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PERMANENT-MAGNET FOUR-RIBBON LIGHT-VALVE FOR PORTABLE PUSH-PULL RECORDING*

E. C. MANDERFELD**

The light-valve described in this paper has been designed specifically as a part of recently developed portable recording equipment when used for push-pull recording. As space is limited in portable equipment, the light-valve was designed to obtain the smallest practical mechanical structure and yet allow the adjustment and maintenance advantages of the standard four-ribbon valve used with fixed channel recording machines.

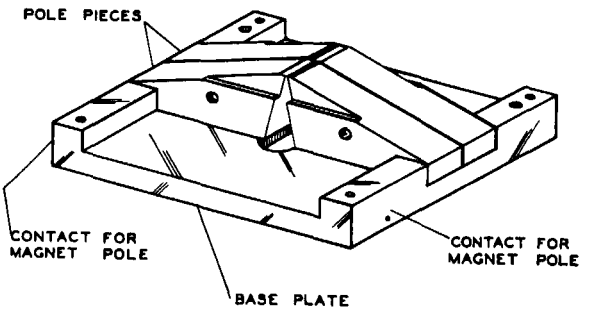

FIG. 1. Showing arrangement of pole-pieces and base plate.

Referring to Fig. 1, it will be noted that four of the pole-pieces (there are four on the bottom and four on the top) are mounted in a shallow slot in a soft steel base-plate. The pole-pieces are accurately machined pieces of "Permendur,"

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a material having the characteristic of high flux transmitting capacity. The pole-pieces are located in the proper position on the base-plate, as well as the cap-plate, by means of an assembly jig and are locked in place by small screws. Pass-

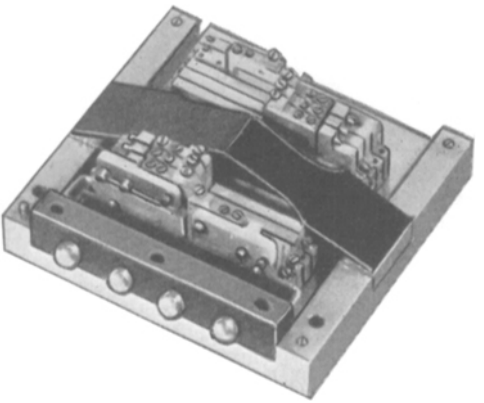


FIG. 2. Top view of pole-piece assembly.

ing through the sides of the pole-pieces on the base-plate are holes so located in each piece as to form a continuous through hole for each pair of poles when properly assembled on the base-plate. This hole is a clearance hole for a through screw that holds the ribbon clamping and adjusting bar assembly to the sides of the pole-piece structure. The arrangement is shown in Fig. 2. The clamping

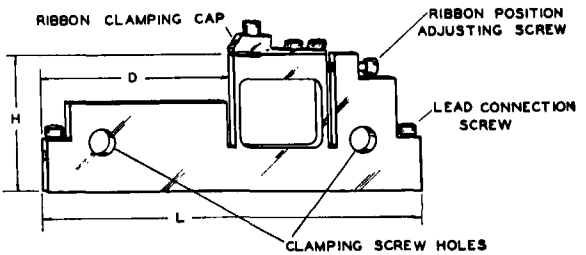


FIG. 3. Clamping bar.

bars, one of which is shown in Fig. 3, are made of steel hardened after machining. The overall length L of all eight bars is identical, but the height H and the distance D vary. The variation in height H is to allow the ribbons, when clamped, to lie in different planes so that they can pass without clashing. In addition, the two end bars on each side are provided with means to move the clamping edge

along the ribbon line for ribbon-tension adjustment. The ribbon-clamping caps are made of steel and are the same for all the clamping bars.

The holes for the screws holding the clamping bars against the sides of the

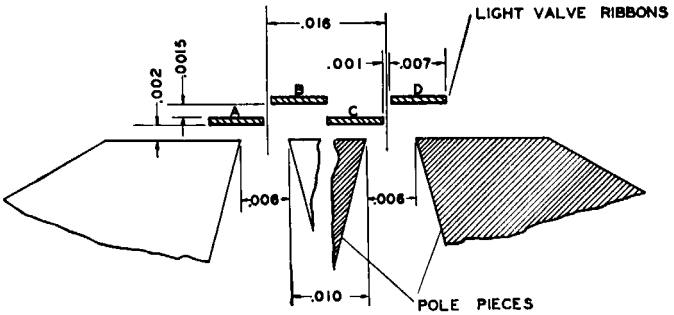


FIG. 4. Cross-sectional view showing positioning of ribbons.

pole-pieces are of sufficient size to allow electrical insulation between the clamp bars and the clamping screws. The individual clamping bars are insulated from each other by means of thin bakelite washers 0.012 inch thick. The electrical connections are made at either end of the clamping bars by means of a stiff con-

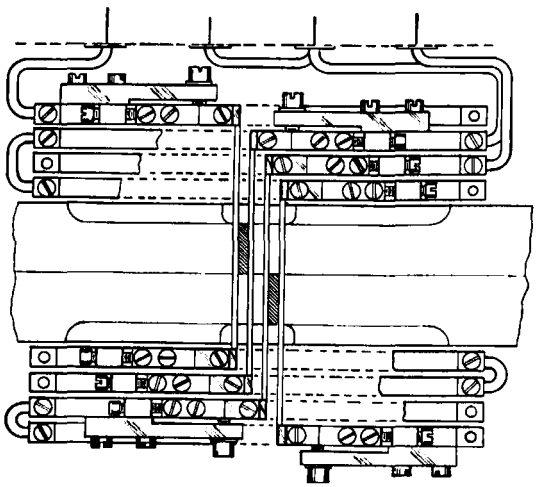
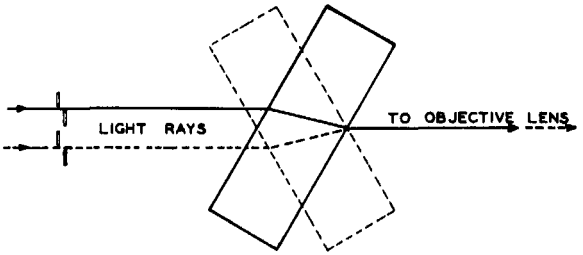


FIG. 5. Arrangement of ribbons over pole-pieces.

necting wire set in a small hole and locked in place by a set screw. To locate the clamping bars properly on each side of the pole-piece structure, a jig is used during assembly which aids in obtaining the proper height H and the proper distance D of all the bars

The cross-section position of the ribbons when placed between the clamping points is shown schematically in Fig. 4. It will be noted that ribbons *A* and *C* are placed on a horizontal plane 0.002 inch above the top faces of the pole-pieces, whereas *B* and *D* are placed slightly higher to give about 0.0015 inch of clearance between the two sets of ribbons. Ribbons *A* and *B* act as one pair and *C* and *D* as the other pair, but being offset in height, they will not mechanically clash if the



6. Refractor prisms.

ribbon amplitude should momentarily exceed the prescribed amount. The spacing for either pair of ribbons can be set for rather wide limits, but normally it is 0.001 inch. The center-lines of the two pairs of ribbons are spaced 0.016 inch apart.

Fig. 5 schematically shows how the individual ribbons are arranged over the pole-pieces. It shows how the two end-clamps are arranged to allow tuning adjustment for any ribbon, as well as how the electrical connections are made. It

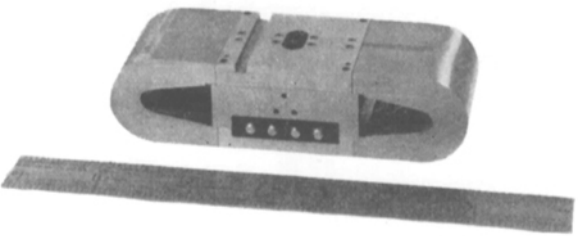


FIG 7. Light-valve and double-magnet assembly.

will be noted that although all the ribbons are of the same length, the dimensions are such that the longitudinal center of each ribbon coincides very closely with the center of its associated pole-piece opening, thereby minimizing bowing effect.

Inasmuch as the center-lines of the two ribbon pairs are located 0.016 of an inch apart, means must be provided to align these center-lines at the film. This is done by small refractor plates mounted in the cap pole-pieces, the principle of which is shown schematically in Fig. 6. One refractor plate and one pair of ribbons are shown solid in this sketch, whereas the other set is shown dotted. The

rays from the condenser lens pass through the light-valve ribbon opening and strike the glass refractor plates at an angle. The rays are then refracted toward the normal, depending upon the angle of the plate and its index of refraction, and emerge from the other side of the refractor plate at the same angle at which they entered, but displaced in the vertical plane, provided the sides of the refractor plates are optically parallel to each other. Thus the objective lens sees the two halves of the light-valve ribbon openings as if they were in line.

The magnetic flux for the ribbon air-gap is supplied by two permanent magnets made of "Alnico." This material is an alloy of iron, aluminum, cobalt, and nickel, and has the characteristic of very high retentivity along with high magnetomotive force, the latter determining the value of light-valve sensitivity.

Stringing and adjusting the ribbons of this new type of light-valve is reasonably simple. As already mentioned, separate screw adjustments are provided for spacing and tuning each ribbon independently, even after the light-valve is completely assembled.

The entire light-valve and double-magnet assembly is quite compact, as shown in Fig. 7. The overall dimensions of the unit are 1.4 inch wide, 1 inch thick, and 4 inches long overall. The overload point is about 9 db. above 0.006 watt, and the closure current approximately 170 milliamperes per ribbon. Field tests under actual operating conditions have shown this type of valve to be very constant in performance and easy to maintain in proper adjustment.

A BASICALLY NEW FRAMING DEVICE FOR 35-MM PROJECTORS*

H. A. DEVRY**

The motion picture projection machine has undergone fewer radical changes and improvements than perhaps any other mechanical electrical device in daily use by so many thousands. This is due partly to the fact that the old designers did a very good job so that radical improvements seemed improbable. However, any mechanical contrivance or machine that has suffered no changes except refinements in 15 to 20 years can hardly be expected to be a really modern machine.

With this thought in mind we have developed not only an improvement, at least so far as simplicity and cost are concerned, but quite a novel and unique application of a silent chain drive, which so far as we or the manufacturer of the chain know, has not been made before.

The feature of the device lies in changing the course of the chain without affecting the shutter. Both shutter and sprocket are motivated by the same chain (Fig. 1).

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