

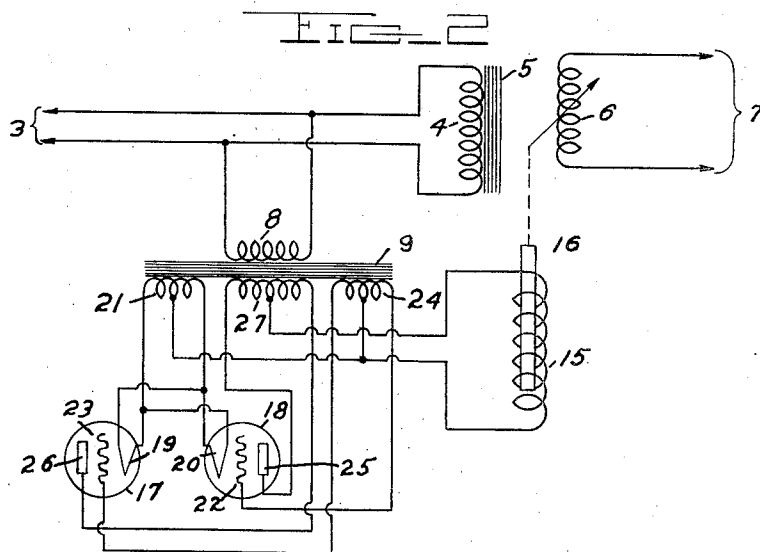
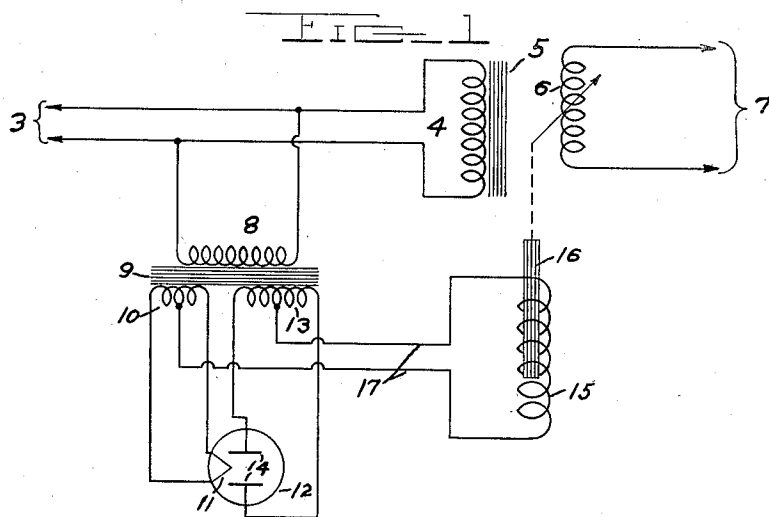
Oct. 10, 1933.

L. A. HYLAND

1,929,431

CONSTANT CURRENT REGULATOR FOR ALTERNATING CURRENT

Filed Jan. 30, 1932



INVENTOR

Lawrence A. Hyland

BY

Robert A. Saunders

ATTORNEY

UNITED STATES PATENT OFFICE

1,929,431

CONSTANT CURRENT REGULATOR FOR
ALTERNATING CURRENT

Lawrence A. Hyland, Washington, D. C.

Application January 30, 1932. Serial No. 589,856

10 Claims. (Cl. 171—119)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

The invention relates to a means for regulating within narrow limits the current supplied to an alternating current consuming device.

It is the object of this invention to provide thermionic control means for the constant current transformer to maintain its output substantially uniform regardless of variations in the supply line.

With the above and other objects in view, the invention consists in the construction, combination and arrangement of parts as will be described more fully hereinafter.

Reference is to be had to the accompanying drawing forming a part of this specification, in which like reference characters indicate corresponding parts throughout the several views, and in which:

Figure 1 is a schematic diagram of an embodiment of my invention wherein is used a rectifier tube;

Figure 2 is a like view of another form of my invention employing two three-element vacuum tubes.

There are many devices using alternating current which require a substantially constant current and frequency input. In general the frequency of the current supplied to consumers is held constant within permissible limits, but this is not true of the voltage, especially when the consuming device is located on the end of a long line where large variable loads are frequently interposed between the end of the line and the source of the current. This variation in the voltage of supply lines is particularly felt at broadcast stations located in the outskirts of the city.

It is the present practice in the larger stations to obtain the power supply entirely from alternating current, transforming the current to whatever voltages are required and rectifying at these voltages. After rectification and filtering, the direct current forms the power input of the broadcast transmitter. The rigid frequency requirements of the Radio Commission make it necessary that the station not only be equipped with direct crystal control but that the crystal be maintained at a constant temperature and that the voltage of the crystal plate supply be maintained at some fixed value, with consequent fixed crystal tube plate current.

Since temperature controlled crystals are being almost universally adopted the only variable now remaining is the power supply to the crystal circuit. The present invention makes possible a greater degree of current uniformity than has hitherto been attained.

The principle of constant current transformers is not new but the application of a rectifier tube to control them is believed to be novel. The rectifier is operated at saturating space current whereby a very small variation in the voltage will cause considerable change in the space current due to the changes in filament temperature and thus make the current transformer much more responsive to changes than if it were applied directly across the line.

In Figure 1 the power supply line is designated by 3, and is connected to the primary 4 of a transformer having core 5 and movable secondary 6 to which the load is connected by wires 7. Primary 8 of a transformer that supplies current to the control device is connected across the wires of line 3, the core of this transformer being designated by 9. A low voltage secondary winding is connected by wires 17 to a solenoid 15 in which is a counter balanced core or plunger 16 that is operatively connected to movable secondary 6 to increase the coupling between coils 5 and 6 when the core moves farther out of the solenoid and decrease the coupling when the movement of the core is in the opposite direction.

The circuit through solenoid 15 includes tube 12 and therefore the current flow through the solenoid is dependent upon the current through the tube. When there is a decrease of the voltage in line 3 the temperature of filament 11 will drop and produce a relatively greater diminution of the current through tube 12, thus lessening the effect of solenoid 15 upon core 16 and permitting the counterbalancing springs or weights to move core 16 farther out of the solenoid and increase the coupling between coils 4 and 6, with a consequent rise of the voltage in wires 7 to the load. Increase in voltage in line 3 has the opposite effect, moving core 16 into solenoid 15 and decreasing the coupling between coils 4 and 6 with resultant drop in the voltage in line 7. As before mentioned, tube 12 is operated at saturating space current and therefore small variations of voltage in line 3 will cause relatively large changes in the current through the tube.

In Figure 2 the line 3, primary 4, core 5, movable secondary 6, load line 7, primary 8 and core 9 are similar in function and construction to the correspondingly numbered parts in Figure 1. Instead of a rectifying tube, however, this modification employs two three-element vacuum tubes, 17 and 18, having their filaments 19 and 20 oppositely connected to secondary 21, their grids 22 and 23 oppositely connected to secondary 24, and their plates 25 and 26 oppositely connected to sec-

ondary 27. One terminal of solenoid 15 is connected to the mid-point of secondary 27 and the other terminal thereof is connected to the mid-points of secondaries 21 and 24. As the current flow through solenoid 15 depends upon the flow through tubes 17 and 18, and the flow through the tubes depends upon the voltage in primary 8, fluctuations of voltage in line wires 3 will be impressed upon the tubes and will be reflected in the strength of solenoid 15. The connection between core 16 and movable secondary 6 is such that a diminution current through solenoid 15 permits movable secondary 6 to be more closely coupled to its primary 4 and so the current in load line 7 is held constant.

It will be understood that the above description and accompanying drawing comprehend only the general and preferred embodiment of my invention, and that various changes in construction, proportion and arrangement of parts may be made within the scope of the appended claims, without sacrificing any of the advantages of my invention.

The herein described invention may be manufactured and used by or for the Government of the United States for governmental purposes without the payment of any royalty thereon.

I claim:

1. In combination, a transformer having its primary coil connected to a supply line and a variably coupled secondary coil connected to the load; a regulating transformer having a primary coil connected to said supply line and two secondary coils; a rectifying tube having a filament connected to one secondary coil of said regulating transformer and two plates connected to the other secondary coil of said regulating transformer, a solenoid connected to the mid-points of the two secondary coils of said regulating transformer, a movable core in said solenoid, and means connecting said core and the movable secondary coil of the first mentioned transformer to increase or decrease the coupling between the coils of said transformer when the current through said solenoid decreases or increases, respectively.

2. In combination, a transformer having its primary coil connected to a supply line and a variably coupled secondary coil connected to the load; a regulating transformer having a primary coil connected to said supply line and three secondary coils; two vacuum tubes having their grids connected to opposite ends of one of the secondary coils of said regulating transformer, their plates connected to opposite ends of another of the secondary coils of said regulating transformer, and their filaments connected to opposite ends of the other of the secondary coils of said regulating transformer, a solenoid having one terminal connected to the mid-point of the coil to which the plates of said tubes are connected and the other terminal connected to the mid-points of the coils to which said grids and said plates are connected, and a movable core in said solenoid connected to the secondary coil of the first mentioned transformer to increase the coupling between the coils of said transformer when the current through said solenoid decreases or increases.

3. In combination, a first transformer having a primary coil and a variably coupled secondary coil, a second transformer having a primary coil connected across the terminals of the primary coil of the first transformer and two secondary coils, a rectifying device having one element connected to one of the secondary coils of the second transformer and other elements connected to the other

secondary coil thereof, an electromagnetic device connected to the mid-points of the secondary coils of said second transformer, a movable member whereof the position is determined by the flow of current through said device, and means connecting said movable member and the secondary coil of the first transformer whereby the coupling between the coils of the first transformer is increased or decreased as the flow of current through said device decreases or increases.

4. In combination, a first transformer having a primary coil and a variably coupled secondary coil; a second transformer having a primary coil connected across the terminals of the first transformer and three secondary coils; two vacuum tubes, one terminal of each of said three secondary coils being respectively connected to one element in one tube and the other terminal of each of said three secondary coils being connected to the corresponding element in the other tube, an electromagnetic device having one terminal connected to the mid-point of one of said three secondary coils and the other terminal connected to the mid-points of the other two of said three coils, a movable member whereof the position is determined by the flow of current through said electromagnetic device, and means connecting said core and the movable secondary coil of the first transformer whereby the coupling between the coils of the first transformer is increased or decreased as the current through said device decreases or increases.

5. In combination, a first transformer having a primary coil connected to a supply line and a variably coupled secondary coil; a second transformer having a primary coil connected to said supply line and a plurality of secondary coils, a thermionic device operatively connected to said secondary coils of the second transformer, electromagnetic means connected to be energized by current through said device, a movable member whereof the position is determined by the flow of current through said means, and means connecting said movable member and the primary coil of said first transformer whereby the coupling between the coils of the first transformer is increased or decreased as the flow of current through said electromagnetic means decreases or increases.

6. In combination, a first transformer having a primary coil connected to a supply line and a variably coupled secondary coil; a second transformer having a primary coil connected to said supply line and a plurality of secondary coils, a plurality of thermionic devices operatively connected to the secondary coils of the second transformer, electromagnetic means connected to be energized by current through said thermionic devices, a movable member whereof the position is determined by the flow of current through said means, and means connecting said member and the secondary coil of said first transformer whereby the coupling between the coils of said first transformer is decreased or increased as the flow of current through said electromagnetic means increases or decreases.

7. In combination, a transformer having a primary coil connected to a supply line and a variably coupled secondary coil, means to move said secondary coil to vary the coupling between said coils, thermionic current rectifying means connected to control the first mentioned means to keep the output of said secondary coil substantially constant and means to impress upon 150

said thermionic means the voltage fluctuations in said supply line.

8. In combination, a transformer having a primary coil connected to a supply line and a
5 variably coupled secondary coil, means to move said secondary coil to vary the coupling between said coils, thermionic means connected to control the first mentioned means to keep the output of said secondary coil substantially constant, said
10 thermionic means being operated at saturation space current, and means to supply current to said thermionic means from said supply line and impress thereon the variations in said line.

9. In combination, a transformer having a

primary coil and a variably coupled secondary coil, and mechanism including thermionic means operated at saturating space current to move said secondary coil to keep the output thereof substantially constant, the said means being operated by current from the supply line. 80

10. In combination, a transformer having a primary coil and a variably coupled secondary coil, and mechanism including thermionic current rectifying means to move said secondary coil to keep the output thereof substantially constant, the said means being operated by current from the supply line. 85

LAWRENCE A. HYLAND.

15 90

20 95

25 100

30 105

35 110

40 115

45 120

50 125

55 130

60 135

65 140

70