Feb. 17, 1970 J. T. HARTEN ET AL 3,496,501

CONVERGENCE COIL ASSEMBLY FOR COLOR TELEVISION

Filed May 19, 1967 2 Sheets-Sheet 1

FIG. 1

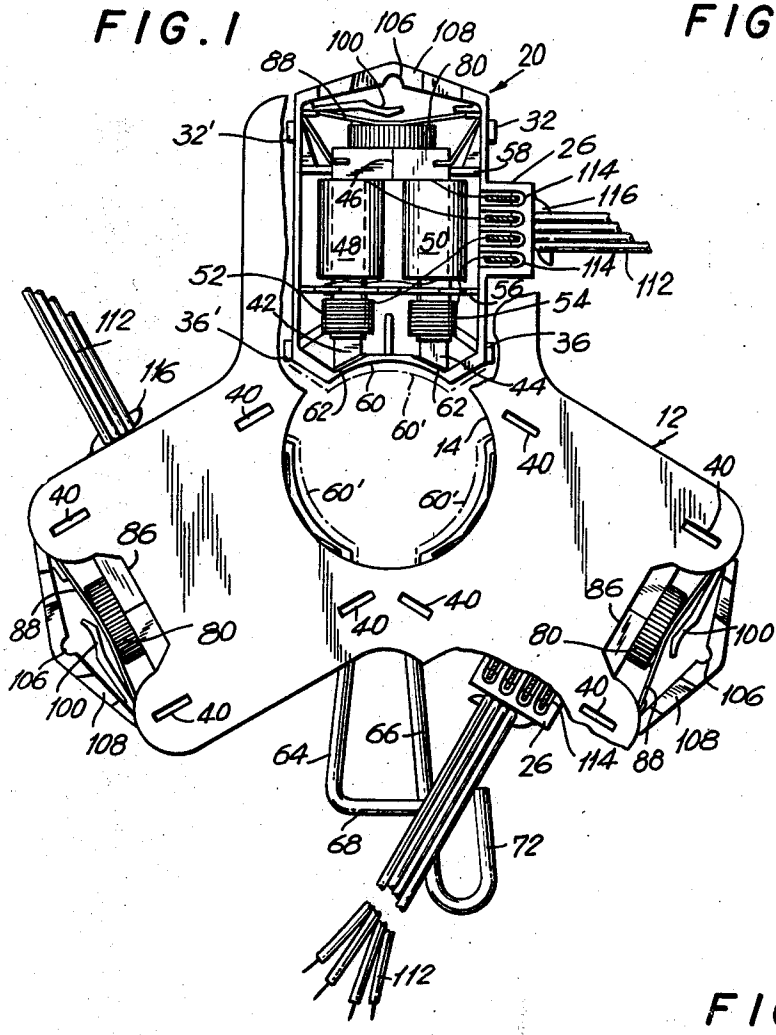


FIG. 2

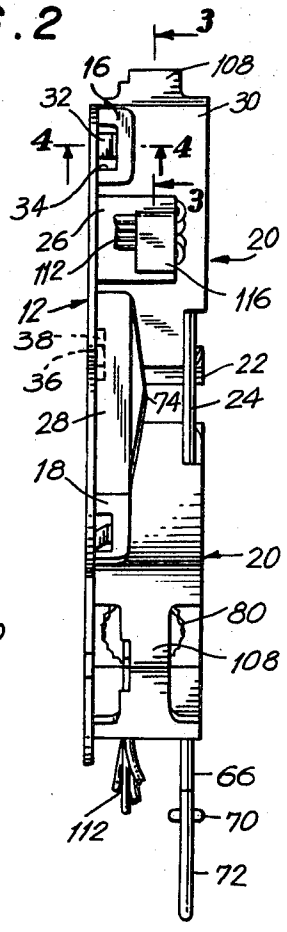


FIG. 3

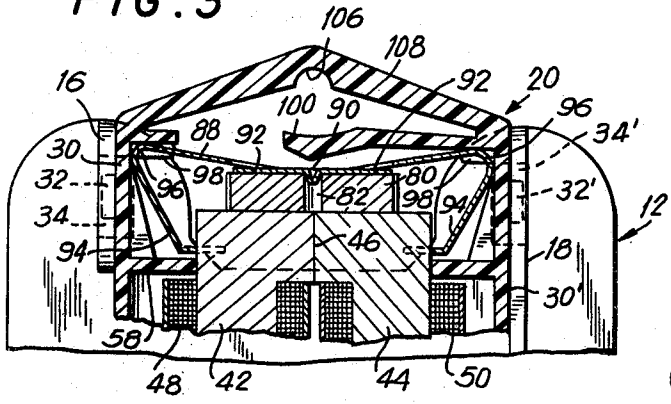
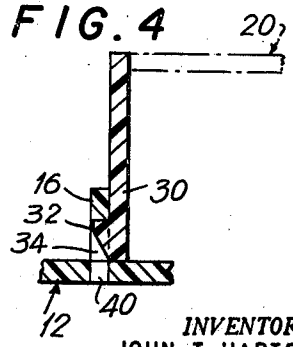


FIG. 4



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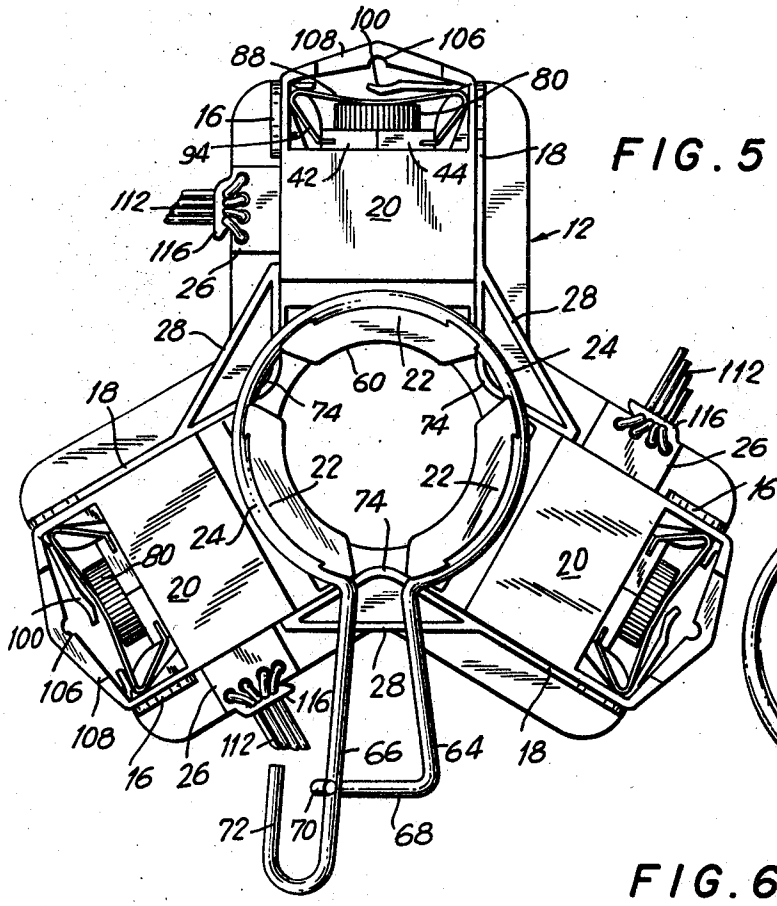


FIG. 5

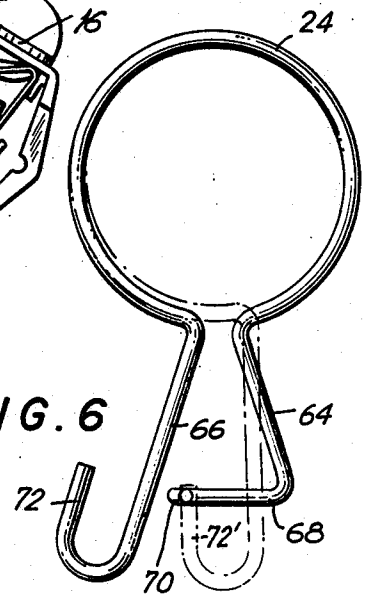


FIG. 6

FIG. 8

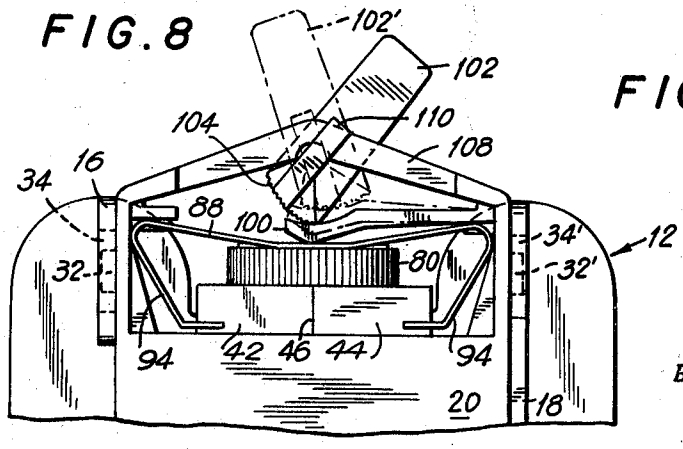
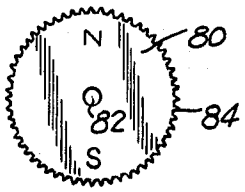


FIG. 7



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CONVERGENCE COIL ASSEMBLY FOR COLOR TELEVISION

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Int. Cl. H01f 5/02
U.S. Cl. 335—212 15 Claims

ABSTRACT OF THE DISCLOSURE

The convergence coil assembly comprises a frame plate with guides at an angle of 120° to receive three coil housings which are slidable radially to compensate for variations in the diameter of the tube neck. At their inner ends the housings have flanges receiving a resilient clamp ring to draw them against the tube neck. The clamp ring may be hooked to provide different degrees of tension. Indicators provide visual alignment of the magnets with a desired part of the gun. A permanent magnet on the outer end of the core of the electromagnets is rotatable for adjustment, and there are means to hold the adjustment.

BACKGROUND OF THE INVENTION

The kinescope or picture tube for color television has a triple gun, and requires color convergence coils disposed behind the main deflection yoke. One problem is a variation in the diameter of the glass neck of the tube. A typical tube specification may be plus or minus 1/16 inch for the neck diameter. Another problem is to secure best axial location of the convergence coil assembly on the neck of the tube. A further problem is to provide easily accessible means for adjustment of the electromagnets, as by means of a permanent magnet which is adjustable relative to the electromagnets.

SUMMARY OF THE INVENTION

The present convergence coil assembly comprises a frame plate with a hole large enough to receive the neck of a color tube of maximum contemplated diameter, and has guides disposed at an angle of 120° to receive three coil housings, these being movable radially on the frame plate to compensate for tube necks of smaller diameter. At their inner ends the housings have flanges receiving a resilient wire clamp ring which draws the housings toward one another and against the tube neck. This ring has outwardly directed end parts which may be hooked together to place the ring under tension. Either of two degrees of tension may be provided, thus additionally compensating for a difference in diameter of the tube neck.

The frame plate has indicators which are located and are visible between the coil housings to indicate the center line of the coils in the housings. This facilitates visual alignment of the coil assembly with a desired part of the gun as seen through the transparent glass of the neck.

A permanent magnet rests against the exposed outer end of the core of the electromagnets. The coil housing and the frame plate are open in order to expose parts of the periphery of the permanent magnet to facilitate rotational adjustment of the same. The permanent magnet is retained in position by a leaf spring mount the middle part of which centers the permanent magnet and also acts as a friction brake bearing against the magnet to retain its adjustment. In addition, an oscillatable locking lever with a locking cam also may be used to lock the adjustment of the permanent magnet. The side of the coil housing is preferably molded with effective strain relief means for the external leads connected to the coils.

The foregoing and additional features are described in the following detailed specification, which is accompanied by drawings in which:

FIG. 1 shows the assembly looking toward the frame plate, with the plate cut away to expose the open side of one of the coil housings;

FIG. 2 is an elevation looking toward the right edge of FIG. 1;

FIG. 3 is a fragmentary section drawn to enlarged scale and taken approximately on the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary section taken approximately on the line 4—4 of FIG. 2;

FIG. 5 is an elevation showing the side of the assembly opposite that shown in FIG. 1;

FIG. 6 is explanatory of the construction of the clamp ring;

FIG. 7 shows the circular permanent magnet; and

FIG. 8 is a fragmentary view like the upper end of FIG. 5 but drawn to larger scale and showing the use of a cam lock as an optional addition to the coil housings.

Referring to the drawing, there is a frame plate **12** (FIG. 1) with a hole **14** large enough to receive the neck of a color tube of maximum contemplated diameter. The frame plate has guides or rails **16** and **18** (FIG. 5) disposed at an angle of 120° to receive three coil housings **20**. These are movable radially to compensate for tube necks of smaller diameter. At their inner ends the housings have arcuate flanges **22** receiving a clamp **24** which draws the housings toward one another and against the tube neck. The parts **16** and **18** act as guides molded integrally with and projecting from the flat surface of the frame plate **12**. The guides **18** are continuous, whereas the guides **16** are interrupted, this being done to make room for a strain relief member **26** which is molded integrally at the side of the housing **20**. The parts may be additionally strengthened and reinforced by diagonal webs **28** which extend between the rail **18** of one arm and the rail **16** of the adjacent arm.

The housings **20** each include a boxlike member one face of which is open for insertion of the coils. When the housing is applied to the frame plate **12** the open face of the housing is covered and closed by the frame plate. The open side of the housing is best shown at the top of FIG. 1, where the frame plate has been cut away to expose the housing.

Referring now to FIGS. 2 and 4, the side wall **30** of the housing has a detent **32** near its outer end. This is received in a slot **34** in the guide rail **16**. As seen in FIGS. 2 and 3, the slot **34** is substantially longer than the detent **32**, thus affording the desired radial sliding movement. There is a similar detent **32'** (FIG. 3) on side wall **30'** movable in a similar slot **34'** in the opposite guide rail **18**. Moreover, the inner ends of side walls **30** and **30'** have similar detents **36** and **36'** (FIG. 1) slidable in similar slots **38** (FIG. 2) and **38'**. Slot **38'** (not shown) is like slot **38** shown in FIG. 2, but is on wall **30'** instead of wall **30**.

In FIG. 1 reference may be made to the slots **40** passing through the frame plate **12**. There are twelve such

slots, four for each of the 120° arms of the frame plate. Referring to FIG. 4, it will be seen that slot **40** is aligned with the guide rail **16** and facilitates formation of the desired slot **34** during the molding operation without requiring the use of movable cores. Instead, fixed cores passing through frame plate **12** serve to form the desired slots **34, 34', 38** and **38'**. In this case the slots are about ⅛ inch longer than the detents received thereby and so provide a radial movement of ⅛ inch.

FIG. 4 shows the sloping shape of the detents, which makes it possible to readily apply the housing to the frame plate by simply pushing it into position. The molding material used is preferably polypropylene, which is somewhat yieldable. A housing may be disassembled from the frame plate by outwardly bending the guides **16** and **18** to release the detents.

Referring now to FIG. 1, the housing contains two L-shaped cores **42** and **44** the outer ends of which are abutted as shown at **46** to provide a U-shaped core. This construction is shown in section in FIG. 3. Coils **48** and **50** are applied to the cores **42** and **44**, and smaller coils **52** and **54** (FIG. 1) are received over the lower ends of the cores **42** and **44**. An insulation spacer **56** may be applied to the core between the larger and smaller coils to hold the coil assembly in position in the box. It also has lugs at which the ends of the coil wire are supported and soldered together.

The outer end of the resulting U shaped core is received in and passes through a mating opening or recess in a partition wall **58** which is molded integrally with the housing. The lower end of the housing has a curved shape indicated at **60** and dimensioned to conform to a tube neck of medium diameter. The inward movement of the housing is indicated in broken lines at **60'** in FIG. 1. The inner ends of the cores **42** and **44** are bevelled to conform to the curvature of the arcuate wall **60** and the tube neck. Thin plates of core material may be used beneath the inner ends of the cores as indicated at **62** to enlarge (axially of the tube neck) the effective area of the inner ends of the magnet poles. The housing as molded receives and locates the plates **62**.

It has already been mentioned that the housings are drawn inward by a suitable resilient wire clamp ring **24** shown in FIGS. 2, 5 and 6. Referring to FIG. 6 the end parts of the clamp ring project outwardly at **64** and **66**. The first end part **64** is additionally bent at **68** toward the second part **66**, and is provided with a small hook **70** at its tip, which may be used to engage the part **66** as is best shown in FIG. 5. This puts the ring under tension, and may be used when the picture tube neck is of large diameter. The second part **66** is additionally reversely bent to provide a third part **72** which is spaced from the second part **66** and which extends inward far enough to receive the hook **70** as shown in broken lines at **72'** in FIG. 6. This provides a different degree of clamp tension, and may be used when the picture tube neck is of small diameter.

Referring to FIG. 5 the adjacent guide rails **16** and **18** are joined at an apex **74**, there being three such apices 120° apart. Referring next to FIG. 2, the normal guide rail height is indicated at **16, 18** and **28**. However, the adjoining parts of the guide rails **16** and **18** slope to greater height at their juncture or apex **74**. The increased height at the apex **74** is made to coincide with the plane of the center lines of the coils in the housing. This is done so that the apex may be used as an indicator which is visible in the space between the inner ends of the coil housings, and which may be visually aligned with a desired part of the triple gun in the neck of the picture tube as seen through the transparent glass of the neck. These indicators greatly facilitate proper axial location of the convergence coil assembly on the neck of the tube.

For independent adjustment of the convergence magnets relative to one another, each has a movable permanent magnet. Referring to FIG. 7, the permanent magnet **80** is made circular for convenient adjustment by rotation about its center hole **82**. It is polarized diametrically, as indicated by the letters "N" and "S." To facilitate manual adjustment the periphery may be knurled or serrated as indicated at **84**. The top and bottom faces of the magnet are flat.

Referring now to FIGS. 1 and 3, the magnet **80** rests directly on the outer end of the core **42, 44** of the electromagnet assembly. The outer end part of the coil housing **20**, outside partition **58**, is open on both faces for easy access to diametrically opposed parts of the magnet **80**, and the frame plate **12** is also cut away or recessed inward as is best shown at **86** in FIG. 1, in order to facilitate manual rotational adjustment of the three permanent magnets **80**.

Referring now to FIG. 3, the permanent magnet **80** may be retained in position by means of a leaf spring mount **88** the middle part of which has a centering teat **90** which is received in the center hole **82** of the permanent magnet in order to locate and pivot the same. The middle portion of the leaf spring **88** bears tightly against the outer face of the permanent magnet **80**, and acts as a friction brake to retain adjustment of the same. To enhance this braking effect two adjacent tongues may be struck downward from the leaf spring as shown at **92**, in order to increase the frictional contact, and to stabilize the relation of the parts.

In the preferred form here illustrated the ends of the leaf spring **88** are extended and are directed inward as shown at **94** (FIG. 3), and are notched to fit around the cores **42** and **44** in order to position the spring **88** which in turn positions the rotatable magnet **80**. The corners **96** of the leaf spring are received in and are held by the housing, and the latter includes locating stops **98** which limit the insertion of the spring as it is being pushed into the housing.

If desired, an additional lock means may be provided to more positively lock the rotational adjustment of the permanent magnet **80**. One part of such a lock, the lock shoe **100**, is molded integrally with the housing **20**, whether or not used. This brake shoe **100** is therefore shown in all figures of the drawing, but is not shown in use except in FIG. 8, in which a locking lever **102** has been added. This lever has a locking cam **104** and a fulcrum molded integrally with the lever. The rounded fulcrum at the top of cam **104** is received in a fulcrum groove **106** (FIGS. 1, 3 and 5), this groove being molded in the outer end wall **108** of the housing. In FIG. 8 the released position of the locking level is shown in broken lines at **102'**. When it is turned to the solid line position **102** the cam **104** bears tightly against the locking shoe **100** and wedges it toward and tightly against the leaf spring **88** and the permanent magnet **80**, thereby securely locking the rotational adjustment of the permanent magnet, without moving or disturbing its adjustment. This is an important advantage of using the shoe **100**. The cam moves past dead center and is self retaining in locked position. As shown in FIG. 8, the locking lever **102** is at the far side of the end wall **108**. An anchor lug **110** is provided on the cam at the inner side of the end wall **108** to hold the lock against escape. The wall **108** is narrower than the housing, as will be seen in FIG. 2.

FIGS. 1 and 5 show a flat four wire cable **112** leading to the coils of each housing. FIG. 1 also shows how the fine wire of the small coils **52** and **54** is led to two of the external leads, while the fine coil wire of the larger coils **48** and **50** lead to the other two wires of the cable. Strain relief means are provided, and for this purpose one side wall of the housing is molded with the strain relief block **26** previously mentioned. As viewed in FIG. 5 there are four holes passing downwardly through each block **26**, and these holes open at their inner ends into slots **114** (FIG. 1) extending toward the inside of the housing. The bared ends of the leads are soldered to the fine coil wires, and this is readily done while the ends project

downward by dipping or pot soldering, subsequent to which the soldered connections may be bent at right angles so as to be received in the slots **114**.

This alone would provide some strain relief, but in addition the outer face of each block **26** has a strain relief arm **116** molded integrally therewith. This arm holds the lead wires in rather sharply reversely bent condition, and thereby additionally anchors the same firmly against external stress to protect the delicate coil wire. In the form here shown each arm is connected at one end and is open at the other end, and tends to move resiliently toward the block **26**.

It is believed that the method of constructing and using our improved convergence coil assembly for color television kinescopes, as well as the advantages thereof, will be apparent from the foregoing detailed description. It will also be apparent that while we have shown and described our improvement in a preferred form, changes may be made without departing from the scope of the invention, as sought to be defined in the following claims.

We claim:

1. A convergence coil assembly for color television comprising a frame plate having a hole large enough to receive the neck of a color tube of maximum contemplated diameter, and having a plurality of substantially equally spaced guide means fixed thereon and spaced circumferentially about said hole, and a plurality of housings operatively connected to the guide means and movable within said guide means toward and away from said hole, magnet means operatively connected to said housings, and means acting on said housings to urge them radially inward toward said hole to adjust the positions of said housings for tube necks of different diameters, said guide means being fixed during the movement of said housings thereby to maintain the relative spaced positions about said hole of said housings and magnet means during said movement.

2. A convergence coil assembly as defined in claim **1**, in which there is a clamp ring to draw the housings toward one another and against the tube neck, and in which the clamp ring is made of relatively stiff resilient wire, and in which the end parts of the clamp ring project outwardly, the first of said end parts being additionally bent toward the second of said end parts and being provided with a hook at its tip to engage the second part in order to put the ring under tension.

3. A convergence coil assembly as defined in claim **2**, in which the second outwardly bent part of the clamp ring is additionally reversely bent to provide a third part spaced from the second part and dimensioned to receive the aforesaid hook of the first part, but with a different degree of clamp tension than when the hook engages the second part.

4. A convergence coil assembly as defined in claim **3**, in which the frame plate has indicators thereon which are located and visible between the coil housings near the tube neck and which serve to indicate the center line of the magnets in the housings, said indicators facilitating visual alignment of the magnets with a desired part of the gun in the neck of the tube as seen through the transparent glass of the neck.

5. A convergence coil assembly as defined in claim **4**, in which there is a permanent magnet resting against the outer end of the core of the electromagnets in each housing, said permanent magnet being rotatable for adjustment purposes, said coil housing and said frame plate being open at opposed parts of said permanent magnet to facilitate manual rotational adjustment of the same.

6. A convergence coil assembly as defined in claim **5**, in which the rotatable permanent magnet has a center hole and is retained by means of a leaf spring mount, the middle part of which has a centering teat received in the center hole in the permanent magnet to locate and pivot the same, the middle part of said leaf spring bearing tightly against said permanent magnet and acting as a friction brake to help retain the adjustment of the same.

7. A convergence coil assembly as defined in claim **6**, in which the coil housing has a lock shoe extending over the center portion of the leaf spring, and has an oscillatable locking lever carrying a locking cam at its inner end, said cam bearing against said locking shoe to wedge the same tightly against the leaf spring and the permanent magnet in order to lock the rotational adjustment of said permanent magnet.

8. A convergence coil assembly as defined in claim **7**, in which the coils have fine wire connected to external leads of heavier wire, and in which the side of the coil housing as molded has strain relief means, with a plurality of holes for said leads, said holes opening at one end into slots transverse to the holes for receiving soldered connections between the fine magnet wire and the heavier lead wire, and said strain relief means including an arm outside the other ends of the holes for reversely bending the lead wires and thereby additionally anchoring them against external stress.

9. A convergence coil assembly as defined in claim **1**, in which the frame plate has indicators thereon which are located and visible between the coil housings near the tube neck and which serve to indicate the center line of the magnets in the housings, said indicators facilitating visual alignment of the magnets with a desired part of the gun in the neck of the tube as seen through the transparent glass of the neck.

10. A convergence coil assembly as defined in claim **1**, in which there is a permanent magnet resting against the outer end of the core of the electromagnets in each housing, said permanent magnet being rotatable for adjustment purposes, said coil housing being open at a part of said permanent magnet to facilitate manual adjustment of the same.

11. A convergence coil assembly as defined in claim **10**, in which the rotatable permanent magnet has a center hole and is retained by means of a leaf spring mount, the middle part of which has a centering teat received in the center hole in the permanent magnet to locate and pivot the same, the middle part of said leaf spring bearing tightly against said permanent magnet and acting as a friction brake to help retain the adjustment of the same.

12. A convergence coil assembly as defined in claim **10**, in which the rotatable permanent magnet has a center hole and is retained by means of a leaf spring mount, the ends of which are reversely bent and directed inwardly and being notched to fit around the core of the electromagnets, and the middle part of which has a centering teat received in the center hole in the permanent magnet to locate and pivot the same, the said middle part of said leaf spring bearing tightly against said permanent magnet and acting as a friction brake to help retain the adjustment of the same.

13. A convergence coil assembly as defined in claim **10**, in which the coil housing has a lock shoe extending over the permanent magnet, and has an oscillatable locking lever carrying a locking cam at its inner end, said cam bearing against said locking shoe to wedge the same tightly toward the permanent magnet in order to lock the rotational adjustment of said permanent magnet.

14. A convergence coil assembly as defined in claim **11**, in which the coil housing has a lock shoe extending over the permanent magnet, and has an oscillatable locking lever carrying a locking cam at its inner end, said cam bearing against said locking shoe to wedge the same tightly toward the permanent magnet in order to lock the rotational adjustment of said permanent magnet.

15. A convergence coil assembly as defined in claim **1**, in which the coils have fine wire connected to external leads of heavier wire and in which the side of the coil housing as molded has strain relief means, with a plurality of holes for said leads, said holes opening at one end into slots transverse to the holes for receiving soldered connections between the fine magnet wire and the heavier lead wire, and said strain relief means including an arm

outside the other ends of the holes for reversely bending the lead wires and thereby additionally anchoring them against external stress.

References Cited

UNITED STATES PATENTS

2,565,331	8/1951	Torsch	335—213
2,897,390	7/1959	Jensen	313—77

3,303,444	2/1967	Leeb et al.	313—77 XR
3,354,337	11/1967	De Both	313—77

G. HARRIS, Primary Examiner

U.S. Cl. X.R.

313—77

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,496,501 February 17, 1970

John T. Harten et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, line 7, "a corporation of New Jersey" should read -- a corporation of Delaware --.

Signed and sealed this 15th day of December 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents