



The Challenge of 8mm Sound Film

By JOHN FLORY

Just as paperbacks have enlarged the field of publishing, 8mm sound film, "another milestone in the communications revolution," may extend the boundaries of the motion-picture industry. Some major technical and economic obstacles must be overcome before the potential of 8mm for home entertainment, community service, religion, medicine, science, business and industry, government and education can be fully realized.

THE 8MM SOUND FILM, recently referred to by an eminent sociologist as "another milestone in the communications revolution," may broaden the perimeter of the motion-picture industry much as paperback books have affected the field of publishing. If present indications prove true, it is predicted that by the year 1976 there could be — world-wide — 15,500,000 8mm sound projectors in use. Therefore, it is timely to examine the major technical and economic obstacles to be overcome before 8mm can be of optimum usefulness for home entertainment, community service, religion, medicine, science, government, business and industry, and education.

At the outset, it can safely be predicted that from now on the growth of the use of 8mm sound film will greatly exceed the rate of increase of 16mm usage.

Figure 1 shows the growth in the use of 16mm sound projectors in the United States to an estimated total of 727,000.

It will be recalled that the first commercial 8mm sound-on-film projector was the Movie-Sound-8, offered to the public by the late Lloyd Thompson and several of his associates of the Calvin Co. nearly a decade ago, back in 1952. The introduction within the last 24 months of such brands of machines as the Cirse (now called Filma), the Elite, the Fairchild, the Fujica and the Kodak Sound 8 would indicate that the time is now ripe for a successful breakthrough in the sales of 8mm sound projectors.

A scrutiny of the growth of the number of 8mm silent projectors in use in the United States reveals an estimated total,

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as of the first of this year, of almost 4,000,000 machines (Fig. 2).

A comparison of the estimated output of 16mm sound projectors manufactured annually in the United States over the last seven years with the output of 8mm silent projectors (Fig. 3) reveals that sales of 8mm machines are growing at a far more rapid rate than in the case of 16mm units.

(Figures for 16mm silent projectors are not compared with those for the 8mm silent projectors because the former type is rapidly becoming obsolete, except for special purposes.)

16mm Projector Sales Statistics

It is believed that around 49,000 16mm sound projectors were made in the United States in 1960, in contrast to around 683,000 8mm silent units. From this, it may be hazarded that the sale of 16mm sound projectors, despite a current bulge resulting from the National Defense Education Act, is soon likely to reach a plateau of maturity. The rate of sales growth (not to be confused with the total number of units sold) will perforce increase far less rapidly from now on in the case of 16mm sound projectors than will the rate of growth of a newer product, such as the 8mm sound-on-film projector.

After all, the nearly 3 million 16mm sound projector owners now in the United States are already sold on the efficacy of the film medium. If it can be proved that there are some major advantages to 8mm sound, then certainly

Fig. 1. Estimated number of 16mm sound projectors in use in the United States as of January 1, 1961.

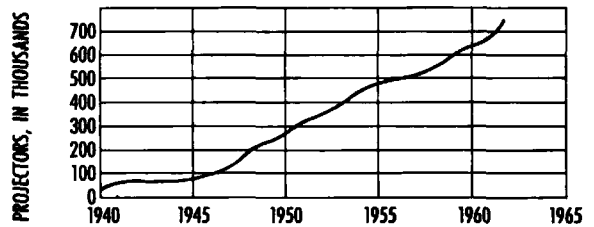


Fig. 2. Estimated number of 8mm silent projectors in use in the United States as of January 1, 1961.

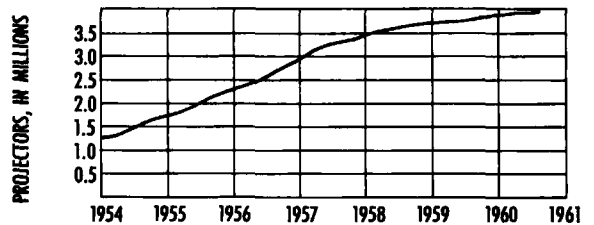
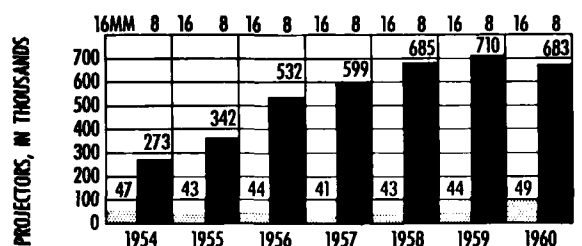


Fig. 3. Comparison of rate of manufacture of 8mm silent projectors vs. 16mm sound projectors in the United States during the last seven years.



it would seem that we shall not have to wait so many years before we have $\frac{3}{4}$ million 8mm sound projectors in use. This will be especially true if 4 to 5 million amateurs be persuaded to convert to 8mm sound, and if somehow the price and quality of the new machines can be made sufficiently attractive.

The Challenges of 8mm Problems

At this point, the industry is faced with a pitfall. In an effort to bring the price of the 8mm sound system down, manufacturers must not yield to the temptation to sacrifice quality. Poor quality 8mm sound projectors, striping and release prints could kill the medium before it even gets properly launched.

This presents serious engineering and technical challenges. By and large, it is much harder to build a good 8mm sound projector than a 16mm counterpart. An analogy might be the fact that a wristwatch requires closer tolerances and greater skill to build than does a large, kitchen alarm clock.

For a number of years, it was generally felt that the slow linear speed at which 8mm film travels would make it impracticable to add a soundtrack. The advent of improved magnetic recording techniques has furnished engineers with considerable experience in the design of magnetic-tape recorders. This was helpful in the early stages of the development of an 8mm sound-on-film motion-picture projector employing a magnetic track.

The paper by John A. Maurer on later pages of this *Journal* deals with the problems of adding sound to 8mm by means of the traditional, photographic-optical soundtrack. Likewise, developments in 8mm have depended upon progress in motion-picture photographic emulsions. Present image quality of emulsions such as Eastman Color Print Film, Type 7383, permits multiple release prints of commercial acceptability at a price considerably below that where Eastman Reversal Print Film, Type 5269, is used. Black-and-white 8mm prints, because of improved grain structure, are feasible today; they were not at the end of World War II.

At this point, it may be helpful to review some of the advantages of 8mm sound film which its proponents feel it can eventually offer.

Advantages of 8mm Sound

The greatest single argument in favor of 8mm sound is that the small-size 8mm film represents what potentially could be great economy in film cost. Because the 8mm (0.143 by 0.196 in.) frame is approximately one-quarter the size of a 16mm frame (0.294 by 0.412 in.), it would appear that an 8mm film should cost only one-quarter the price of a 16mm film of the same screen running time. This is obviously "par for the course."

In actual practice, there are a number of factors which, at least at the outset, make it difficult to effect such economies at this stage in the development of the medium. Here are some of the principal advantages often cited in favor of 8mm sound films:

1. economy of release prints,
2. lower-cost projectors,
3. less-bulky prints (an advantage when carrying, storing or shipping),
4. smaller-sized projectors,
5. lighter-weight release prints (an advantage in an age of air transportation),
6. more portable projection equipment — less weight,
7. improvement in looping performance (of motion pictures in connection with continuous-running or repetitive projectors) and
8. self-threading or cartridge-load mechanisms to become more feasible.

The full potentialities of 8mm sound film will not come to fruition, however, until a wholly new 8mm system is perfected. This must offer the public:

- (a) quality, low-cost projectors.
- (b) quality, inexpensive release prints.
- (c) quality, low-cost methods of making reduction prints.
- (d) quality, low-cost methods of original production in 8mm for informal subjects, with satisfactory duplicates, in moderate numbers, obtainable.
- (e) new print marketing and distribution setups.

Optical vs. Magnetic Sound

As any new field begins to develop, there are always a number of different paths by which progress can be made. It is always a problem for the pioneer to choose the path that seems, at the time, to be the most promising.

The manufacturer who contemplates marketing an 8mm sound-on-film projector must make a "command decision" early in his thinking as to the relative merits of 8mm optical sound vs. those of 8mm magnetic sound. At the present time, the fact that manufacturers of several makes of machines have all chosen to use the magnetic soundtrack method may have been brought about by the following factors:

Optical Sound Advantages:

1. Optical release prints inherently less expensive than magnetic-striped prints.
2. No danger of soundtrack erasure.

Optical Sound Disadvantages:

1. More difficult to achieve good quality soundtracks.
2. Better quality laboratory processing required for optical prints — finer tolerances.
3. Optical projectors not primarily suited for those who want to show their own

homemade motion pictures as well as run professionally produced products.

Magnetic Sound Advantages:

1. Magnetic sound opens up the vast amateur market.
2. Good quality magnetic sound easier to obtain.
3. Soundtracks can be readily personalized to suit a specific audience, and can be translated at less expense into a needed foreign language — particularly where fewer than six release prints are needed.

Magnetic Sound Disadvantages:

1. Theoretically, magnetic prints cost more than optical prints.
2. Danger of accidental erasure.

Economic Potentialities of the Amateur Cine Market

In the United States, it is generally felt by the trade that unless a family has an income of at least \$5,000 a year, it is not normally a good prospect for amateur cine products. At the present time, there are about 30,000,000 families with an income of \$5,000 and upward per year. This represents 56% of the family purchasing units in the country.

It is estimated that there are now approximately 5,300,000 amateur cine cameras in use in the United States and about 4,000,000 silent-8 projectors.

Any appreciable penetration of the amateur cine market with 8mm sound projectors would seem to require a machine that permits the amateur to add sound to his personally made motion pictures. The complexities of optical sound recording are such that most leaders in the industry doubt whether the average amateur would be able to cope with the technical problems of recording sound through traditional, optical photographic methods. The large number of $\frac{1}{4}$ -in. magnetic-tape recorders being sold annually in the United States (425,000 units in 1960) indicates that the layman is able to record voice messages on tape without too much trouble.

It is obvious that considerable sales resistance would be encountered if two incompatible types of sound projectors were needed in every home — one capable of magnetically recording and reproducing the customer's own pictures and the other able to reproduce only professionally made films available with optical soundtracks.

In the case of 16mm combination magnetic-optical sound projectors, it has been found that a dual-purpose machine is considerably more expensive than a single-purpose unit. The demands for the lowest-possible-cost machine in order to penetrate the home market would seem — at the present time — to preclude the successful introduction of

8mm sound projectors having a dual (optical as well as a magnetic) capability.

It has been suggested that while magnetic projectors would satisfy the home market, 8mm optical units would be preferable for educational, industrial and other institutional uses.

This is the point at which the manufacturer is faced with a major policy decision as to the type of machine he will espouse. Even though it is more difficult to make a high-quality 8mm sound projector than its 16mm counterpart, the public — because of the heretofore lower cost of the home 8mm film medium — has come to expect that 8mm machines will be priced at considerably less than 16mm equipment.

The television industry long since discovered that until it could offer a satisfactory receiver costing the customer \$200 or less, it was not able to generate mass sales.

Thus, many leaders in the photographic industry feel that mass sales of 8mm sound projectors will ultimately depend — if the amateur market is to be exploited — upon the industry's ability to turn out a satisfactory-quality unit in the neighborhood of \$200 or even \$150. At the present time, this does not appear to be imminent.

On the other hand, it would seem desirable to settle upon the type of apparatus which promises ultimately the largest potential sales.

It has been said that until an American manufacturer can turn out upward of 250,000 units per year of a single piece of apparatus as complicated as a sound projector, it does not pay him to automate the manufacturing process, and he cannot avail himself of those economies that derive only from mass production.

Considering that 16mm sound projectors have been on the market for 28 years in the United States, and now are manufactured industry-wide at the rate of only 40,000 to 60,000 machines per year, a single manufacturer would have to make five times as many machines as the entire industry is now turning out in order to lift the building of sound projectors to a truly mass-production basis.

On the other hand, the U.S. photographic industry is currently manufacturing 8mm silent projectors at the rate of an estimated 683,000 units per year.

It would seem, therefore, that somehow the manufacturing of 8mm sound projectors must be conducted on a scale comparable to that which now prevails in the case of silent units, if the ultimate economies are to be achieved.

As a corollary to mass production, however, is the matter of mass sales. It is at this point that it would appear logical to emphasize a type of machine which will have universal applications in

the amateur, as well as the professional, phases of the nontheatrical film field.

Need for Low-Cost 8mm Prints

Here we are faced with another dilemma.

It is obvious that the rate of institutional purchases of 8mm sound projectors will depend, to a very considerable extent, upon the availability of professionally produced films in the 8mm width.

This "chicken-or-the-egg" dilemma is accentuated by the fact that many producers of professional motion pictures are reluctant at this point to enter the 8mm field. They hesitate to invest in 8mm preprint materials, an inventory of 8mm preview and release prints — and even more important — a whole new marketing approach, until there are enough 8mm sound projectors out in the field to provide a ready-made market.

In other words, the 8mm sound projector is not an isolated piece of apparatus. It is merely one important component of an entirely new system of screen communication. Until all the other components are properly introduced, the system will not function with maximum effectiveness.

Right at the moment, the chief bottleneck to wider adoption of the 8mm sound-film system is the difficulty of getting high-quality, low-cost release prints.

Other papers in this group of papers about 8mm film indicate some of the problems which must be overcome to achieve this; they also indicate the rapid progress that has already been made.

It is becoming apparent that those of us who would engage in exploring the potentialities of 8mm sound film must set our sights high. We must be willing to accept wholly new concepts insofar as the magnitude of the market is concerned. Anything less is doomed to failure. Eight-millimeter sound film has no real merit unless a way can be found to deliver onto the screen a moving image in color, with concomitant sound, which is not too inferior to that which up until now has been delivered by the average 16mm sound projector.

Furthermore, both the laboratory cost of release prints and the ultimate retail sales price must be drastically less than is now the case for traditional 16mm prints.

At the present time, large sponsors of business motion pictures probably require an average of about 100 prints of each of their major motion-picture subjects. One large distributor of sponsored films feels that at least between 400 and 500 prints are needed to secure national 16mm audience saturation within a period of 12 to 24 months.

In the case of nonsponsored educational films for the school market, a

total of 400 to 600 prints — over at least a five-year marketing period — is probably the number of prints required by the distributor of an averagely successful classroom motion picture. (It is an unusual school picture that sells over 2,000.)

There are, of course, cases where sponsors have used as many as 5,000 prints, and where a nearly equal number of prints of a nonsponsored classroom film have been purchased by those film libraries catering to the school market. Nonetheless, looked at as a whole, 500 prints of a single production is a generous average sale for the present 16mm nontheatrical film field in the United States.

(By way of comparison, it should be noted that the *Film Daily Yearbook* for 1957 indicated that the average number of prints required for a feature picture, made by a major company, was 300.)

If 8mm sound film develops into the mass medium that its proponents predict, it will be necessary to think in terms of 5,000, 10,000, 25,000, 50,000, and even 100,000 release prints of a single production.

A wholly new marketing pattern will have been created to produce sales of this magnitude. Already, some distributors are exploring the economic and merchandising problems that are involved in creating thousands of fresh sales outlets for the new, narrow-gauge, low-priced prints. Camera stores, supermarkets, phonograph-record shops, drug-stores, sporting-goods houses, department stores and aggressive direct-mail campaigns are being contemplated as some of the avenues for achieving volume print sales on a scale almost comparable to the paperback book publishing field — where a minimum run of 250,000 copies is the usual practice.

Obviously, production costs, when amortized across sales of this magnitude, can be reduced to a comparatively minor amount per individual print. Distributors will then demand that marketing expenses and laboratory release-print costs be kept to the lowest possible figure per unit sold, for that is where their future profits lie.

The competitive pressures of such mass printing of 8mm sound release prints will inevitably bring about a technological revolution in motion-picture laboratory release-printing practices. There are indications that once a descending cost spiral begins to come into effect, the base of nontheatrical motion-picture film usage is destined to broaden at an astounding rate.

Market Opportunities for 8mm Sound

For example, last year American business and industry spent a total of \$11.7 billions to advertise its products and services. Of this, the majority was aimed at the consumer market. The



Fig. 4. Distribution of income and spending in 1959. (Based on Survey of Current Business, April 1960.)

U.S. consumer market, after taxes, represented annual purchases of \$314 billions in 1959. Figure 4 indicates the pattern by which purchases were made by various income groups in 1959 (the most recent year for which income distribution data are available).

It will be noted that families having an annual income of \$7,500 per year and up account for 53% of all the consumer goods and services sold in the United States. It is these families that are first likely to become owners of 8mm sound projectors.

If we look at that segment of the population which has an annual income (often because of two or more wage-earners in a single family purchasing unit) of \$5,000 per year and up, we find that this group accounts for 79% of all consumer purchases. This 56% of the families represents the most logical potential owners of 8mm sound projectors. At the present time, 95% of them already own one or more television sets; 77% of them own one or more automobiles; 98% of them own radios; 98% own electric refrigerators (Fig. 5).

A further analysis of American consumer advertising budgets indicates that they are primarily directed at Mrs. Housewife. She is, except for certain mechanical equipment and major items, by and large the purchasing agent for the American family. At the present time, it is extremely difficult for the sponsor of a business film to get his production seen through 16mm channels by a significant number of Mrs. Housewives.

It is estimated that there are over 1,000,000 clubs and other organized groups, of 50 or more members each, which hold regular monthly meetings and which theoretically are potential audiences for nontheatrical motion pictures. Presently, the sponsor of a business film finds it difficult to reach many of the most desirable of the women's clubs unless they are closely affiliated with a Parent Teachers Association, a church or a Grange. That is because ownership of 16mm sound projectors is, at present, largely restricted to institutions. Women's groups closely oriented to a school, to a

church or to a rural Grange hall do have ready access to projection facilities.

On the other hand, hundreds of thousands of other women's groups are not self-equipped insofar as projectors are concerned. Perhaps some indication of future trends can be had through an analysis of the extent to which women's clubs use 2 by 2 color slides. Apparently enough 2 by 2 slide projectors are owned by individual club members to make it possible for many of the clubs to include slides on their regular programs. They use a machine brought to the meeting from home by one of the members.

Limited experiments conducted by the Boy Scouts a few years ago concerning the use of silent 8mm movies for Cub Scout activities indicated that Den Mothers found it relatively easy to supply their own machines when needed.

Thus, it would seem logical to assume that if 8mm sound projector ownership ever reaches as high as 25% of the U.S. homes which can afford them, the sponsors of promotional films, producers of for-sale educational and documentary films and distributors of Hollywood, entertainment-film productions will, for the first time, be in a position to sell and to circulate their product in a vast, new, and highly lucrative market. The large number of school, television and entertainment film subjects which could be revamped and adapted for this new audience is a further factor pointing to the eventual opening up of the field.

Vast Potential International Market

Throughout the world there are many less-developed countries which are desperately anxious to use the sound motion picture for purposes of education, enlightenment and economic advancement. The drastically low purchasing power of individuals and institutions in many of these overseas countries has, up until now, prevented the maximum utilization of the — for them — too expensive 16mm medium.

The capability of 8mm sound projectors of handling magnetic-stripped tracks will very definitely prove to be a significant factor in opening up areas of the world which until now have been

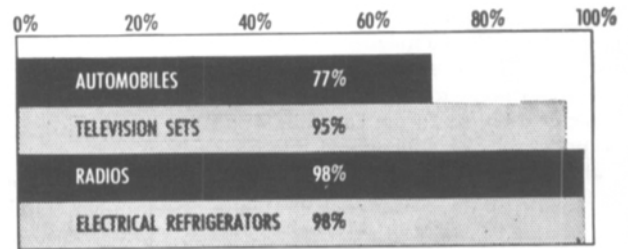


Fig. 5. Ownership of automobiles and household electrical equipment by U.S. families of \$5,000 annual income and up. (Sources: 1961 EM Week; Federal Reserve Survey Consumer Finances.)

held back, through the barrier of language, from using nontheatrical films to any great extent.

World statistics on the nontheatrical film field are largely inaccurate or impossible to obtain. There are indications, however, that the Free World outside of the United States may, at the present time, be using almost the same number of 16mm sound projectors as are in use in the United States. In other words, if by the middle of this year there are approximately 750,000 16mm sound units in the United States, the Free World's total is probably close to 1,250,000 16mm sound units.

In the case of 8mm sound projectors, the tablecloth arithmetic might run something like this:

If there are approximately 30,000,000 American homes having an annual income of \$5,000 annually and up, it is not unreasonable to hope that one-quarter of these families will become the owners of 8mm sound projectors by the year 1976. This would mean that U.S. homes would own 7,500,000 units.

Next, there is the nontheatrical film field consisting of business and industry, education, government, religion, civic, social welfare and recreation groups, etc., and medicine. At the present time, this is where most 16mm sound film is used.

Although 16mm will continue to be employed for large audiences, it is conservative to anticipate that the field will also, by 1976, be using at least four 8mm sound projectors for every 16mm machine now in use. Thus, the U.S. nontheatrical film field should account for an additional 3,000,000 8mm sound projectors.

On top of this, another 5,000,000 8mm sound projectors can possibly be anticipated for the rest of the Free World. Table I shows how this adds up.

"Milestone in Communications Revolution"

This, then, is the broad outline of what that very perceptive sociologist labeled "another milestone in the communications revolution." It is apparent that not only has Man entered upon a Space Age; he has also embarked upon

an era in which the motion picture is launched on a growth period of stupendous proportions. Film and the moving-image are well on the way to overtaking the printed word as Man's most popular form of recorded information.

As all of us know, Man's road to the stars is won only through hard work, increased engineering achievements, and at the cost of many failures along the way. In the same manner, there are many obstacles to be hurdled before 8mm sound film becomes an unqualified success.

The need is here!

Teachers clamor for a system which will allow youngsters to check out film prints from the school library and run them at home in preparation for the next day's classes. Great refinements in projector threading, reliability and screen brilliance are demanded daily. Church groups seek some satisfactory answer to

motion pictures sufficiently economical to be used in graded Sunday Schools. Doctors and scientists are becoming excited, as witness the recent formation of the American Science Film Association, about the motion picture as an everyday tool to use alongside the slide rule and the computer in their research activities.

Business leaders faced with rising labor costs are desperately using audiovisual means to improve worker productivity and to expand overall company sales and profits. Government leaders all over the globe are calling for bold new uses of the motion-picture medium to interpret and to disseminate programs and messages of official importance.

Where is that complete college curriculum on 8mm sound film and teaching machines which can be airlifted to the jungles of Africa and Latin America, or to the Near East?

Table I. Predicted Total Number of 8mm Sound Projectors in Use by 1976.

Location	Units
U.S. Home Cine . . .	7,500,000
U.S. Nontheatrical . .	3,000,000
U.S. Total:	10,500,000
Overseas Free World . .	5,000,000
Total	15,500,000

With such a potential market in the offing, present engineering problems no longer seem quite so difficult or expensive to solve.

Already, educators are pointing out that today's educated citizen must be filmicly literate too. Our children will discover that the mark of an Educated Man is not only that he can handle his native language in written and spoken forms with finesse, but that he can also express himself in the international language of the film and of the moving image.

Early 8mm Sound Developments

By WILLIAM D. HEDDEN
and KENNETH B. CURTIS

Although increased interest and activity have been shown recently in the use of 8mm sound films, following the introduction of several 8mm sound projectors, much research and development had been done in the past by those interested in 8mm films. This paper presents a historical résumé of the work of the late Lloyd Thompson and some of his early developments. Particular attention is given to the sound projection equipment that he introduced and to some of the film procedures that he utilized to make release prints.

IT IS WELL KNOWN that one of the leading pioneers in the development of the 8mm field was the late Lloyd Thompson, former Vice-President of The Calvin Company. Even when 16mm was hardly established, Lloyd was experimenting with 8mm sound. Since his tragic death in December, 1960, it has been believed that some record of these early developments in 8mm might be both important and interesting to record.

Before discussing the 8mm work specifically, brief mention is necessary of Lloyd's technical background in 16mm. In 1932 Lloyd Thompson joined forces with Forrest and Betty Calvin who were then operating an advertising company. Thus began the production organization and laboratory known as The Calvin Company. This company was one of the first to utilize 16mm film as

a commercial communications medium. Lloyd supplied the technical and engineering force to this organization. For the most part, 16mm laboratory equipment was practically nonexistent. Processing machinery, printers, sound recording equipment and laboratory production techniques were all designed, constructed and put in operation under his direction. An understanding of this background is essential to appreciate Lloyd's early 8mm efforts.

In the middle 1940's, The Calvin Co. was developing a considerable amount of amateur home motion-picture film. By then 16mm was an accepted industrial tool; however, Lloyd was greatly impressed at the very high ratio of 8mm to 16mm amateur film received. He wondered why there could not be sound for 8mm also.

In 1946 Lloyd formed the Continental Products Corp. to market an 8mm sound system that he had developed. This system was patterned after the Vitaphone System where a turntable played sound as a projector showed the picture. He synchronized the two by placing a 1000-cycle note on the disc running at 33 $\frac{1}{3}$

rpm. This tone started the projector which was threaded at a sync mark on the film. Synchronization was accomplished in this manner. A description of this projector* was published in 1947. The projector was designed so as to use a Kodascope 8-33 projector mechanism. This simplified Continental's manufacturing operation. (See Figs. 1-3.)

One other interesting point about this first Movie-Sound-8 should be mentioned. The projector was designed to operate at 16 frames/sec, as most 8mm work was done at that speed. Arrangements were made through Castle Films to release numerous film subjects for home consumption.

Records were made to accompany the pictures. Since most of these films existed as 16mm 24 frames/sec sound subjects, some method was necessary to convert the pictures to 16-frames/sec prints. Lloyd accomplished this by building a skip frame printer that skipped every third frame. Thus a 16-frames/sec print could be obtained with the normal sound on the disc. A few critical observers could detect this difference when the picture and sound disc were projected in synchronization; however, the arrangement generally was quite successful and very good synchronization was obtained.

The turntable operated at 78 and 33 $\frac{1}{3}$ rpm. The 33 $\frac{1}{3}$ speed was used for the Castle subjects and other subjects com-

* Lloyd Thompson, "The Movie-Sound-8 Projector," *Jour. SMPTE*, 49:463-467, Nov. 1947.

Presented on May 9, 1961, at the Society's Convention in Toronto by William D. Hedden (who read the paper) and Kenneth B. Curtis, Calvin Productions Inc., 1105 Truman Rd., Kansas City 6, Mo.

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