

The power amplifier is a separate unit, and is transported in a separate case together with the speaker. The object of this arrangement is to provide for connecting the system to other amplifiers, such as those in radio receivers, public address systems, existing 35-mm. amplifying equipment, *etc.* The pre-amplifier contains an output transformer which may be matched with any power amplifier transformer impedance. Such an arrangement makes the Debie projector extremely flexible, since the power amplification can be chosen to suit any special requirement: the radio can be used in the home; industrial companies that already have 35-mm. installations can use their present amplifiers and wiring; churches and schools can use their public address equipment; small theaters also can use their 35-mm. equipment.

For transportation and storage, the entire equipment is compactly contained in two cases, one of which contains the projector and the other the amplifier and speaker (Fig. 6). The simplified, high-precision construction of the projector mechanism produces a very low level of operating noise and permits it to be operated without a housing or "blimp" case, so that all parts are well cooled and at all times accessible. The weight of the entire equipment is 52 pounds.

DEPUE OPTICAL REDUCTION SOUND PRINTER*

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When building an optical sound printer it is advantageous to adhere to the general path of the film in the conventional continuous film printer because then the operators will encounter no difficulty in threading and operating the machine (Fig. 1).

The system of lenses and the film movement were suggested by the earlier experiments of A. F. Victor. Both the 35-mm. and the 16-mm. sprockets are on a single shaft, one inside the other. This arrangement appeared to offer the advantages of simplicity of construction and convenience in locating the fairly large flywheel. The two films travel in the same direction and at the proper speeds, with a minimum variation of motion of one film relative to the other. The right-angled prism immediately above the 25-mm. copying lens (Fig. 2) corrects for the otherwise reverse movement of the 16-mm. film.

The 16-mm. film upon which the picture is printed at another time has but one edge perforated, the sound-track occupying the other edge. To simplify the construction and operation the 35-mm. sprocket has but one row of teeth, and the 16-mm. drum is fitted next to it in a position corresponding to the space between the two sides of the 35-mm. sprocket, thus greatly simplifying threading the machine. The 16-mm. film is carried past the printing station not by a sprocket but by an accurately made stainless steel drum of exactly the right size to move the film without slippage. A 24-tooth stainless steel sprocket

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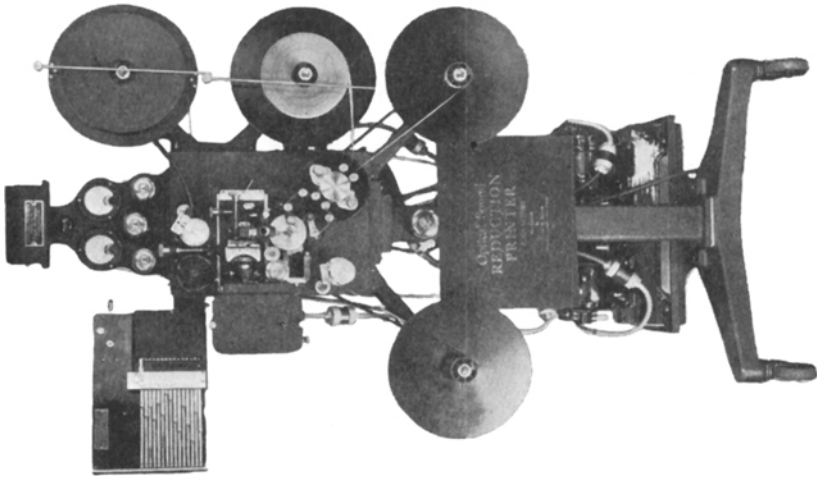


FIG. 1. Depeux optical sound reduction printer.

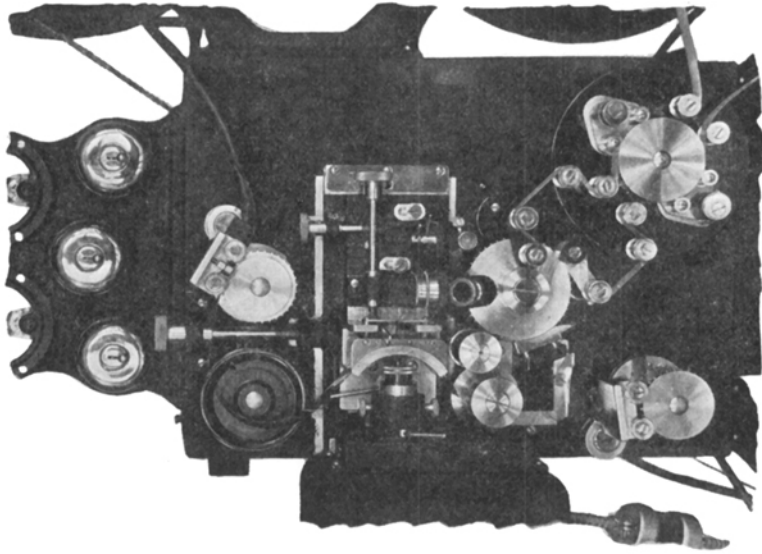


FIG. 2. Close-up of printing gate and sprockets.

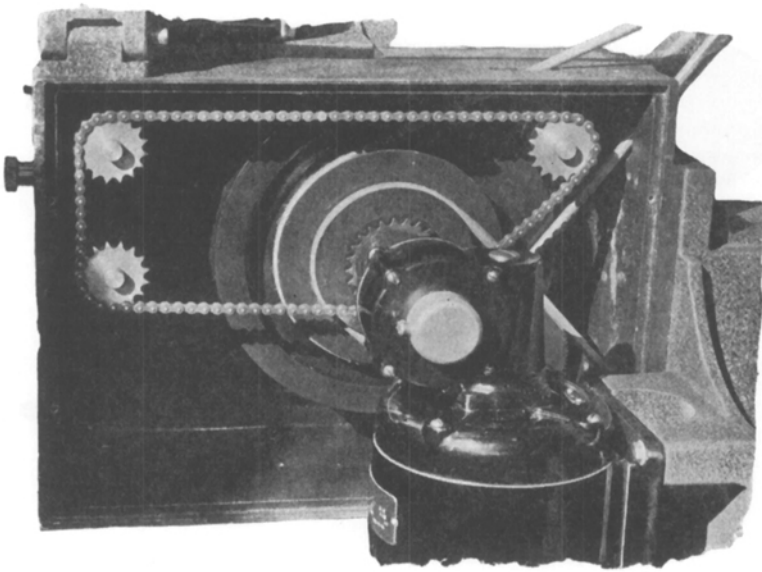


FIG. 3. Rear view of printer, showing drive and fly-wheel.

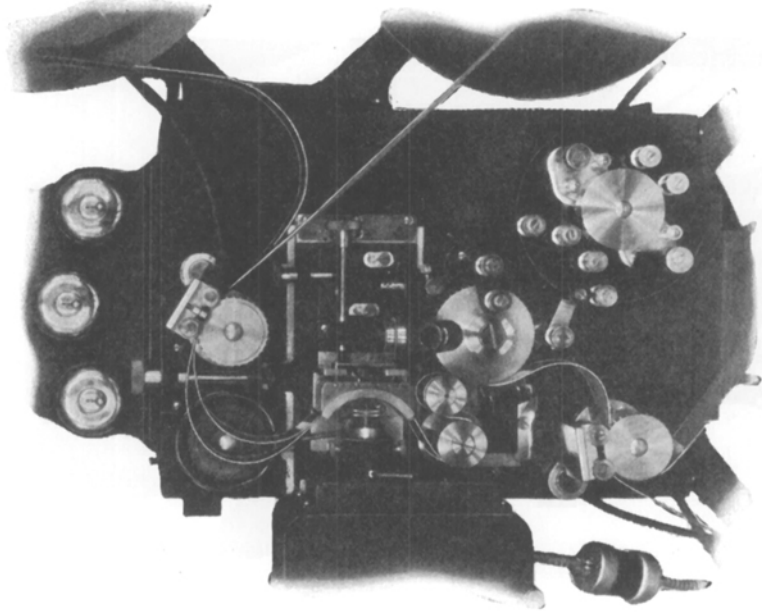


FIG. 4. Close-up of printer threaded for contact printing 35-mm. sound-track.

of very accurate construction is used as feed and take-up sprocket for the 16-mm. film. This feed sprocket is driven by a train of three spur-gears located just inside the housing casting, two of which are of steel and one non-metallic. The center non-metallic gear is so mounted that it can be adjusted to engage the other two gears exactly, thus allowing a minimum of play between sprockets. The minimum number of gears are employed.

Considerable experimenting has shown that by passing the film over several stationary rollers and one tension roller mounted upon an arm immediately below the printing drum (Fig. 2), it is possible to prevent irregularities of film movement caused by contact with sprocket teeth from being communicated to the point of printing.

The same scheme is carried out in the 35-mm. film movement, to a lesser degree. After the film has been fed from the upper 35-mm. sprocket, it follows a gentle curve before entering the curved printing track against which it is held by a shoe. The illuminating beam reaches the negative through an aperture in the curved track. From the negative, light passes to the prism and down to the printing lens. The sound negative then is passed around a pair of rollers before reaching the 48-tooth pulling sprocket. A shoe holds the film gently against the sprocket.

Fig. 3 shows the 12-pound flywheel, which is separated from the motor drive by a rubber disk $\frac{3}{8}$ inch thick and 5 inches in diameter. In the disk are six holes, of which three are engaged by pins upon the flywheel and three by pins in a flange on the reduction-gear shaft. This provides a filtered drive to the printing sprockets. The 35-mm. feed and take-up sprockets are driven from a chain sprocket on the reduction-gear shaft through an 8-mm. roller pin chain. Also, the two rewind belts are on the motor side of the filter, and any variation in take-up speeds does not interfere with the smooth running of the printing sprocket. The main bearings are provided with felt linings between bushings which, when soaked with oil, assure lubrication for several days.

It is interesting to note the results of an experiment made by using a very soft spongy rubber filter disk in place of the hard rubber disk. While the sound seemed to be somewhat smoother, a stroboscope showed considerable irregularity of movement of the 35-mm. film at the printing gate, a surprising result in view of the rather heavy flywheel. Undoubtedly this condition would have an unpleasant effect with certain recordings. Consequently, the firmer rubber was used.

In order to provide a satisfactory supply of direct current for the printing lamp, a motor-generator is located upon a bracket at the base of the pedestal. A $\frac{1}{6}$ -hp., 110-v., a-c. motor drives a 10-v., d-c. generator. The small knob just below the pilot lamp and above the voltmeter and ammeter, controls the generator field-winding resistance, and the exact voltages required can be almost instantly obtained. The motor-generator set is considered superior to a storage-battery as a source of current, especially when the printer is used continuously for long periods of time.

The achromatic condenser system consists of two plano-convex lenses $\frac{7}{8}$ inch in diameter. The mechanical slit is adjustable, the width normally being set to 0.0025 inch. A micro objective lens then forms an image of the mechanical slit reduced in size four times. This optical printing slit on the negative therefore is about 0.0005 inch wide.

The copying lens is of 25-mm. (1-inch) focal length. Focusing is accomplished by varying the separation between the two films accurately and by the independent focusing of the lens and the separate movement of the 35-mm. film to and from the prism and copying lens. The optical slit imaging system and the film gate are moved as one unit to insure against disturbing the slit focusing. The lamp is also easily adjusted by a knurled screw at the bottom of the lamp house. It is moved up or down until the light at the printing point is whitest. There are separate adjustments sidewise and back and forth which, once made, need not be given any further attention until a new lamp is installed. Focusing and setting the optical system at the factory assure correct focus and width of sound-track.

In Fig. 4 the printer is shown threaded for contact printing sound-track on 35-mm. film. The two 16-mm. disks are slid along on their respective spindles to allow for 35-mm. rolls. The 35-mm. raw stock is threaded over the sprockets and rollers and through the curved gate with the negative. The printing of standard film through an 0.0005-inch illuminated slit is possible only with the uniform film movement assured by the heavy flywheel. Under the stroboscope, or stop-motion light, the two films show good contact and synchronous movement, both perforations standing exactly in alignment.

The 16-mm. flange and take-up spindles are made to accommodate 1200-foot rolls of positive film.