March 14, 1939. L. G. TUBBS 2,150,302

INDICATING MEANS

Filed May 22, 1935

Fig. 1.

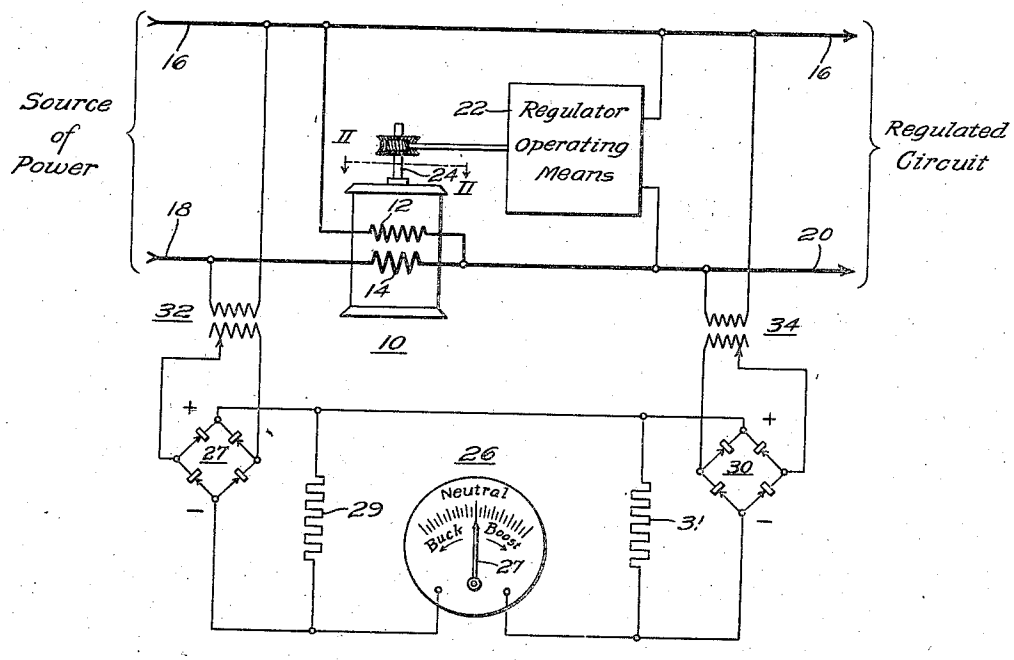
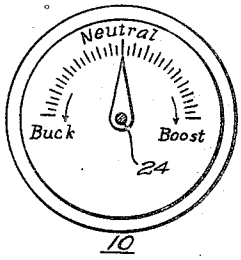


Fig. 2.



WITNESSES:

C. J. Weller.

E. B. Bryant

INVENTOR

Lester G. Tubbs.

BY

Ezra W. Farrag

ATTORNEY

Patented Mar. 14, 1939 2,150,302

UNITED STATES PATENT OFFICE

2,150,302

INDICATING MEANS

Lester G. Tubbs, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application May 22, 1935, Serial No. 22,787

6 Claims. (Cl. 177—311)

My invention relates to position indicating means and it has particular relation to systems for indicating the position within its range of voltage adjustment of an induction or other type circuit-voltage regulator.

Generally stated, the object of my invention is to improve, simplify and reduce the cost of the systems of this character.

Another object is to eliminate the necessity for mechanical connections between the regulator and the associated position-indicating device.

An additional object is to provide a system in which the regulator and its position-indicating device may be separated by great distances.

A further object is to provide a system in which the indicating device responds to a measure of the electrical performance of the regulator.

My invention, together with additional objects and advantages, will best be understood through the following description of a specific embodiment thereof when taken in conjunction with the accompanying drawing in which:

Figure 1 is a diagrammatic view of apparatus and circuits representing my improved indicating means applied to an induction regulator of conventional design, and,

Fig. 2 is an enlarged view, taken along section line II—II, showing a mechanically-actuated winding position-indicating device installed upon the top of the regulator of Fig. 1.

Referring to the drawing, the improved indicating system of my invention is illustrated in Fig. 1 as being applied to an induction regulator 10, the relatively movable and inductively coupled windings 12 and 14 of which are interconnected between a source of alternating current power, designated by conductors 16—18, and a feeder or other load circuit 16—20 in which it is desired that the voltage be maintained constant or otherwise adjusted.

Winding 12 is energized directly by the power source voltage while winding 14 is series connected between main circuit conductors 18 and 20 in a manner to introduce into the regulated circuit a component of corrective voltage which in phase position and magnitude is determined by the nature of the inductive coupling between the two regulator windings. This coupling is varied by changing the relative positions of these two windings as by manually actuated or automatically controlled operating means generally indicated at 22.

When, as is illustrated in Fig. 2, the coupling adjusting shaft 24 occupies the neutral position, no appreciable voltage is induced in winding 14 and the regulated circuit has impressed upon it the voltage of the power supply circuit.

Rotation of the shaft 24 in the counter-clockwise direction causes to be induced in this winding a voltage which subtracts from that of the supply circuit 16—18 and which in magnitude is determined by the extent of such rotation. Similarly, rotation of the shaft in the clockwise direction from the neutral position causes to be induced in winding 14 an additive voltage which increases the potential impressed upon the regulated circuit 16—20.

It is frequently desirable to indicate at a remote point the position of the regulator within its buck or boost range of voltage adjustment. In accordance with my invention I attain this objective by the use of a specially calibrated voltmeter 26 provided with a pointer 27 which moves over a scale which may in effect be a duplicate of that illustrated in Fig. 2. This voltmeter has impressed thereon a measure of the difference between the voltages acting in the before-referred to supply and regulated circuits through an energizing circuit which I have represented as including a pair of rectifiers 28 and 30 respectively energized, through transformers 32 and 34, by a measure of the voltage acting in power circuit 16—18 and that in regulated circuit 16—20.

These two rectifiers are series connected in polarity opposition with the device 26 which is preferably adjusted to maintain its pointer in the illustrated neutral position when the induction regulator 10 occupies the neutral winding position depicted in Fig. 2 and when the voltage of power source 16—18 is of normal value. Preferably a pair of loading resistors 29 and 31 are also utilized in the manner shown.

The rectifier output polarities are such that the meter 26 biases its pointer to the right when the regulator 10 is adjusted in the boost or voltage raising direction and to the left when the regulator is operated in the buck or voltage lowering direction. In consequence, indicating device 26 at all times shows the position of the regulator within its voltage-adjusting range as long as the input and output circuits of the regulator remain energized.

In operation, the above-described system has proven unusually successful. Because of its simplicity and low cost, it is far superior to previously known systems of this character. By permitting the regulator and its winding position indicating device to be separated by great distances, it is suitable for many applications in which me-

chanically actuated indicators are wholly unsuitable.

Nor is this system restricted in application to the illustrated induction type of regulator. Analysis of its operation will show it to be equally applicable to any type of comparable voltage-adjusting device which is placed between a supply and a regulated circuit whether of the direct-current or alternating-current type. Its range of application is therefore exceedingly broad.

Although I have shown and described a certain specific embodiment of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the scope of the appended claims.

I claim as my invention:

1. In a system comprising an electrical power circuit, a load circuit energized therefrom, and voltage adjusting means interconnected with said circuits for adjusting the voltage of the load circuit, the combination of means for indicating the position of said voltage adjusting means within its range of voltage adjustment comprising a voltmeter and a circuit for impressing thereon a measure of the difference between the voltages acting in the said power and load circuits.

2. In a system comprising an electrical power circuit, a load circuit energized therefrom, and voltage adjusting means interconnected with said circuits for adjusting the voltage of the load circuit, the combination of means for indicating the position of said voltage adjusting means within its range of voltage adjustment comprising a direct-current voltmeter and a circuit for impressing thereon a direct-current potential which in polarity and magnitude is a measure of the difference between the voltages acting in the said power and load circuits.

3. In a system comprising an alternating-current power circuit, a load circuit energized therefrom, and an induction regulator having a pair of inductively-coupled windings interconnected with said circuits for the purpose of adjusting the voltage of the load circuit, the combination of means for indicating the relative positions of said regulator windings comprising a direct-current voltmeter, a rectifier energized by a measure of the voltage acting in said power circuit, a second rectifier energized by a measure of the voltage acting in said load circuit, and a circuit for impressing upon said voltmeter the difference between the output voltages of said two rectifiers.

4. The combination with two interconnected electrical circuits and voltage adjusting means connected therebetween and operable to a plurality of positions for varying the voltage ratio between said circuits, of means for indicating the position of said voltage adjusting means comprising means for developing a voltage component that is a measure of the input circuit voltage, means for developing a voltage component that is a measure of the output circuit voltage, and means differentially responsive to said two voltage components.

5. The combination with two interconnected alternating-current circuits and voltage adjusting means connected therebetween and operable to a plurality of positions for adjusting the voltage ratio between said circuits, of means for indicating the position of said voltage adjusting means comprising means for developing unidirectional voltage components responsive, respectively, to the voltages of said two alternating-current circuits, and means responsive in direction and degree to the differential values of said unidirectional components.

6. The combination with two interconnected alternating-current circuits and voltage adjusting means connected therebetween and operable to a plurality of positions for adjusting the voltage ratio between said circuits, of means for indicating the position of said voltage adjusting means comprising means for developing two alternating-current voltage components that are a measure, respectively, of the voltages of said two interconnected circuits, two rectifier means subject, respectively, to said two alternating-current voltage components for developing unidirectional voltage components, and means responsive in direction and degree to the differential values of said unidirectional components.

LESTER G. TUBBS.