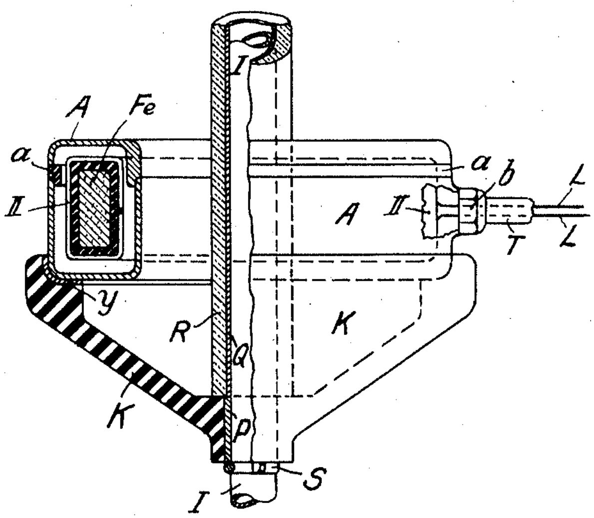
Sept. 17, 1940. H. WEHRLIN 2,214,915

HIGH FREQUENCY CURRENT TRANSFORMER

Filed Feb. 18, 1937

Fig.1



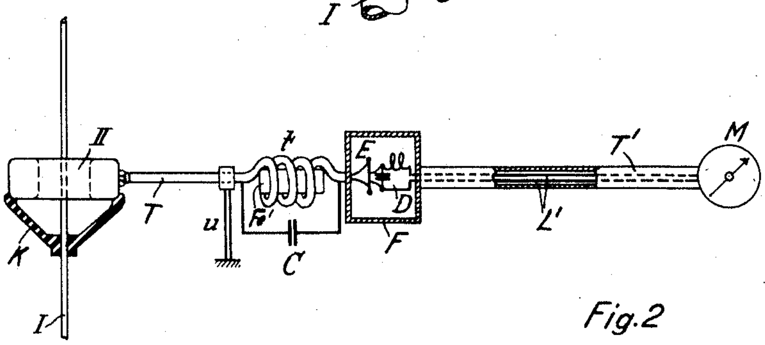


Fig.2

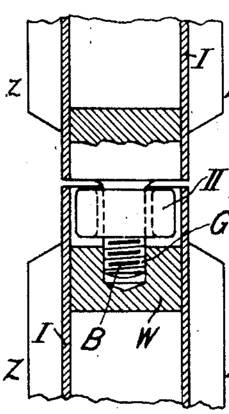


Fig.3

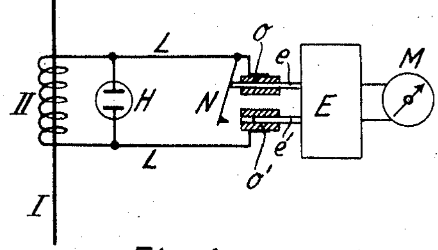


Fig.4

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HIGH FREQUENCY CURRENT TRANSFORMER

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5 Claims. (Cl. 175—358)

It is well known to employ current transformers when measuring high frequency currents by means of arrangements of the kind wherein the points of reading and those of measurement are not identical. Another reason why current transformers should be used is that the inherent capacity of the instruments employed would be too great if they were directly included in the line, whereas the inherent capacities of the current transformer allow of being rendered much smaller.

The invention proposes to provide high frequency current transformers with cores made of high frequency iron.

Under certain conditions the ratio of transformation is equal to that of the number of turns, leakage and watt power being required here to be sufficiently small.

In arrangements as provided by the invention the spatial dimensions and thus the inherent capacities and leakage are reduced by furnishing the secondary coil with a core of high frequency iron.

Some embodiments of the invention are disclosed hereafter by way of example, reference being had to the accompanying drawing in which

Fig. 1 is a partially sectioned view of one form of the novel current transformer. Fig. 2 is a partially diagrammatic and partially sectioned view showing a slight modification of the current transformer represented in Fig. 1 and a measuring equipment therefor. Fig. 3 is a sectional view of a third modification of a current transformer as provided by the invention. Fig. 4 is a schematic representation illustrating a novel mode of attaching a measuring equipment to a current transformer.

I denotes the primary conductor which may be a tube, for instance. II designates the toroidal coil which as shown in Fig. 1 is provided with a core *Fe* of high frequency iron. Coil II is carefully screened. The screening A arranged to such end is such that no short-circuiting effects shall occur. For this purpose the screening A has a circumferential slot filled up with an insulating ring *a*. Coil II and screening A are as a whole mounted on an insulating body K made of a ceramic material, for instance, and are in this way spaced from conductor I by a certain distance. Body K is supported by a spring ring S seated in an annular groove of conductor I. Also a number of rings S may be provided in this way. Body K in order to avoid air gaps is metallized where it contacts with conductor I and ring S. The metallizing layer or coating is denoted by P. The body K may also have a metal coating Y where it contacts with the screening A. A tube R, made of a ceramic material, for example, and provided inside with a metal coating Q, is inserted over conductor I. The arrangement is such that the thickness of the wall of tube R and the distance between tube R and screening A are in the inverse ratio of the dielectric constants of the insulating material and of air. In this way puncture is prevented to the greatest possible extent. Tube R may be formed integral with the body K. The screening A has a socket *b* by means of which a tube T is secured thereto in order to screen a line L by which coil II is connected to a measuring equipment E, D, M, Fig. 2. This equipment comprises a direct current indicator M and a thermo-electric couple E, connected in circuit therewith. If E and M are not comprised in one device, line L′ interconnecting E and M should be carefully screened by a tube T′, because otherwise this line may happen to receive high frequency currents while no current is flowing through conductor I. Since the thermo-electric couple E becomes heated by a high frequency current received by the line L′ the indicator M would be caused to deflect its pointer and thus to give a wrong indication. If a most careful screening should not be sufficient to obviate this, then it will be suitable to interpose a choke or a filter chain D between E and M in order to prevent high frequency energy received by L′ from acting upon the thermo-electric couple E. A means of this kind would have to be provided between A and E if the measuring equipment were to be protected from currents received by line L. The arrangement D, E may be contained in a screening F.

If short or very short waves are concerned then the body K is so constructed that the dielectric between conductor I and transformer II is constituted by air only. This feature is likewise shown in Fig. 2. It will be seen that conductor I is here not contained in an insulating tube such as tube R represented in Fig. 1. In this way due to the low dielectric constant a small capacity between transformer II and conductor I is obtained, that is, a capacity which is adequate to the high frequencies.

If the line interconnecting transformer II and thermo-electric couple E or indicator M is longer than $\lambda/4$, λ being the wavelength, then it is advantageous to give part of the screening tube T a helical shape, as shown at *t*, in order that the line in this tube shall be coiled to form a choke, and this choke too may be fitted with a core *Fe′* of high frequency iron. Between II and t the screening T is earthed by a conductor u and preferably at the current loop or potential node. If a definite operating wave is employed the choke at t may be connected in parallel with a condenser C in order to form therewith an arrester circuit tuned to the operating frequency.

The arrangement shown in Fig. 3 may be used if conductor I is of a comparatively large diameter. Conductor I is here made in two tubular parts. One of these carries a metal bolt B. The other part is fitted with a metal block W, disposed therein. Coil II is disposed within the other part, which thus also acts to screen it. The two parts of the conductor I are fastened to each other by a screw joint G, formed by a thread provided on bolt B and a thread provided in the block W. Care should be taken that the two parts of conductor I do not contact with each other, since otherwise short-circuiting effects may occur. The heat due to the resistances constituted by the screw joint G may be removed by cooling fins Z with which conductor I is provided.

The measuring equipment E, M if required to be exchangeable may be provided with plug contacts e, e' adapted to be inserted in sleeves o, o' to which coil II is connected over line L, as shown in Fig. 4. Care should be taken that when removing the device E, M from the plug sleeves o, o' transformer II is automatically short-circuited since otherwise very great high frequency voltages may occur at these sleeves. As a representative example of an arrangement adapted for this purpose a contact spring N is shown that tends to make contact with sleeve o' while being held out of contact therewith by plug contact e. Further, the occurrence of high voltages in the case of wire breakage on the secondary side can be obviated by a glow discharge tube H arranged to bridge over line L, and tube H may be arranged then to actuate an alarm device.

The novel arrangement allows of predetermining by calculation the ratio of transformation except for about 10%.

Differences that may occur can in accordance with a further feature of the invention be compensated by varying the self-induction of the secondary coil II. This may be done as follows:

The core of the coil II may be made in several parts and these may be displaced with respect to each other in order to obtain the requisite readjustment, or parts of the coil II may be displaced with respect to each other, or a combination of these two modes may be employed. Also, the core of coil II may be provided with a bore intended to receive a pin made of high frequency iron. The self-induction is then varied by inserting this pin into the bore and by displacing it therein, if necessary, or by removing it from the bore.

What is claimed is:

1. A high frequency current transformer comprising a tubular primary conductor having an intermediate portion of reduced diameter around which is positioned a secondary coil, and two portions of larger diameter respectively extending in opposite directions from said intermediate portion, said tubular primary conductor having an extension encircling said secondary coil and acting as a screening therefor.

2. A transformer according to claim 1, wherein the primary conductor is made in two parts and wherein a threaded electrically conductive bolt is employed to interconnect these, the secondary coil being arranged to surround this bolt.

3. A transformer according to claim 1, wherein the primary conductor is made in two tubular parts spaced from each other.

4. A transformer according to claim 1, wherein the primary conductor is composed of two tubular parts provided with cooling fins at the ends thereof facing each other.

5. A high frequency transformer comprising a first substantially cylindrical conducting member having an end, a second substantially cylindrical conducting member having an end substantially abutting but not electrically contacting the end of said first member, at least one of said members being hollow at its end whereby said abutting ends define a cavity, an annular core of high frequency iron disposed within said cavity, electrically conductive means extending from said first member through said core to said second member to unite said two members into one current conductor, and a winding wound on said core to provide an electromagnetic coupling to said current conductor.

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