

Jan. 23, 1968

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3,365,686

ADJUSTABLE COIL

Filed July 14, 1965

2 Sheets-Sheet 2

Fig. 4

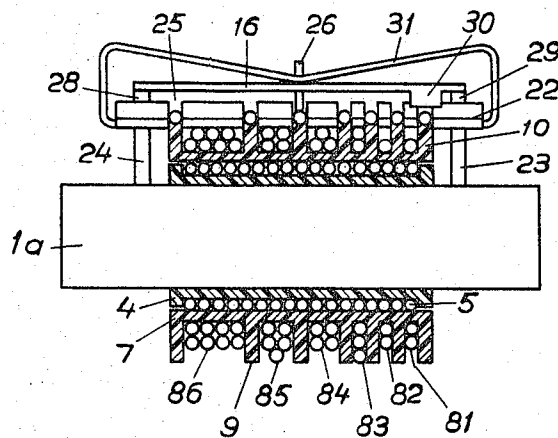
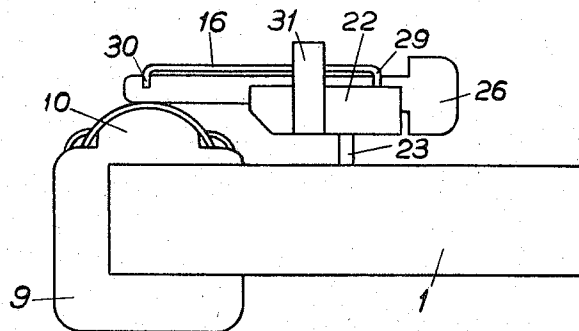


Fig. 5



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ADJUSTABLE COIL

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Filed July 14, 1965, Ser. No. 471,827

Claims priority, application Sweden, July 17, 1964,

8,723/64

2 Claims. (Cl. 336—150)

ABSTRACT OF THE DISCLOSURE

An adjustable electrical coil with a terminal at one of its ends. For a part of its length at the open end, a number of turns of the coil are arranged at a greater distance from the center of the coil than the corresponding parts of the other turns. These turns are shaped as contact parts. A spring-activated contact plate is arranged laterally to the coil and is provided with the second terminal of the coil. It has a first contact engageable with the contact part situated nearest to the first terminal and a movable contact engageable with any one of the rest of the contact parts. When the movable contact is in its place, the first contact is not in connection with its contact part of the coil but when the movable contact is not in its place the first contact is in connection with its contact part.

In many cases it is necessary to have a coil with an adjustable number of turns, for example in electromagnets for over-current relays, where it is necessary to have the same number of ampere-turns at different current settings, it being desirable to have the same flux in the relay magnet at all current settings in order more easily to obtain a constant re-setting value of the relay armature. The same is also true for electromagnets which are used as driving means for time-lag over-current relays of the induction type with rotating discs of aluminum or copper, where it is necessary to have the same transformation ratio at different loads at each of the different over-current settings, since the time curves would otherwise be different, which would jeopardise selective tripping.

To achieve this adjustability is of course easy with a one layer coil but when it comes to a multi-layer coil it is not possible to make contact directly with the desired turn if this happens to be in an inner layer. Therefore, the coil has been split up into a number of separate smaller coils on a bobbin divided into the required number of sections. The two leads from each coil were then connected to a connecting board on which the desired number of ampere turns could be connected in. This is a rather complicated and costly way. The object of this invention is to provide in a simple way means to bring the desired turn up to or a little above the outer layer, thus making it possible to make a connection to it directly with a screw or a plug contact without any extra connections.

The present invention relates to a coil with an adjustable number of turns in which it is not necessary to make any such taps. The invention is characterised in that a movable contact on a spring loaded contact plate arranged adjacent to the winding is arranged to be able to be brought into contact with a certain turn of the winding.

In order to do this the coil is wound on a special bobbin divided into sections separated from one another by insulating flanges of the same number as the desired number of current settings. A small part of the flanges sticks out a little more than the rest and is provided with a groove for the appropriate turn of the winding passing from one section to another. If for instance 160 ampere turns are required with settings for 4, 5, 6, 7, 8, 9 and 10 amps, the

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winding can be divided into a bottom layer with 16 turns and an upper layer with 24 turns, the last layer being divided into 6 sections of 2, 2, 3, 4, 5 and 8 turns respectively. The number of ampere turns is then constant within 1.25% for the different current settings.

In the accompanying drawing, FIG. 1 shows a longitudinal section through an iron core with one winding for a time-lag over-current relay. FIG. 2 is a cross section through the winding and FIG. 3 shows how the contact plate is arranged. FIGS. 4 and 5 show another embodiment of the structure.

The embodiment of the invention shown in FIGS. 1 to 3 of the drawing has a laminated iron core 1 for a time-lag over-current induction type relay. On the core an insulating bobbin 4 is arranged. The winding in the example for 160 ampere turns consists of two parts, an inner part 5 with (in the embodiment shown) 16 turns evenly distributed in one layer upon the bobbin 4 and with a lead-in wire 6. Outside another insulation bobbin 7, which separates the two winding parts, lies the outer part 8 which here is divided up into six sections 81, 82, 83, 84, 85 and 86. Of these, the first two sections each consist of two turns, part 3 three turns, part 4 four turns, part 5 five turns and part 6 eight turns. Each section of the winding has on both its sides a flange 9 of insulating material which extends outwards from the bobbin 7 and covers about half the length of a winding turn. A corresponding number of flanges 10 extend from the same insulation layer on the upper side of the winding. The flanges 9 and 10 have a thickness which is somewhat larger than the diameter of the wire. The flanges 10 are grooved on their upper side in order to accommodate a winding wire.

The winding is made so that beginning from the left in FIG. 1, the inner part 5 is wound in 16 evenly distributed turns. When the sixteenth turn is completed, the wire is led up on the flange 10 situated furthest to the right in FIG. 1 as is shown by 11 in FIG. 2. The wire will remain on the flange on account of the earlier mentioned groove. The wire then goes downward and first forms the inner turn and then the outer turn of the winding section 81 in FIG. 1. After this the wire goes up onto the second flanges 10 and from the right and then forms the two turns of the section 82. In the same way the remaining sections are formed, the difference being that the section 83 has three turns, the section 84 has four turns, the section 85 has five turns and the section 86 has eight turns. At the end of the last turn in the section 86, the wire is drawn up onto the left flange 10 and is then fixed by some turns being wound round the insulated lead-in wire 6. The completed winding will thus have seven parts which at the transition from one part to another are higher than the rest of the winding.

On the two vertical parts of the core 1, two supports 12 are fastened. Each support is provided at the upper end with a flange 13 bent at right angles to which a block 14 of an insulating material is fastened. At the left end shown in FIG. 3 the block 14 is provided with an upright flange 15. Against these flanges 15 lies a contact plate 16 of conducting material, suitably brass. The contact plate is flexibly held by means of a screw 17 screwed into each block 14, which screw has a spring 18 between its screw head and the contact plate, so that the spring forces the contact plate downwards. In the contact plate there are a number of threaded holes 19, as many as the number of ridges 10 and placed directly above these. A movable contact 20 has a grooved head and a threaded part which can be screwed in a hole 19 so that it comes into metallic contact with the part of a winding turn lying on a flange 10, whereby the contact plate also becomes connected with this winding turn. Straight above the flange situated furthest to the right in FIG. 1, two holes are drilled in the

contact plate. Of these, one lies in line with the other holes 19, while the other hole lies somewhat to the side, as is evident from FIG. 3.

In this extra hole, a screw 21 is threaded in so far that it is in contact with the turn lying on the extreme right-hand flange 10 when the contact 20 is removed or only partly screwed into the contact plate. When the contact 20 is completely screwed home, the screw 21 is not in contact with the winding. The screw 21 thus prevents the current path through the winding 5 from being broken when the screw is moved, which is necessary whenever the invention is applied to a current transformer or to a relay which is connected by way of a current transformer.

If that part of the winding whose number of turns is to be variable consists of a single layer, it is of course immediately possible to select a suitable winding turn with which the movable contact 20 is to make contact, but if the winding has several layers, the winding must be arranged in the above given way. The embodiment shown and described refers to an electro magnet for an induction disc over-current relay. It is intended for 160 ampere-turns at all current settings which in the present case are 4, 5, 6, 7, 8, 9 and 10 amperes. The corresponding numbers of effective winding turns are 40, 32, 27, 23, 20, 18 and 16. By dividing up the turns in the outer part of the winding as shown, the largest deviation from the correct number of ampere turns of the coil will be only 1.25%.

FIGS. 4 and 5 show another embodiment of the invention where the contact mechanism is differently arranged. The arrangement of the winding is identical to that described above. A piece 22 of insulating material is fastened to the core by means of bolts 23 and 24. The piece 22 is provided with a number of grooves 25 into which a movable contact plug 26 can be pushed. The number of grooves is equal to the number of flanges 10 and to the number of current settings. The contact plate 16 has two turned-down lips 28 and 29 which fit into recesses in the piece 22 and function as hinges for the contact plate. A slot spring 31 presses the contact plate and thus the contact plug downwards against the winding in order to ensure good contact. The contact plate 16 has a further turned-down lip 30 which makes contact with the winding turn lying on the flange 10 situated furthest to the right

when the plug is partly or totally removed. When the plug is removed the circuit is therefore not broken, but instead the winding is automatically set to the highest current setting. This embodiment has the advantage over that shown in FIGS. 1-3, that the contact plug can be made with far heavier dimensions than the contact screw 20. Thereby its thermal capacity and conductivity are increased which materially decreases the possibility of harmful high temperatures being reached when contact is made between the plug and the winding during overload conditions.

I claim:

1. An adjustable electrical coil having a plurality of turns, one end of said coil being provided with a first terminal, some of said turns having contact parts at a greater distance from the center of the coil than the corresponding parts of the other turns, a plate, means mounting said plate adjacent to the coil for movement towards and from the coil, said plate having a second terminal for the coil, said plate having a first contact engageable with a first contact part situated nearest said first terminal of the coil, said plate having contact receiving means adjacent each contact part, at least one movable contact carried by said contact receiving means and engageable with any one of said contact parts, and spring means engaging said plate and urging it towards the coil, the height of said movable contact being greater than that of said first contact.

2. An adjustable coil according to claim 1, said contact receiving means comprising a plurality of threaded holes in said plate and said movable contact having a threaded portion engaged in one of said holes.

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