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J. P. PUTNAM

2,013,764

METHOD OF MAKING COILS

Original Filed Aug. 9, 1933

Fig. 1

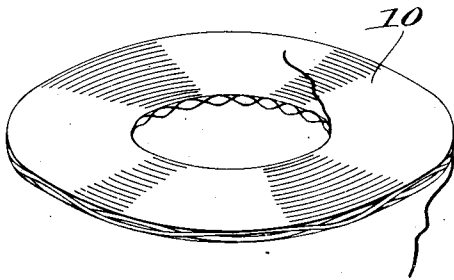


Fig. 2

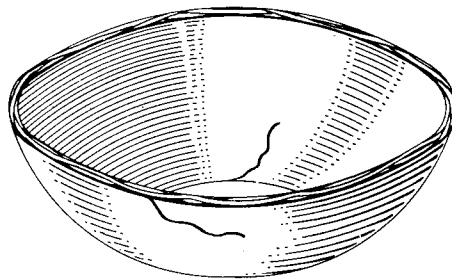


Fig. 3



Fig. 4

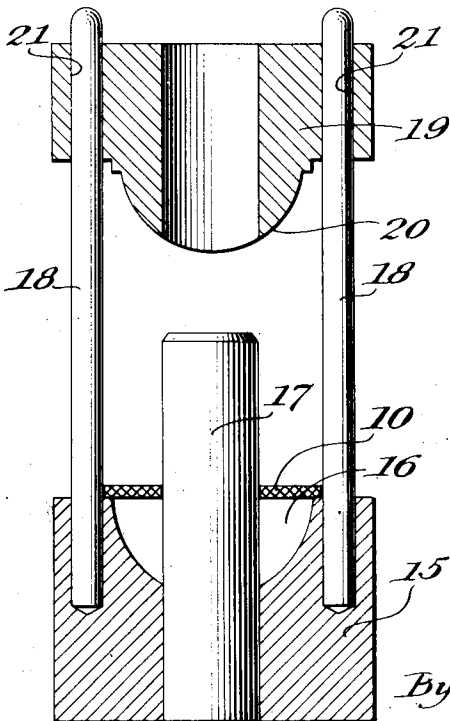
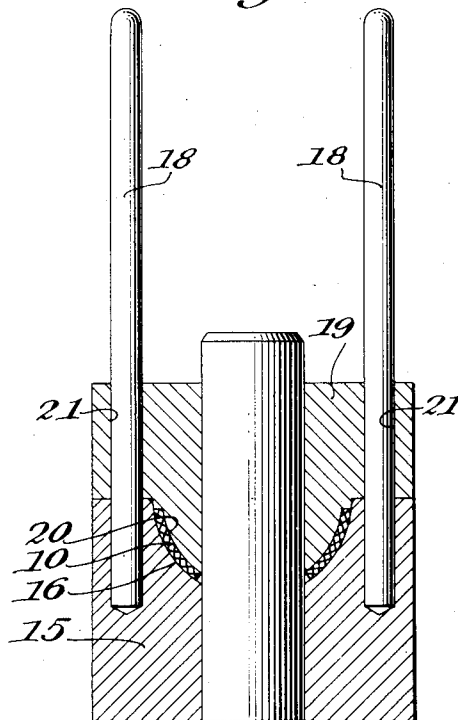


Fig. 5



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UNITED STATES PATENT OFFICE

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METHOD OF MAKING COILS

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Original application August 9, 1933, Serial No.
684,407. Divided and this application October
31, 1934, Serial No. 750,843

3 Claims. (Cl. 140—71)

This invention relates to a method of produc-
ing concaved wire coils, such as are used in a
spherical variometer. The invention particular-
ly involves the method of making a concaved
universal or cross-wound coil, and is a division
of my application Serial No. 684,407, filed August
9, 1933 for a Variometer.

Spherical variometers are old in the radio art,
but in the past have been difficult and expensive
to manufacture and of such large physical bulk
as to be impractical. Heretofore concave coils
have had to be wound very expensively by hand,
in a single layer, or as layer wound coils on a
basket-like frame work, of poor electrical qual-
ities and occupying too large a space in a set to
make them practical. For these various reasons
the honeycomb coils, basketweave coils, bank-
wound, and helical coils of the prior art have been
unsatisfactory. Recently a coil of high induc-
tance has been wound in the form of a flat annu-
lar ring or disk, using the so-called universal or
cross-wound winding. Such coils, however, could
not be satisfactorily wound in a concaved form
for use on a spherical variometer. My invention
relates to the method of making such concaved
cross-wound coils and comprises placing the flat
annular ring or disk in a suitable die and concav-
ing the same by impact.

In the drawing:

Fig. 1 is a perspective view of a coil wound in
flat annular form;

Fig. 2 is a perspective view of the same coil,
as concaved;

Fig. 3 is an enlarged side elevation of a uni-
versal wound coil showing its construction;

Fig. 4 is a side elevational view of the die part
used in concaving the coil, shown in separated
relation;

Fig. 5 is a vertical cross sectional view of the
die part used in concaving the coil, in assembled
relation.

Before explaining in detail the present inven-
tion it is to be understood that the invention is
not limited in its application to the details of con-
struction and arrangement of parts illustrated
in the accompanying drawing, since the inven-
tion is capable of other embodiments and of be-
ing practiced or carried out in various ways. Also
it is to be understood that the phraseology or
terminology employed herein is for the purpose
of description and not of limitation, and it is not
intended to limit the invention claimed herein
beyond the requirements of the prior art.

In the drawing, 10 represents a flat annular
cross-wound coil, before concaving. The "uni-

versal" or cross-wound coil, known also to the
textile and radio trade as a "diagonal" or "V-
wind coil" or package is wound on a cylindrical
rotating core by a machine having a thread arm
which oscillates axially from side to side as the
coil is rotated, thus giving each strand an undu-
lating or waving motion as it is built onto the
core. The coil may be wound to a thickness
of $\frac{1}{8}$ ", having three or four turns per layer;
the turns of each radial layer being wound at an
angle to those of the preceding layer, crossing
and then binding them in place. The wire is laid
in helices which extend from one edge of the coil
to the other and back again with the turns cross-
ing each other at sharp angles at regular inter-
vals, the wind reversing with a sharp bend and
each turn crossing over the next preceding layer
binding it in place at each crossing. Thus from
the nature of the winding each group of three
or four strands, comprising a radial layer of
strands, is twisted or turned over on itself at the
top and bottom parts of each wave. Such a coil
is illustrated in enlarged view in Fig. 3. The ac-
curacy of winding is such that the individual
turns of alternate radial layers can be laid in ex-
actly the same radial plane, resulting in the build-
ing of an extremely rigid and self-sustaining coil.
This method of winding a self-sustaining coil or
package is widely used in the textile trade for
producing cops or packages of yarn and thread.
This method of winding was first described in
United States Patent No. 480,158 to Simon W.
Wardwell, granted August 2, 1892. The dominant
characteristic of the so-called "universal
system" is that each helix extends a sufficient
distance in one direction so that it binds and
holds the next proceeding reverse helix and is
bound and held by the reverse helix next succeed-
ing. The wire coil for radio use is usually fur-
ther held together by being saturated with a
"dope" or adhesive such as paraffin. When
wound in this manner the coil forms a highly
efficient inductance coil of high inductance, much
superior to single and multi-layer coils.

The flat annular coils 10 wound as just de-
scribed, I adapt for use with a variometer by con-
caving them to form rotor and stator coils. The
coils are concaved by placing them preferably in
a suitable die and pressing them into shape. To
avoid breakage of the coils, they should be shaped
by the impact of a sharp blow in the die, rather
than by slow pressure. The die that I have used,
illustrated in Figs. 4 and 5, comprises a female
member 15 having a suitable concavity therein

16, a removable core 17 for holding the coil in position, guide posts 18, and a male member 19 with a convex portion 20. The male portion 19 is provided with holes 21 for sliding on guide posts 18. When compressed in this die, the coils have received a concave shape suitable to form rotor and stator coils. This is the first practical and inexpensive method of making compact hemispherical coils of small size yet high inductance as far as I am aware. The coils when carefully compressed in an accurately made die, are formed to proper shape without mutilation or danger of short-circuiting, which would prevent uniformity of inductance in the case of a number of such coils. By utilizing the flat annular universal or cross-wound coil, and concaving it in a suitable die, I have been able to produce a highly successful variometer of high efficiency, inex-

pensively made and which occupies a very small space.

I claim:

1. The method of producing a wire coil which consists in winding a flat annular coil and then subjecting the coil to force between suitable dies to produce a concavo-convex coil. 5

2. The method of producing a concaved cross-wound wire coil which consists in winding a flat annular cross-wound coil and then subjecting the coil to force between complementary convex and concave die members. 10

3. The method of producing a concaved cross-wound wire coil which consists in winding a flat annular cross-wound coil, placing the coil on a cylindrical core and compressing it between complementary convex and concave die members. 15

JOHN P. PUTNAM.