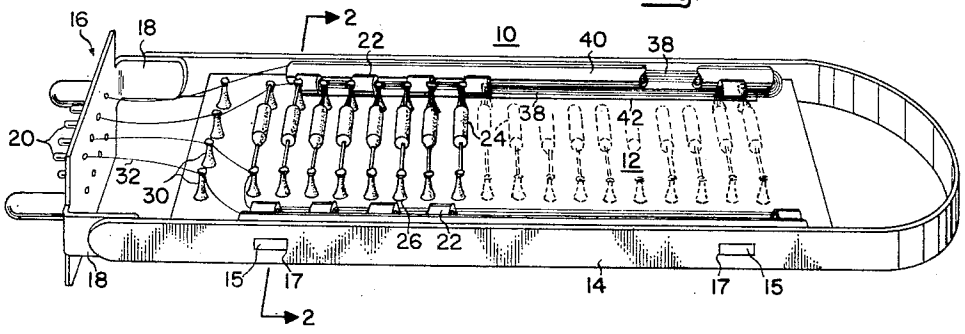
Feb. 11, 1958 J. P. JONES 2,823,372

MAGNETIC CORE MOUNTING ASSEMBLY

Filed Dec. 31, 1954

Fig. 1



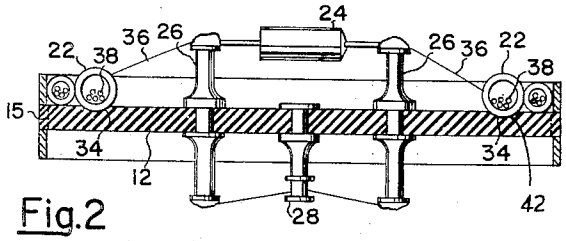


Fig. 2

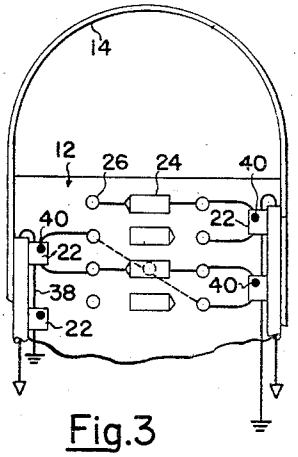
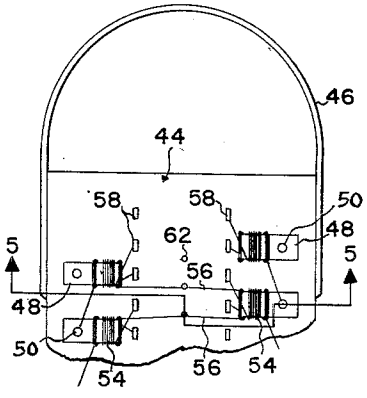


Fig. 3

Fig. 4



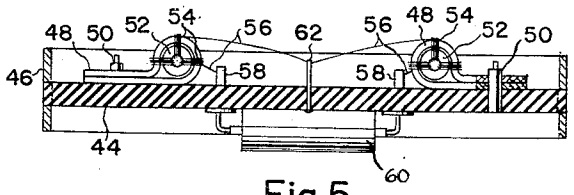
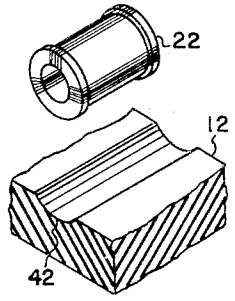


Fig. 5

Fig. 6



INVENTOR
JOHN PAUL JONES

BY

Palgemond B. Vartier

ATTORNEY

United States Patent Office 2,823,372 Patented Feb. 11, 1958

2,823,372

MAGNETIC CORE MOUNTING ASSEMBLY

John Paul Jones, Pottstown, Pa., assignor to Burroughs Corporation, Detroit, Mich., a corporation of Michigan

Application December 31, 1954, Serial No. 479,018

12 Claims. (Cl. 340—174)

This invention relates to mounting assemblies for miniature and sub-miniature electronic circuit components and apparatus, and more particularly to means for handling and mounting cores or bobbins of toroidal formation.

In the utilization of toroidal magnetic cores in electronic equipment, such, for example, as computers, it is desirable, in order to save space, to employ the smallest available parts. Although it is generally known that very small magnetic cores require less power than larger ones, the use of exceptionally small or so-called miniature and subminiature magnetic cores in modern electronic equipment has been delayed by the lack of proper mounting and packaging techniques. Magnetic cores presently in use generally consist of small insulating bobbins or spools usually of a ceramic material about the hub or center of which is wrapped a band or strip of magnetizable material. The wrapped cores are then treated in such a manner as to prevent deterioration due to moisture, rough or unusual handling or mounting stresses and strains developed during assembly. The smallest magnetic core bobbins presently capable of being wound by commercial machines are on the order of 3/8" inside diameter. A 1/8" outside diameter bobbin is not only quite small for winding by means of presently available equipment, but it is also difficult and impractical to hold in the hand for manual winding. This latter difficulty creates a decided time lag in the winding of such small cores.

One of the decided advantages of small magnetic cores is the electrical advantage of a low power requirement. In shift registers of 40 magnetic cores or bits the saving in power by utilizing the smallest diameter cores is considerable over that required when using the conventional core of 3/8" inside diameter.

Each magnetic core is or may be provided with one or more toroidal electrical windings. Each one of these windings in turn may comprise multiple strands of very fine insulated wire. The number of windings on any individual core is determined, in a large measure, by the electrical application in which it is to be used and in some measure by the particular mounting structure employed. For example, where it is desired to employ multiple turn magnetic cores wherein each one of the windings is individually separated or spaced from the other windings, it is necessary to provide a mounting apparatus adapted to receive the magnetic cores so that the windings may be protected from damage during the winding operation and yet be easily and efficiently applied.

In prior magnetic core applications, the larger size core bobbins including their multiple windings have been stacked on a central shaft and insulated one from the other by means of suitable insulating material. The number of cores that can be stacked in this manner was limited by the space requirements in the equipment with which the electrical circuitry was to be utilized. The large size cores have greater power requirements and thus require many more turns per winding. Obviously, such

an assembly was generally bulky, difficult to assemble and service and had a relatively limited storage capacity.

In those applications where single cores have been utilized with plug-in mounts, the core and mounting arrangements varied with the application and as a result standardization of the mounting assembly was practically unobtainable.

It is an object of the present invention, therefore, to provide an improved mounting means for small magnetic cores which overcomes these difficulties and solves these problems in a highly efficient manner.

It is another object of the invention to provide an improved mounting apparatus for magnetic cores utilizing the symmetrical alignment of the cores to simplify the application of electrical windings to the individual cores.

It is also an important object of the invention to provide an improved pluggable magnetic core assembly of standardized design having an enlarged storage capacity and wherein the advance or shift winding is easily applied.

Other objects and advantages of the present invention will become more fully apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an isomeric view of a magnetic core assembly according to the present invention;

Fig. 2 is a sectional view of the device of Fig. 1, the view being taken along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary schematic view of a magnetic core mounting assembly;

Fig. 4 is a plan view of a fragmentary portion of another and different magnetic core mounting assembly according to the present invention;

Fig. 5 is a sectional view of the device of Fig. 4, the view being taken along the line 5—5 of Fig. 4; and

Fig. 6 is a perspective view of a magnetic core body including toroidal windings such as is used in the magnetic core assembly of Fig. 1.

A magnetic core mounting assembly in accordance with the present invention is illustrated generally in Figs. 1 through 5, inclusive. Referring now more particularly to Figs. 1 and 2 of the drawing, there is shown a pluggable magnetic core mounting assembly generally indicated at 10, incorporating the improved mounting structure of the present invention and including as one of the main body members a substantially flat panel 12. The panel 12, which may be fabricated from insulating or conducting material as desired, is surrounded and supported by a U-shaped handling member or frame 14. A socket engaging plug 16 is secured to the open end of the frame 14 by welding, soldering, or braising the plug extensions 18—18 to the parallel side portions or arms of the frame. The pins 20 in the plug 16 permit the assembly 10 to be detachably engaged with a socket or other associated electrical circuitry (not shown), and the whole unitary assembly can thus be quickly and easily inserted or removed therefrom. Lateral projecting tabs 15 on the panel 12 are received within complimentary apertures 17 in each of the side arms of the frame 14. The panel is thus supported in the plane of the frame. This type of fabrication is relatively inexpensive and easily assembled.

One or both surfaces of the panel 12 may be utilized, as herein shown, to support various electrical components, such as the magnetic core elements 22 and the diode elements 24. Each magnetic core element may be of the conventional design hereinbefore mentioned comprising a ring shaped bobbin or spool of ceramic material having several turns of a band of magnetizable material wrapped therearound and further having an axial bore completely therethrough. An example of such a mag-

netic core component having three toroidal windings thereon is illustrated in Fig. 6. The invention is not limited to such core design and it is understood that differently constructed core components may be utilized for different embodiments of the invention. Each diode **24** is of conventional design including a central body portion and oppositely projecting conductive leads or stems as shown. It is also understood that differently constructed diodes may also be incorporated in structures embodying the invention.

The diodes **24** are preferably mounted in spaced relation to one surface of the panel and transversely to the longitudinal dimension of the panel. This may be accomplished in the manner shown by supporting the stems of the diodes on two rows of upstanding terminal lugs **26** arranged in parallel relation on opposite sides of the panel's centerline. As indicated in Fig. 2 a single row of terminal lugs **28** may be provided on the opposite surface of the panel as a means for cross connecting wires. A separate transverse row of terminal lugs **30** may be provided on the panel adjacent to the open end of the frame and used to support leads **32** extending from different components on the panel to the terminal pins **20** of the plug member **16**. In this manner the cores and the diodes may be connected to the external circuitry. Wire leads **34** also extend from the diode supporting terminals **26** to one of the windings on an adjacent magnetic component **22**.

A serious problem confronted in magnetic shift registers is the delay line effect, which becomes more noticeable as the number of magnetic core bits are increased. Another serious problem is the handling and wiring of the magnetic bobbins or cores. These problems are alleviated by the magnetic core mounting arrangement of the present invention. The cores are mounted upon the panel in one or more rows with the axes of the respective bores extending parallel to the surface of the panel and in alignment with one another. The axial alignment is very helpful in the threading of common advance windings through the rows. Moreover, the cores may be secured close to the surface of the panel and substantially protectingly within the plane of the frame **14**.

Figs. 1, 2 and 3 illustrate one desirable form of mounting for the cores **22**. The cores are secured to one face of the panel in two parallel rows extending along the side marginal portions of the panel and near the side arms of the frame. As shown best in Fig. 2, each core is positioned on a surface portion of the panel with the axis of its bore extending parallel thereto. The cores of each row are thus aligned end to end and any common winding therefor, such as the advance winding **38**, may be threaded through either row of cores from one end to the other end. Several turns of the common advance winding **38** are shown extending axially through the bores of each row of core elements. This forms the operating leg of the winding. The return leg of the advance winding extends alongside of the row of core elements and preferably between the row and the adjacent side of the frame **14** as shown. The return path of the advance winding **38** is protectingly sheathed in a tubular cover member **40**, which may be composed of any suitable insulating material such as the conventional "spaghetti" tubing employed in the wiring of radio receivers.

To provide a firm support for the core and to assure proper alignment by the assembler, it is preferred to provide the panel with a straightline groove for each row before the cores are assembled onto the panel. The grooves are milled in the surface of the panel along the lines where the rows of cores are desired. Two such grooves are shown at 42—42 in Figs. 1, 2 and 6. In order to form a firm seat for the cores, the grooves are given a cross sectional contour conforming to the exterior configuration of the core. In this instance where the cores are cylindrical in shape, each groove is given a transverse arcuate formation having its radius of curvature corresponding to that of the cores. A firm securement for the cores, and one which can be easily handled by the assembler, is the use of cement. The latter may be deposited in the grooves just before the cores are placed therein.

From the foregoing, it is clear that a multiple array of magnetic cores can be assembled on an insulating member simply and quickly, due regard having been taken for the circulation of air, the spacing of components, and the orderly arrangement of the various associated electrical and mechanical parts. The interconnecting leads **37** may thus be manually applied without any mechanical interference between adjacent components.

The magnetic cores may be precoded, as, for example, by the dot notations **40** shown schematically in Fig. 3. Thus a plurality of cores and associated windings can be laid out before final assembly and the cores and other components such as the diodes **24** symmetrically arranged on the insulating support **12** with the various dot notations exposed to view. The operator, who may then be required to interconnect the various components of the assembly by soldering or otherwise, simply follows the prearranged dot sequence. This results in efficient, accurate and rapid fabrication of the magnetic core mounting assemblies and tends to avoid complicated set up procedure.

Another embodiment within the purview of the present invention is the mounting means suggested by the views of Figs. 4 and 5. An insulating panel member **44** is mounted within a frame **46**, similar to the panel **12**, and is provided across one of its flat surfaces with a series of insulating flexible fiber clips or loops **48**, the formation of which is best shown in Fig. 5. One or both surfaces of the panel **44** may be utilized to support the clips or loops. The two ends of each loop are brought together and are secured by any suitable fastening means, such as a pin **50**, to the panel. Individual cores **52**, lacking their respective toroidal windings, are captivated within separate loops **48** in spaced parallel rows along the side edges of the panel **44**.

As shown in Figs. 4 and 5, the clips **48** mount the cores **52** of each row with the bores of their axes extending parallel to the plane of the panel and in substantial alignment with one another. Moreover, by this mounting arrangement the cores closely hug the surface of the panel and are protectingly housed within the clips and protectingly guarded by the surrounding frame **46**.

Operating windings **54** for each one of the cores **52** are then applied thereto so as to encircle each core in a circularly spaced pattern as shown. Various leads **56** for applying suitable electrical potentials to the windings **54** are secured to separate ones of two parallel rows of connectors or terminals **58** which are disposed immediately adjacent the cores **52**. The terminals **58** may extend through the panel and be connected to the stems of diode elements **60** arranged in a row along the bottom side of the panel. A group of common terminals **62** disposed along the center line of the panel **44** provides additional connecting means for use with associated component circuitry. The core mounting assembly of Figs. 4 and 5 provides a simple and rapid way for handling and mounting small magnetic cores during application of windings thereto. When the cores are mounted in this manner, they may be pivoted about their respective fastening means **50** and raised to positions where the winding turns may be easily and conveniently applied, then repositioned for terminal connection of the stripped ends of the windings. In this fashion it is possible to insert new cores or to replace a defective core with a minimum of effort. Moreover, no other means of securement than the winding turns themselves are necessary for retaining the cores within their respective clips.

There has thus been provided as a result of this invention an improved magnetic core mounting assembly wherein very small magnetic cores may be quickly and

protectingly mounted on panel like members with minimum occupation of space. By arranging the core elements in rows with their axies in alignment and parallel to the supporting surface, it is possible to rapidly and conveniently thread common windings through the cores of each row. Thus the electrical windings may be more efficiently applied to each core. By staggering the cores of one row with respect to the cores of the other row, as shown in Figs. 3 and 4, the connections from one row to the other row may extend transversely of the panel without crossing one another. Where such connections would cross they may be located on the other side of the panel as indicated in Fig. 3. It is also possible to interconnect the cores by means of other circuit components, such as diodes, et cetera, as a result of the symmetrical arrangement of the cores in rows on the flat surface of a panel.

What is claimed is:

1. A magnetic core assembly including, in combination, a relatively rigid panel of electrically non-conductive material, a metallic frame enclosing at least three sides of the panel and connected to the panel to support the same within the plane of the frame, the frame having a width greater than the thickness of the panel and rising to a height above one surface of the panel, a plurality of similarly formed axially aligned ring-shaped magnetic cores, means mounting the cores on said surface of the panel with the axes of the cores extending parallel thereto and in substantially axial alignment with one another, individual windings on said cores, and a common winding for the cores extending through the cores in general parallel relation to said surface of the panel, the raised relation of the frame to said surface of the panel serving to protect the magnetic cores and windings carried thereon.

2. A magnetic core assembly comprising, in combination, a substantially rectangularly shaped electrically non-conducting panel, a U-shaped frame having substantially parallel side arms, means supporting said panel in the plane of the frame and between the parallel arms thereof, at least one row of axially aligned ring-shaped magnetic cores mounted on a surface portion of the panel having the axes of the cores extending in axial alignment with one another and parallel to the surface portion of the panel and to the side arms of the U-shaped frame, and windings encircling said cores.

3. A magnetic core assembly comprising a rectangularly shaped electrically non-conducting supporting panel having one surface theerof provided with recessed areas, a U-shaped handle for the panel having the side arms thereof extending along the parallel side edges of the panel and connected thereto, the handle being of a width to extend slightly above said surface of the panel when said panel is supported therebetween, axially aligned magnetic cores seated in said recessed areas with their axes extending parallel to said surface of the panel, and windings encircling each core.

4. A magnetic core assembly comprising a relatively rigid supporting panel of electrically non-conducting material having mounting tabs projecting from opposite edges thereof, a handling frame of U-shaped configuration having a pair of side arms terminating in the open end of the frame, the side arms of the frame being provided with complementary apertures receiving the tabs of said panel to support the latter within the plane of the frame, an electrical plug assembly having a plurality of conductive pins associated with one end thereof, means connecting the plug assembly to the open end of the U-shaped frame in bridging relation to the side arms thereof, a plurality of axially aligned magnetic cores mounted on said panel, electrical windings encircling said cores, and leads connecting the windings of said cores to separate pins on said plug assembly.

5. A magnetic core assembly comprising a supporting member of electrically non-conducting material, a handle for said supporting member, said supporting member being provided with recessed areas, a plurality of ring shaped magnetic cores seated in said recessed areas in end to end relation to one another and in substantial axial alignment with one another, windings encircling each of said cores, and a plurality of leads electrically interconnecting the windings on the magnetic cores.

6. A magnetic core assembly comprising a rigid electrically non-conductive supporting panel, a U-shaped frame for the panel, the parallel side arms of said frame extending along the edges of said panel and being of a width exceeding the thickness of said panel, a surface portion of said panel being provided with recessed areas along the side margins thereof, a plurality of annularly shaped magnetic cores mounted in a row in said recessed areas, the axes of the bores of the cores being in alignment with one another and extending parallel with the plane of the panel, electrical windings encircling said cores, and an additional winding common to all of the cores in the row threaded through the bores of the core of each row and provided with an elongated lead disposed parallel and adjacent said rows.

7. A magnetic core assembly including, in combination, a relatively flat, rigid, electrically insulating member having at least one groove formed in a surface portion thereof, and a plurality of annularly shaped magnetic cores disposed in a row in said groove with the axes of the cores extending parallel to the surface portion.

8. A magnetic core assembly including, in combination, a relatively rigid electrically non-conducting panel having a surface portion thereof provided with a groove of arcuate cross section, and a plurality of ring-shaped magnetic cores seated in said groove so that the axes of the cores are in alignment with one another and coincide with the axis of the groove.

9. A magnetic core assembly including, in combination, a relatively rigid electrically non-conducting panel having a surface portion thereof provided with a groove of arcuate cross section, and a plurality of ring-shaped magnetic cores seated in said groove so that the axes of the cores are in alignment with one another and coincide with the axis of the groove, and a common winding for the cores extending through the aligned holes of the cores.

10. A magnetic core assembly comprising an electrically insulating rigid member of substantially rectangular configuration having the longitudinal side marginal surface portions thereof milled to form two parallel elongated grooves, one groove being adjacent to each side edge of the member, a plurality of ring-shaped magnetic core components of substantially circular cross section seated in said grooves, the magnetic core components of each groove having their bores axially aligned with one another.

11. A magnetic core assembly comprising, in combination, an electrically insulating member of relatively rigid material, said insulating member being provided with tab-like projections along at least two parallel edges thereof, a U-shaped handling member, the parallel side portions of the U-shaped member being perforated to receive the tab-like projections of said insulating members so as to support said insulating member in the plane of said U-shaped member, an electrical plug assembly having a plurality of terminal pins and adapted to receive individual wires in each one of the pins, the plug assembly being secured to the handling member at the open end thereof, one surface of said rigid member being provided with a slot adjacent to each of its sides, the slot being cut to a depth of approximately half the thickness of the insulating member, a plurality of magnetic cores mounted in each of the slots in rows end to end with the bores of each of the cores of a separate row in axial alignment with one another, and electrical windings encircling said cores.

12. A magnetic core assembly comprising a substantial-

ly flat, relatively rigid electrically non-conducting panel, a plurality of clip-like elements formed of electrically insulating material disposed in a row along one surface of said member, said clip-like elements providing substantially circular clamping areas having their axes extending parallel to said surface of the panel and in substantial coincidence with one another, a plurality of magnetic cores, each core being substantially circularly shaped, each of said cores being disposed in the clamping area of a different one of said clip-like elements so that the axes of the cores of each row are in substantial coincidence with one another, and electrical windings surrounding each core and each clip-like element within which it is clamped so as to securely fasten each core to its clip-like element.

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