

[54] CONVERGENCE MAGNET AND HOUSING ASSEMBLY	3,259,864	7/1966	Marzolf et al.	336/192
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[75] Inventor: Donald G. Hojnacki, McHenry, Ill.	3,354,337	11/1967	De Both.....	335/212 X
[73] Assignee: Coilcraft, Inc., Cary, Ill.	3,466,381	9/1969	Boehmke.....	336/192
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[21] Appl. No.: 346,138

Primary Examiner—G. Harris

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 103,710, Jan. 4, 1971.

[52] U.S. Cl. 335/210, 335/213, 336/192

[51] Int. Cl. H01f 7/00

[58] Field of Search 335/210, 212, 213; 313/75, 313/76, 77; 336/192

[57] **ABSTRACT**

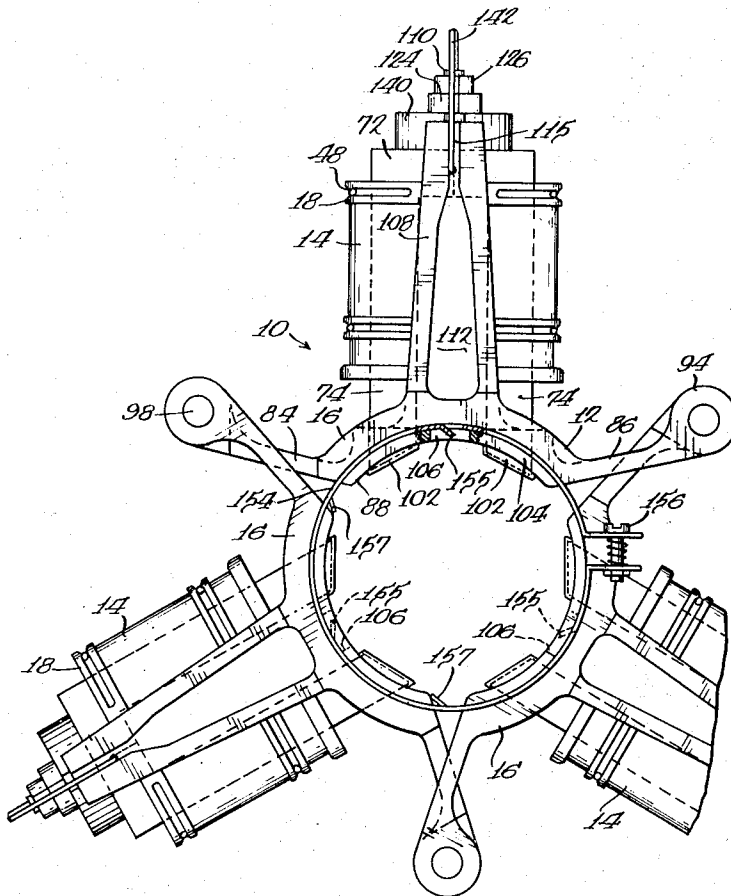
A low cost convergence magnet and housing assembly having the advantages of small size, simplicity, superior cooling, superior adjustment to varying kinescope neck sizes, stability against jarring or shock, cheapness, and security of terminal wires and their connections to winding leads.

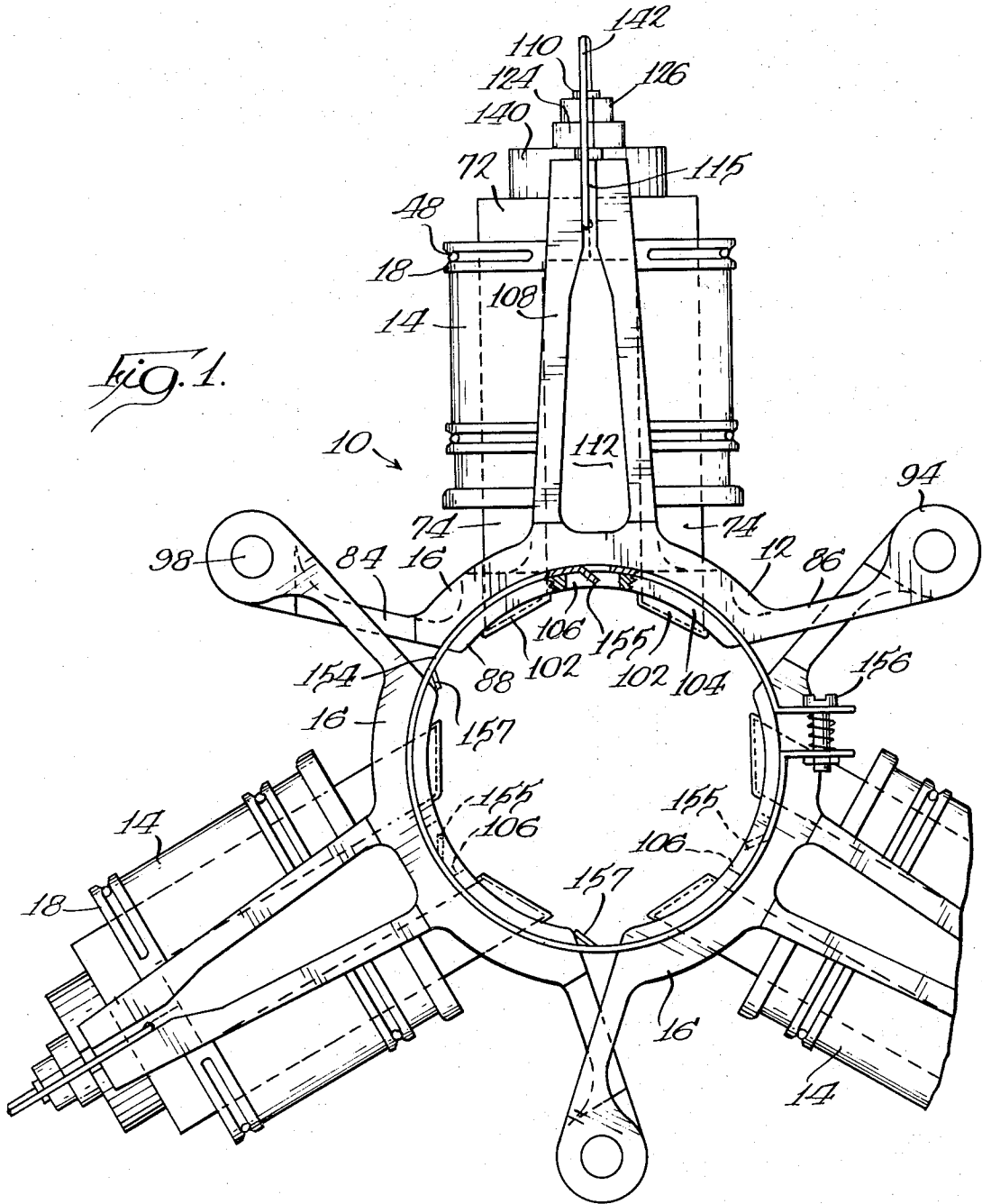
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21 Claims, 7 Drawing Figures





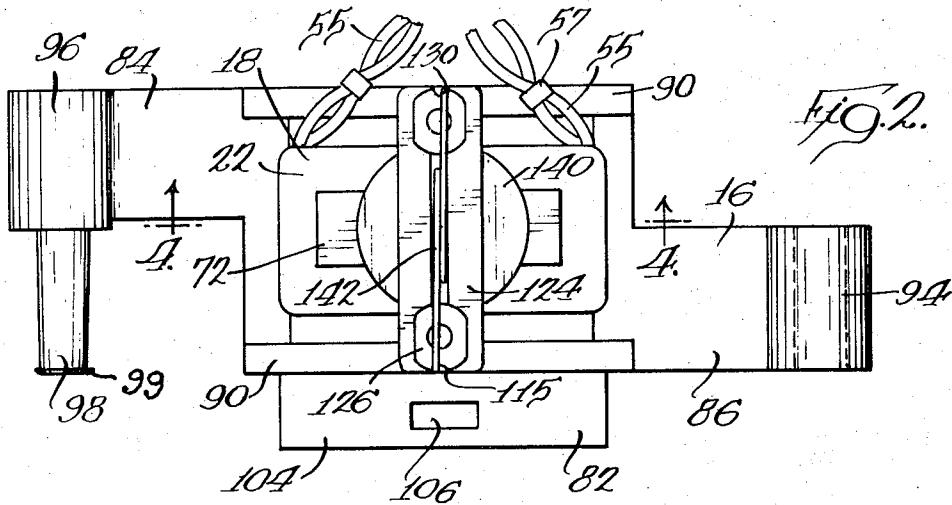


FIG. 2.

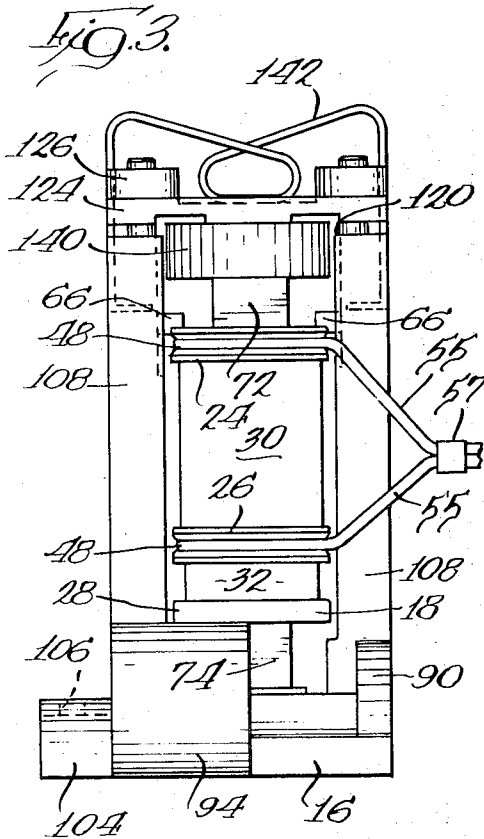


FIG. 3.

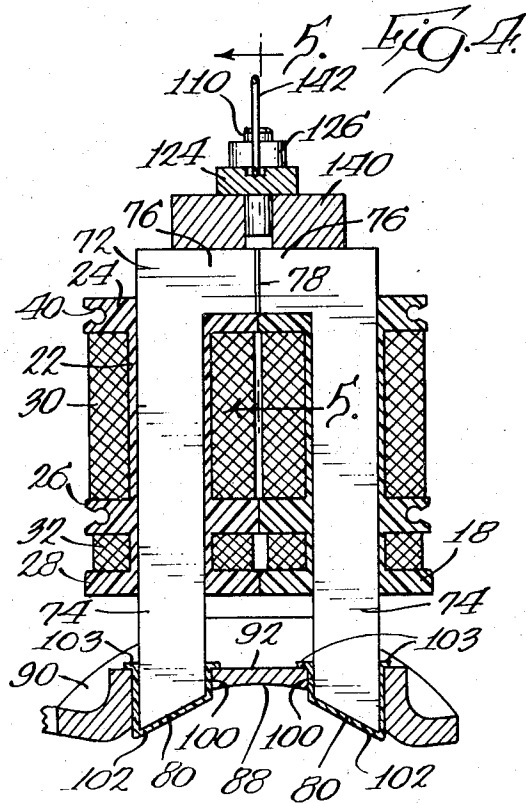
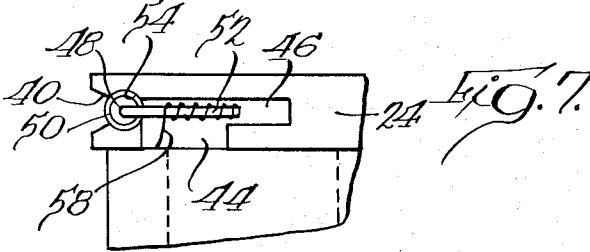
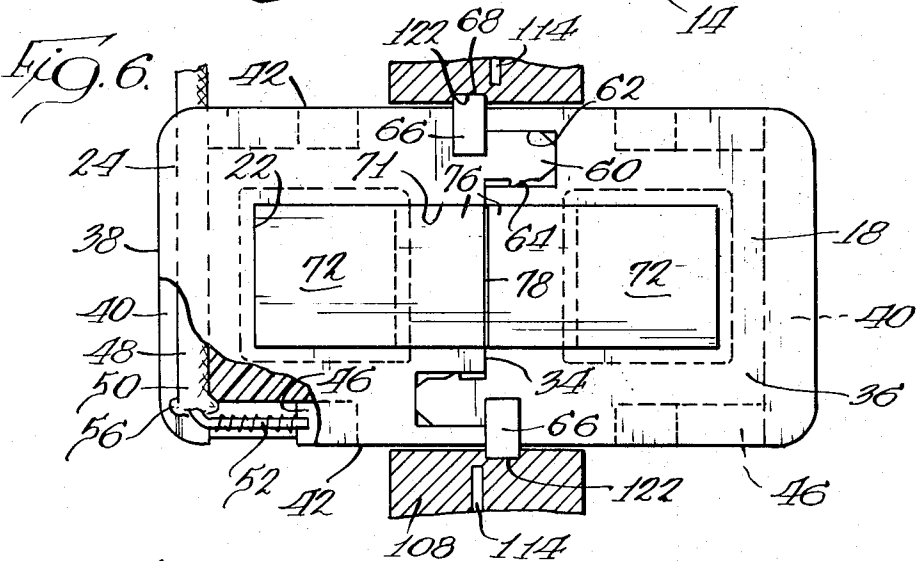
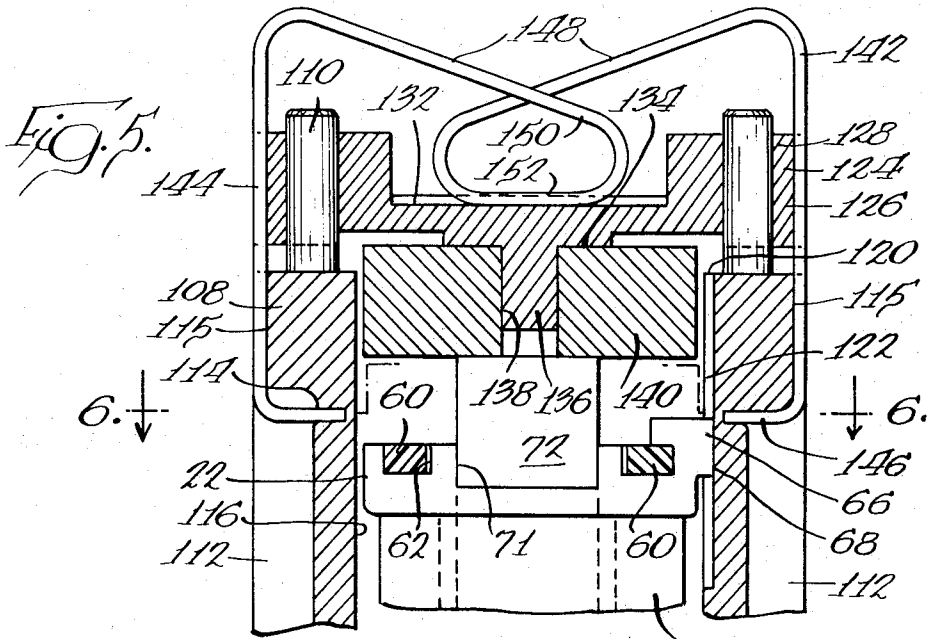


FIG. 4.



CONVERGENCE MAGNET AND HOUSING ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. application Ser. No. 103,710 filed Jan. 4, 1971, by Donald G. Hojnacki entitled "Convergence Magnet and Housing Assembly."

BACKGROUND OF THE INVENTION

Convergence magnets, as is well known, are one or two piece U-shaped cores with the windings on the legs emplaced on the neck of the kinescope tube in a circumferential array with the free ends of the cores confronting pole pieces within the tube. The closer the core ends can be brought to the pole pieces, or in other words, to the glass tube neck, the more efficiently convergence can be controlled.

Convergence magnet housings are characteristically intricately shaped bodies best formed by injection molding. In all cases, so far as is known, they are formed of three interlocking segments, each segment of which is a one-piece molding to encompass the periphery of the U-shaped core of the magnet. The parting line of the molds is in the plane of or in a plane parallel to the plane of the flat side of the U-shaped core. Thus molding exigencies practically demand the formation of a groove open to one side of the housing for the reception of the free core ends. To mold through apertures, stopped holes, for the reception of the core ends would notably increase the cost of molding the housing segments.

Further, the floors of the grooves receiving the core ends have necessarily a certain minimum thickness. Under injection molding procedures, about the least section that will predictably fill without weakness is 12 mils.

Open grooves have been molded in the housing floors but lateral pressure must be exerted on the convergence magnets for proper positioning, and to keep the housings from spreading, face covers are employed which reduce air circulation and increase bulk. Also, pole shoes are employed which result in a more expensive housing molding, a mechanically weaker molding, an additional expense element, and further added expense in the labor of inserting them into the housings.

SUMMARY OF THE INVENTION

The present invention contemplates a wholly different philosophy of convergence housing molding whereby the above disadvantages are substantially avoided. Instead of an encompassing one-piece molding, the housing consists of an integral housing platform to be in contact with the tube neck and side posts to embrace the convergence magnets. A separate cross-beam is provided to bridge the side posts to hold their outer ends in proper position and to exert radially inward pressure on the magnets. By this concept, the molds may part in a radial direction and so, practically, permit the formation of open holes in the housing floor for the reception of the core ends. This, of course, permits the core ends to be brought into immediate adjacency with the neck of the tube and at the same time positively locates them. Among other advantages of

this design than improved efficiency and the positive location of the core ends may be mentioned improved heat dissipation, and the convergence housing assembly may be notably smaller than those presently used and crowd a television cabinet less. As a further characteristic of this same structure, better protection is provided to the neck of the kinescope, and the assembly as a whole and its adjustment on the tube has greater resistance to shock and vibration. Also, the magnet assembly incorporates provision for direction connection of lead wires providing a high level of strain relief and superior protection of the lead wire-coil winding connection.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation of a convergence housing assembly embodying the invention;

FIG. 2 is a top plan view of the top convergence magnet assembly of FIG. 1 and an associated section of the convergence housing;

FIG. 3 is an elevation looking at the structure of FIG. 2 from the right side thereof;

FIG. 4 is a section taken along the line 4—4 of FIG. 2;

FIG. 5 is an enlarged section taken along the line 5—5 of FIG. 4;

FIG. 6 is a section taken along the line 6—6 of FIG. 5; and

FIG. 7 is a front elevation of the lower left hand portion of FIG. 6.

DESCRIPTION OF A PREFERRED EMBODIMENT

The convergence housing assembly 10 described here consists basically of a convergence housing 12 proper and three dual bobbin convergence magnet assemblies 14. The housing 12 itself consists of three identical segments 16, one associated with each of the convergence magnets which are slipped together to provide the complete annular convergence housing.

Each magnet assembly includes a pair of identical molded bobbins 18. The bobbins include a central square tube 22 with a top or outer flange 24, a middle flange 26 and a bottom or inner flange 28 all of said flanges being generally square in plan. The middle square flange 26 is not central, but rather is situated closer to the bottom flange 28. The vertical frequency exciter coil 30 is wound on the bobbin above the middle flange and the horizontal frequency exciter coil 32 is wound on the bobbin below the middle flange.

As stated, the flanges are generally square with, however, some modifications. Referring particularly to FIG. 6 which illustrates the top or outer flanges 24, it will be noted that the top flange has two sharp corners defining an inside edge 34 or an edge which abuts the like edge of the other identical form 36 when mated together, and two rounded outside corners between which extends the outside edge 38. The outside edge has a longitudinal slot 40 therein having a keyhole configuration as best seen in FIGS. 4 and 7. The lateral edges 42 of the top flange are undercut as at 44 adjacent the outer corners and in communication with the keyhole slot. The undercut 44 has a groove extension 46 in the direction of the inner edge 34.

This edge construction makes possible the attachment of the winding leads to external lead wires or hook-up wire and the anchoring of the lead wires in se-

cure, protected, strain-resistant fashion. As particularly illustrated in FIGS. 6 and 7, the external lead wire 48 with insulation 50 on it is stripped as at one end 52 and the insulated segment of wire adjacent the stripped end is snapped into the keyhole slot 40, the radius of the inner more-than-semi-circular groove being proportioned to contain the insulated wire tightly. A short length of insulation 56 extends out beyond the keyhole groove at the stripped end.

The lead 58 of the winding is wrapped around the stripped end of the external lead wire and the connection solder-dipped. The heat from the soldering operation causes the protruding insulation 56 to shrink back and swell, and thus locks the external lead wire against displacement under a longitudinal pull from the keyhole slot 40. Thereafter, the stripped wire end with attached winding lead is bent back into the recess 44 and groove 46 where it lies inside the exterior confines of the flange. The downwardly open undercut 44 provides a protected passage for the winding lead to its connection with the stripped end 52. It will be appreciated also that the right angle bend in the external lead wire will further provide strain relief.

The top and middle flanges 20 and 26 are, alike, equipped with the keyhole slot and related structure, and the emergent hook-up 55 is bunched equidistant from the two slots as with the wrapper or shrinkable sleeving 57, to avoid longitudinal strain on the slot containment and so still further provide strain relief.

The top and bottom flanges 24 and 28 are also provided with means for hooking two of the bobbins together in paired relation. Since the structure is identical on both top and bottom flanges, only that of the top flange is shown in FIG. 6. Each of the bobbins has a shallow tab 60 molded to extend in the plane of the top surface of the upper flange 24 (and the bottom surface of the bottom flange) outwardly from the inside edge thereof adjacent one side of the inside edge 34 and a shallow pocket 62 adjacent the other side of the inside edge 34 molded in the top surface of the upper flange (and the bottom surface of the bottom flange) to receive and contain a tab 60. The tabs have protruding barbs 64 on the inside lateral edges thereof to engage the walls of the pocket 62 with a firm, controlled frictional fit over a range of depth of insertion which resist withdrawal.

Likewise, each of the bobbins has a guide block 66 integrally formed on the top flange 24. This block stands above the general plane of the top flange and projects beyond the lateral side of the top flange as at 68. The inner side 70 of the block is aligned with the inside edge 34 of the top flange so that when two bobbins 20 and 36 are mated together as illustrated in FIG. 6, the guide blocks of each lie on opposite sides of the assembly but also are offset slightly with respect to each other since they also lie on opposite sides of the meeting line of the inside edges 34.

The top flanges likewise have rectangular recesses 71 formed centrally in the top surfaces thereof extending to the inside edges 34.

It will be appreciated that the two bobbins of the pair illustrated in FIG. 6 are identical, and no need arises to form and stock bobbins of different configurations.

As thus far described, each magnet assembly consists of the separate bobbins having means for interlocking with each other and with the windings 30 and 32 thereon. To complete the magnets, L-shaped magnetic

cores 72 are cemented in the central apertures of the bobbins, the long legs 74 thereof being contained in the bobbins and extending an appreciable distance below, and the short legs 76 lying against the top flange 24 of the bobbins in the recesses 71 facing the inside edge 34 of the flange. A kraft paper gap material 78 is cemented to the face of the short leg 76 of one of the L-cores with an air drying non-elastic adhesive, and the two individual bobbins are pressed together and engaged with each other by virtue of the tab and pocket arrangements 60 and 62 with the faces of the short legs 76 of the L-shaped cores 72 pressed together on opposite sides of the paper gap material 78. The pocket and tab arrangement permits a range of relative positioning as between the two bobbins such that the engagement of the two cores will govern the depth of insertion of the tabs into the pockets. The recesses 71 orient the short legs exactly in direct confrontation with each other.

The lower ends of the long legs of the L-shaped cores terminate in oppositely beveled surfaces 80 to conform approximately to their ultimate positioning on the neck of the color kinescope to approach as closely as possible the pole pieces within.

The housing 12 proper, as stated, consists of three identical somewhat resilient molded segments or members 16. Each of these members comprises a central platform section 82 and connecting arms 84 and 86 extending oppositely therefrom. The underside of the platform section has a concave curvature 88 to conform generally to the neck of a kinescope. Adopting the orientation of FIG. 1 as representing a front view of the housing assembly, the platform section 82 has flanges 90 on its forward and back edges standing outwardly concentric with the curvature of the underside 88 of the platform section 82. The top side of the platform section between the flanges provides a flat platform 92.

The connecting legs 84 and 86 extend from the edges of the platform section at a slight upward angle with respect to each other, each of these legs being slightly less than half of the width of the platform section, the leg 84 extending outwardly from the rear half and the leg 86 extending outwardly from the front half of their appropriate platform section edges. Connecting leg 86 terminates in a front-and-back-oriented tube 94 and connecting leg 84 terminates in a fore-and-aft-oriented cylinder 96 having a pin 98 of less diameter extending concentrically from the forward edge of the cylinder 96 terminating at its forward end in a slight head 99. The pin 98 is snugly but freely receivable in the bore of the tube 94 of another adjacent element 16. The head 99 is forceable through the sleeve and secures the assembly.

The platform has two laterally or circumferentially spaced square holes 100 therethrough to accommodate the projecting ends 80 of the long legs 74 of the core magnet 72. Soft plastic boots 102, formed to enclose the lower ends 80 of the magnet core, constitute the actual support of the magnet ends within the platform 82, the boots being equipped with outwardly extending flanges 104 about their upper open ends which seat on the top surface 92 of the platform. The boots protect the neck of the kinescope from scratching by the hard core material and thus minimize danger of implosion. The boots are not cemented to the platform but are permitted to float somewhat in their apertures to pro-

vide for slight errors of concentricity as between the neck of the kinescope and the curve projected by the platform.

The boots are theoretically unnecessary but practically of great importance. The convergence assembly is assembled prior to installation on the tube neck. Tubes have a relatively abrupt shoulder in the transitional area between the non-glass and fitting and the larger diameter neck. The sintered cores are hard, brittle, sharp-edged, and sharp-cornered. Working the assembly with naked, inwardly protruding core ends over the shoulder would be a near impossibility without scratching the glass.

The boots being separately formed, they are not limited by considerations of the least section which can be filled by injection molding. A preferred method of formation is by vacuum-molding a sheet of polypropionate into a multiple cavity mold and separating the individual boots. A thickness of 4 to 6 mils is characteristic, and this thickness represents the whole of the separation of the core ends from the tube neck.

A flange 104 extends forwardly out from the bottom 88 of the platform and has a like curvature. The flanges have windows 106 formed therein in the approximate center thereof.

Vertical support beams 108 (FIG. 5) are molded to extend perpendicularly upward from the platform 92 centrally on the front and back sides thereof. At their tops, they terminate in dowel extensions 110. On their outer surfaces they have relieved areas 112 and blind transverse holes 114 at the top of the relieved areas adjacent but oppositely displaced from the centers of each area. Grooves 115 extend upward from the holes 114.

The inside facing surfaces 116 of the support beams 108 are vertically planar. Vertical grooves 122 open into the top surfaces 120 of the support beams inside the extensions 110 and extend downwardly therefrom. The grooves 122 accommodate the guide blocks 66 of the magnet assembly and hence are offset, one on one side and the other on the other side of the center line connecting the two vertical support beams 108.

The dowel extensions 110 mount slidably a crosshead 124. The crosshead is roughly a plate-like molding adapted to span the vertical support beams and includes integral bosses 126 at its ends with holes 128 therein to receive the dowel extensions 110. The outside vertical edges of the bosses and underlying ends of the crosshead are grooved as at 130. Between the bosses, the crosshead has a longitudinal groove 132 in its upper surface and, on its lower surface, an integral downwardly facing bearing plate 134 in the center thereof and an integral magnet stud 136 projecting centrally downward from the bearing plate 134.

The stud 136 fits in the center hole 138 of a permanent disc magnet 140. The underside of the magnet bears against the top side of and spans the gap between the short legs 76 of the L cores 72. The magnet is magnetized to provide for a static flux in each L core which can be varied from full N to full S.

An M-shaped spring 142 is employed to secure the magnet assemblies 14 to their associated elements 16 of the housing 12. The spring consists of two parallel outer legs 144 terminating at inturned ends 146. The downwardly convergent center legs 148 cross and recurve to form a loop or bight 150 having a flat bottom 152. The inturned ends 146 will be contained in the

blind holes 114 with the outer legs 144 extending upward in the grooves 115 and 130 to a point above the dowels 110. The convergent legs 148 extend downward to position the bottom 152 of the bight 150 within the slot 132. The spring 142 is so proportioned as to impose downward pressure against the crosshead 124 so as to urge the convergence magnet assembly firmly into the contact with the neck of the kinescope and to secure the permanent magnet 140 and the crosshead 124 resiliently against the short legs 76 of the L-shaped cores. The flanges 104 (FIG. 4) of the protective boots 102 limit the movement of the pole pieces and thus permit a preliminary assembly of the pole pieces within the convergence housing prior to installation of the housing on the neck of the tube. The spring, of course, accommodates to any variation in the L core lengths or the thickness of the permanent magnet 140. The outside legs 144 of the spring likewise are formed to urge the vertical support beams toward each other to assure engagement of the projecting blocks 66 in the associated grooves 122 in the support beams.

In the assembled convergence housing as illustrated in FIG. 1, the normal, relaxed, interior diameter of the circle defined by the three convergence housing segments will be about 1.31 inches, the low end of the limit of tolerance of a color kinescope neck. The tolerance normally permitted such necks is from there up to about 1.55 inches. The resilience of the legs 84 and 86 permit such expansion of the housing to the larger diameter. Upon such application of the housing to the neck of a kinescope, the boots 102 are free to lift up somewhat within the apertures containing them and raise the coil assemblies accordingly against the spring 142.

A ring clamp 154 is fitted over the flanges 104 of the housing segments. The ring clamp has inwardly directed struck-out tongues 155 received in the windows 106 of the flanges and a pair of similar, oppositely facing tongues 157 engaging the lateral edges of the flange of one of the housing segments 16. The tongues collectively secure the clamp to the flanges for shipment and handling without fear of loss and position the clamp properly with respect to the housing for a tightening of the clamping screw 156 to lock the convergence housing to the neck of the tube.

From the foregoing description of a preferred embodiment of this invention, the particular advantages thereof will be readily appreciated. A magnet assembly is employed which may be inexpensively constructed and which, upon completion, is essentially unitary or integral. Consisting of the two independent bobbins, the windings may be inexpensively applied with conventional means, the cores inserted, and the bobbins then secured together to constitute an assembled structure strong in itself and requiring no additional securing means or enclosure. The bobbins possess unique means for locking hook-up wire in place so preventing strain on the winding leads or the connection of those leads to the hook-up wire.

The unitary nature of the magnet assemblies permits a convergence housing which need have no other purpose than simply positioning the magnet assemblies and need not be relied on to impart any structural strength to the magnet assemblies. Therefore, the housing assembly may be minimal, light, and inexpensive. Also, since the magnet assemblies are self-supporting, the housing assembly consequently need form only a place-

ment and guiding function; no need for the enclosure of the magnet assembly appears and they are substantially fully exposed to cooling ambient air.

The assembly of the magnets to the housing is likewise notable for ease. The boots 102 are placed in the square holes 100 and the long legs 80 of the magnetic cores 72 are inserted into the boots with the guide blocks 66 entering the vertical grooves 122 on the inside of the support beams 108. The support beams can be sprung slightly apart to facilitate such insertion. Thereafter, the disc magnet 140 is set in place and the crosshead mounted to the dowel extension and the spring 142 applied. The operations of assembly thus are simple and few. The assembly of the three housing segments into a complete housing is conventional.

The control of the position of the magnet assemblies by the housing, though minimal, is sufficient to hold the magnets effectively against shock or vibration. The boots exactly position the ends of the long legs of the magnet cores. The engagement of the guide blocks in their associated grooves contains the upper ends of the magnet assemblies against any movement except for vertical reciprocation. The crosshead 124 holds the upper ends of the support beams 108 at an exact spacing such that the guide blocks are supported movably but inescapably within the grooves 122. The spring supplies downward pressure to keep the crosshead in place, to place the disk magnet 140 in intimate contact with the short legs of the L-shaped cores 72, to load the disk magnet frictionally to eliminate the possibility of accidental rotation under shock or vibration, and to urge the whole magnet assembly into intimate contact with the neck of the kinescope.

I claim:

1. A convergence assembly for a color kinescope comprising a convergence magnet assembly for each gun within said kinescope, a segmental housing adapted to encompass the neck of said kinescope, each of the segments thereof mounting one of said magnet assemblies, each of said magnet assemblies being of the type having a U-shaped core and bobbins with windings thereon on the legs of said core, said segments including a pair of spaced radial posts containing a magnet assembly therebetween, apertures in said segments admitting the ends of said legs into a position of adjacency with said kinescope neck, radial guiding means on said posts and said bobbins cooperating with each other and with said apertures to confine the movement of said magnet assembly to a solely radial direction, and means resiliently urging said magnet assemblies radially inward.

2. The combination of claim 1 in which said bobbins are identical and each includes a top flange and a bottom flange each having aligned straight edges, integral tongues formed adjacent one end of said edges and pockets equally adjacent the other end of said edges conformed to engage frictionally said tongues over a range of depth of insertion of said tongues into said pockets.

3. The combination of claim 2 wherein said tongues include a protrusion on a lateral edge thereof.

4. The combination of claim 1 wherein the bobbins of said magnet assemblies include outer flanges, said flanges having generally opposite, laterally producing guide members and said posts have radial grooves in the facing surfaces thereof containing said members.

5. The combination of claim 1 including additionally thin boots contained in said apertures conformed to the ends of said other legs.

6. The combination of claim 1 including additionally a crosshead spanning and radially slideable on said posts outwardly of said magnet assemblies to space the outer end of said posts, against which said resilient means bears.

7. The combination of claim 6 including additionally a rotatable biasing permanent magnet supported and confined for rotation against said opposing core legs by said crosshead.

8. The combination of claim 7 wherein said permanent magnet is a disk magnet having a central aperture therethrough and said crosshead includes a pin on the inner surface thereof engaged in said aperture.

9. The combination of claim 2 wherein one of said flanges has a longitudinal slot in one edge thereof, a length of insulated hook-up wire tightly contained in said slot and extending therebeyond at both ends, one of said ends having a soldered connection to a lead of an adjacent winding, a portion of the insulation of said wire between the end of said slot and said soldered connection being bulged against the end of said slot.

10. The combination of claim 9 wherein said slot has a keyhole configuration in cross-section to retain said wire with a more-than-semi-circular engagement.

11. The combination of claim 9 wherein said flange is undercut on an edge adjacent said grooved edge and said soldered connection is bent to be contained in said undercut.

12. A convergence assembly for a color kinescope comprising a convergence magnet assembly of the type having a U-shaped core and windings on the legs of said core, a segmental housing adapted to encompass the neck of said kinescope, each of the segments thereof mounting one of said magnet assemblies, each of said segments including a pair of radial posts spaced longitudinally with respect to the neck of said tube embracing the sides of a magnet assembly, the plane established by the legs of said magnet being transverse to the plane established by said posts.

13. The combination of claim 12 including interengaging guiding means as between said posts and said magnet assembly to confine movement of said magnet assembly to a radial direction only and means resiliently urging said magnet assembly radially inward.

14. The combination of claim 13 including additionally a cross head spanning and slideable on the outer ends of said pair of posts against which said resilient means bears.

15. The combination of claim 12 wherein each of said segments having holes therethrough admitting the legs of said magnet to confine said legs for movement only in a direction toward and away from said neck.

16. The combination of claim 15 including additionally thin plastic boots enclosing the free ends of said legs.

17. The combination of claim 16 wherein said boots having flange members engaging the sides of said holes to limit the extension of said legs through said holes.

18. In combination, a bobbin, a winding on said bobbin, a flange on said bobbin having a straight edge, a longitudinal groove in said edge extending to one end thereof, a length of insulated hook-up wire tightly contained in said groove and extending beyond said end and having a soldered connection to a lead of said

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winding beyond said end, the insulation of said wire having an integral swelling therein against said end.

19. The combination of claim 18 wherein said groove has a keyhole configuration in cross-section to contain said wire with a more-than-semi-circular bearing.

20. The combination of claim 12 wherein said U-shaped core comprises a pair of L-shaped cores with

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legs thereof confronting each other, said windings being on the other legs of said cores.

21. The combination of claim 20 including additionally a rotatable biasing engagement magnet supported for rotation against said confronting core legs.

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