United States Patent

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[73] Assignee **General Electric Company**

[54] **HOLDING DEVICE FOR A POT CORE**
12 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **248/314,** 248/300, 336/65
[51] **Int. Cl.** **H01f 15/02**
[50] **Field of Search** 248/309, 314, 311, 310, 300; 336/65, 67, 83

[56] **References Cited**

UNITED STATES PATENTS

2,282,040	5/1942	Doran	336/67 X
3,162,829	12/1964	Wildy et al.	336/83
3,197,167	7/1965	Sturgis	248/314

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ABSTRACT: A ferrite pot core is held in a device having two side members attached to and extending in the same parallel directions from a base. Flanges extend inwardly toward each other at the ends of the side members. A resilient support member is slideably positioned between the side members. The support member has seating surfaces near the side members, and is curved to form a surface for engaging the base near its center. When a core is mounted in the device, the core is held between the side members and under resilient pressure between the flanges and the seating surfaces.

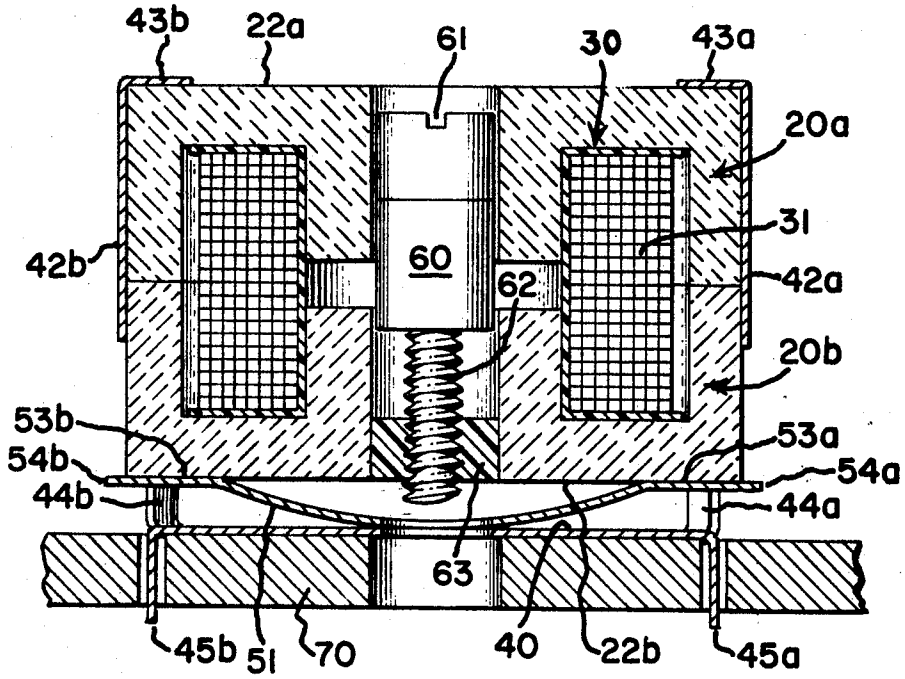

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FIG.1

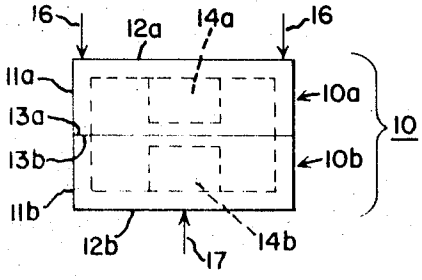


FIG.3

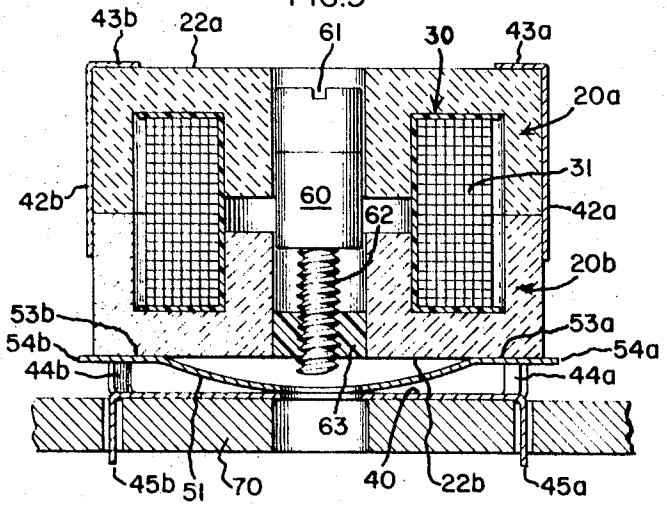


FIG.4

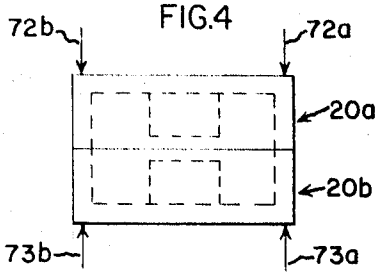
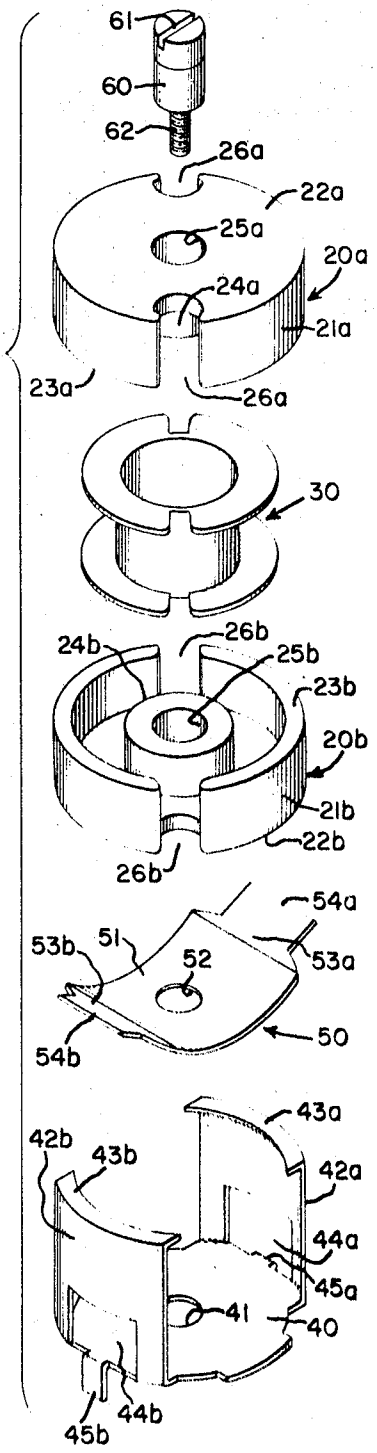


FIG.2



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HOLDING DEVICE FOR A POT CORE

BACKGROUND OF THE INVENTION

Our invention relates to a device for holding a ferrite core, and particularly to such a device for holding a relatively fragile ferrite pot core at its strongest point.

A ferrite pot core is used with an inductive coil to increase the Q of the coil, and thus provide better inductive qualities to an electrical circuit. The term "pot core," as used in this specification, means a core formed of two similar halves; each half having an opening bounded by a cylindrical wall, a bottom at one end of the wall, and a coaxial projection extending from the bottom toward the open end of the wall. A coil, usually prewound, is placed on the projection of one of the halves. The two halves are assembled with their projections coaxially aligned, and with the edges at their open ends in engagement. The ends of the two projections are separated by an air gap which determines the inductive characteristics of the coil. Thus, this air gap is critical, and should remain as constant as possible, despite environmental changes, shock, or vibration. Ferrites are preferred for such pot cores because of their superior electrical characteristics and qualities. However, ferrites are relatively weak from a structural or strength standpoint. This weakness has limited the uses of ferrites to cores which are relatively strong but which may not be electrically desirable, or which have required special holding devices that are relatively difficult to make and unsatisfactory to use.

Accordingly, an object of our invention is to provide a new and improved device for holding a ferrite pot core.

Another object of our invention is to provide an improved device that can securely hold a relatively fragile ferrite core without damaging the core.

Another object of our invention is to provide a new and improved device for holding a ferrite pot core having two assembled halves.

Another object of our invention is to provide an improved device that permits easy placement of a pot core in the device, and that securely holds the core.

Holding devices for ferrite pot cores have, of course, been invented and used. One such device is described in U.S. Pat. No. 3,197,167 entitled "Mounting Clip for Pot Core," and granted to Andrew C. Sturgis on July 27, 1965. The clip described in that patent is particularly intended to hold a pot core formed of two halves as previously described hereinbefore. Because the inductive characteristics of the coil depend upon the air gap between the core projections, the edges at the open end of the cylindrical walls should be firmly held together. The clip described in the patent provides pressure in the vicinity of the center of one bottom and pressure around the periphery of the other bottom. We have found that the pressure exerted at the center of one bottom and the pressure exerted around the periphery of the other bottom cause an unbalanced force which may break the engaged, facing edges of the two core halves, or which may break the core bottom receiving pressure at its center. This breakage can occur during assembly, or as a result of environmental changes, or as a result of shock or vibration. And because smaller cores and coils are being used to save space or to be operative at higher frequencies, the physical strength of such cores is correspondingly reduced.

Accordingly, another object of our invention is to provide an improved device that holds two cylindrical, can-shaped core halves by opposed longitudinal pressure around the periphery of the two core bottoms.

Another object of our invention is to provide a device for holding an assembled pot core under relatively large pressure but in a way that is unlikely to damage the core.

A very specific object of our invention is to provide an improvement in the mounting clip described in U.S. Pat. No. 3,197,167.

Another object of our invention is to provide a holding device that has the advantage mentioned, and that is relatively easy to manufacture and use.

SUMMARY OF THE INVENTION

Briefly, these and other objects are achieved in accordance with our invention by a holding device having a mounting base with two side members extending in the same parallel direction from the base. A respective flange is attached to each side member at a corresponding location, and extends at a right angle from the side member toward the other flange. A resilient support member is movably positioned between the two side members. The support member has two spaced seating surfaces that lie in a common plane and that are respectively located near the side members. A pot core comprising two cylindrical, can-shaped core halves is positioned with the cylindrical walls between the side members. The bottom of one core half engages the two flanges, and the bottom of the other core half engages the seating surfaces. The resiliency of the support member provides pressure at the seating surfaces so that the core is held by opposed longitudinal pressure at the periphery of the two bottoms. Thus, our holding device securely holds a pot core by pressure exerted at the strongest points of the core.

BRIEF DESCRIPTION OF THE DRAWING

The subject matter which we regard as our invention is particularly pointed out and distinctly claimed in the claims. The structure and operation of our invention, together with further objects and advantages, may be better understood from the following description given in connection with the accompanying drawing, in which:

FIG. 1 shows a pot core with arrows indicating the pressure applied by a prior-art holding device;

FIG. 2 shows an exploded perspective view of a pot core and a holding device in accordance with out invention;

FIG. 3 shows a cross-sectional view of a pot core held in our holding device; and

FIG. 4 shows a pot core with arrows indicating the pressure applied by a holding device in accordance with our invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Before describing the new and improved holding device in accordance with our invention, we will describe the prior-art holding device which led to our invention.

FIG. 1 shows a pot core **10** which comprises two substantially similar halves **10***a*, **10***b* made of a suitable ferrite. Each of the halves **10***a*, **10***b* is can shaped and has a respective cylindrical wall **11***a*, **11***b*. One end of each of the walls **11***a*, **11***b* is closed by a respective circular bottom **12***a*, **12***b*, and the other end of each of the walls **11***a*, **11***b* is left open and bounded by an edge or rim **13***a*, **13***b*. Coaxial or concentric projections **14***a*, **14***b* extend from the respective bottoms **12***a*, **12***b* toward the open ends, but do not extend to the plane formed by the respective edges **13***a*, **13***b*. The two halves **10***a*, **10***b* are assembled with a suitable coil positioned around the projections **14***a*, **14***b* and with the a**13***a* , **13***b* in engagement. Thus, the coil between the projections **14***a*, **14***b* and the cylindrical walls **11***a*, **11***b* is provided with a suitable ferrite magnetic circuit having an air gap whose spacing depends upon the separation of the projections **14***a*, **14***b*. This air gap is critical in determining the inductance of the coil, and should be maintained as constant as possible so that the coil inductance also remains constant. For this reason, the halves **10***a*, **10***b* should be tightly held together so that this air gap does not change.

U.S. Pat. No. 3,197,167 describes a mounting clip for holding a pot core, such as the core **10** described in connection with FIG. **1**. The mounting clip described in that patent provides pressure at the peripheral edges of the bottom **12***a* of the core half **10***a*, as indicated by the arrows **16**; and provides pressure at the center of the bottom **12***b* of the core half **10***b*, as indicated by the arrow **17**. While these pressures hold the halves **10***a*, **10***b* together, their magnitude is mainly limited by the strength of the ferrite material forming the bottom **12***b*. The strength of the bottom **12***b* is lowest at the center, which is the point at which pressure is applied. And even if this pres-

sure is below the breaking strength of the bottom 12*b*,it tends to separate or break the edges 13*a*, 13*b*. Hence, a pressure which is desired to hold the halves 10*a*, 10*b* together against environmental changes, shock, or vibration may be too great for the strength of the ferrite, or may require an unacceptably thick piece of ferrite. These conditions have limited or restricted the usefulness and applications of ferrite pot cores.

In order to overcome the disadvantages of prior-art holding devices, such as the mounting clip shown in the above-mentioned patent, we have invented a holding device which applies pressure to the halves of a pot core at the points of maximum strength. An exploded perspective view of a pot core and our holding device is shown in FIG. 2, and a cross-sectional view of an assembled pot core and our holding device is shown in FIG. 3. With reference to FIGS. 2 and 3, we show a typical pot core having two substantially similar ferrite core halves 20*a*, 20*b* that are formed with respective cylindrical walls 21*a*, 21*b*. One end of each of the walls 21*a*, 21*b* is closed by a circular bottom 22*a*, 22*b* and the other end of each of the walls 21*a*, 21*b* is left open and bounded by a respective rim or edge 23*a*, 23*b*. Coaxial or concentric projections 24*a*, 24*b* extend from the respective bottoms 22*a*, 22*b* toward the open end, but do not extend as far as the rims 23*a*, 23*b* toward the open end, but do not extend as far as the rims 23*a*, 23*b* so as to provide the desired air gap after the halves 20*a*, 20*b* are assembled. Each of the projections 24*a*, 24*b* is provided with a concentric hole or opening 25*a*, 25*b* to admit a tuning element or slug that will be described. The walls 21*a*, 21*b* may also be provided with one or more longitudinal holes or openings 26*a*, 26*b* to permit leads to be brought out from a coil positioned in the halves 20*a*, 20*b*.

The coil or inductance placed in the core halves 20*a*, 20*b* is preferably prewound, either as a self-supporting coil or on a suitable spool or bobbin 30. The spool or bobbin 30 may be made of plastic and is shaped and dimensioned so that it can fit in the space between the projections 24*a*, 24*b* and the cylindrical walls 21*a*, 21*b*. In FIG. 2, a coil is not shown on the spool or bobbin 30, but in FIG. 3 this coil is indicated by the reference numeral 31.

If desired, a tuning member, comprising a cylindrical piece of ferrite that forms a tuning slug 60, may be provided. The tuning slug 60 may have a slot or rotating means 61 for turning the tuning slug 60, and may have a threaded end 62 that fits in a suitable threaded receptacle 63 (shown in FIG. 3) positioned in the core half 20*b*.

In order that a pot core such as described can be securely held with little chance of damage or breakage, we have provided a new and improved holding device. Our holding device is preferably formed from a resilient, thin sheet of spring steel, and comprises a base 40 that has a generally, but not necessarily, circular shape. A central hole 41 may be placed in the base 40 to provide clearance or access. Two side members 42*a*, 42*b* extend upward from the base 40 in substantially the same parallel directions. The side members 42*a*, 42*b* extend equal distances from the base 40 and are provided with respective flanges 43*a*, 43*b*. These flanges 43*a*, 43*b* extend toward each other in a common plane and at substantially right angles to the side members 42*a*, 42*b*. The side members 42*a*, 42*b* are preferably positioned at diametrically opposite points on the base 40, and are preferably cylindrical and concave on their inner faces to conform with the cylindrical walls 21 *a*, 21*b* of the core halves 20*a*, 20*b* with very close spacing. The side members 42*a*, and 42*b* are provided with corresponding openings 44*a*, 44*b* which are generally rectangular in shape, and which extend upward from the base 40 toward but short of flanges 43*a*, 43*b*. Suitable holding tabs 45*a*, 45*b* may be formed from the material that is removed for the openings 44*a*, 44*b* if desired. These holding tabs 45*a*, 45*b* extend downward from the base 40 in the opposite direction from the side members 42*a*, 42*b*. The base 40 with its side members 42*a*, 42*b*, its flanges 43*a*, 43*b*. The base 40 with its side members 42*a*, 42*b*, its flanges 43*a*, 43*b*, and its holding tabs 45*b* is preferably formed from a single integral piece of resilient spring steel by suitable punching and bending operations.

Our holding device also comprises a support member 50 for use with the base 40. This support member 50 is preferably formed from a resilient, thin sheet of spring steel. The member 50 is formed with a concave or dished portion 51 that is generally and partially cylindrical. This concave portion 51 provides resiliency or springiness to support and compress a pot core, as will be explained. A central hole 52 may be provided in the portion 51 for clearance or access. It is to be understood, however, that the portion 51 may take a number of shapes and configurations. When the concave or dished portion 51 is formed, it provides plane seating surfaces 53*a*, 53*b* which lie at diametrically opposite sides of the support member 50. These seating surfaces 53*a*, 53*b* may have any suitable dimensions, although we have found that dimensions approximately the same as the dimensions of the flanges 43*a*, 43*b* provide good support and retention for the pot core. The part of the support member 50 bordering the portion 51 and between the seating surfaces 53*a*, 53*b* may have the straight edges as shown. The support member 50 is also provided with holding or retaining tabs or extensions 54*a*, 54*b*. These holding or retaining tabs 54*a*, 54*b* are shaped to fit within the openings 44*a*, 44*b* respectively in the side members 42*a*, 42*b*.

Before our holding device receives a pot core, the support member 50 is inserted between the side members 42*a*, 42*b* with the seating surfaces 53*a*, 53*b* positioned between the side members 42*a*, 42*b*, and with the holding or retaining tabs 54*a*, 54*b* extending through their respective openings 44*a*, 44*b*. This is done by tilting or canting the support member 50 until its retaining tabs 54*a*, 54*b* can be passed through the openings 44*a*, 44*b*. With the support member 50 properly inserted, it presents a convex surface toward the base 40, and can be slid or moved up and down with respect to the side members 42*a*, 42*b*, but is retained therebetween. After a pot core with its coil is assembled, the side members 42*a*, 42*b* are spread, and the core inserted with its cylindrical sides adjacent or in contact with the inner faces of the side members 42*a*, 42*b*, but is retained therebetween. After a pot core with its coil is assembled, the side members 42*a*, 42*b* are spread, and the core inserted with its cylindrical sides adjacent or in contact with the inner faces of the side members 42*a*, 42*b*. The core is pushed down until the bottom 22*b* engages the seating surfaces 53*a*, 53*b* of the support member 50. Further pushing causes the support member 50 to move down until the convex lower part of the dished portion 51 engages the base 40 along a straight line and bends or flexes enough so that the bottom 22*a* clears the flanges 43*a*, 43*b*. The flanges 43*a*, 43*b* can then snap or move back over the upper core half 20*a*. With proper dimensions for the various parts of our holding device relative to a pot core, the pot core can be held securely between the side members 42*a*, 42*b*, and also between the flanges 43*a*, 43*b* at the top and the seating surfaces 53*a*, 53*b* at the bottom. We prefer that when a pot core is positioned in our holding device, the seating surfaces 53*a*, 53*b* lie in a common plane (as shown in FIG. 3) to provide good support for the core. The resiliency of the support member 50 presses against the pot core with sufficient pressure to securely hold the pot core in assembled relation. The assembled pot core and our holding device may be mounted on a suitable panel chassis 70 by inserting the holding tabs 45*a*, 45*b* through suitable openings, and held by soldering the tabs 45*a*, 45*b* to the chassis or panel 70. The tuning member can be attached by threading the end 62 in its receiving member 63 and adjusted so that the tuning slug 60 provides the desired inductive effect for the pot core.

FIG. 4 shows the pot core of FIGS. 2 and 3 with arrows to indicate the pressures or forces provided by our holding device on the pot core. The arrows 72*a*, 72*b* represent the pressure or force provided by the flanges 43*a*, 43*b*, and the arrows 73*a*, 73*b* represent the force or pressure provided by the seating surfaces 53*a*, 53*b*. The magnitude of these forces depends, of course, upon the resiliency of the support member 50 and the relative dimensions of the pot core and our holding device. This resiliency and these dimensions can be varied to provide any suitable force or pressure. We have found that a relatively large force (with improved core stability) may be

provided, since, as shown in FIG. 4, the arrows 72*a*, 73*a*, and the arrows 72*b*, 73*b* are in direct opposition along a longitudinal line extending through the cylindrical walls of the core halves 20*a*, 20*b*. In other words, the forces to hold a pot core in accordance with our invention are directed along the lines of the greatest (i.e., compressive) strength of the core halves 20*a*, 20 *b*, so that relatively large pressures can be provided to securely hold the core halves 20*a*, 20*b* together despite changes in environment, or shock, or vibration. Furthermore, these forces tend to press the edges 23*a*, 23*b* together so that there is very little likelihood of the core halves 20*a*, 20*b* becoming separated, especially since the side members 42*a*, 42*b* provide some lateral holding or restraint.

It will thus be seen that our holding device provides a new and improved arrangement for holding ferrite cores, particularly ferrite pot cores. Our holding device is relatively easy to manufacture and assemble, and pot cores may be inserted or mounted in our holding device relatively easily by an operator. While we have shown only one embodiment of our holding device, persons skilled in the art will appreciate that modifications may be made. For example, the circular or arcuate length of the flanges 43*a*, 43*b* and the seating surfaces 53*a*, 53*b* may be varied. The exact configuration of the concave or dished portion 51 of the support member 50 may also be varied. Thus, in addition to the generally and partially cylindrical configuration of the portion 51 that we show, we have also successfully built and tested a support member having a concave or dished portion that is generally and partially spherical, and that has a central opening and radial slits to provide resilient support. While we prefer that the base 40, the side members 42*a*, 42*b*, and the flanges 43*a*, 43*b* be formed as an integral piece, they may be formed from separate pieces and joined. And various materials, such as metals or plastics, may be used if they provide the desired resiliency. Therefore, while our invention has been described with reference to a particular embodiment, it is to be understood that modifications may be made without departing from the spirit of our invention or from the scope of the claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A holding device for a ferrite core and the like comprising:
   a. a base;
   b. at least two side members attached to said base and extending therefrom in the same generally parallel direction;
   c. said side members being shaped and spaced to receive and hold a ferrite core therebetween;
   d. a respective flange attached to each of said side members at substantially the same distance from said base and extending inwardly therefrom at substantially a right angle with respect to said side members;
   e. said flanges being shaped and spaced to receive and hold a ferrite core;
   f. and a resilient support member formed of a single piece of material and having extensions for movably retaining said support member between said side members;
   g. said support member having spaced seating surfaces positioned between and in the vicinity of said side members and a curved portion joining said seating surfaces for engaging said base along a straight line, whereby a ferrite core can be positioned on said support member and held between said side members and resiliently held between said seating surfaces and said flanges.

2. The holding device of claim 1 wherein said resilient support member is retained between said side members for movement therealong.

3. The holding device of claim 1 wherein said resilient support member is relatively thin and wherein said curved portion presents a convex surface for engaging said base.

4. The holding device of claim 3 wherein said base, said side members, and said flanges are formed from an integral piece of relatively thin material.

5. The holding device of claim 1 wherein said resilient support member is retained between said side members for movement therealong, and wherein said resilient support member is relatively thin and presents a convex surface for engaging said base.

6. The holding device of claim 5 wherein said base, said side members, and said flanges are formed from an integral piece of relatively thin material.

7. The holding device of claim 6, and further comprising means for attaching said base to a structure.

8. An improved device for holding a cylindrical pot core having cylindrical sides and circular bottoms comprising:
   a. a substantially flat base having first and second side members extending upward at substantially right angles with respect to said base;
   b. said first and second side members being spaced and having curved facing surfaces so as to substantially conform to at least a portion of the cylindrical sides of a cylindrical pot core;
   c. first and second flanges extending toward each other from said first and second side members respectively at substantially right angles;
   d. said first and second flanges lying in substantially a common plane that is substantially parallel to said base so as to engage the outer edges of a bottom of a cylindrical pot core;
   e. said first and second side members having openings therethrough that are correspondingly positioned;
   f. and a resilient support member having a central bearing portion with a convex shape adapted to rest on the upper portion of said base, first and second seating surfaces respectively positioned in the vicinity of said first and second side members so as to engage the outer edges of a bottom of a cylindrical core, and first and second retaining members respectively extending beyond said first and second seating portions for passing through said openings in said side members and slideably retaining said support member between said first and second side members.

9. The improved holding device of claim 8 wherein said support member is formed of an integral piece of relatively thin resilient material that is dished to form a resilient central bearing portion.

10. The improved holding device of claim 9 wherein said base, said side members, and said flanges are formed from an integral piece of relatively thin material.

11. The improved holding device of claim 9 wherein said central bearing portion has the shape of a partial cylinder.

12. An improved device for holding a cylindrical pot core having cylindrical sides and circular bottoms comprising:
   a. a substantially flat base having a plurality of side members extending upward at substantially right angles with respect to said base;
   b. said side members being spaced and having curved facing surfaces so as to substantially conform to at least a portion of the cylindrical sides of a cylindrical pot core;
   c. a flange respectively mounted on each of said side members and extending therefrom at substantially a right angle;
   d. said flanges extending toward each other and lying in substantially a common plane that is substantially parallel to said base so as to engage the outer edges of a bottom of a cylindrical pot core;
   e. said side members having openings therethrough that are correspondingly positioned;
   f. and a resilient support member having a central bearing portion with a convex shape adapted to rest on the upper portion of said base, a seating surface respectively positioned in the vicinity of each of said side members so as to engage the outer edges of a bottom of a cylindrical core, and a retaining member respectively extending beyond each of said seating portions for passing through said openings in said side members and slideably retaining said support member between said side members.