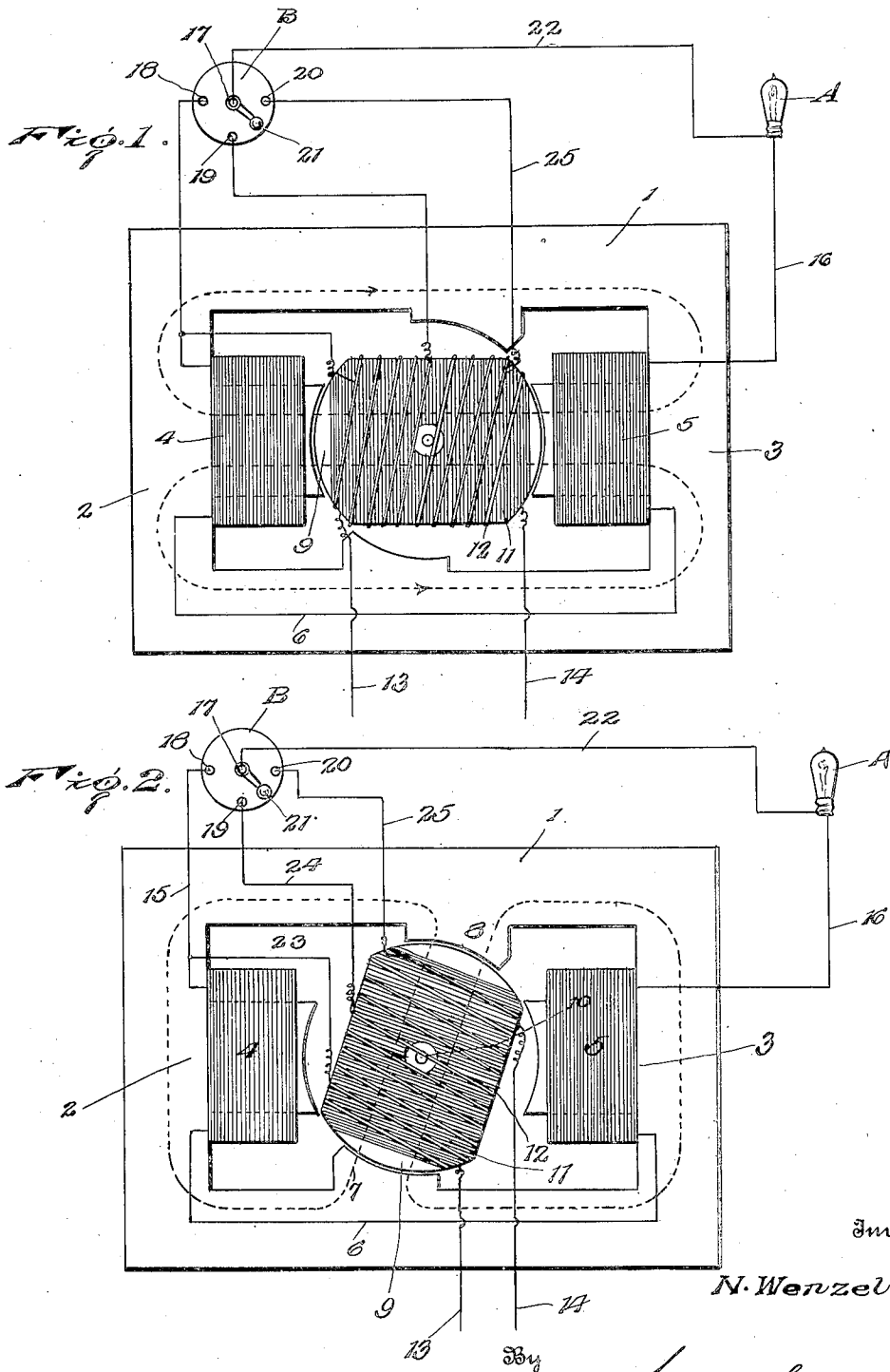


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N. WENZEL  
REGULATING TRANSFORMER

Filed Feb. 10, 1921



## UNITED STATES PATENT OFFICE.

NICOLAS WENZEL, OF TWIN FALLS, IDAHO.

## REGULATING TRANSFORMER.

Application filed February 10, 1921. Serial No. 443,985.

*To all whom it may concern:*

Be it known that I, NICOLAS WENZEL, a citizen of the United States, residing at Twin Falls, in the county of Twin Falls and State of Idaho, have invented certain new and useful Improvements in Regulating Transformers, of which the following is a specification.

This invention relates to a selective alternating current regulator which is particularly adapted for use as a dimmer in controlling the brilliancy of incandescent lights such, for instance, as banks of lights used in theatrical work.

In the past it has been the practice to control the brilliancy of such banks of lights by the use of non-inductive resistance. However, the use of this type of resistance is attended by many disadvantages, one of which is that the current is controlled in steps or jumps which produce a flicker in the lights as a change is made from one degree of brilliancy to another, thus making it practically impossible to use incandescent lights having supersensitive filaments unless an impracticable number of steps or jumps are used.

Another disadvantage of the non-inductive type of current controller or regulator in this connection is that the resistance heats to an abnormal degree and is rendered useless when left at one step for any length of time unless elaborate and costly provisions are made to take care of this heating. Also this heating is objectionable by reason of the fire risk involved.

Furthermore, another disadvantage of the non-inductive resistance control for banks of lights is that one instrument can only be used for the exact load for which it is designed.

Therefore, one of the most important features of the present invention resides in the provision of an instrument for delivering a current of selected voltage, which may be varied from maximum to approximate zero, or vice versa, to a bank of lights in such a manner that there are no distinct steps or jumps which would cause the lights to flicker.

A further advantage consists in providing an instrument, the construction of which is such that there is no excess heating of the device with the result that the fire risk is practically eliminated.

Another feature consists in providing a

device which is so constructed that it may be used for any load whatsoever within its maximum capacity.

In the drawings:

Figure 1 is a top plan view in connection with the wiring diagram;

Figure 2 is a view similar to Figure 1 but showing the instrument in the position of approximate zero current delivery.

In detail:

The instrument, as shown herein for the purpose of disclosing the invention, comprises a closed laminated iron core 1 having opposite active poles 2 and 3 upon which the secondary windings 4 and 5, respectively, are carried. The secondary windings are connected in series in such a manner that the magnetic lines of force induced in the one winding flow in the same direction as the magnetic lines of force induced in the other, such connection being effected by means of the wire 6.

Adjacent each pole 2 and 3 are interpoles 7 and 8, respectively, for a purpose to be hereinafter set forth.

Within the core 1 and cooperating with the poles 2 and 3 and the interpoles 7 and 8 is an armature or movable core 9 carried by a shaft 10 and which mounts a primary coil or winding 11 and an auxiliary secondary winding 12.

The lead wires 13 and 14 of the line current connect with the primary coil or winding 11, while the lead wires 15 and 16 of the secondary coils 4 and 5 are connected with the load A through a switch B. The switch B is provided with contacts 17, 18, 19 and 20, the contact 17 being connected with one side of the load and carrying a switch lever 21 for engagement with the contacts 18, 19 and 20 as selected. The contact 18 is connected with the outgoing lead 15 of the coil 4, while the outgoing lead 16 of the coil 5 is directly connected to the load, the return wire 22 from the load being connected to contact 17 as above mentioned. The contacts 18, 19 and 20 are also connected by wires 23, 24 and 25 with taps leading from points on the auxiliary winding 12 of the armature or core 9. The entire instrument is enclosed in a suitable oil-tight casing and the shaft 10 is provided with a crank on the outside of the casing. Also any suitable indicator may be used in connection with the crank for determining the condition of the armature or core 9.

The operation of the instrument is as follows and is based on the inductive principle:

If current from a commercial or other source is led in by the line wires 13 and 14 to the primary 11 when the armature or core 9 is in the position shown in Figure 1 with the ends of the same opposite the active poles 2 and 3, the maximum voltage of the line is induced in the secondary coils 4 and 5 and passes to the load as indicated by the wiring. This induction is represented by the dotted lines of force shown in Figure 1.

When the armature or core 9 is placed as in Figure 2, with its ends alining with the interpoles 7 and 8, there is no passage of the lines of force through coils 4 and 5 and consequently the current passing through the device is approximate zero since the lines of force follow the paths indicated in dotted lines and pass through the closed core without including the secondary windings 4 and 5. The object of the interpoles 7 and 8 is to form a closed magnetic circuit upon the primary winding. The action of the instrument is, that, in the zero inductive position, it has the action of an ordinary impedance or choke coil. Therefore, there is practically no current consumed and no current delivered in this condition of the instrument, the action of the core 9 being to form a closed magnetic circuit in combination with the core 1, thereby cutting down the flow of current in the primary. At the same time the main secondary coils 4 and 5 through the intermediary of one of the contacts 19 and 20 become choke coils to resist the flow of current which may be set up in the auxiliary secondary 12.

At any point intermediate the two extreme positions shown in Figures 1 and 2 a proportionate amount of current is delivered to the load depending on the position of the armature or core 9 with respect to the active poles and the interpoles.

In the intermediate positions all of the magnetic lines of force which do not thread through coils 4 and 5 by paths provided by core poles 2 and 3 pass through interpoles 7 and 8 taking a path through core 1, shunting coils 4 and 5. These lines of force tend to impede the flow of current in the primary winding.

The advantage of the auxiliary secondary winding 12 is to increase the efficiency of the instrument by reason of the fact that this auxiliary secondary winding is wound upon the same core as the primary and receives all the lines of force passing through the primary core. In order to compensate for any drop in line voltage caused by fluctuations of the commercial current, the taps 23, 24 and 25 are provided for cutting in and out the sections of the auxiliary secondary winding defined by said taps in the manner hereinbefore set forth.

Of course, I am aware that Patent No. 390,820, issued October 9, 1888, to Nikola Tesla, contemplates the use of an inductive transformer and regulator of the similar type to that herein described by me, but the principal advantage of my invention over the device shown in this patent consists in providing means choking down the current flow in the primary at the zero inductive position and to take care of the difference in input from the line wires so as not to affect the load A with the core 9 in the intermediate positions; or in other words, providing means for compensating for fluctuations in the commercial current received by the instrument.

While in the foregoing, I have set forth a specific embodiment of the invention for the purpose of disclosing a principal involved, it is, nevertheless, to be understood that in practicing the invention various modifications falling within the scope of the appended claims may be resorted to.

I claim:

1. A selective current regulator comprising a movable armature and a primary winding thereon, a closed stationary core with poles situated diametrically opposite each other, a secondary winding on each of said poles and means for altering the inductive relation between the windings to deliver an induced current to the load selectively ranging from maximum strength to approximate zero strength and means choking down the current flow in the primary winding.

2. A selective current regulator comprising a movable armature and a primary winding thereon, a closed stationary core with poles situated diametrically opposite each other, a secondary winding on each of said poles, interpoles on said closed stationary core, each of said interpoles being situated nearer to the secondary pole on one side than to the secondary pole on the other side thereof.

3. A selective current regulator comprising a movable armature and a primary winding thereon, a closed stationary core with poles situated diametrically opposite each other, a secondary winding on each of said poles, inter-poles on said closed stationary core, each of said interpoles being situated nearer to the secondary pole on one side than to the secondary pole on the other side thereof, said primary winding being connected with a line current and said secondary winding connected with a load.

4. A selective current regulator comprising a movable armature and a primary winding thereon, a closed stationary core with poles situated diametrically opposite each other, a secondary winding on each of said poles, inter-poles on said closed stationary core, each of said inter-poles being

situated nearer to the secondary pole on one side than to the secondary pole on the other side thereof, said primary winding being connected with a line current and said secondary winding connected with a load, said secondary windings being connected in series, so that the magnetic line of force induced therein will flow in the same direction in both secondary windings.

5 10 5. A selective current regulator comprising a movable armature and a primary winding thereon, a closed stationary core with poles situated diametrically opposite each other, a secondary winding on each of said poles, inter-poles on said closed stationary core, each of said inter-poles being situated nearer to the secondary pole on one side than to the secondary pole on the other side thereof said primary winding being connected with a line current and said secondary winding connected with a load; said secondary windings being connected in series, so that the magnetic line of force induced therein will flow in the same direction in both secondary windings, an auxiliary winding on said armature divided into sections, a switch in the circuit of said secondary winding, each section being connected with an individual contacting point in said switch for selectively including one or all of said sections in said circuit.

6. A selective current regulator comprising a movable armature and a primary winding thereon, an auxiliary winding divided into sections on said armature, a closed stationary core with a pair of poles in axial alinement with each other, a secondary winding on each of said poles, a pair of axially alined inter-poles forming projections on said stationary core, the axis of

said inter-poles being inclined to the axis of said secondary poles; said primary winding being connected with a line current and said secondary windings being situated in the circuit of a load and connected in series in such a manner, that the magnetic lines of force induced in one of the secondary windings will flow in the same direction as the lines of force induced in the other of the secondary windings.

7. A selective current regulator comprising a movable armature and a primary winding thereon, an auxiliary winding divided into sections on said armature, a closed stationary core with a pair of poles in axial alinement with each other, a secondary winding on each of said poles, a pair of axially alined inter-poles forming projections on said stationary core, the axis of said inter-poles being inclined to the axis of said secondary poles; said primary winding being connected with a line current and said secondary windings being situated in the circuit of a load and connected in series in such a manner, that the magnetic lines of force, induced in one of the secondary windings will flow in the same direction, as the lines of force induced in the other of the secondary windings; a switch in said circuit provided with a plurality of contact points, said switch having permanent connection with the load and one of said secondary windings being connected with one of said contact points, one of said sections of the auxiliary winding being connected with said first contact point of the switch and each of said other sections being connected with a separate one of said contact points in the switch.

In testimony whereof I affix my signature.  
NICOLAS WENZEL. [L. S.]