INTEGRATED SOLENOID COIL AND RECTIFIER ASSEMBLY

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This invention contemplates the formation of an integrally constructed solenoid coil and rectifier unit and wherein the entire unit is encapsulated with only the input terminals to the unit being exposed and required to be connected to an AC power supply line for operating the solenoid coil with direct current.

In FIGURE 1 there is illustrated a bobbin 10 which is formed of an elastomeric material such as nylon. The bobbin 10 is molded in the usual manner for use with solenoids and includes a bobbin comprising a hollow tubular portion 11 and a pair of end flanges 12 and 13 at respective ends of the tubular portion 11.

The end flange 13 includes protrusions 14 and 15 each having respective entrances 16 and 17 to accommodate a pair of terminals 18 and 19 which are formed of a conductive metal and serve as AC power supply line input terminals. Each of the terminals 18 and 19 has a small lip or gripping finger at one end thereof so that it is held within the bobbin 10 by pushing the respective terminal into its protrusion with the lip or fingers engaging the bobbin within the protrusion to securely mount thereto.

A coil 20 of thin wire is wound in overlapping layers on the tubular portion 11, with one lead end 21 of the coil 20 being wrapped around the terminal 18 preparatory to making the usual solder electrical connection thereto.

In between the protrusions 14 and 15, and immediately adjacent the end flange 13, there has been provided a frame 22 forming a pocket which accommodates a stack of selenium rectifier plates 23. Obviously, with such an arrangement the entire rectifier unit can be encapsulated with an insulating plastic covering right along with the coil and bobbin. The frame 22 is formed of a relatively thin, preferably resilient material integral with the bobbin. The frame 22 includes two Y-shaped portions 24 and 25 at each end thereof having their tails formed integrally with the protrusions 14, 15 and interconnected by a top and bottom flat portion 26. The rectifier stack 23 is constructed of the required number of selenium plates to provide the voltage rating necessary for the coil 20. The frame 22 is formed such that the distance between the top portion 26a and the bottom flat portion 26b, in the unstressed condition of the frame, is just slightly less than the height of the rectifier stack 23.

The Y-shaped portions 24 and 25 provide the necessary supporting structure for the plates between the protrusions 14 and 15, and also provide a slight amount of resiliency between top flat portion 26a and bottom portion 26b. Thus when the stack of rectifier plates 23 is inserted into the frame 22, the flat portions 26a and 26b are urged slightly apart to accommodate the plates, and upon full insertion of the stack 23 within the frame 22 the Y-shaped portions 24 and 25 operate on the portions 26a and 26b to resiliently but firmly maintain the stack therebetween. A pair of rectifier terminals 27 and 28 are provided and project slightly beyond a front edge 29 of the frame 22 so that electrical connections can be made between the plates 23, the coil 20 and the terminals 18 and 19.

A second coil lead 30 which is the other end of the coil 20 with respect to the lead 21, is mechanically and finally electrically connected to the rectifier lead 27. It may also be noted from FIGURE 1 that the AC terminal 19 is electrically connected to the rectifier terminal 28 by means of a wire 31. Thus, electrically the rectifier plates 23 and the
3. A coil 20 are connected in series with an AC power supply line so that the input alternating current supply is rectified by the plates 23 in the usual and well-known manner to provide a rectified direct current to operate the solenoid coil 20.

Referring now to FIGURE 2, there is shown the completed integral coil and rectifier circuit construction according to the principles of the present invention. It may be particularly noted that the unit shown in FIGURE 2 includes the bobbin 10, with the coil 20 wound thereon, the rectifier plates 23 held within the frame 22 and the terminals 18 and 19. The constructed unit as shown in FIGURE 1 is then encapsulated with encapsulating material similar to that forming the bobbin and the frame to provide the completed and encapsulated coil and rectifier 34 as shown in FIGURE 2. Encapsulation protects the entire unit from shock and from possibly corrosive or destructive foreign materials.

The encapsulating material 33 is formed completely around the rectifier stack 23, the frame 22, the coil 20 and the bobbin 10, so that only the AC input terminals 18 and 19 protrude from the assembly. The interconnections between the rectifier plates 23 and the coil 20 have of course been encapsulated so that they lie wholly within the material 33. Thus, there has been provided a compact integral rectifier and coil construction such that direct current operation of the coil is effected in an efficient manner.

As an illustration of the compactness of such a unit as is illustrated in the drawings which embodies the principles of the present invention, the frame 22 accommodates selenium plates which are approximately $\frac{1}{4} $" square. Also, the space between the top flat portion 26a and the bottom flat portion 26b is such that for operation of a 120 volt AC coil 8 to 10 plates, each being approximately 0.030" thick, will fit therebetween.

Other means might be employed to hold the rectifier stack in position within the entire unit is encapsulated, in accordance with the principles of the invention. For instance, the bobbin 10 could be formed with only the tubular portion 11, and the end flanges 12 and 13. The terminals 18 and 19 could then be press-fitted into the end flange 13 in a similar manner as described previously. A separate frame structure including portions substantially similar to the frame 22 and the associated portions of protrusions 14 and 15 might be slipped onto the terminal 18 and 19. The coil could then be wound on the tubular portion 11, the rectifier stack inserted into the frame, the series connection made between the rectifiers and the coil, and finally the entire unit encapsulated to derive a unit similar in appearance to that shown in FIGURE 2.

Also, in the cut away perspective view of FIGURE 1 there has been shown merely for illustrative purposes a half-wave rectifier formed by the rectifier plates 23. Similar arrangements could be provided if it were desired that a full-wave, or other types of rectifier circuits be encapsulated with the coil in an assembly as shown in FIGURES 1 and 2.

Although the drawings and specification present a detailed disclosure of a preferred embodiment of the present invention, it is to be understood that the invention is not limited to the specific form disclosed, but covers all modifications, changes and alternative constructions falling within the scope of the principles taught by the invention.

I claim as my invention:

1. An integrated coil and rectifier circuit comprising:
   a bobbin for supporting said integrated circuit,
   a coil of thin wire wound in overlapping layers on said bobbin,
   a plurality of selenium plates forming a rectifier circuit and serially connected to said coil, and
   a frame on said bobbin in resilient engagement with said plates and maintaining said plates therewith.

2. An integrated coil and rectifier circuit for operating from an AC supply line comprising:
   a bobbin for supporting said integrated circuit,
   a coil of thin wire wound in overlapping layers on said bobbin,
   a frame integral with said bobbin including
   a chamber having at least two sides resiliently formed with respect to each other, and
   a plurality of selenium plates interconnected to form a half-wave rectifier circuit and serially connected to said coil,
   said plates resiliently maintained within said chamber to enable said coil to operate with rectified alternating current supplied from said supply line via said rectifier circuit.

3. An integrated coil and rectifier circuit comprising:
   a bobbin for supporting said coil and rectifier circuit,
   a coil of wire wound in overlapping layers on said bobbin,
   a rectifier circuit on said bobbin serially connected to said coil; and
   means including encapsulating material for enclosing said coil and rectifier circuit coextensively with said bobbin.

4. An integrated AC solenoid coil and rectifier circuit comprising:
   a bobbin including an end flange and a hollow tubular member,
   a coil of thin wire wound in overlapping layers on said tubular member,
   a frame adjacent said end flanges,
   a plurality of selenium rectifier plates held within said frame, said rectifier plates coupled to form a half-wave rectifier circuit serially connected to said coil, and
   means including encapsulating material for enclosing said coil, said rectifier plates held within said frame coextensively with said bobbin.

5. In an alternating current solenoid assembly including a bobbin and a coil wound thereon, the improvement comprising:
   a selenium rectifier circuit for supplying rectified current to said solenoid coil, and
   means integral with said bobbin for compactly mounting said rectifier circuit within said assembly.

6. In an alternating current solenoid coil assembly including a bobbin and a coil wound thereon, the improvement comprising:
   a selenium plate rectifier circuit in series connection with said solenoid coil for supplying rectified current thereto,
   a frame on said bobbin for resiliently supporting said rectifier circuit in close operating position to said coil on said bobbin, and
   means including enclosing said frame and rectifier circuit integrally with said bobbin and coil.

7. A solenoid coil assembly comprising:
   a bobbin formed of electrically nonconductive material and having a tubular winding portion and end flanges formed on opposite ends of said winding portion,
   a pocket formed in one of said end flanges, an alternating current rectifier assembly carried within said pocket,
   a coil wound on said winding portion, and
   means connecting said rectifier assembly in series with said coil.

8. A solenoid coil assembly constructed in accordance with claim 7 wherein said assembly is completely encapsulated in an impervious electrically insulating material and wherein terminals are connected in series with said coil and rectifier assembly and protrude from the encapsulated coil assembly.

9. A solenoid coil assembly comprising:
   a bobbin formed of electrically nonconductive material and having a tubular winding portion, one of said end flanges having spaced apart walls cooperating to define a pocket,
a coil wound on said winding portion, means connecting said rectifier assembly in series with said coil, and wherein said spaced apart walls are formed of resilient material and are spaced apart a distance in their unstressed condition somewhat less than one dimension of said rectifier assembly, whereby the resiliency of said spaced apart walls will grip and positively maintain said rectifier assembly in a fixed position within said pocket.

10. A solenoid coil assembly constructed in accordance with claim 9 wherein said assembly is completely encapsulated in an impervious electrically insulating material and wherein terminals are connected in series with said coil and rectifier assembly and protrude from the encapsulated coil assembly.

No references cited.

MILTON O. HIRSHFIELD, Primary Examiner.

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