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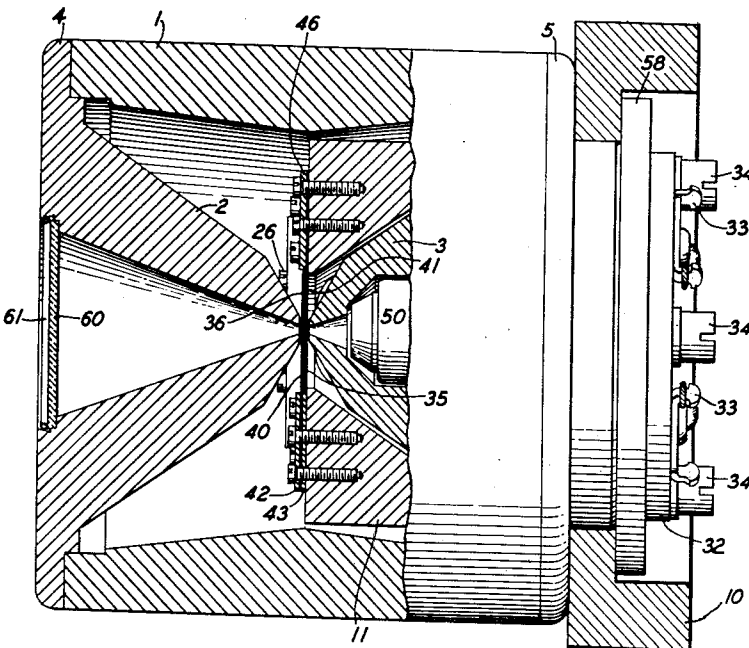
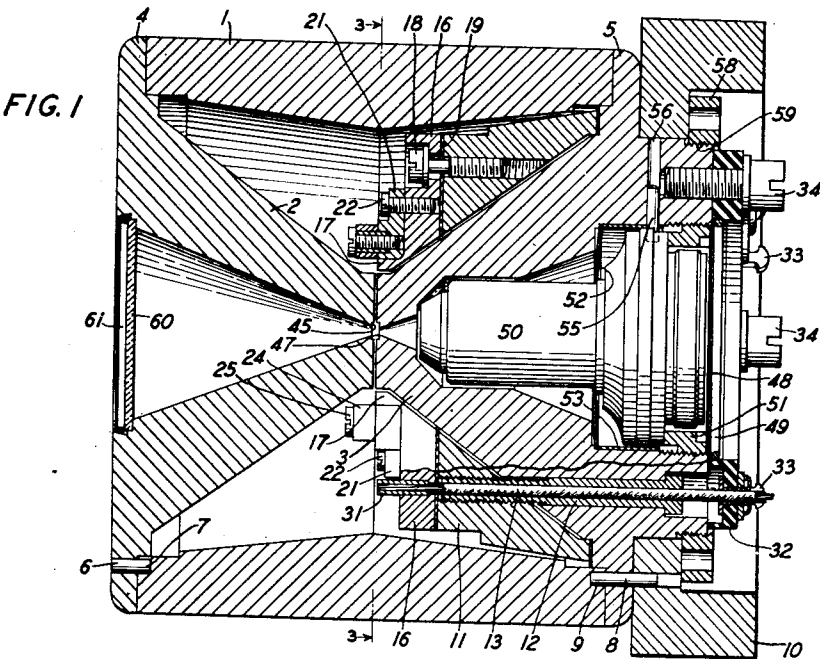
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LIGHT VALVE

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2 Sheets-Sheet 1



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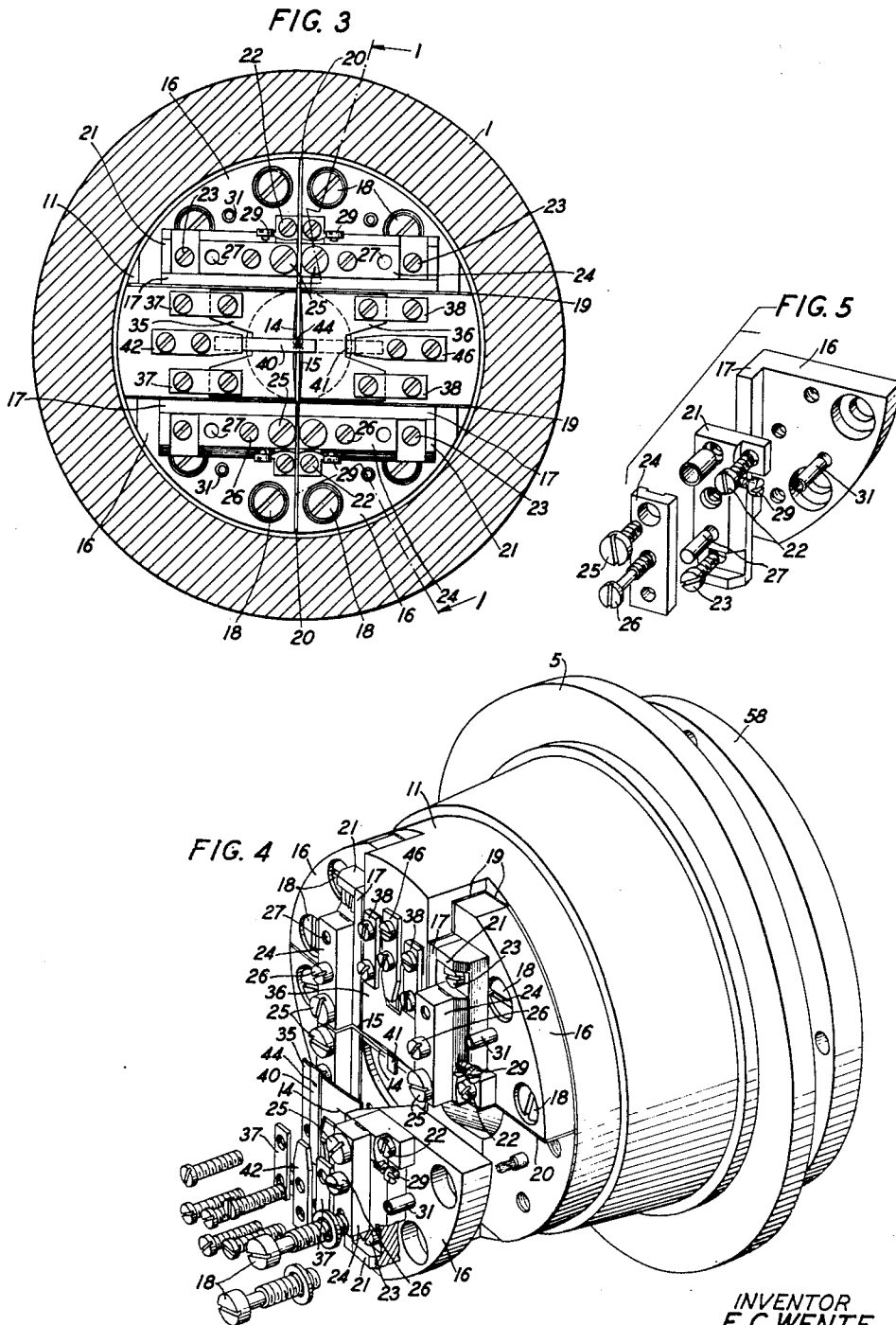
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LIGHT VALVE

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9 Claims. (Cl. 88-61)

This invention relates to improvements in translating devices such as light valves employed in sound film recording systems.

The object of the invention is to provide a self-contained light valve of compact construction having a highly efficient magnetic system.

A feature of the invention resides in the provision of a novel magnet structure permitting the disposition of the apertured pole-pieces with respect to the magnet in the paths of greatest flux leakage between the poles of the magnet.

A further feature of the invention resides in the provision of novel means for securing certain of the light valve elements together, which securing means provides a passage for electrical conductors carrying signal currents from the exterior of the light valve to the movable light modulating ribbons within the light valve.

Small, compact light valves have been developed heretofore for use in sound film recording apparatus in which space is a limiting factor. In these light valves a permanent magnet is used in place of the electromagnet of the earlier light valves. It has been found in the permanent magnet light valves employed heretofore an appreciable percentage of the total flux is lost in leakage paths between the magnet poles. This condition greatly limits the efficiency of the valve due to limited useful flux at the air-gap.

This difficulty has been overcome by a light valve construction in which a permanent magnet is employed having a shape permitting the disposition of the apertured pole-pieces in the paths of greatest flux leakage between the poles of the magnet. Specifically, the magnetic structure of the light valve in accordance with this invention comprises a cylindrical permanent magnet presenting annular pole-pieces of opposite polarity at the opposite ends thereof and a pair of conical, apertured pole-pieces extending inwardly from the opposite ends of the cylindrical magnets with their bases in magnetic conductive connection with the magnet pole faces. The pole faces of the pole-pieces are separated to form an air-gap in which a vibratile ribbon is suspended in front of the aligned apertures in the pole-pieces. Novel means are provided permitting the passage of an electrical conductor from the exterior of the light valve unit to the vibratile ribbon within the light valve. These and other features of the invention will become apparent from the following description taken when read in connection with the accompanying drawings in which:

Fig. 1 is an elevation, in section taken along 55 16 having an integral upturned flange 17. The

line 1-1 of Fig. 3, of a light valve in accordance with this invention;

Fig. 2 is a view, partly in section, of the light valve of Fig. 1 rotated through 90 degrees about the optical axis;

Fig. 3 is a section through lines 3-3 of Fig. 1;

Fig. 4 is a partly exploded view in perspective of one pole-piece and a ribbon supporting member associated therewith, and

Fig. 5 is a detailed showing in perspective of one ribbon clamping unit.

Referring to Fig. 1, numeral 1 designates a cylindrical member of permanent magnet material presenting annular pole faces at opposite ends thereof. A pair of apertured, conical pole-pieces 2 and 3 are provided with integral flange portions 4 and 5, respectively. The pole-pieces extend inwardly from opposite ends of the magnet with their flange portions in contact with an annular pole face of the magnet.

To insure proper location of the pole-pieces in the magnet, there is provided a pin 6 in pole-piece 2 which extends into a recess 7 in magnet 1. Similarly, pole-piece 3 is provided with a pin 8 which extends into recess 9 in the magnet. The pin 8 extends to the exterior of the light valve assembly and provides means for properly locating the light valve in an adapter plate 10 of non-magnetic material which may be secured to a film recording apparatus.

The pole-piece 3 has mounted thereon a member 11 of non-magnetic material which constitutes a support for ribbon clamping units and aperture forming members to be described in the following paragraphs.

Supporting member 11 is secured to pole-piece 3 by means of four machine screws 12, one of which is shown in Fig. 1. Machine screw 12 has a central boring providing a passage for an insulated conductor 13 by means of which the sound modulated currents are transmitted to the movable light modulating elements of the light valve.

A pair of current conducting light modulating ribbons 14 and 15 are supported above the pole face of pole-piece 3 adjacent the aperture therein. The ends of each ribbon are anchored by means of individual clamping units of non-magnetic material which are secured to member 11. The four clamping units provided are identical in structure and, therefore, a detailed description of one unit, as shown clearly in Figs. 4 and 5, will suffice.

The clamping unit comprises a mounting block 16 having an integral upturned flange 17. The

mounting block is secured to member 11 by machine screws 18. It will be noted, particularly from Fig. 1, that there is sufficient clearance between the screws 18 and the mounting block 16 to permit limited movement of the mounting block relative to the supporting member 11 to permit adjustment of the block prior to final clamping thereof by means of these screws. Blocks 16 are electrically insulated from member 11 by insulating material 19. The mounting blocks are also insulated from each other by insulating strips 20. Strips 20 also constitute means for maintaining the conducting ribbons in approximately proper spaced relation. The thickness of strip 20 should, therefore, have a thickness roughly equal to the desired spacing between the working edges of the ribbons 14 and 15 and must be of uniform thickness throughout.

A clamp carriage 21 is secured to block 16 by machine screws 22 and 23. A clamp 24 engages one end of a conducting ribbon on the clamp carriage as shown clearly in Fig. 4. Clamp 24 is secured to carriage 21 by means of machine screws 25 and 26. A pin 27 cooperates with holes in the carriage 21 and clamp 24 to insure proper alignment of the clamping edges of the clamp carriage and clamp. Machine screw 29 engages a threaded hole extending through carriage 21. The end of the screw 29 bears against a face of flange 17.

Referring to Fig. 1, one end of wire 13 may be soldered in a metallic sleeve 31, which sleeve is press-fitted into block 16. The other end of wire 13 extends through an annular terminal support 32 of insulating material and is connected to a terminal 33. Machine screws 34 secure annular member 32 to the rear face of pole-piece 3. Electrical connections from a source of sound modulated current may be made to terminals 33. It is understood that four terminals are provided and that a current conducting wire similar to wire 13 is carried from each of the four mounting blocks 16 to one of the terminals 33.

In order to reduce the resistance of the electrical circuit including the vibratile ribbons 14 and 15 these ribbons, clamp 24, clamp carriage 21 and mounting block 16 are coated with a thin film of gold.

To prevent excessive movement of ribbons 14 and 15 at overload and to prevent contact between the ribbons and aperture plates 40 and 41, hereinafter described, two metallic guard strips 35 and 36, disposed in the plane including the ribbons, are secured to supporting member 11 by clamping bars 37 and 38, respectively. The end of strips 35 and 36 adjacent the ribbons 14 and 15, respectively, conform substantially to a curve assumed by the ribbons at their extreme open position during normal operation of the light valve. These guard plates are, however, positioned to provide sufficient clearance for the ribbons during normal operation.

Disturbing light reflections from the inner surface of pole-piece 2 and from the surfaces of the ribbons 14 and 15 are effectively eliminated by providing a plurality of opaque apertured elements spaced along the optical system with the apertures disposed at the optical axis. A pair of apertured elements are disposed on opposite sides of the ribbons 14 and 15. These elements are designated by numerals 40 and 41. Apertured element 40 is secured to member 11 by clamp 42. A shim 43 (Fig. 2) is provided for raising element 40 above the plane including the ribbons and guard member 35. The free end

of element 40 is apertured as at 44 and extends into a groove 45 in the pole face of pole-piece 2 with the aperture 44 in alignment with the pole-piece aperture. Element 41 is secured to member 11 by clamp 46. The apertured free end of element 41 extends into a groove 47 and pole-piece 3 with the aperture in optical alignment with the pole-piece aperture and the aperture in element 40. In Fig. 1, the conducting ribbons 14 and 15 and apertured elements 40 and 41 are not shown in position between the pole faces. However, the position of these elements with respect to the pole faces is clearly shown in Figs. 2, 3 and 4.

An objective lens tube 50 is mounted in the aperture of pole-piece 3 and is held therein by means of externally threaded ring 51 which engages an internal thread on pole-piece 3. A flat annular disc spring 52 maintains the lens tube 50 in engagement with the bearing surface of ring 51. A shim 53 may be provided to align the center of the lens tube with the center line of the optical system. Rotation of the lens tube in the pole-piece aperture is prevented by a pin 55 cooperating with hole 56 and pole-piece 3 and a similar hole in the lens tube housing 50.

An additional apertured member 48 (Fig. 1) is secured to the rear face of pole-piece 3 by means of a coil of spring wire 49. This apertured member prevents the transmission of disturbing light reflections from the inner surface of the lens tube 50.

A transparent plate 60 is secured in pole-piece 2 by means of a spring wire 61 to insure the exclusion of dust and prevents the transmission of acoustic disturbances to the ribbons 14 and 15.

Before assembling the elements of the valve into a complete unit as shown in Fig. 1, the unit assembly, as shown in Fig. 4, including pole-piece 3, supporting member 11, mounting blocks 16 and the ribbon clamping elements 21 and 24 are mounted in a specially constructed device by means of which the spacing and tensioning adjustments of the conducting ribbons, adjustment of the aperture forming members 40 and 41 and ribbon guard plates 35 and 36 are made with respect to each other and to pole-piece 3 prior to the assembly of this unit with pole-piece 2 in magnet 1. While in the adjusting device, spacing strips 20 are inserted between two adjoining blocks 16 and these blocks are adjusted with respect to the aperture in pole-piece 3 by simultaneous movement thereof. The operation is repeated for the second pair of adjoining blocks on the opposite side of the pole-piece aperture. When proper adjustment is obtained, screws 18 are given a final turn sufficient to clamp the blocks in adjusted position. In the next operation each ribbon end is clamped between its clamp carriage 21 and clamp 24. There is sufficient clearance between screws 22 and 23 and the holes in carriage 21 (when the screws are loosened slightly) to permit movement of the carriage and associated clamp with respect to block 16. By moving screw 29 in a clockwise direction to cause the end thereof to engage the flange 17, the carriage 21 and associated clamp 24 are moved in a direction longitudinally of the conducting ribbon clamped thereby to produce the proper tension adjustments of the ribbon. The clamp carriage is rigidly secured to block 16 after the ribbons are properly tensioned. The guard plates 35 and 36 and apertured members 40 and 41 are then adjusted and clamped in po-

sition with respect to ribbons 14 and 15 and the aperture in pole-piece 3.

The lens tube 50 is also adjusted to proper position in the pole-piece 3 while this unit is mounted in the adjusting device.

The unit assembly, as shown in Fig. 4 is then assembled with pole-piece 2 in magnet 1.

What is claimed is:

1. A translating device comprising a cylindrical member of permanent magnet material, a pair of apertured conical pole-pieces each provided with a flanged base, means secured to one of said pole-pieces for supporting a conducting element above the face of said pole-piece adjacent the aperture therein, said pole-pieces extending inwardly from opposite ends of said cylindrical magnet with the flanged portions thereof in magnetic conductive engagement with said magnet.
2. A translating device comprising a pair of oppositely disposed conical shaped pole-pieces provided with aligned apertures, a supporting member of non-magnetic material surrounding one of said pole-pieces and secured thereto, an opaque member having an aperture in one end thereof, means securing said opaque member to said supporting member above the faces of said pole-piece with the apertured end thereof extending into the area of the aperture in said pole-piece, a conducting element having its ends secured to said supporting member and disposed between said pole-pieces, and a cylindrical member of permanent magnet material encircling said pole-pieces with each of its ends in magnetic conductive connection with one of said pole-pieces.
3. A translating device comprising a cylindrical magnet, a pair of apertured pole-pieces extending inwardly from opposite ends of said magnet and in magnet conductive connection with opposite polar extremities thereof, a conducting ribbon, a member of non-magnetic material surrounding one of said pole-pieces, means on said member for supporting said ribbon above the face of said pole-piece adjacent the aperture therein, and means extending through said pole-piece and member for securing said member to said pole-piece, said securing means having a central boring providing a passage for an electrical conductor between said ribbon and an externally mounted terminal means.
4. A translating device comprising a cylindrical member of permanent magnet material, a pair of apertured pole-pieces extending inwardly from opposite ends of said member in magnetic conductive connection therewith, a pair of opaque elements each having an aperture in one end thereof and disposed in spaced relation in the air-gap between said pole-pieces with the apertures therein in alignment with the apertures in said pole-pieces, a conducting ribbon disposed between said opaque members adjacent the aperture therein, and a common supporting means for said ribbon and said opaque members.
5. A translating device comprising a cylindrical magnet, a pair of oppositely disposed apertured pole-pieces extending inwardly from opposite ends of said magnet, a conducting ribbon, non-magnetic means secured to a surface of one of said pole-pieces within the magnet for supporting said ribbon between the oppositely disposed pole faces of said pole-pieces adjacent the apertures therein, a lens tube mounted wholly within said ribbon supporting pole-piece in alignment with the aperture in the pole face thereof, adjustable means for retaining said lens tube in said pole-piece and resilient means within said pole-piece for urging said lens tube against said retaining means.
6. A translating device comprising a pair of conically shaped oppositely disposed apertured pole-pieces each provided with a recess in the face thereof, a conducting ribbon disposed in the air-gap between said pole-pieces, a pair of opaque members each having an aperture in one end thereof, means mounting each opaque member with the apertured end thereof extending into the recess in the pole face of one of said pole-pieces, and a cylindrical member of permanent magnet material encircling said pole-pieces with each of its ends in magnetic conductive connection with the base of one of said pole-pieces.
7. A translating device comprising a cylindrical member of permanent magnet material, a pair of apertured pole-pieces extending inwardly from opposite ends of said member and in magnetic conductive connection therewith, the inwardly extending ends of said pole-pieces forming an air-gap between the faces thereof, a supporting member of non-magnetic material secured to one of said pole-pieces within said cylindrical member by a plurality of centrally bored screw means extending through said pole-piece and supporting member, a conducting ribbon disposed in the air-gap between said pole-pieces, a plurality of metallic ribbon clamping units secured to, but insulated from, said supporting member, and an electrical conductor extending through each of said screw means, each conductively connected to one of said ribbon clamping units.
8. A translating device comprising a hollow cylindrical member of permanent magnet material, a pair of apertured conical pole-pieces each provided with a base, means secured to one of said pole-pieces for supporting a conducting element above the face of said pole-piece adjacent the aperture therein, said pole-pieces extending inwardly from the opposite ends of said cylindrical magnet to substantially midway between said ends with their base portions in magnetic conductive connection with said magnet and with their apertures in alignment.
9. A magnet structure for a translating device comprising a hollow cylindrical member of permanently magnetized material having a pole-piece positioning surface at each end, a reentrant apertured pole-piece in magnetic conductive connection at each end of the cylindrical member, said pole-pieces each having a positioning flange complementary to one of the positioning surfaces and secured to the cylindrical member solely by magnetic attraction.

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