April 20, 1965 J. M. AMMERMAN 3,179,857

MAGNET HOLDER

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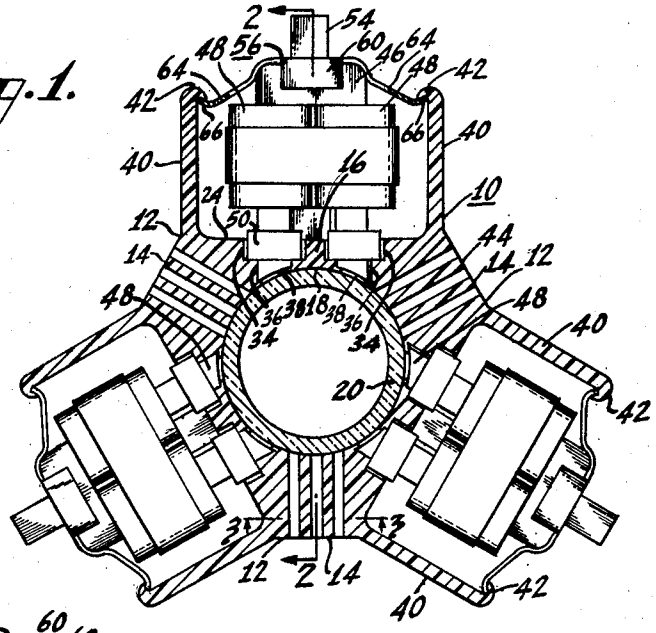
Fig. 1.



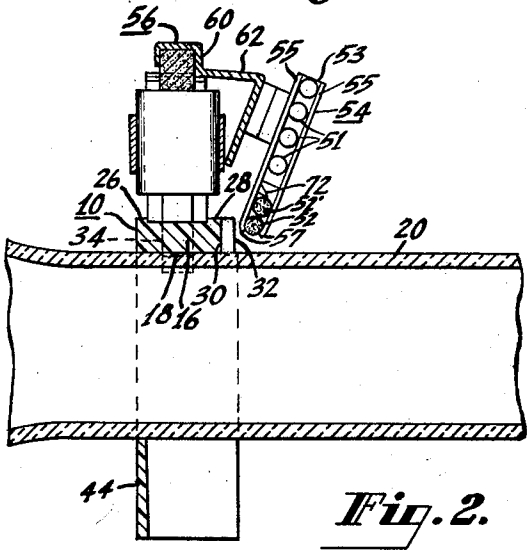


Fig. 2.

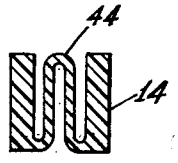


Fig. 3.

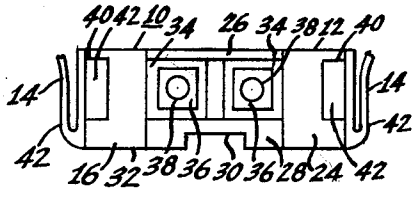


Fig. 4.

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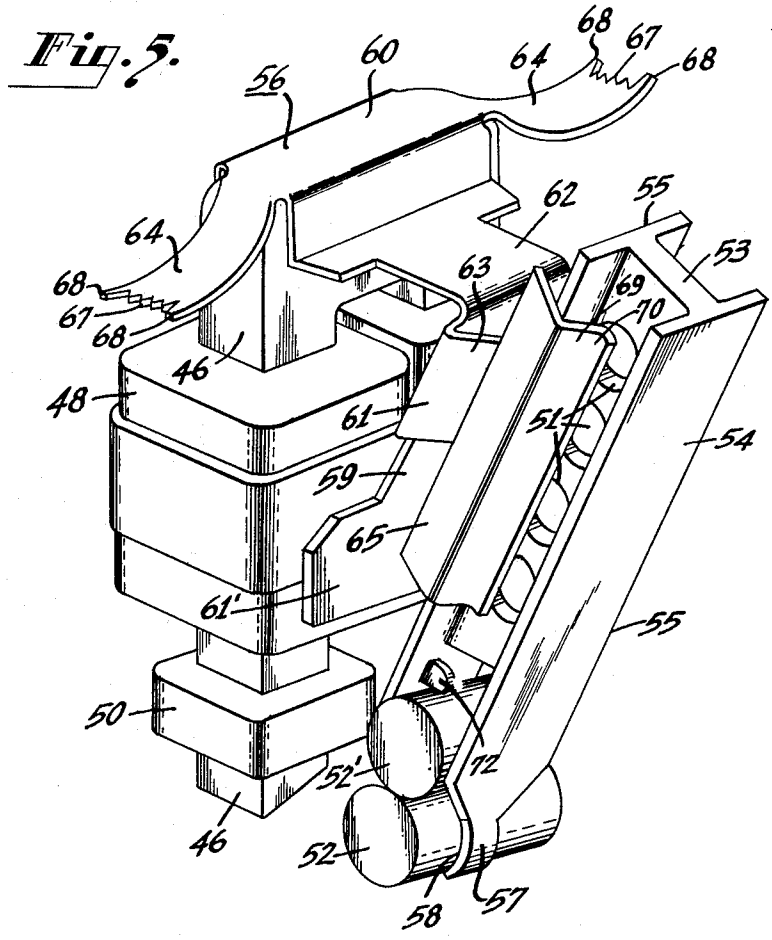
Fig. 5.



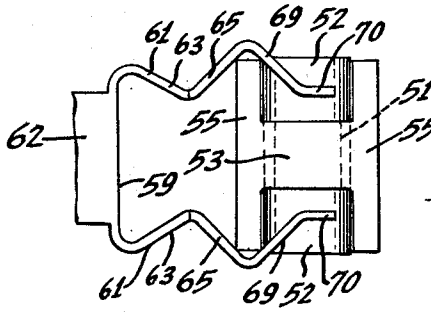


Fig. 6.

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3,179,857

MAGNET HOLDER

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This invention relates to apparatus for holding beam convergence magnets on the neck of a cathode ray or picture tube.

In producing color television pictures, a three-color tube, such as RCA Type 21FJP22, having three electron beams is provided, said tube having a plurality of triads of phosphor dots on the inside of the face thereof. The electron beams are each deflected both horizontally and vertically to scan the phosphor coated face of the cathode ray tube, each electron stream hitting only corresponding respective ones of the phosphor dots of each triad thereof. A shadow mask, having strategically positioned holes therein, is provided in the path of the beam between the electron guns and the phosphor coated face to assure that each electron stream is directed to its respective dots only. Convergence magnetic structure is provided for helping to converge the beams as they strike their respective dots during deflection of the several beams. A part (pole pieces) of this magnetic structure is mounted inside of the neck of the cathode ray or picture tube and another part (pole piece exciters) of this structure is mounted on the neck of the tube in the vicinity of the internally mounted magnetic structure. This invention relates to the part of the magnetic structure and to the holder therefor that is mounted externally of and on the neck of the tube.

The external magnetic structure includes an electro-magnet and a permanent magnet for each beam of the picture tube. Each electro-magnet includes a winding (or a pair of windings) energized by a variable voltage to provide dynamic horizontal convergence of the beam and a second winding (or a second pair of windings) energized by a variable voltage to provide dynamic vertical convergence of the beam. Both windings (or both pairs of windings) are mounted on a ferrite core. If two pairs of windings are provided, the core may be of horseshoe or U-shape and a winding of each pair of windings may be mounted on each leg of the core. The steady (i.e. static) component of the convergence field may be provided by a permanent magnet. The electro-magnet and the permanent magnet for each beam are mounted on the neck of the picture tube and are adjusted to the position in which best convergence results.

In the normal construction of picture tubes, the necks thereof may vary in diameter, in roundness and in diamter gradient along the length of the neck within the normal manufacturing tolerances. Prior art mounting means for the convergence magnets leaves something to be desired in cheapness, in ease of manufacture, and in ease and facility of positioning the plurality of convergence magnets on the neck of the picture tube and of adjusting the magnets to an optimum position, and for firmly retaining the magnets in their adjusted position.

It is therefore an object of this invention to provide an improved structure for holding convergence electro-magnets and permanent magnets on the neck of a picture tube.

It is an object of this invention to provide an easily mountable and positionably adjustable structure for firmly holding convergence electro-magnets and permanent magnets in adjusted position on the neck of a cathode ray tube whose dimensions may vary in accordance with normal manufacturing tolerances from the nominal dimensions thereof.

The invention comprises a unitary magnet holder structure of non-magnetic, non-conducting, elastic material, having magnet supporting portions which include magnet holding arms, joined together by resilient portions of the structure. The structure has an internal diameter somewhat less than the external diameter of the neck of a picture tube in the vicinity of the internal convergence structure thereof. Spring clip means are included for holding a plurality of convergence magnets on the magnet supporting portions of the magnet holder by cooperation of the spring clips and the magnet holding arms. The spring clip is formed with spring arms that slidably hold a plastic rod or beam having resilient plastic fingers which hold one or more permanent magnets. The magnet holder is pushed on over the end of the neck of the picture tube and rotated if necessary to obtain optimum adjusted position with respect to the internal convergence structure, at which position the unitary magnet holder is stretched or elastically increased in internal diameter and expanded by the larger diameter of the neck of the picture tube, thereby firmly holding the magnet holder on the neck of the picture tube and retaining it in its adjusted position thereon.

This invention is more fully explained in the following detailed description thereof taken with the accompanying drawing in which:

FIG. 1 is a view (partly in section) of the magnet holder of this invention mounted on the neck of the picture tube, as seen from the screen end of the tube, and holding the convergence magnets thereon, the internal magnet pole piece structure not being shown;

FIG. 2 is a section of the magnet holder and tube neck on line 2—2 of FIG. 1;

FIG. 3 is a partial section on line 3—3 of FIG. 1;

FIG. 4 is an edge view of one section of the magnet holder with the magnet removed;

FIG. 5 is a perspective view of a spring clip in position on an electro-magnet, the spring clip holding a beam which in turn holds a plurality of permanent magnets; and

FIG. 6 is a partial top view of FIG. 5.

The main magnet holder structure **10** of one embodiment of this invention, shown in FIGS. 1 and 2, is made of one piece of plastic material as by molding. Since this structure is adapted to hold three dynamic convergence electro-magnets and three or more static convergence permanent magnets, it comprises three identical magnet holding sections **12** spaced symmetrically around the axis of the main structure **10**. The magnet holding sections are joined by identical resilient sections **14**, the ends of the resilient sections **14** being joined to the ends of the magnet holding sections **12** to provide overall resilience to the main structure **10**. Due to the fact that each of the magnet holding sections **12** and each of the resilient sections **14** are identical, only the upper one pair of sections comprising a magnet holding section **12** and a resilient section **14**, will be described in detail.

As shown in FIGS. 1, 2 and 4, the magnet holding section **12** comprises a body **16** of plastic material having an inner partially cylindrical surface **18** having a radius of curvature about equal to the outside radius of the neck of the picture tube **20**. One outer surface **24** of the body **16** is generally planar and has a pair of ridges **26** and **28** (see FIGS. 2 and 4) along each edge of the planar surface **24**. These ridges **26** and **28** which extend radially outward from the tube axis and perpendicular to the planar surface **24** for a short distance are shorter in length than the longer dimensions of the planar surface **24** and are centered with respect thereto. The ridge **28** is substantially wider than ridge **26**. A rectangular notch **30** is provided in a lateral surface **32** of

the body 16 and extending into the ridge 28, said notch 30 extending perpendicular to the generally planar surface 24 and centrally positioned along the length thereof.

A pair of holes 34, extending perpendicularly to the surface 24 are formed in the body 16. The holes 34 are symmetrically spaced along the length of the surface 24 with respect to the center thereof, the outer boundaries of the holes being in planes including the ends of the ridges 26 and 28 and perpendicular to lateral surface 32. The portions of the holes 34 adjacent the planar surface are of square shape in cross-section, a further intermediate portion 36 of the holes being also of square shape but smaller in size than the first square hole portion. The smaller square hole portions 36 are of blunted wedge shape with the narrow edge of the wedges facing towards each other. The square portions of the hole 34 do not extend entirely through the body, the inner end 38 of the hole being round and of a diameter less than the side of the smaller square hole 36.

Flexible arms 40 of uniform thickness and of relatively greater width than thickness extend from the ends of the generally planar outer surface 24 and perpendicular thereto with the greater dimension of arms 40 extending perpendicularly to the lateral surface 32 of the body 16. These arms 40 may be of a width equal to a side of the large square portion of hole 34 and are positioned in alignment with the large portion of the holes 34 as shown in FIG. 4. The free ends 42 of the arms 40 have inturned, hook-like, tip portions.

As stated above, each of the three magnet supporting sections 12 are identical in size and shape. The magnet supporting sections are held together by the three resilient sections 14 comprising folded spring-like ribbons 44 of plastic material, the ends of the ribbons 44 being integral with the ends of the magnet holding sections 12, one end of each ribbon 44 being integrally attached to the notched lateral surface 32 of a magnet holding section 12, the planes of the surfaces of the ribbons 44 being generally radially directed with respect to the cathode ray tube neck 20 on which structure 10 is to be mounted.

The electro-magnets held by the above-described magnet supporting holding structure have a horseshoe or U-shaped core 46, the free ends on legs of the U being cut away to conform generally with surface of the neck 20 of a cathode ray tube whose axis is perpendicular to a plane through both legs of the U-shaped core 46. Two pairs of coils 48 and 50 are mounted on the core 46, one coil of each pair of coils 48 and 50 being mounted on each of the legs of the core 46. One pair of coils 48 is mounted on the legs of the core 46 adjacent the base or closed end thereof and comprise the vertical convergence coils which are connected in series and the two free terminals of these two coils are connected to connectors (not shown) mounted on these coils 48. The other pair of coils 50 comprising the horizontal convergence coils is each mounted on a respective portion on the legs of the core 46 between the vertical coils 48 and the cut-away ends of the core legs. These horizontal coils 50 are also connected in series and the two free terminals are also connected to connectors (not shown) mounted on the vertical coils 48. Energization of the horizontal and vertical coils 48 and 50 by suitable waves varying respectively at horizontal and vertical beam deflection rates provides the dynamic component of the magnetic field by which beam convergence is achieved in a known manner.

The constant or static component of each magnetic field is supplied by small bar magnets 52 and 52' held adjustably close to the neck 20 of the tube and close to the poles of the U-shaped electro-magnet core 46. While two bar magnets 52 and 52' are shown in FIGS. 2 and 5, one may be sufficient to produce the necessary static field. Each bar magnet is cylindrical in shape and the axis thereof extends parallel to a plane through both legs of the U-shaped core 46 and normal to the axis of the holder.

A bar or beam 54 of plastic material is provided for holding the permanent magnets 52. This beam 54 has an H-shaped cross section for a portion of its length, holes 51 being provided in the web portion 53 of the beam. The lower ends (as viewed in FIGS. 2 and 5) of the flanges 55 of the beam are tapered to form resilient fingers 57. A bar magnet 52 is held by the resilient fingers 57, a portion of the inner surface of the resilient fingers being inwardly curved at 58 to provide a magnet fitting surface which holds a magnet 52 in properly aligned position. If a second magnet 52' is required, it can be placed above the lower magnet 52 and between it and inwardly projecting boss 72. The beam 54 itself is supported on the base of the U-shaped core 46 by a resilient metal clip 56, the spring clip 56 (in cooperation with arms 40, FIG. 1) also holding the electro-magnet core 46 on the magnetic holder 12 as will be explained.

The spring clip 56 is best shown in FIG. 5. It is made of sheet spring metal of uniform thickness, cut and bent to the form to be described. The spring clip 56 comprises a downward slanting portion 59, having a tab 61' of greater width than the width of the slanting portion 59. If desired, the tab 61' may be taped to the magnet coils 48. A pair of spring arms 61 (see also FIG. 6) extend laterally from the slanting portion 59. First short portions 63 of the arms 61 extend slantingly towards each other and then further short portions 65 extend slantingly away from each other and third short portions 69 extend slantingly towards each other. The final end portions 70 of the arms 61 extend parallel to each other and perpendicular to the slanting portion 59. As shown in FIG. 5, the portions 65, 69 and 70 extend both above and below portion 63. One flange 55 of the beam 54 is held between the two arms 61 at the junctions of the second and the third slanting portions 65, 69, by the resilient action of arms 61. While the beam 54 may be slid with respect to arms 61 to its adjusted position, the beam 54 is restricted from tipping or wiggling with respect to the arms 61 by the resilient pressure of the junctions between portions 65 and 69 of arms 61 on the flange 55 in contact therewith. Furthermore, since the arms 61 are so formed that only one flange 55, or the other thereof, may be held by the arms 61, the magnets must be held oriented with their axes perpendicular to the axis of the picture tube 20 on which the magnet holding device is to be mounted.

The spring clip also includes a channel portion 60 shaped to fit over and resiliently embrace the base of the U-shaped core 46, there being a bridge portion 62 connecting the portion 59 and the channel portion 60. The spring clip 56 also includes a pair of spring arms 64 which extend outwardly from the core-embracing or channel portion 60. The arms 64 are bent to conform with the shape of the base of the core 46 and extend outwardly for a distance, and then the ends 66 of the arm are bent at an acute angle out of the plane of the outwardly extending portions thereof and away from the core-embracing portion 60 thereof. The ends 66 of these arms may be roughened or may have teeth 67 formed therein for a purpose to be described. Tabs 68 may be added at the ends of the toothed portion thereof, for a purpose to be described.

The magnetic structure may be assembled as follows: one leg of the beam 54 holding one or more bar magnets 52 and 52' at one end thereof, is thrust between resilient arms 61 of the spring clip 56 in such direction that the bar magnets 52 are near the ends of the legs of the core 46. The channel portion 60 of the spring clip 56 is then pushed over the base of the core 46 having the four coils (48, 48, 50, 50) mounted on the legs thereof. The resultant structure is assembled to the plastic magnet holder section 12 by orienting it so that the beam 54 is towards the notched side 32 of the plastic holder section 12. Then the tips of the legs of the core 46 are inserted into the smaller rectangular holes 36 in the plastic holder section

12. The spring clip arms 64 are bent towards the legs of the core 46 and the arms 40 of the plastic holder section 12 are bent away from each other until the ends 66 of the spring clip 56 can be inserted under the inturned tips 42 of the plastic arms 40. In this position, the teeth 67 on the tips of the spring arms 64 and tabs 68 tend to prevent sliding of the clip arms 64 with respect to the plastic arms 40. Furthermore, the resilience of the spring clip arms 64 and of the plastic arms 40 holds the magnet assembly firmly in position on the plastic magnet holder section 12. The position of the bar magnets 52 may be adjusted towards and away from the neck 20 of the cathode ray tube on which the plastic magnet holder 10 may be placed by sliding the beam 54 with respect to spring arms 61 of the spring clip 56 that holds it. If the magnets 52 are improperly oriented, the beam 54 may be removed, rotated 180° about its longitudinal axis and replaced between arms 61. The purpose of notch 30 (FIG. 4) is to provide clearance for the beam 54 so that the bar magnet 52 may be moved closer to the pole piece structure inside of the tube.

The magnet holder 10 is positioned on the neck 20 of the cathode ray tube with which it is to be used by inserting the free end of the neck 20 of the tube in the hole through the magnet holder 10 and by pushing the plastic holder 10 along the neck 20 of the tube. The plastic holder 10 is pushed along the neck 20 of the tube to its final adjusted position thereon, the diameter of the hole through the magnet holder 10 being enlarged slightly by elastically deforming the folded portions 14 of the magnet holder 10, whereby the plastic magnet holder 10 is firmly held in its adjusted position. Since the cross section of the tube neck 20 is substantially cylindrical, even though it may not be perfectly cylindrical, the plastic holder 10 can also be rotated as well as be moved axially, to arrive at its final adjusted position.

The herein described magnet holder 10 provides a fixed angular relation between the magnets 46 and 52 held thereby. The magnet holder 10 will conform itself to the neck 20 of a cathode ray tube even though the neck 20 varies in roundness or diameter from the nominal dimensions thereof within commercially acceptable tolerances. The magnet holder 10 permits adjustment of the position of the holder 10 on the neck 20 of the cathode ray tube both axially of the neck and annularly thereof and firmly holds its adjusted position. Also, the permanent magnets 52 and 52' are held firmly in their adjusted position with respect to the neck 20 of the picture tube.

What is claimed is:

1. A magnet holder of resilient non-conductive, non-magnetic material for a magnet having legs,
said holder comprising a plurality of circumferentially arranged sections,
one of said sections comprising a magnet holding section,
each magnet holding section comprising a body having a generally planar outer surface opposite a generally cylindrical inner surface,
arms extending from said generally planar surface in a direction away from said cylindrical surface,
the free ends of said arms being turned towards each other and towards said generally planar surface and being adapted to receive the ends of a magnet-retaining spring clip,
there being holes through said body perpendicular to said generally planar surface to receive the legs of said magnet.

2. The combination of a magnet and a magnet holder,
said magnet holder comprising resilient non-conductive, non-magnetic material,
said holder comprising a plurality of circumferentially arranged sections,
one of said sections comprising a magnet holding section having ends,

and the other of said sections comprising a spring-like section having ends,
an end of said spring-like section being joined to an end of said magnet holding section,
said magnet holding sections comprising a body having a generally planar outer surface opposite a generally cylindrical inner surface,
arms extending from said planar surface in a direction away from said cylindrical surface,
the free ends of said arms being turned towards each other and towards said generally planar surface,
there being holes through said body perpendicular to said generally planar surface,
a magnet having legs,
said legs extending into said holes in said body,
a spring clip having ends and a magnet embracing portion,
said magnet embracing portion resiliently holding said magnet,
and said spring clip ends extending into the inturned portions of said arms.

3. The combination of a magnet and a magnet holder,
said magnet holder comprising resilient non-conductive, non-magnetic material,
said holder comprising a plurality of circumferentially arranged pairs of sections,
one of each pair comprising a magnet holding section and the other of each pair comprising a spring-like section,
the ends of the spring-like section being joined to the ends of said magnet holding section,
said magnet holding sections comprising a body having a generally planar surface opposite a generally cylindrical surface,
arms extending from said planar surface in a direction away from said cylindrical surface,
the free ends of said arms being inturned towards each other and towards said generally planar surface,
there being holes through said body perpendicular to said generally planar surface,
a magnet having legs,
said legs extending into said holes in said body,
a spring clip having ends and a magnet embracing portion,
said magnet embracing portion resiliently holding said magnet,
and said spring clip ends extending into the inturned ends of said arms.

4. The combination of a magnet and a magnet holder,
said magnet holder comprising resilient non-conductive, non-magnetic material,
said holder comprising a plurality of circumferentially arranged pairs of sections,
one of each pair comprising a magnet holding section and the other of each pair comprising a folded ribbon section,
the ends of the ribbon section being joined to the ends of said magnet holding section,
said magnet holding sections comprising a body having a generally planar surface opposite a generally cylindrical surface,
arms extending from said planar surface in a direction away from said cylindrical surface,
the free ends of said arms being inturned towards each other and towards said generally planar surface,
there being holes through said body perpendicular to said generally planar surface,
a magnet having legs,
said legs extending into said holes in said body,
a spring clip having ends and a magnet embracing portion,
said magnet embracing portion resiliently holding said magnet,
and said spring ends extending into the inturned ends of said arms.

5. The combination of a magnet and a magnet holder,
said magnet holder comprising resilient non-conductive, non-magnetic material,
said holder comprising a plurality of circumferentially arranged pairs of sections,
one of each pair comprising a magnet holding section and the other of each pair comprising a folded ribbon section,
the ends of the ribbon section being joined to the ends of said magnet holding section,
said magnet holding sections comprising a body having a generally planar surface opposite a generally cylindrical surface,
arms extending from said planar surface in a direction away from said cylindrical surface,
the free ends of said arms being turned towards each other and towards said generally planar surface,
there being holes through said body perpendicular to said generally planar surface,
a magnet having legs,
said legs extending into said holes in said body,
a spring clip having spring ends and a magnet embracing portion,
said magnet embracing portion resiliently holding said magnet,
and said spring ends extending into the inturned portions of said arms,
said spring clip also including a pair of arms each having joined oppositely slanting portions,
a beam member,
one flange of said beam member being held between the junctions of the oppositely slanting portions,
and a permanent magnet being held by said beam member at one end thereof.

6. An arrangement for adjustably holding permanent magnets on an electro-magnet comprising,
a spring clip having a magnet embracing portion,
said spring clip also including a pair of arms each having joined oppositely slanting portions,
a beam member comprising two spaced flanges joined by a web to form a structure having an H-shaped cross-section,
one flange of said beam member being held between the junctions of the oppositely slanting portions,
and a permanent magnet being held by said beam member at one end thereof.

7. An arrangement for adjustably holding permanent magnets on an electro-magnet comprising,
a spring clip having a magnet embracing portion,
said spring clip having spring ends extending in opposite directions from said magnet embracing portion,
said spring clip also including a bridge portion and a slantingly extending portion,
a pair of arms extending laterally of said slanting portion,

the arms each having joined oppositely slanting portions,
a beam member comprising two spaced substantially parallel elongated flanges joined for at least a portion of their respecitve lengths by a web to form a structure having an H-shaped cross-section,
one flange of said beam member being held between the junctions of the oppositely slanting portions,
and a permanent magnet being held by said beam member at one end thereof.

8. An arrangement for adjustably holding permanent magnets on an electro-magnet comprising,
a spring clip having a magnet embracing portion,
said spring clip also including a pair of arms each having joined oppositely slanting portions,
a beam member comprising two spaced substantially parallel elongated flanges joined by a web to form a structure having an H-shaped cross-section,
the web of said beam member extending less than the length of said beam member,
the flanges of said beam member being formed to hold a permanent magnet,
one flange of said beam member being held between the junctions of said oppositely slanting portions.

9. An arrangement for adjustably holding permanent magnets on an electro-magnet comprising,
a portion of spring metal having arms extending laterally therefrom,
each of said arms having portions which extend slantingly towards each other,
and portions which extend slantingly away from each other joined to said first-mentioned slanting portions,
a beam member comprising two spaced substantially parallel elongated flanges joined by a web to form a structure having an H-shaped cross-section,
one flange of said beam member being held between the junctions of the slanting portions,
the web of said beam member extending less than the length of said beam mmeber,
the flanges of said beam member being formed to hold a permanent magnet.

10. A permanent magnet holder comprising,
a beam member comprising two spaced flanges joined by a web to form a structure having an H-shaped cross-section,
the web of said beam member extending less than the length of said beam member,
the flanges of said beam member being formed to hold a permanent magnet.

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JOHN F. BURNS, *Primary Examiner.*