENT SUPPLY SYSTEMS, THE EFFICIENCY OF ELECTRIC LIGHTING INSTALLATIONS AND FOR SUPPLYING ELECTRICAL APPARATUS OPERATING AT VERY LOW TENSION

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FIG.1

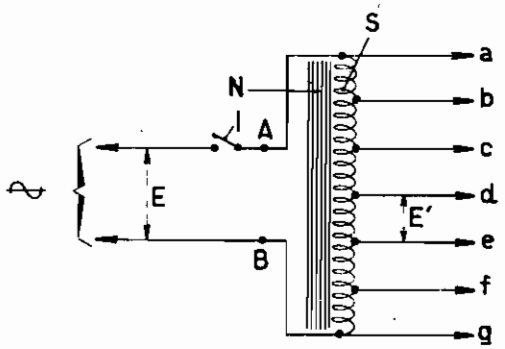
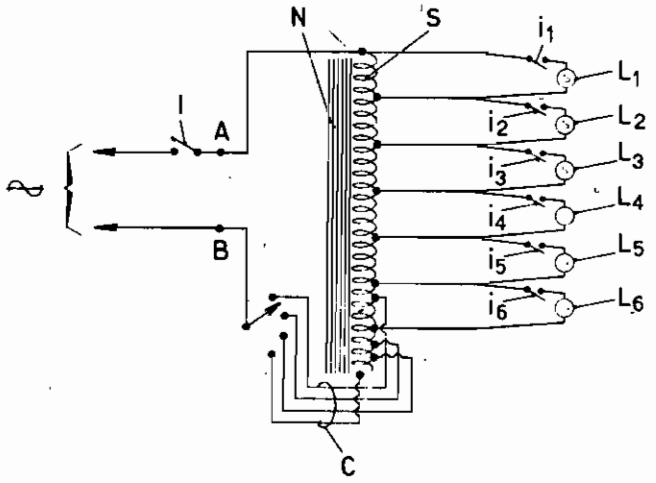


FIG.2



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METHOD AND DEVICE FOR INCREASING, ON ALTERNATING CURRENT SUPPLY SYSTEMS, THE EFFICIENCY OF ELECTRIC LIGHTING INSTALLATIONS AND FOR SUPPLYING ELECTRICAL APPARATUS OPERATING AT VERY LOW TENSION

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It is known that for an equal expenditure of energy, the luminous flux emitted by metal filament electric lamps operating at very low voltage (between 6 and 20 volts for example) is greater than that emitted by lamps operating directly on the usual supply mains voltage (110–220 volts, etc.).

The following table shows, by way of example, the luminous efficiencies, on the one hand of lamps supplied at 20 volts, and on the other hand of lamps supplied at 115 and 220 volts respectively.

Consumption in watts	Luminous flux expressed in lumens for voltages of—		
	20 volts	115 volts	220 volts
15	185	135	120
25	355	260	220
40	640	460	375
60	1050	760	600
75	1380	1000	850
100	1850	1450	1200
150	2750	2250	2000
200	4000	3000	2750
300	6500	5000	4500

It would appear to be logical, in a household lighting installation operating on an alternating current supply system, to reduce the voltage of the supply system by placing a transformer at the output of the meter of the installation and use very low voltage lamps.

This solution, however, offers rather serious drawbacks. It would, in fact, be necessary to change all the conductors of the existing installation and replace them by conductors of larger cross-section, owing to the fact that very low voltage lamps (6 to 20 volts) require a heavier current. This modification of the installation would involve a fairly considerable initial expense. Furthermore, the transformer placed at the output of the meter would always have to be of higher power than that necessary for operating all the lamps of the installation simultaneously and said transformer would have to remain connected to the supply system, even for the operation of a single lamp, thereby involving fairly high continuous no-load losses.

The method which is the object of the present invention and the device for carrying out said method enable the above specified drawbacks to be obviated.

The method which is the object of the invention consists, on the one hand in converting solely the existing lighting apparatus (whatever they may be and designed to operate at a usual voltage of between 110 and 220 volts) into apparatus suitable for operating at a very reduced voltage, this being effected without its being necessary to touch the existing installation in any way, and on the other hand in interposing in parallel between the supply system and the very low voltage lamps, a choke-coil (preferably with a closed core) provided with a number of intermediate tappings equal to the divisor minus 1 adopted for transforming the voltage of the supply system down to a very low voltage, this being done so as to make it possible to supply individually or simultaneously the various lamps connected between the various tappings of the choke-coil, its being possible for said lamps optionally to be of different unit powers.

The device (tapped choke) used for carrying out the invention behaves like a very high efficiency 1/1 ratio autotransformer (a fact which is all to the user's advantage), the single winding of which is provided with a number of tappings, whereby one of the very low voltage lamps supplied by the device can cease to operate (either by being turned off purposely, or owing to deterioration) without the operation of the other low voltage lamps still in use being substantially modified.

The drawback of the well known system of the supplying at low voltage a plurality of lamps connected in series across the terminals of the supply system is thus avoided, in which arrangement all the lamps in question had to be constructed to take strictly the same amperage, the failure of one of them necessarily involving the stoppage of the whole arrangement.

In the two figures of the accompanying drawing, there is shown, on the one hand the fundamental diagram for carrying out the method, and on the other hand the practical wiring diagram of a device according to the invention.

According to the invention and as shown in Fig. 1, a choke-coil S preferably provided with a closed core N, is connected across the terminals A and B of an alternating current supply system whereof the voltage is E. In addition to the output terminals *a* and *g*, the coil S is provided with intermediate tappings *b*, *c*, *d*, *e*, *f* (which are preferably equidistant), in such a manner that between each bridge *a*—*b*, *b*—*c*, *c*—*d*, *d*—*e*, *e*—*f* and *f*—*g*, a voltage E′ is obtained which is suitable for supplying a lamp at a very low voltage.

It will immediately be seen that the various lamps may have unit powers that are slightly different from each other; furthermore, one of the lamps may be switched off without involving

a stoppage of the operation of the other lamps connected to the circuit. A device of the type of the one shown herein can readily be incorporated, owing to its small size, in chandeliers and any other lighting apparatus, its being quite possible for the switch I of the existing installation to subsist for the control of all the lamps connected to the device.

The device shown diagrammatically in Fig. 2 for practically carrying out the method is similar, in principle, to the one shown diagrammatically in Fig. 1, but is provided at one end of the choke-coil S with a number of tappings C which enable it to be connected to supply systems of different voltages.

In this figure, i_1, i_2, i_3, etc. designate the individual switches controlling the very low voltage lamps L_1, L_2, L_3, etc.

Tests which were carried out when the invention was applied to very low voltage electric lighting gave results that showed in a striking manner the economy it was possible to effect.

One of these tests was made on an existing installation comprising fifteen 150 watt 115 volt lamps giving 90 lux (measured on a plane one meter from the ground, below the luminous source) for an exact consumption of 2,268 watts. After the installation had been converted according to the invention and fifteen 100 watt lamps were used all operating at 20 volts, 105 lux were obtained for a consumption of 1,540 watts, measured under the same conditions as above. The result is therefore a decrease of consumption of 728 watts (i. e. over 30%), on the one hand, and an increase of 15 lux on the other hand.

The invention can equally well be applied to the lighting of dwelling houses and to that of commercial or industrial premises.

The invention is moreover applicable not only to electric lighting, but also anywhere it is desired to supply at will, simultaneously or individually, a plurality of apparatus at a voltage which is not dangerous (for example electric toys).

It is moreover obvious that the device for carrying out the novel method may be subjected to modifications of detail without departing from the invention. Thus, for example, the multiple tapping choke-coil may be arranged simultaneously either as a voltage step-up autotransformer (in the case of the simultaneous supply of a fairly large number of low voltage apparatus by a relatively low voltage supply system, for example 110 to 115 volts), or as a voltage step-down autotransformer (case of the simultaneous supply of a small number of low voltage electric apparatus by a relatively high voltage supply system, for example 220–240 volts.

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