

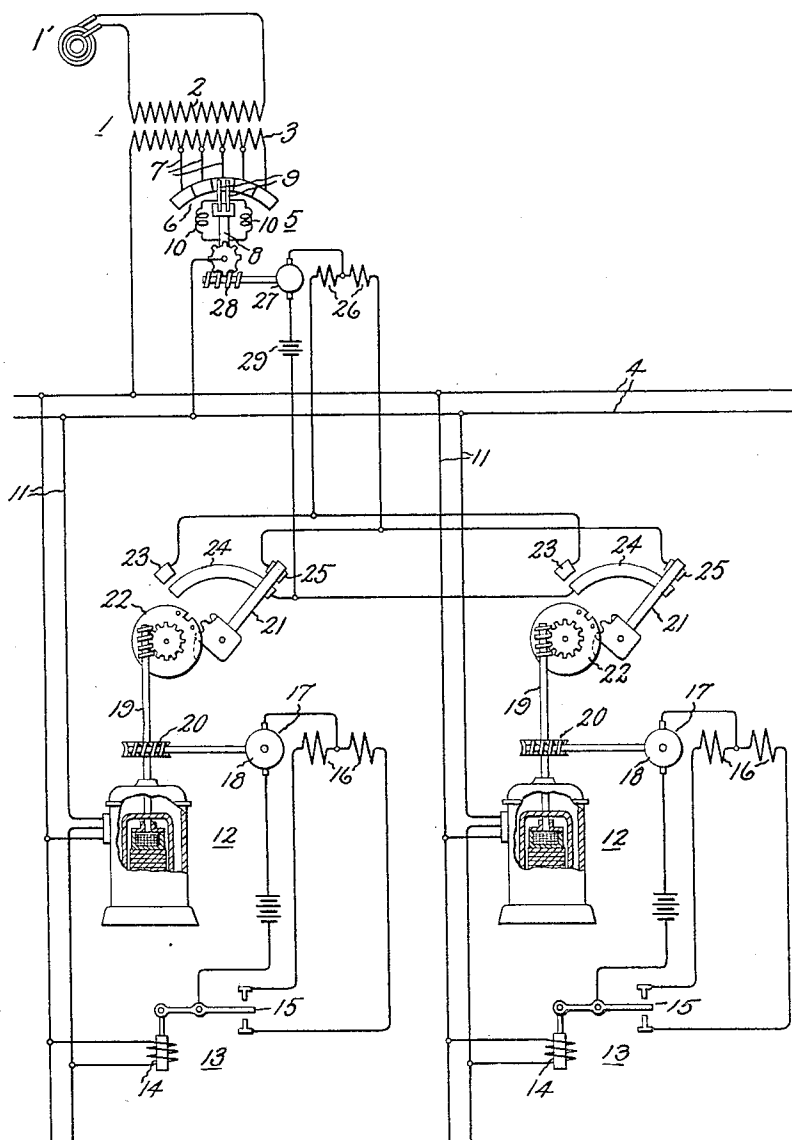
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W. S. MOODY

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ELECTRICAL DISTRIBUTION SYSTEM

Filed Dec. 18, 1929



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UNITED STATES PATENT OFFICE

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ELECTRICAL DISTRIBUTION SYSTEM

Application filed December 18, 1929. Serial No. 415,033.

My invention relates to electrical distribution systems and particularly to the automatic operation of transformer ratio adjusters under load in feeder regulating systems.

Ratio adjusters for transformers which are designed and constructed to operate under load involve apparatus of considerable complexity, which is not adapted for frequent and rapid movement. Automatic control of such devices as through their direct control by voltage responsive contact making means is consequently impractical. I, however, provide means in connection with a distribution system containing a plurality of feeders, with their respective voltage regulators, for securing an additional range of voltage control through the automatic operation of a ratio adjuster on the supply transformer, such operation nevertheless being at time intervals so infrequent as to be unobjectionable.

It is an object of my invention to provide a new and improved regulating system for distribution systems.

It is a further object of my invention to provide new and improved means for the automatic operation of a transformer ratio adjuster under load conditions.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring now to the single figure of the drawing, which is a diagrammatic representation of my invention, 1 is a supply transformer, whose primary winding 2 is connected to any suitable source of current supply 1' and whose secondary winding 3 is connected to bus 4 through a ratio adjuster 5, shown as of the tap changing type. This adjuster comprises a segmental arrangement of contacts 6, each of which is connected to a different tap 7 of the secondary 3. Arranged to move over these contacts is a brush arm 8 comprising a pair of relatively insulated brushes 9 connect-

ed to arm 8 through reactances 10. The purpose of this arrangement is to permit of changing from tap to tap without breaking the circuit or short-circuiting a portion of the secondary 3. Such arrangements are old and well known in the art. Connected to bus 4 are a plurality of feeders 11, each with its separate regulator 12, illustrated as of the well-known induction type. Each regulator is provided with suitable means for securing its automatic operation comprising a voltage responsive contact making device 13, shown as a solenoid 14 connected across its respective feeder 11 for causing the operation of a suitable switching device 15 for closing the circuit of one or the other of reversing field windings 16 on motor 17. The armature 18 of motor 17 is mechanically coupled to shaft 19 of each regulator through suitable gear mechanism 20. Each feeder voltage regulator is also equipped with limit switching means shown as comprising a pivotally mounted contact arm 21, operatively connected to shaft 19 through suitable motion transmitting means 22, this arm being adapted to bridge contacts 23 and 24 when the regulator is in one of its extreme positions and to bridge contacts 24 and 25 when it is in its other extreme position. All of contacts 23 are connected to one field winding 26, of motor 27, while all of contacts 25 are connected to the other field winding 26 of motor 27, which is arranged so as to cause reverse operation of the motor. Motor 27 is mechanically coupled to tap changing arm 8 by means of suitable mechanism 28. Contacts 24 are connected, through any suitable source of current supply, shown as battery 29, to the other terminal of motor 27.

The operation of my device is as follows. Assume that each of the feeders 11 is connected to a variable load and that power is being supplied to bus 4 through transformer 1. If the loads on feeders 11 are at or near their normal values, regulators 12 will be at positions intermediate their extreme posi-

tions. Hence contacts 21 will be approximately midway between contacts 23 and 24. If now slight changes in load occur on feeders 11, their respective regulators 12 will automatically regulate the voltage, through the operation of voltage responsive devices 13, causing motors 17 to turn their respective regulators in the proper direction. Consequently changes in voltage on feeders 11, within the range of regulation of regulators 12 will not cause contacts 21 to engage either contact 23 or contact 25 and hence will not cause the operation of motor 27 and ratio adjuster 5. If, however, the voltage on any one or more of the feeders 11 should change beyond the regulating limits of its respective regulator, contact arm 21 will be made to bridge either contacts 23 and 24 or 24 and 25, thereby closing a circuit including motor 27 and the proper field winding thereof for causing its rotation to be such as to make ratio adjuster 8 operate to produce such a voltage on bus 4 that the feeder regulator or regulators which are at their limits of regulation will again be able to take up an intermediate position. When this happens, the circuit to motor 27 will be broken and the ratio adjuster will cease to operate until such time when any one of the feeder regulators reaches the limit of its range.

Although the feeder regulators have been shown and described as voltage regulators, it will of course be obvious to those skilled in the art that they could equally well be current regulators without departing from my invention.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from my invention and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a system of distribution, a circuit, a regulator therefor, said regulator having two extreme positions which limit its range of regulation, an additional regulator for said circuit, and means responsive to the movement of said first-mentioned regulator to either one of its extreme positions for causing the operation of said additional regulator.

2. In a system of distribution, a plurality of feeder circuits, adjustable means for varying an electrical characteristic of said circuits, a separate regulator having two predetermined regulating limits for each of said feeder circuits, and means cooperating with said adjustable means for effecting operation thereof when any one of said regulators at-

tains either one of its predetermined regulating limits.

3. In a system of distribution, a plurality of feeder circuits, adjustable means for varying an electrical characteristic of said circuits, a separate regulator for each of said feeder circuits, said regulators being responsive to changes in an electrical characteristic of their respective feeders, and means operative in response to any one of said regulators reaching its limit of regulation for causing said adjustable means to vary said characteristic in such a manner that said regulator will again operate within its regulating range.

4. In a system of distribution, a source of current, a plurality of feeder circuits, means connecting said source to said feeder circuits, said means including adjustable means for varying the voltage of said feeder circuits, a separate voltage regulator for each feeder circuit, and means responsive to any one of said regulators reaching its extreme regulating position for causing said adjustable means to vary said voltage in such a manner that said regulator can operate within its regulating range.

5. In a system of distribution, a source of current, a plurality of feeder circuits, means connecting said source to said feeder circuit, said means including adjustable means for varying an electrical characteristic of said feeder circuits, a separate voltage regulator for each feeder circuit, separate means responsive to variations in the voltage of each feeder circuit for causing operation of its respective regulator, and means responsive to an extreme position of any one of said regulators for causing said adjustable means to vary said voltage in such a manner as to cause said regulator to leave its extreme position and for arresting the operation of said adjustable means when said regulator leaves its extreme position.

6. In a system of distribution, a source of alternating current, a transformer, means connecting said source to one winding of said transformer, a plurality of feeder circuits, means connecting said feeder circuits to the other winding of said transformer, a ratio adjuster for said transformer, a separate regulator for each feeder circuit, and means responsive to the movement of any one of said regulators to an extreme position for causing said ratio adjuster to operate in such a manner as to necessitate said regulator leaving its extreme position in order to perform its regulating function.

7. In a system of distribution, a source of alternating current, a transformer, means connecting the primary winding of said transformer to said source, a plurality of feeder circuits, means connecting said feeder circuits to the secondary winding of said transformer, a ratio adjuster connected to

said transformer, a separate regulator for each feeder, responsive to the voltage of its respective feeder, limit switches mechanically connected to each regulator, and means
5 responsive to the closure of any one of said switches for operating said ratio adjuster in such a manner that the resultant voltage change on said feeders tends to cause the regulator, one of whose limit switches is closed,
10 to open said switch.

In witness whereof, I have hereunto set my hand this 16th day of Dec., 1929.

WALTER S. MOODY.

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