Oct. 31, 1950 H. HARTMANN 2,527,881

INSTRUMENT TRANSFORMER

Filed Nov. 7, 1946

FIG. 1.

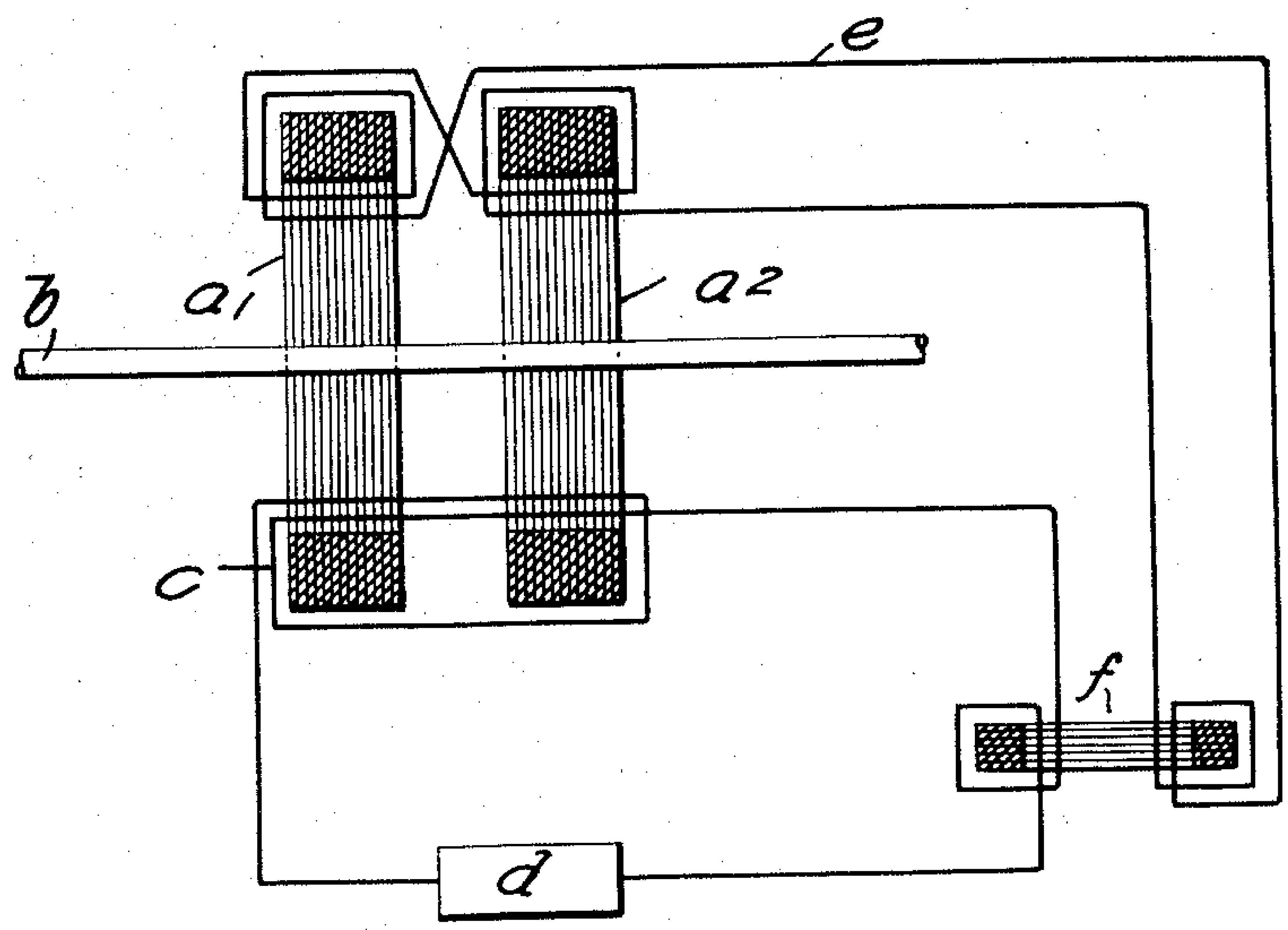
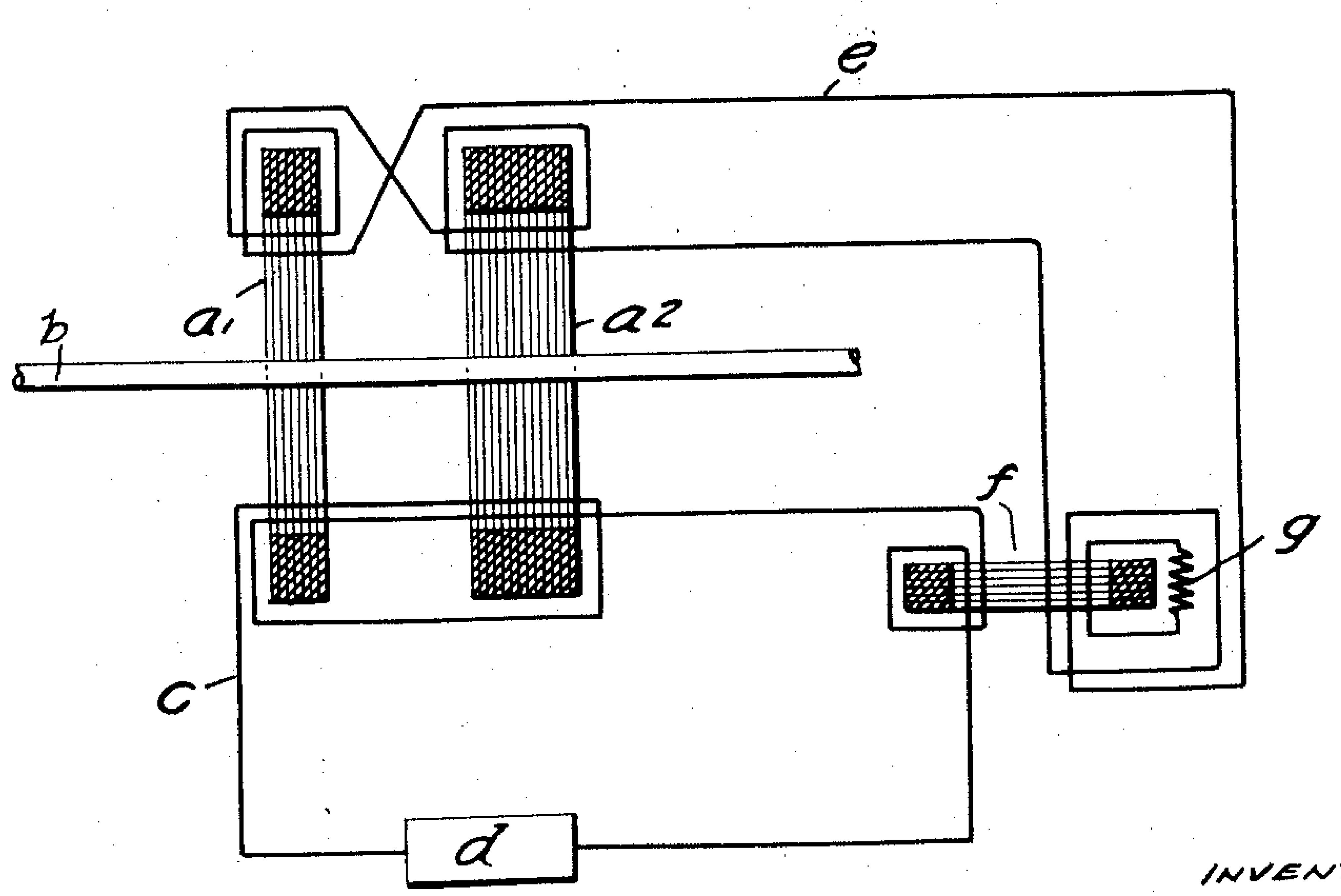


FIG. 2.



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2,527,881

INSTRUMENT TRANSFORMER

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4 Claims. (Cl. 323—44)

1

The purpose of a controlled natural premagnetisation in a current transformer is to enable, without the aid of an extraneous current source, a premagnetising flux which is as far as possible constant to be superposed on the useful flux when the primary current varies, in order to reduce errors over the entire working range of the transformer.

When parts of the secondary winding also act as the premagnetising winding, the transformation ratio is generally affected when the premagnetisation is adjusted. It has therefore been proposed to employ auxiliary loads for the adjustment of the premagnetisation. In order to prevent the premagnetising flux from producing a potential in the secondary and premagnetising winding, it is nevertheless necessary to select a certain ratio for the cross-sections of the partial cores of the transformer. Even in this case, however, the useful flux will induce a potential in the premagnetising winding according to the difference in cross section of the individual core parts. Furthermore there is no longer a free choice as regards the number of premagnetising turns, because the prescribed value of the secondary current strength with a given number of ampere-turns no longer enables an optional number of turns to be used. With the usual value of 5 amperes for the secondary current the possibility of making any adjustment is very limited due to the small number of turns.

It has also been proposed to separate the premagnetisation winding galvanically from the main windings of the transformer by inserting an excitation transformer in the primary circuit of the instrument transformer. By arranging the excitation core for the premagnetisation in the window space enclosed by the primary winding, the space requirement increases and the primary winding requires an increased number of turns. The amount of insulating material required to insulate the primary winding from the low-potential parts thus also increases. Furthermore in this case the core must have a length of iron which is sufficiently great to enclose the primary coil, that is to say its length becomes practically as great as that of the measuring transformer core. This is a disadvantage when the excitation transformer for regulating the premagnetisation is to be designed with a saturation characteristic. In this case with 1/1 rated current, the excitation transformer will be strongly saturated. A large number of ampere-turns is thus required in order to obtain saturation with a core having such a large length of iron.

2

The present invention concerns a current transformer with a two-part magnet core for controlled natural premagnetisation with a premagnetising winding which is excited from the secondary circuit of the transformer, the aforementioned disadvantages being avoided according to the invention by supplying the premagnetising winding from the secondary of an excitation transformer, the primary of the latter being energized from the secondary winding of the main transformer.

Constructional examples of instrument transformers embodying the invention are shown in the accompanying drawings, in which Fig. 1 is a combined schematic and sectional view of a dual core transformer with core sections of equal cross sectional area, while Fig. 2 is a similar view of a modified construction wherein the core sections are of different size and means are provided for adjusting the saturation characteristic of the exciter transformer.

The current transformer possesses two premagnetised core parts a_1, a_2 with the primary conductor *b* and the secondary winding *c* which surrounds the core sections with one or more turns. The secondary circuit is connected to a load *d*. The premagnetising winding *e* arranged in cross-connection is supplied from the excitation transformer *f* which is linked with the secondary winding of the current transformer and is connected in series with the load *d*. The premagnetising winding is thus galvanically separated from the other windings of the transformer. This allows great freedom as regards the division of the number of winding turns. All undesirable reactions on the transformer windings due to the premagnetisation are avoided.

Due to the excitation transformer *f* being supplied from the secondary side of the current transformer, the excitation transformer can be constructed with a very short length of iron. The length of iron of the excitation transformer for a 220 kv. current transformer thus for instance amounts to about $^1/_{10}$ of the iron length of the instrument transformer core. This results in a very great reduction in the necessary number of ampere-turns, and due to the small dimensions, it is possible to achieve a good saturation characteristic. Furthermore there is a reduction in the amount of material required.

Due to the excitation transformer being connected in series with the secondary load, the load is balanced. In instrument transformer specifications it is stipulated that the measuring accuracy must be maintained when the load drops from full-load to quarter load. Since the excitation transformer acts as a basic load, the effect of a change in load is decreased. A further load compensation is effected by the rapid rise in power absorbed by the excitation transformer when the current increases, this being due to the saturation characteristic.

It is easily possible by selecting suitable cross-sections for the part cores, to compensate the load in the secondary circuit, due to the excitation transformer. For this purpose the part core in which the premagnetising flux adds itself to the useful flux has to be strengthened. The potential drop at the excitation transformer in the secondary circuit is thus eliminated.

The saturation characteristic of the excitation transformer can be obtained by the addition of voltage-dependent resistances such as are indicated by *g* in Fig. 2.

I claim:

1. In an instrument type current transformer wherein the primary and secondary are interlinked by a multi-part magnetic core, an alternating current premagnetizing winding surrounding said core sections, and an exciter transformer electrically linked only with the secondary of said current transformer and which includes a magnetic core having a saturation characteristic and primary and secondary windings thereon, said premagnetizing winding being connected to the secondary winding of said exciter transformer, and the primary winding of said exciter transformer being circuit connected with and supplied from the secondary of said current transformer.

2. A current transformer as defined in claim 1 wherein the core of said exciter transformer has a saturating winding thereon connected in circuit with and supplying current to a resistor element the effective resistance of which is dependent upon the applied voltage.

3. A current transformer as defined in claim 1 wherein the primary winding of said exciter transformer is arranged in series with the main load supplied by the secondary of said current transformer.

4. A current transformer as defined in claim 1 wherein the different parts of said current transformer core differ in cross-sectional area.

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