Nov. 29, 1955 H. A. BERNREUTER 2,725,529

ELECTRICAL INSTRUMENTS

Filed Nov. 13, 1951

Fig. 1

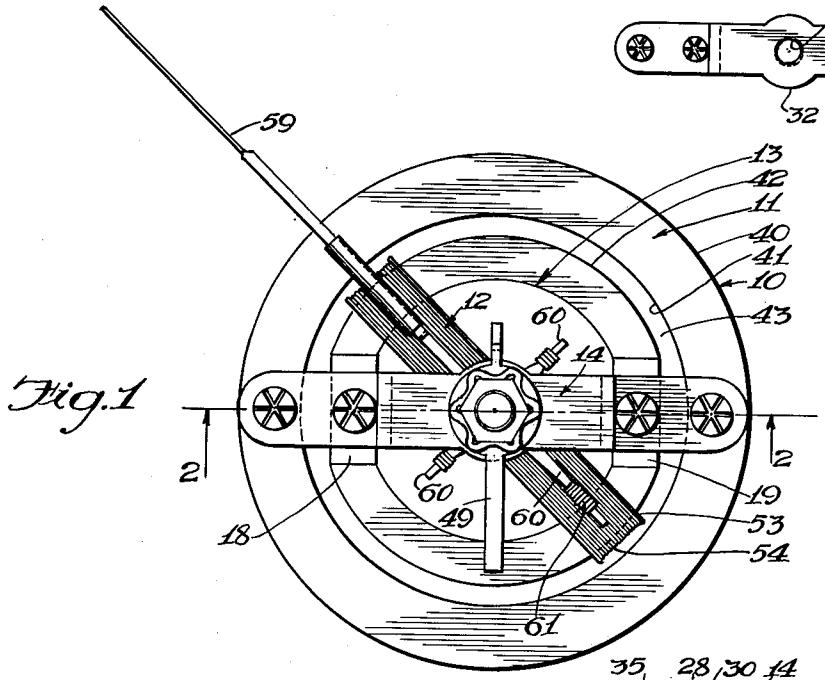


Fig. 5

Fig. 4

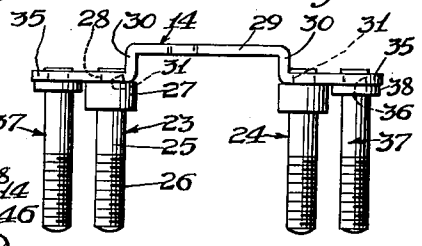


Fig. 2

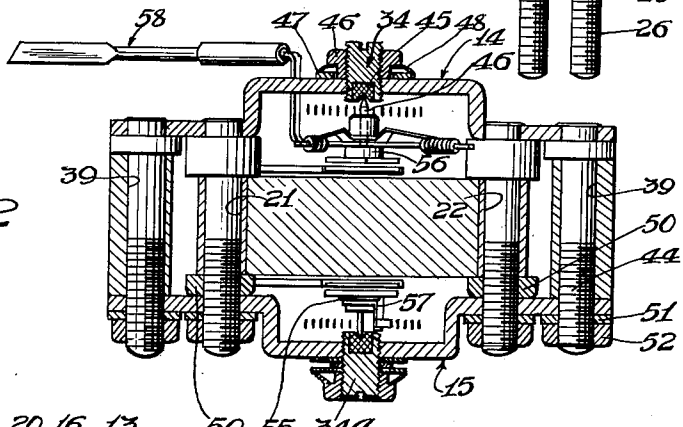
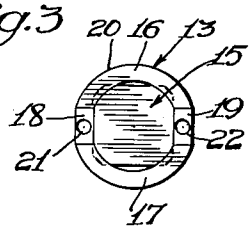


Fig. 3



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ELECTRICAL INSTRUMENTS

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5 Claims. (Cl. 324—151)

The present invention relates to electrical instruments, and is particularly concerned with electrical instruments of the moving coil type, in which a permanent magnet is employed inside the moving coil as a core.

One of the objects of the invention is the provision of an improved electrical instrument of the class described which is rugged in construction, and which utilizes a minimum weight of permanent magnet material, and which maintains its calibration for a long period of time without necessity for readjustment or repair of its parts.

Another object of the invention is the provision of an improved construction for electrical instruments of the class described which is light in mass, and which is self-shielding in so far as other magnetic influences are concerned, and in which the bridges and bearings for the moving coil are fixedly supported on the magnetic core.

Another object of the invention is the provision of an improved construction in which the bridge is supported on the magnetic core by means of rods of non-magnetic metal passing through sections of non-magnetic metal which have been integrally attached to an Alnico permanent core block so that it is unnecessary to drill any holes in the Alnico; and the holes are provided in the non-magnetic metal, which may be more easily worked for supporting the bridge in a solid and permanent manner upon the permanent magnet core.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings accompanying the specification,

Fig. 1 is a top plan view of an electrical instrument movement embodying the invention;

Fig. 2 is a sectional view, taken on the plane of the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a diagrammatic plan view of the permanent magnet core with its pole pieces and brass inserts for supporting the bridge;

Fig. 4 is a side elevational view of the bridge construction with its supporting posts;

Fig. 5 is a top plan view of the bridge of Fig. 4.

Referring to the drawings 10 indicates the moving coil instrument movement assembly, which preferably includes an annular yoke 11 of paramagnetic material, such as soft iron, a moving coil assembly 12, a permanent magnet core assembly 13, and a pair of bridge assemblies 14 and 15.

The permanent magnet core assembly 13 is shown in Fig. 3 in plan; and it consists of a permanent magnet block 15, to which there have been integrally secured, by sweating, the two pole pieces 16 and 17 and two block-like brass inserts 18, 19. The pole pieces 16 and 17 are partially annular; and with the two brass blocks 18 and 19 they completely surround the permanent magnet

block 15, which is preferably made of paramagnetic material of high coercive force, such as that sold under the trade name "Alnico."

The parts mentioned are all integrally sweated together to form a solid metallic core assembly, the outer surface 20 of which is machined to a cylindrical form.

The two brass blocks 18 and 19 are provided with drilled apertures 21, 22 for receiving the inner bridge posts 23 and 24 (Fig. 4). The inner bridge posts 23, 24 are preferably made of brass or other nonmagnetic material, and each includes a cylindrical shank 25 with a lower threaded portion 26 and a cylindrical enlargement 27 near the reduced upper end portion 28. The upper bridge 29, forming a part of the bridge assembly 14, comprises a strip of brass, which is provided with the upwardly extending offsets 30 adjacent the two apertures 31, which receive the bridge posts 23 and 24.

The two offsets 30 are joined by the body of the bridge 29, which has a central partially circular enlargement 32, having a central threaded bore 33 for the upper jewel supporting screw 34. The upper bridge 29 also has yoke supporting portions 35 at each end, with a bore 36 at each end, for receiving the yoke supporting posts 37.

Each yoke supporting post 37 may be similar in construction to the core supporting posts 23, 24, except that the enlarged cylindrical portion or head 38 on the yoke supporting portion 37 is shorter in an axial direction so that the yoke 11 may be supported symmetrically with respect to the core 13, although the yoke is deeper in an axial direction.

All of the posts 23, 24, 37, 37 have their upper reduced end portions 28 secured in the apertures 31 and 36 by being upset or deformed or riveted over above the bridge 29, with the posts extending at right angles to the bridge.

The soft iron yoke 11 has a pair of diametrically oppositely located axially extending bores 39 for receiving the posts 37; and the yoke 11 is preferably of uniform cross section and of annular shape, having an outer cylindrical surface 40 and an inner cylindrical surface 41.

The inner cylindrical surface 41 is spaced from the outer cylindrical surface 42 of the core 13 by a definite uniform annular space 43, providing an air gap, which is of uniform width except at the brass inserts 18 and 19, where the air gap is of less importance because the moving coil 12 does not move into this range of the air gap.

The lower bridge 15 comprises a similar brass strip, which has registering apertures 44 for receiving the ends of the posts 23, 24, and 37 carried by the upper bridge. Both bridges have the central enlargement 32 and threaded bore 33 for the jewel supporting screws 34 and 34*a*, which may be similar.

Each jewel supporting screw has a socket in its inner end for receiving the jewel 45, having a conical bearing depression for receiving the conical end 46 of each spindle carried by the moving coil assembly 12. Each jewel supporting screw 34 is threaded into the bore 33, where it is secured by a lock nut 46, having an annular shoulder 47 for engaging a spring washer 48, which in turn engages the spring supporting member 49 that is rotatably mounted on a cylindrical portion of the lock nut 46.

The posts 23 and 24 pass through the bores 21, 22 of the permanent magnet core, which is secured on these posts by nuts 50. The nuts 50 act as spacers for spacing the permanent magnet core assembly 13 from the lower bridge; and the enlargements 27 act as spacers for spacing it from the upper bridge.

The posts 37 pass through the apertures 39 in the yoke 11; and all of the posts pass through the apertures 44 in the lower bridge 15 and are provided with split lock wash-

ers 51 and nuts 52, fixedly securing the bridges to the magnetic core assembly 13 and to the yoke 11.

The moving coil assembly 12 may consist of a substantially rectangular spool 53 of nonmagnetic material, such as aluminum, supporting the coils of insulated wire 54, to which the trunnion assemblies 55 and 56 are secured in axial alignment. Each trunnion assembly includes a conically pointed spindle 46 and a spring supporting member 57 secured thereon for supporting the inner end of a current transmitting spring, each of which is connected to one end of the coils 54.

The outer end of each spring is connected to an outer spring supporting member 49; and the upper trunnion assembly 56 carries a suitable pointer assembly 58, with the elongated pointer 59 extending in one direction, and three balancing arms 60 extending in three directions at right angles and provided with adjustable spring counterweights 61.

The operation of the present instrument movement is substantially the same as all other instruments of this type, as the moving coil receives current through the springs, which produces a magnetic field reacting with the field that is caused by the permanent magnet 15.

The outer yoke 11 shields the coil from extraneous magnetic influences; and the fixed securement of the yoke and permanent magnetic core by means of bridges and through bolts provides an air gap of definite size, which is maintained throughout the life of the instrument, and which involves a minimum amount of machine work in the manufacture of the movement.

The present movement is particularly rugged and adapted to withstand jar; and it may be manufactured in very small sizes so that it is light in mass, self-shielding, and solid in construction.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electrical instrument movement comprising an upper bridge and a lower bridge of nonmagnetic metal, each bridge comprising a strip of metal having a central threaded aperture, a threaded member in each said aperture, a jewel carried by each threaded member, the jewels facing each other, and said bridges being provided with a pair of aligned apertures adjacent each end, four threaded studs, each having an enlargement and a reduced portion beyond said enlargement, said reduced portions being secured in the apertuers in one of said bridges, an annular field yoke of paramagnetic metal, having inner and outer cylindrical surfaces, and having diametrically located parallel through bores receiving the outermost two of said studs, a permanent magnet core assembly comprising a central core magnetized diametrically and located in an annular pole piece member having inner and outer cylindrical surfaces, and comprising a pair of partially annular pole pieces joined by sweating at their ends to a pair of brass inserts, said inserts having a pair of parallel through bores receiving the innermost of said studs, the other bridge being mounted with its apertures receiving said studs outside the pole piece assembly and yoke, and secured by threaded members clamping the pole piece member and yoke against said enlargements, and securing the pole piece assembly and yoke in definite spaced relation to each other to form a uniform annular air gap, and a moving coil unit mounted in said jewels and rotating in said air gap between the pole piece assembly and the yoke.

2. An electrical instrument movement comprising an upper bridge and a lower bridge of nonmagnetic metal, each bridge comprising a strip of metal having a central threaded aperture, a threaded member in each said aperture, a jewel carried by each threaded member, the jewels facing each other, and said bridges being provided with a pair of aligned apertures adjacent each end, four threaded studs, each having an enlargement and a reduced portion beyond said enlargement, said reduced portions being secured in the apertures in one of said bridges, an annular field yoke of paramagnetic metal, having inner and outer cylindrical surfaces, and having diametrically located parallel through bores receiving the outermost two of said studs, a permanent magnet core assembly comprising a central core magnetized diametrically and located in an annular pole piece member having inner and outer cylindrical surfaces, and comprising a pair of partially annular pole pieces joined by sweating at their ends to a pair of brass inserts, said inserts having a pair of parallel through bores receiving the innermost of said studs, the other bridge being mounted with its apertures receiving said studs outside the pole piece assembly and yoke, and secured by threaded members clamping the pole piece member and yoke against said enlargements, and securing the pole piece assembly and yoke in definite spaced relation to each other to form a uniform annular air gap, and a moving coil unit mounted in said jewels and rotating in said air gap between the pole piece assembly and the yoke, said bridges each having its central portion offset outwardly to provide increased central space for said moving coil unit.

3. An electrical instrument movement comprising an upper bridge and a lower bridge of nonmagnetic metal, each bridge comprising a strip of metal having a central threaded aperture, a threaded member in each said aperture, a jewel carried by each threaded member, the jewels facing each other, and said bridges being provided with a pair of aligned apertures adjacent each end, four threaded studs, each having an enlargement and a reduced portion beyond said enlargement, said reduced portions being secured in the apertures in one of said bridges, an annular field yoke of para-magnetic metal, having inner and outer cylindrical surfaces, and having diametrically located parallel through bores receiving the outermost two of said studs, a permanent magnet core assembly comprising a central core magnetized diametrically and located in an annular pole piece member having inner and outer cylindrical surfaces, and comprising a pair of partially annular pole pieces joined by sweating at their ends to a pair of brass inserts, said inserts having a pair of parallel through bores receiving the innermost of said studs, the other bridge being mounted with its apertures receiving said studs outside the pole piece assembly and yoke, and secured by threaded members clamping the pole piece member and yoke against said enlargements, and securing the pole piece assembly and yoke in definite spaced relation to each other to form a uniform annular air gap, and a moving coil unit mounted in said jewels and rotating in said air gap between the pole piece assembly and the yoke, said core and pole pieces being substantially shorter than said yoke and located inwardly of both ends of said yoke, for maximum shielding of said yoke and moving coil unit.

4. In an electrical instrument movement comprising an upper bridge and a lower bridge of nonmagnetic metal, each bridge comprising a strip of metal having a central threaded aperture, a threaded member in each said aperture, a jewel carried by each threaded member, the jewels facing each other, and said bridges being provided with a pair of aligned apertures adjacent each end, four threaded studs, each having an enlargement and a reduced portion beyond said enlargement, said reduced portions being secured in the apertures in one of said bridges, an annular field yoke of paramagnetic metal, having inner and outer cylindrical surfaces, and having diametrically located parallel through bores receiving the outermost two of said studs, a permanent magnet core assembly comprising a central core magnetized diametri-

cally and located in an annular pole piece member having inner and outer cylindrical surfaces, and comprising a pair of partially annular pole pieces joined by sweating at their ends to a pair of brass inserts, said inserts having a pair of parallel through bores receiving the innermost of said studs, the other bridge being mounted with its apertures receiving said studs outside the pole piece assembly and yoke, and secured by threaded members clamping the pole piece member and yoke against said enlargements, and securing the pole piece assembly and yoke in definite spaced relation to each other to form a uniform annular air gap, and a moving coil unit mounted in said jewels and rotating in said air gap between the pole piece assembly and the yoke, and spacing means carried by said threaded studs and engaging the ends of said pole piece assembly to center the pole piece assembly longitudinally inside the annular yoke.

5. An electrical instrument movement comprising an upper bridge and a lower bridge of nonmagnetic metal, each bridge comprising a strip of metal having a central threaded aperture, a threaded member in each said aperture, a jewel carried by each threaded member, the jewels facing each other, and said bridges being provided with a pair of aligned apertures adjacent each end, four threaded studs, each having an enlargement and a reduced portion beyond said enlargement, said reduced portions being secured in the apertures in one of said bridges, an annular field yoke of paramagnetic metal, having inner and outer cylindrical surfaces, and having

diametrically located parallel through bores receiving the outermost two of said studs, a permanent magnet core assembly comprising a central core magnetized diametrically and located in an annular pole piece member having inner and outer cylindrical surfaces, and comprising a pair of partially annular pole pieces joined by sweating at their ends to a pair of brass inserts, said inserts having a pair of parallel through bores receiving the innermost of said studs, the other bridge being mounted with its apertures receiving said studs outside the pole piece assembly and yoke, and secured by threaded members clamping the pole piece member and yoke against said enlargements, and securing the pole piece assembly and yoke in definite spaced relation to each other to form a uniform annular air gap, and a moving coil unit mounted in said jewels and rotating in said air gap between the pole piece assembly and the yoke, said magnetic core being integrally secured inside said pole pieces and brass inserts by being sweated to said pole pieces and brass inserts.

References Cited in the file of this patent

UNITED STATES PATENTS

1,740,548	Macgahan	Dec. 24, 1929
1,920,764	Nickle	Aug. 1, 1933
1,927,346	Lawrence	Sept. 19, 1933
2,245,781	Hickok	June 17, 1941
2,414,462	Grace	Jan. 21, 1947
2,607,812	Lederer	Aug. 19, 1952