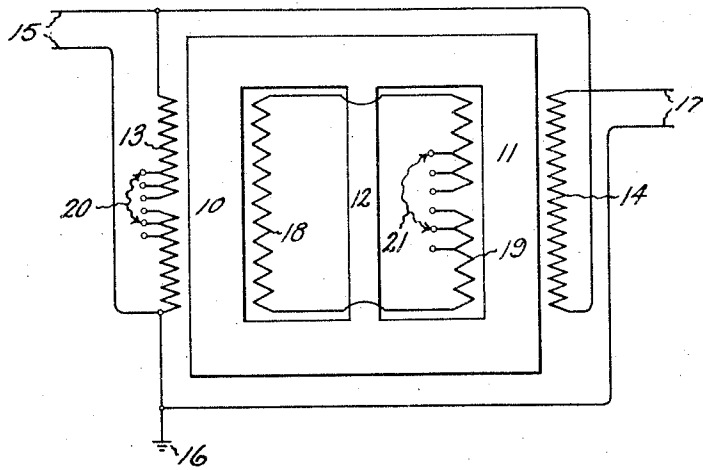


July 29, 1930.

H. A. GERMAIN
AUTO TRANSFORMER
Filed Nov. 7, 1929

1,771,919



Inventor:
Henry A. Germain
by *Charles E. Fuller*
His Attorney.

UNITED STATES PATENT OFFICE

HENRY A. GERMAIN, OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

AUTO TRANSFORMER

Application filed November 7, 1929. Serial No. 405,518.

My invention relates to auto transformers. This type of transformer is simpler and less expensive than a transformer with separate primary and secondary windings and is often used to connect together two circuits operating at different voltages when it is not necessary that the two circuits be insulated from each other. An auto transformer winding includes a section which is common to the two circuits connected to the transformer and a section which is in series with the two circuits. Varying conditions in the two circuits make it necessary at times to adjust the voltage ratio of the common and series windings of the transformer and the general object of the invention is to provide an improved auto transformer arranged for adjustment of the voltage ratio of its common and series windings.

Further objects and advantages will appear and the invention will be more fully explained in the following description taken in connection with the accompanying drawing which shows diagrammatically an auto transformer constructed in accordance with the invention.

The auto transformer shown in the drawing includes a magnetic core having two outer winding legs 10 and 11 and a central leg 12 which, as shown, may not have any winding. The main winding of the transformer includes a common winding 13 on the winding leg 10 of the core and a series winding 14 on the winding leg 11 of the core. An outside circuit 15 is connected across the common winding 13 which has one end connected to the ground 16. Another outside circuit 17 is connected across the entire main winding, the circuit 17 operating, of course, at a voltage which is equal to the sum of the voltages of the common and series windings 13 and 14 and which is therefore higher than the voltage of the circuit 15.

An auxiliary winding 18 on the winding leg 10 is connected to a second auxiliary winding 19 on the winding leg 11, the auxiliary windings 18 and 19 being connected with their voltages in opposition. One of the windings 13 and 18, preferably the winding 13, is provided with taps and a suitable tap

connector 20 so that the voltage ratio between these two windings may be adjusted or varied by changing the number of effective turns in the tapped winding. One of the windings 14 and 19, preferably the winding 19, is similarly provided with taps and a suitable tap connector 21 so that the voltage ratio between these two windings may also be adjusted or varied. By confining the latter taps to the auxiliary winding 19 and leaving the series winding 14 free of all tap connections, this winding 14 may be effectively insulated without difficulty although the entire series winding of an auto transformer often operates at voltages which are far above ground potential. It will be apparent that with the arrangement which has been described, the voltage ratio between the common winding 13 and the series winding 14 may be varied and adjusted as desired by changing either or both of the tap connections and thus the effective number of turns of the windings 13 and 19.

The numbers of turns in the windings 13, 14, 18 and 19 are preferably so chosen that with the normal or average ratio between the voltages of the common and series windings 13 and 14, the same amount of magnetic flux will flow in both of the winding legs 10 and 11 of the core. Under these conditions, there will be no flux in the central core leg 12. If, however, this normal ratio between the voltages of the common and series windings is changed by changing the effective number of turns in either or both of the windings 13 and 19, then one of the winding legs 10 and 11 will necessarily carry more flux than the other, the excess flux finding an easy return path through the central or third core leg 12. Under extreme conditions, the amount of excess return flux in the core leg 12 will usually be considerably less than the amount of flux in either of the winding legs 10 and 11 so that the cross section of the core leg 12 may be considerably smaller than that of either winding leg.

The invention has been explained by describing and illustrating a particular embodiment thereof but it will be apparent that various changes may be made without departing

from the spirit of the invention or the scope of the appended claims.

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

1. An auto transformer including a magnetic core having three legs, a common winding and an auxiliary winding on one of said legs, a series winding and an auxiliary winding on another of said legs, said auxiliary windings being connected together with their voltages in opposition, and means for varying the effective number of turns in one of said windings to vary the ratio between the voltages of said common and series windings, the third core leg providing a return path for excess flux in either of said winding legs.

2. An auto transformer including a magnetic core having three legs, a common winding and an auxiliary winding on one of said legs, a series winding and an auxiliary winding on another of said legs, said auxiliary windings being connected together with their voltages in opposition, and means for varying the effective number of turns in one of said windings to vary the ratio between the voltages of said common and series windings, the third core leg having a smaller cross section than either of said winding legs and providing a return path for excess flux in either of the winding legs.

3. An auto transformer including a magnetic core having three legs, a common winding and an auxiliary winding on one of said legs, a series winding and an auxiliary winding on another of said legs, the two auxiliary windings being connected together with their voltages in opposition, and means for varying the effective number of turns in one of the windings on each of said winding legs to vary the ratio between the voltages of said common and series windings, the third core leg providing a return path for excess flux in either of said winding legs.

4. An auto transformer including a magnetic core having three legs, a common winding and an auxiliary winding on one of said legs, a series winding and an auxiliary winding on another of said legs, said auxiliary windings being connected together with their voltages in opposition, and means for varying the effective numbers of turns in said common winding and in one of said auxiliary windings to vary the ratio between the voltages of said common and series windings, the third core leg providing a return path for excess flux in either of said winding legs.

5. An auto transformer including a magnetic core having three legs, a common winding and an auxiliary winding on one of said legs, a series and an auxiliary winding on another of said legs, said auxiliary winding being connected together with their voltages in opposition, said series winding being free of connections between its terminals, and means including tap connections for varying

the effective number of turns of one of the other three windings to vary the ratio between the voltages of said common and series windings, the third core leg providing a return path for excess flux in either of said winding legs.

In witness whereof, I have hereunto set my hand this 5th day of Nov., 1929.

HENRY A. GERMAIN.