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MAGNETIC SHUNT FOR U-SHAPED METER CORES

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Fig. 1

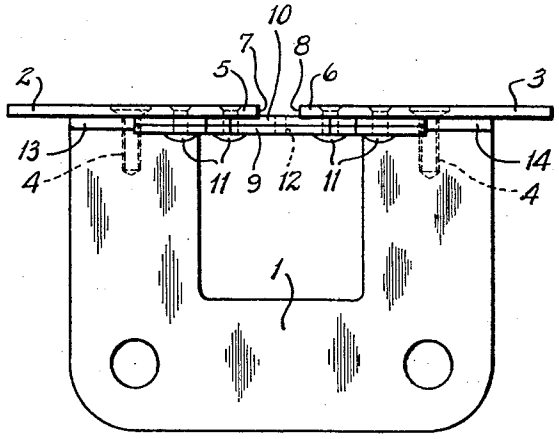
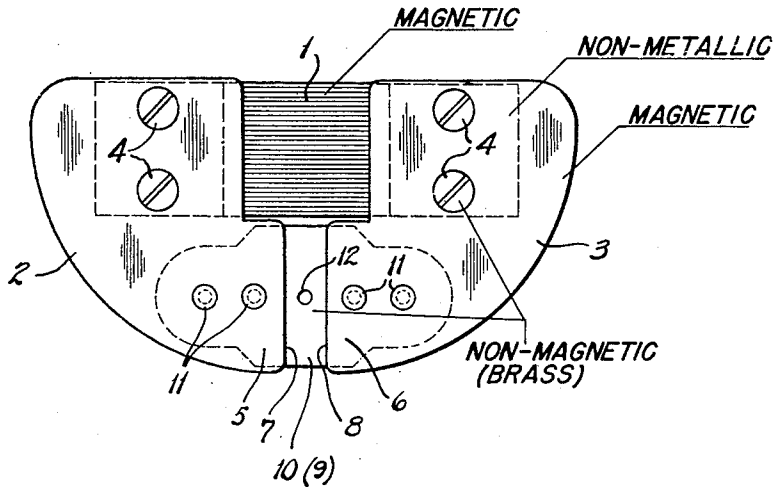


Fig. 2



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MAGNETIC SHUNT FOR U-SHAPED METER CORES

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The present invention relates to new and useful improvements in induction measuring apparatus, more particularly to watt hour meters.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawings:

Figure 1 is a side elevation of a typical, preferred and illustrative meter core embodying the present invention; and

Figure 2 is a top plan view of the current core shown in Figure 1.

As is known, the load curves of induction measuring apparatus show a negative error produced by the current damping, which error is reduced to a considerable extent by magnetic shunt arrangements, of which a number of forms are known. In one shunt arrangement, which is especially advantageous, both the total flux and also the shunted flux are each conducted through at least one air gap. Such a shunt arrangement of this kind produces a very strong compensating moment by the high magnetic resistance in the part of the current core carrying the total flux, and requires only a minimum number of ampere turns.

A highly advantageous constructional form of a shunt arrangement of the kind above mentioned comprises two pole extension plates fixed to the polar surfaces of the current core with non-magnetic material intercalated, the projecting parts of such pole extension plates being connected together by a magnetic bridge or bar so as to leave a narrow air gap in which is fixed a member of non-magnetic material. In this arrangement however, the bridge or bar is not saturated at high loads, but saturation takes place in the two projecting parts of the pole plates by reason of the large magnetic resistance present at these places, so that a comparatively large amount of material is required for obtaining the shunting action. The mere cost of the large amount of metal required is not the most

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important disadvantage. As is generally known, the shunting action depends largely on the quality of the sheet iron employed in the shunt.

Therefore endeavors have long been made to render one's self as independent as possible of the unavoidable differences in the magnetic properties of the dynamo sheet iron employed. Since the sheets of dynamo sheet iron of one lot are usually uniform among themselves in their magnetic properties, it is obviously more advantageous in the present day mass production to be able to make the largest number of shunt plates from one lot of dynamo sheet metal and to use as little dynamo sheet metal as possible for such shunt plates. A further disadvantage of these shunt arrangements is the difficulty of adjusting exactly the air gap between the two pole plate projections. An exact adjustment of this air gap is however, necessary for obtaining such a satisfactory shunting effect.

The present invention has for its object the avoidance of the disadvantages of the above mentioned shunt arrangement. In accordance with the invention this result is attained by connecting the shunt plate to the two pole plates which are fixed to the polar surfaces of the current core and spaced therefrom by intercalation of non-magnetic material, at the same time providing a bridge or bar which is saturated at high loads, non-magnetic material being likewise intercalated between the shunt plate and the pole plates. Preferably, the shunt arrangements are so formed that the pole plates which extend considerably beyond the polar surfaces of the current core at one longitudinal side thereof each have a projection and the front faces of these projections are kept at such a distance apart from one another that substantially no lines of force run between them.

The air gap conducting shunted lines of force between the two pole plates is substantially eliminated in this shunt arrangement due to the comparatively great distance apart of the pole plate projections from one another. Here the shunted lines of force are rather conducted substantially over the bridge or bar of the shunt plate, so that the latter, since it has the maximum magnetic resistance, is saturated at high loads. For the shunting action consequently only a single place in the system, namely the bridge or bar of the shunt, is important. The amount of material used for making the shunt plate can therefore be very small, so that a large number of shunt plates can be made from each lot of the dynamo sheet iron.

The exact initial adjustment of the shunt can

be accomplished simply and easily in view of the fact that the path of the shunted lines of force between the pole plates and the shunt plate is formed entirely of a non-metallic spacing plate which can be of any desired predetermined thickness, the thickness being chosen in accordance with the magnetic characteristics of the shunt plate and the magnitude of the error to be corrected.

It will be understood that the foregoing general description and the following detailed description as well are exemplary and explanatory of the invention but are not restrictive thereof.

Referring now in detail to the illustrative and preferred embodiment of the invention as shown in the accompanying drawings, the current core 1 is formed as a laminated U-shaped core of conventional form on the pole pieces of which are fixed the pole extension plates 2 and 3 which are secured thereto by screws 4 and spaced from the pole pieces by the interposed non-metallic plates 13 and 14. The pole extension plates 2 and 3 are formed of magnetizable material such as dynamo sheet iron and project beyond the pole surfaces of the current core 1, the portions of these extension plates which project towards each other being numbered 5 and 6. The adjacent and usually parallel edges 7 and 8 of the pole extension plates 2 and 3 are mechanically held in fixed relation to each other at such a distance that the lines of force between them are relatively few and almost insignificant. The space between the edges 7 and 8 is bridged by means of a shunt plate 9 which is secured to the pole extension plates 2 and 3 by means of the non-magnetic rivets 11, preferably of brass, while the shunt plate 9 is accurately and rigidly spaced from the projecting portions 5 and 6 by means of the non-magnetic plate 10 which is also preferably of brass, the thickness of the plate 10 being determined by the magnetic characteristics of the particular lot of dynamo sheet iron from which the plate 9 is formed. The plate 9 is preferably centrally enlarged, and extends beneath the pole plate extension pieces 2 and 3 providing an overlapping area of the plate 9 each of which is at least of as large an area as the portion of the plate 9 lying between the edges 7 and 8, while the width of the plate 9 between the edges 7 and 8 is substantially or almost the same as the width of the edges 7 and 8.

In order to provide for a more exact adjustment of the saturation in the shunt 9, the shunt plate 9 may be drilled with one or more small holes 12, these holes serving to reduce the cross sectional area of the shunt 9 between the hole plate edges 7 and 8 so as thereby to reduce the saturation value of the shunt.

The spacing between the edges 7 and 8 of the pole extension plates 2 and 3 is relatively great compared to the thickness of the shunt plate 9, and in actual practice is several times as great, thereby causing substantially all of the shunted flux to pass the plate 9 rather than cross the air gap between the plate edges 7 and 8. Since the bridge of the shunt plate 9 lies across the gap between the edges 7 and 8, and

the plate 9 is more closely spaced to the plates 2 and 3 than the edges 7 and 8 are from each other, the shunt 9 alone will be subject to saturation at high loads, and the active field of operation of the shunt is thereby limited to a very small portion. The shunt 9 is of relatively small size, and only a small amount of the dynamo sheet iron from which it is made is required thereby permitting a large number of such shunts to be made from a particular lot of magnetic material.

The difficulty of securing an accurate adjustment of the shunt is completely avoided inasmuch as the front faces or edges 7 and 8 of the pole extension pieces are rigidly held in a fixed relation to each other, and the plate 9 is fixedly spaced from the plates 2 and 3 by means of the brass spacer plate 10. After these parts have been secured together by the rivets 11, the distance remains unchangeable, and the saturation limit of the shunt plate 9 can be adjusted or changed only by drilling in it the final compensating holes 12.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

1. In combination in an induction measuring apparatus, a U-shaped current core having at least one air gap, pole plates secured to said core at the poles of said core, a shunt plate connected to and bridging an air gap between said pole plates, non-metallic spacing elements between the pole plates and the core, and a non-magnetic spacing member between the shunt plate and pole plates at the air gap, said pole plates both extending to one side of the core and towards each other to provide an air gap between their adjacent edges, the air gap being relatively large with reference to the space provided by the non-magnetic spacing elements whereby the shunt plate is saturated at heavy current loads and substantially no lines of force run between the pole plates at the air gap.

2. A current core as claimed in claim 1 in which the shunt plate has a hole drilled therein in the air gap.

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