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Technical Report of a Visit to Motion-Picture Facilities in the USSR

By FRANK CAPRA, WILLIAM E. GEPHART, JR., ETHAN M. STIFLE, and DEANE R. WHITE, *Leader*

A brief report, "Comments in Moscow on Motion-Picture Industry," appeared in the December 1963 Journal, *pp. 957–8. Some additional background and general information are given here before the main portion of this technical report. At the Society's Technical Conference in Los Angeles, April 12–17, 1964, an entire session will be devoted to some personal reporting of the visit, a full discussion of equipment and facilities with many color slides, and a report on Soviet color film, particularly raw stock samples and processed color negatives which were obtained on the trip. Color prints made in the United States from the Russian negatives will be projected at the Conference. The illustrations in this report are from photographs by William E. Gephart, Jr., and Ethan M. Stifle.*

Background

In 1962 negotiations were completed between the United States and the Soviet Union covering cultural exchange visits in several areas. One of these contemplated an exchange of visits by technical people familiar with the motion-picture industry. The first exchange visit was made by a party of three citizens of the USSR to the USA early in 1962. Those visitors were E. V. Akkuratov, O. I. Ioshin and B. N. Konoplev. In accord with arrangements with the State Department, the SMPTE acted as official host during that visit, though the main responsibility for its program remained with the State Department.

Early in 1963 the State Department turned to the SMPTE for assistance in organizing a reciprocal visit. The 1962 negotiations had contemplated two pairs of visits in this field in the years 1962 and 1963. In view of the delays that had been encountered, completion of two pairs of visits by the end of 1963 seemed quite unlikely; but this fact enhanced the importance of completing the first pair, because otherwise that which started as a plan for exchange would become a one-way street. The Society was requested to aid in securing three delegates to join with a fourth named directly by the State Department. Financial obligations were involved, as the State Department, acting in accord with general policy relative to these visits, would not give direct financial support to the delegates suggested by the Society. The matter was resolved with the selection of Messrs. Gephart, Stifle and White, who could go with financial backing from individual companies and the Society. The fourth man of the delegation, as arranged by the State Department, was Producer-Director Frank Capra.

Itinerary

Review of recent Russian journals and records of the State Department indicated that motion-picture work was being done in a number of cities. Eight of these were selected and suggested to the USSR for inclusion in the itinerary of the proposed visit. The formal reply from the USSR accepted six of these. On October 21, in Moscow, problems associated with travel time and the effect of the national holiday on November 7 and 8, the 46th anniversary of the October revolution of 1917, were discussed between the USSR State Committee for Cinematography and the US delegation, with the result that one more city, Tbilisi, was dropped from the itinerary. This still left the group with a tight schedule but one which eventuated in visits to eighteen sites of present and proposed motion-picture activity distributed over the remaining five cities: Moscow, Leningrad, Kiev, Odessa and Alma-Ata. In brief:

Four studios in active operation that were said to account for about half the total feature film production in the USSR were visited. One of these, Mosfilm, the largest studio in the Soviet Union, appeared clearly the leader in technology as well as in quantity of output.

Each of five theaters visited was selected for its special significance in the motion-picture program in the USSR.

The Leningrad TV station was viewed as a busy operation that makes extensive use of motion pictures in its program.

Visits to the Scientific Research Cine Photographic Institute (NIKFI) in Moscow and to the Central Design Bureau in Leningrad gave an appreciation of the developmental effort being expended in this field.

Observation of the facilities of the State School for Cinematography in Moscow showed an operation which emphasizes the importance attached to motion pictures in Soviet planning.

The actual itinerary became:

Travel Log of Visit

Saturday, Oct. 19 — Left New York City

Sunday, Oct. 20 — Arrived Moscow

Monday, Oct. 21 — Met with State Committee for Cinematography, (First Session) A. F. Barinov, Deputy Chairman, presiding

Tuesday, Oct. 22 — At Mosfilm

Wednesday, Oct. 23 A.M. — Visited State School for Cinematography
P.M. — Visited Release Color Printing Plant

Thursday, Oct. 24 — At Alma-Ata, visited Kazakhfilm Studio there

Friday, Oct. 25 — At Alma-Ata, because no return flight open

Saturday, Oct. 26 — Flew Alma-Ata to Kiev via Moscow

Sunday, Oct. 27 — At Kiev, visited site of new studio under construction and saw cine panorama (Kinopanorama) projection in theater in city

This report was received on February 13, 1964.

Monday, Oct. 28 — Visited Dovzhenko Studio

Tuesday, Oct. 29 — Flew to Odessa and visited Odessa Kinap (cine equipment factory)

Wednesday, Oct. 30 — Returned to Moscow, visited Mosfilm processing laboratory

Thursday, Oct. 31 — Flew to Leningrad, visited Lenfilm Studio

Friday, Nov. 1 — Visited Central Design Bureau

Saturday, Nov. 2 — Visited release color printing plant, TV station, and large re-recording room in Leningrad News Reel Studio, equipped for 9-channel sound re-recording

Sunday, Nov. 3 — Sightseeing, returned to Moscow by train that night

Monday, Nov. 4 — Met with members of Union (Club) of Moscow Cinematographic Engineers

Tuesday, Nov. 5 — Visited Scientific Research Cine Photographic Institute (NIKFI), visited Kremlin Palace of Congresses

Wednesday, Nov. 6 — Visited Rossiya Theater

Thursday, Nov. 7 — Watched the parade in Red Square as guests of State Committee, reception by U.S. businessmen, attended by Krushchev in evening

Friday, Nov. 8 — Worked on notes for report, dinner party for our hosts

Saturday, Nov. 9 — Visited the Circular Kinopanorama Theater at the Exposition grounds, particularly the exhibition of cine equipment

Sunday, Nov. 10 — Visited Leningrad Theater, Moscow, met with State Committee, (Second Session) and dined with group

Monday, Nov. 11 — Returned to USA
(Total mileage — 17,000; In the USSR — 6,400)

Organization of Motion-Picture Production in the USSR

As a background for interpreting the technical situation found, the following résumé (prepared by Frank Capra) of the organization and direction of motion-picture production, as explained by top Soviet film officials, is presented to tell how feature films are conceived and produced in the Soviet Union.

Art Committees

Ideas for pictures, scripts and the finished films are approved or disapproved by Art Committees.

An Art Committee is generally a committee of 25 persons, composed of seasoned Party members, writers, directors, actors, critics and artists from other fields. Their functions seems roughly comparable to our executive producers.

Ideas for pictures come most often from film directors, but they can also be initiated by the Art Committees.

Judging from the fact that there are four such committees at Mosfilm Studio, each committee supervises a maximum of about ten films per year.

Let us say a director gets an idea for a feature picture. He takes it up with the Art Committee for discussion. The political "message" is argued back and forth.

If the Committee finally approves, the director himself may write the script, or assign the writers he asks for, or the writers are suggested by the committee. The idea now gets the green light to go into script form.

As the script progresses, further meetings are held with the committee, which analyzes the writing, makes suggestions for changes, and generally sees to it that the writers don't hook or slice out of bounds across the Party line.

If the finished script is approved, the Art Committee helps select or okays the cast, and the picture goes into photography with the director functioning as a producer-director.

Budgets

An official was asked, "Does the Art Committee approve or set limits on the budget?"

The answer was vague. Since there is no profit motive, costs are relatively unimportant. At any rate, the controlling factor in whether a picture is made depends not on cost, but on whether it has artistic merit *and* advances the Communist cause, or follows the current Party line.

During the shooting of the film, the Art Committee sees the rushes or rough cut sequences. If it has any suggestions it passes them on to the director.

The director is not obliged to take the suggestions, but if he doesn't he will have to take the full responsibility for the picture and, as one man put it, "If he makes a political mistake, I would not like to be in his shoes."

But if the director follows the suggestions, then the responsibility is shared or shouldered by the Art Committee.

Final Approval

Before the film is released to the public, it has to be reviewed by the appropriate State Committee. If any tough problems arise out of the film, it is most probably passed on to the Central Committee for final judgment.

It is a fair assumption that any film disapproved by higher authorities will likely *not* be released for public showing.

Thus one can see the tight control the Party has on the contents of a film. The artistic presentation is more or less left up to the creators, but the themes and messages presented must have Party approval.

One can very well imagine the problems of a director working for 25 executive producers!

Fig. 1. Class and instructor at the State School for Cinematography, Moscow.

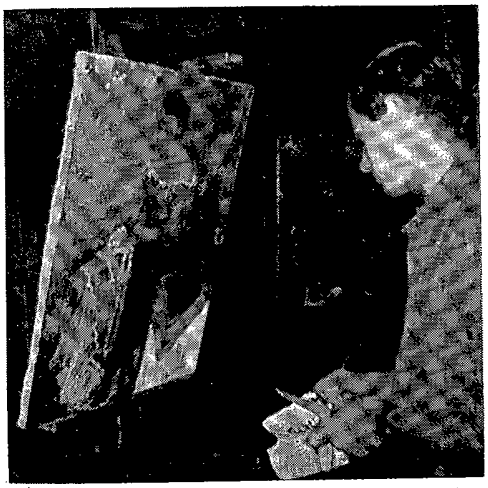

Fig. 2. Art instruction at the State School for Cinematography, Moscow.

Salaries

All artists and technicians are paid a yearly salary, for life, subject, of course, to good conduct.

Students at State Schools are paid a living wage while learning. If they graduate they are assured of a job.

Beginners get a certain starting salary. After several years of service they get an increase. After many more years of service they arrive at the top salary. The general impression was that the top salary was around $12,000 per year.

Bonus System

A creative artist who works on a *big hit* picture gets a bonus (for directors this bonus is about $8,000). The bonus for a *moderate hit* is probably half as much. For all other films there is no bonus.

Worker Training

Basically, the new workers coming into the motion-picture industry are trained in two schools, one in Leningrad for operators and technologists, and one in Moscow for the "creative" workers: script writers, directors, camera men, sound recorders and editors and (surprise) film critics.* We visited only this latter school, which is provided with very complete facilities in which principles taught can be put into immediate used by the students. Of course this school teaches the accepted or dictated basic concept of the motion-picture medium as a creature of today's dominant political party. This is particularly important because of the reported presence here on scholarship of more than 100 persons from 23 underdeveloped countries. This will tend to favor use of Russian equipment and acceptance of their philosophy.

The course for writers, directors and camera men is $5\frac{1}{2}$ years; for all others $4\frac{1}{2}$ years.

The professors are experienced, seasoned professionals, but the administrators are undoubtedly key Party men. Classes are small and give opportunity for much individual instruction.

Applicants are chosen on the basis of previous education, adeptness in their chosen profession, and of course, for their conformity of political thinking. No maverick can get into or stay in this school. This is quite understandable, inasmuch as the students are the future molders of public opinion with guaranteed jobs on graduation. Here they educate the *educators*.

The school has excellent camera and sound equipment; its own stages (four new ones are under construction), film laboratory, editing and projection rooms; its own art classes; its own library of films and of scripts from all over the world. They use only 35mm professional equipment in their film classes. The students make many films, some of which attain theatrical distribution.

Eighty per cent of the creative working talent in films and TV were trained in this school. The other 20% are probably mostly actors who graduated from dramatic schools.

At present there are 700 students, including many foreigners, in the State School. Another 700 study through special correspondence courses. The school has an aura of *eliteness* about it. Many apply but few are chosen.

Release Channels

Three main channels for release of motion pictures were indicated: permanent theaters, television and mobile projection units.

Permanent theaters of various sizes are available to people living in populous regions. TV programs can also reach people at home, living in much the same area. Mobile units take motion pictures to units and groups out of reach of the permanent theaters. There is an important administrative difference between the situations in the USSR and in the USA. In the USSR release of pictures through the theaters and through TV is determined by one governmental center that is expected to make the two methods of release supplement each other without the competition evident in the USA.

Permanent Theaters

The showpiece of the permanent theaters is the Palace of Congresses in the Kremlin. This large theater, 6,000 seats, is shown, of course to many Moscow visitors, and has been described at length in the journal *Tekhnika Kino i Televideniya* from which these data are taken.

	Wide Format (70mm)	*Wide Screen (35mm Anamorphic)*	*Regular (35mm 4×3)*
Screen width	27.0 meters	25.0 meters	13.7 meters
Screen height	12.2 meters	10.0 meters	10.0 meters
Total light	45,000 lumens	24,000 lumens	20,000 lumens
Uniformity ratio	0.6	0.75	0.77
Relative aperture of optical system	*f*/2.0		*f*/1.8
Steadiness of image in gate	0.03mm		0.025mm
Arc current	180 amp		
Positive carbon diameter	12mm		
Negative carbon diameter	14mm		
Reel capacity	1500 meters		
Flutter, optical tracks	0.3%		
Flutter, magnetic tracks	0.4%		

While it is outstanding for its size as a motion-picture theater, it is designed for many other uses also. In it are held large meetings, or congresses, theatrical and operatic presentations, and, of course, such events of outstanding interest in the Soviet Union as the recent wedding of Cosmonette Valentina Tereshkova and Cosmonaut Adrian Nikolayev. Two features were included for such uses. Multiple sound circuits permitted conduct of meetings requiring instantaneous translation as required to permit delegations to select a language provided for them to understand the message of a speaker. Small speakers in the back of each seat in the auditorium permitted sound boost when needed without the obvious discrete sound radiation centers sometimes evident.

A large theater, 3,000 seats, was built and put in use prior to the opening of the Palace. This was the Rossiya Theater which had many of the same features

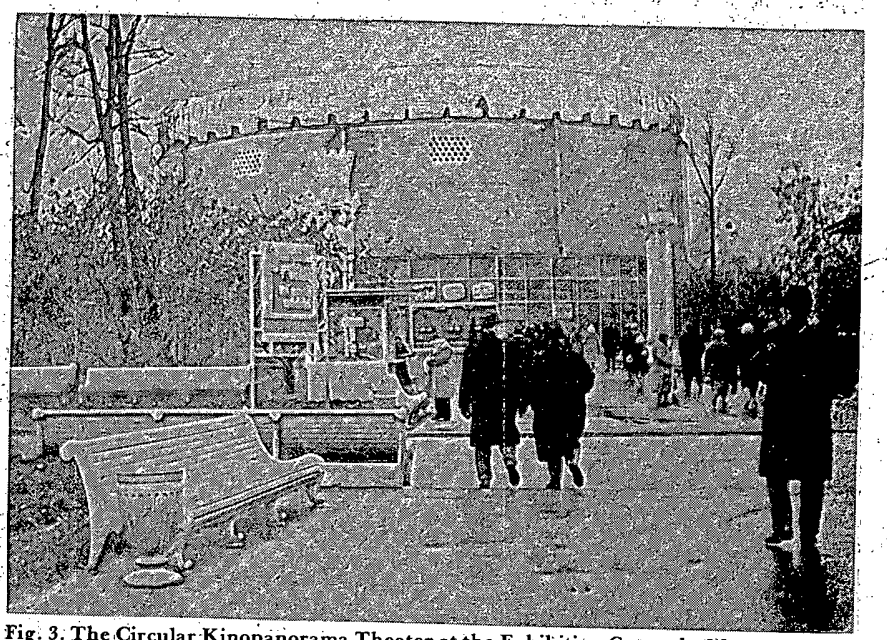

Fig. 3. The Circular Kinopanorama Theater at the Exhibition Grounds, Moscow.

* See also, Don G. Williams, "Worldwide training in film and television production," *Jour. SMPTE, 72:* 279–281, Apr. 1963.

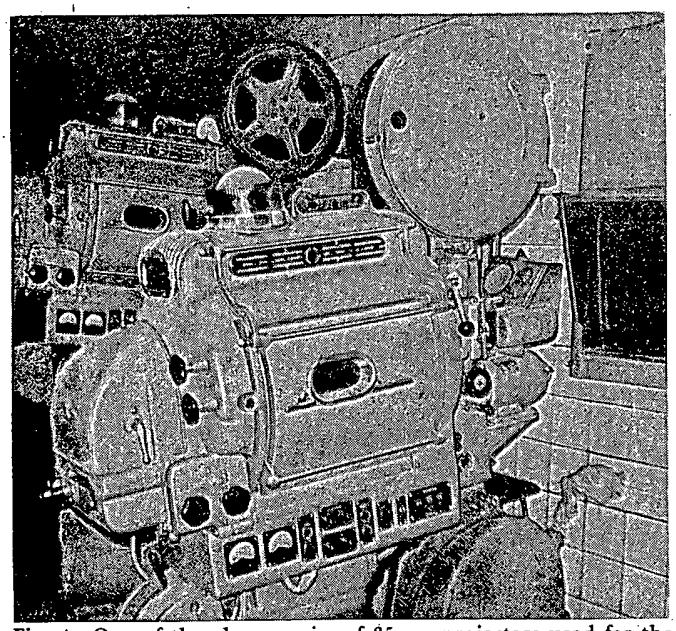

Fig. 4. One of the eleven pairs of 35mm projectors used for the exhibition of pictures in the Circular Kinopanorama system.

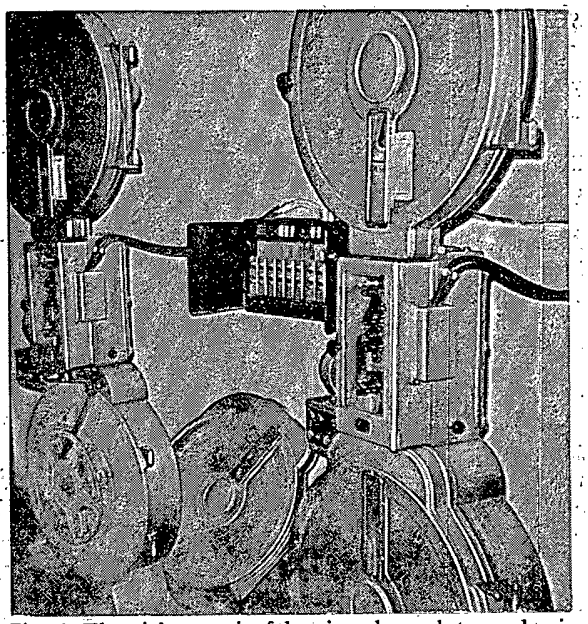

Fig. 5. The pick-up unit of the nine-channel stereophonic sound system at the Circular Kinopanorama Theater.

included such as provision for multilingual gatherings. Two smaller theaters were housed in the same building and were well attended at the time of the delegation's visit.

One of these was showing cartoons, and had a large proportion of young people in the audience. The two cartoons shown while the delegation was in the theater seemed to us heavy handed with a "Message." The second theater was showing news or documentary films. Again the choice was one that carried the "Message." This was in keeping with the impression created by papers and magazines on sale on the stands. The technical quality of the films shown was adequate.

The Palace of Congresses and the Rossiya Theater are both pilots or prototypes of theater construction under way and planned for the future. The program attests to the belief that motion pictures have not reached their peak usage in the USSR and that the provision of large theaters is appropriate to the long range plans of the Soviet Union.

The discussions in connection with this phase of theater development included some assessment of the role to be anticipated for 70mm (wide-format), 35mm anamorphic (wide-screen), and 35mm 4 × 3 format (normal) pictures. All projectors seen which could handle 70mm films were the dual type, that is, also handling 35mm films; thus, with appropriate changes of projection lens any type of 35mm or 70mm film original could be shown. Thirty to fifty theaters were scheduled to be so equipped by the end of 1963 and further increase was anticipated. We heard discussion of the proposition that all feature film production ought to be in 70mm, leaving to the laboratory all the steps required in the preparation of other formats from such wide-format originals. The equipment involved will be discussed at another point.

The three other theaters visited were clearly for special purposes. One of these for Circular Kinopanorama presentations was located on the grounds of the Exhibit of Progress of National Industry in Moscow. A theater visited in Kiev was provided with the three interlocked projectors required for Kinopanorama presentations. A small Moscow theater, called the Leningrad Theater, was set up for rear projection onto a translucent screen and was also the site of a test installation of automatic changeover equipment. These three theaters will now be considered in greater detail.

The screen of the Circular Kinopanorama theater was divided into eleven arc segments. Each such segment had two screen areas, one above the other, to provide greater height than would have been available with the format of the frame used on each film. Accordingly, for full screen coverage, 22 35mm projectors were used. Each projector was powered by a 1-kw xenon lamp. Sound records were carried as magnetic tracks on a separate fully coated 35mm film. The reproducing equipment appeared to be their standard type for nine-channel stereophonic reproduction. The entire system was controlled from a central console with interlocking circuitry to assure the synchronism of all units.

The demonstration witnessed reminded one very much of filmed material used in the USA, though the actual scenes photographed were clearly of Soviet origin. It is interesting to note that USSR experience also indicated that a twenty-minute viewing period is about right for a standing audience. The theater interior was said to be 16 meters in diameter, possibly slightly larger than the one at Disneyland though that unit operates with a 16mm, not a 35mm system.

In discussions of plans for the future it was indicated that if, or when, additional units are built or changes are made, the present 22-projector system may be replaced by an 11-unit system using anamorphic lenses set to increase the vertical image on the screen image. It appears that the extra height permitted by the double screen system is considered important, though not all scenes of the demonstration film shown made use of this double height.

The Kinopanorama film seen at Kiev was not impressive. The prints were dirty, the separate sections were mismatched or had faded unevenly and the mating edges were unduly prominent. Vertical registration was maintained acceptably, and this was the only favorable comment that the delegation could make about the brief test seen. In discussions of the possible future of this type of presentation, reference was made to tests which had been conducted in the USSR in an attempt to appraise the feeling of "presence" or "participation" for a viewer of the three-film Kinopanorama type in comparison with that for a viewer of a wide-format (70mm) presentation. The result showed the wide-format film as only slightly inferior to the three-film system in this respect and far superior in ease of handling and freedom from troubles. As a net conclusion, no further growth of the Kinopanorama type of presentation is anticipated and its ultimate replacement by 70mm films with six- or nine-channel stereophonic sound is probable.

The Leningrad Theater installation was quite different from the others. The theater was small, some 300 seats only,

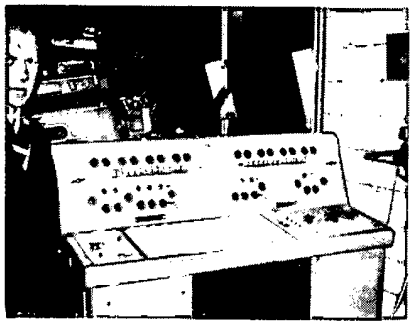

Fig. 6. Control desk for the Circular Kinopanorama system.

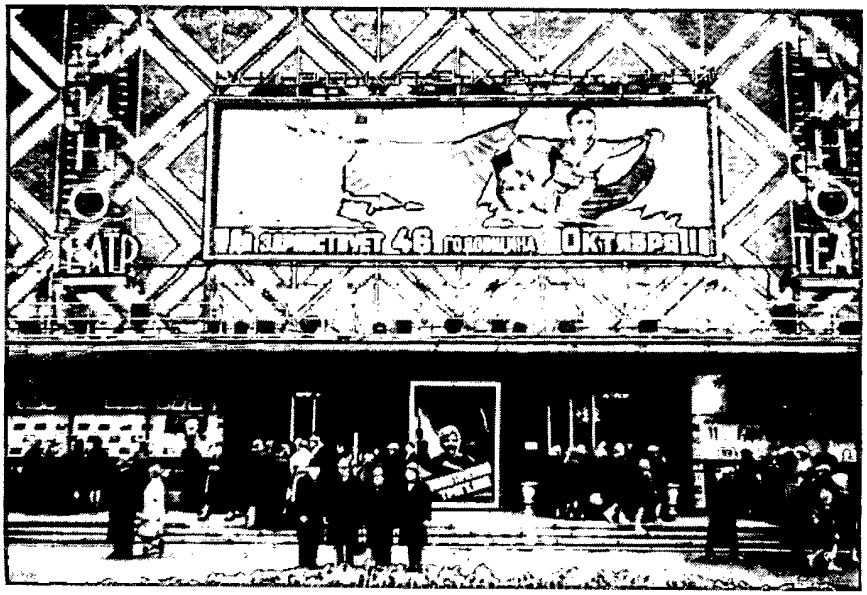

Fig. 7. Outside the Leningrad Theater, Moscow.

and on one side was a restaurant area apparently serving light lunches, operating at a higher level of ambient light than the main seating area but not fully screened from it. The intensity level on the 6 by 8 ft (estimated) translucent screen was such that the picture could still be distinguished from the table or counter area as well as from the main seats. (We did not see popcorn there.)

In the projection booth were two 35mm projectors with 1-kw xenon lamps as light sources. The system was specially designed to reduce labor in the booth. To this end, conventional film reels and magazines had been replaced by an unconventional film handling system. The unwinding film came from the center of a roll which was carried by a circular array of rollers fastened to a large annular plate or flange. This resembled some of the systems used for continuous projection of long lengths of film. However, this film was not in a closed loop, but wound up on a plate and roller assembly in a bottom magazine quite similar to that which would have been used if the film had been handled on reels. The film was therefore ready for reprojection without rewinding merely by taking the completely rewound unit from the bottom magazine and putting it in the upper magazine and threading the projector, pulling leader from the *center* of the unit. The plane of this upper magazine was horizontal, laid on its side as compared to a conventional unit.

The heart of the system, which was under test, was automatic start, stop and changeover equipment. A piece of metalized tape had been fastened to the film edge (extending over the perforations and reperforated) at a selected point near the end of the reel. The metal was sensed by a high-frequency sensing system as it passed into the projector and the resulting signal actuated a sequence device which actuated the units as required to start the second projector and stop the first. It was indicated that this system was in its debugging stages, preparatory to final design decision. The one changeover observed went smoothly, but it was not clear whether or not it was fully automatic. The operator might have performed part of the switching function on signal from the sensing unit.

Leningrad TV Station

A visit to the large TV station at Leningrad gave one glimpse of the methods used to handle film as a source of broadcast material. Much filmed material is available from the motion-picture studios of the USSR and can be handled here whether in 35mm or 16mm form. While no figures were given, the 35mm form was judged to predominate. Material originally photographed as wide-screen (anamorphic) or wide-format (70mm) originals is released through TV by preparation of 35mm normal (4 × 3) format films through laboratory copying procedures which permit the 35mm copy to follow action as required for optimum quality in the narrower format.

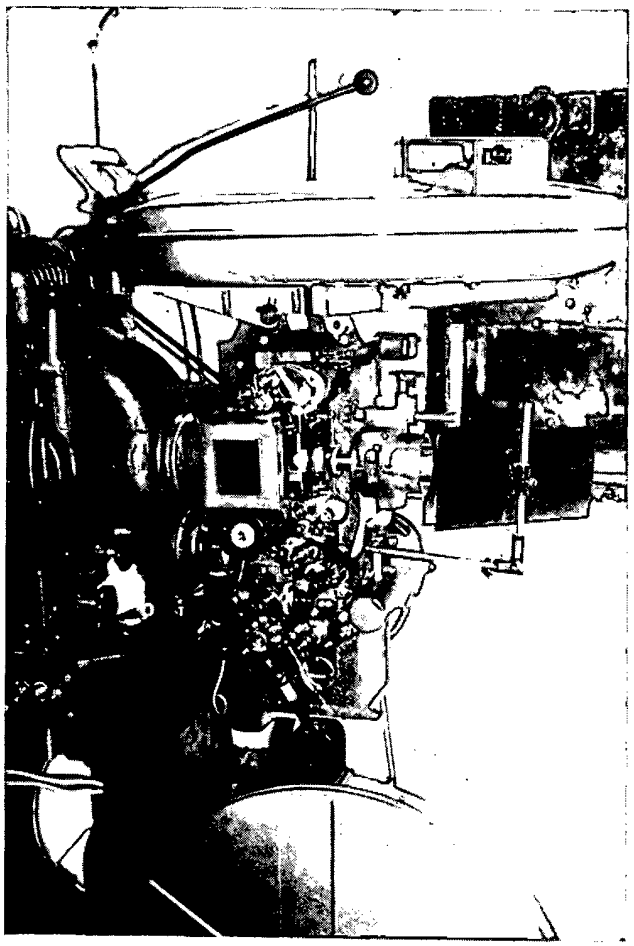

Fig 8. Projector used in the Leningrad Theater, Moscow. (Note the horizontal plane of the unwind reel.)

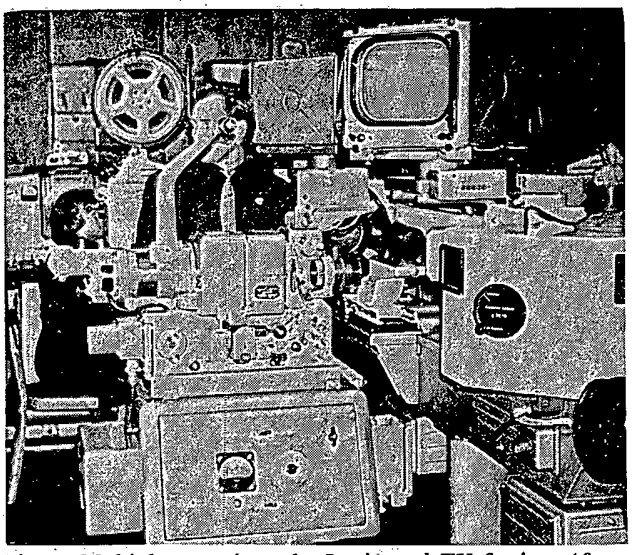

Fig. 9. Multiplexer unit at the Leningrad TV Station: 16mm projector, foreground; and 35mm projector ready for operation in the background.

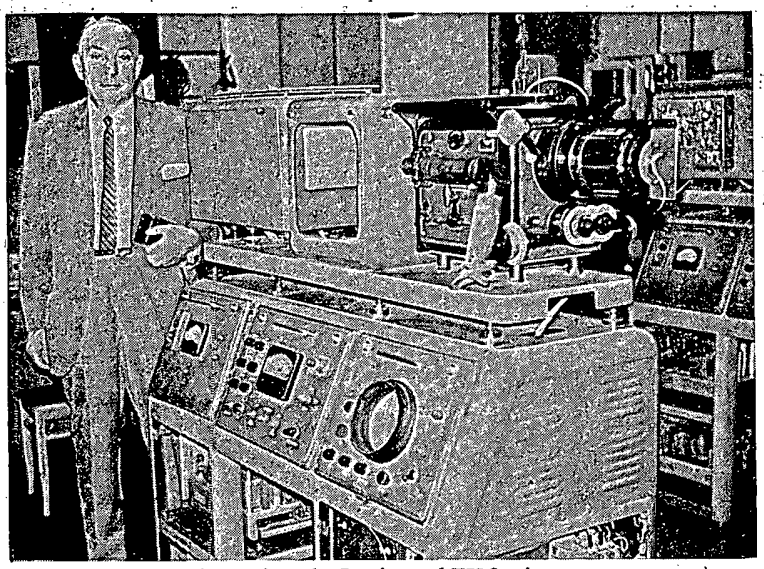

Fig. 10. Film-recording unit at the Leningrad TV Station.

Documentary and news films are produced by station personnel who have camera and laboratory facilities available. Reversal processing and conventional negative and print procedures are available for use as needed.

The multiplexer for the film to TV camera step had three 35mm and two 16mm projectors as well as two positions for 2 × 2 slides. The standard frame rate for sound films in the USSR is the same as in the USA, 24 frames/sec. However, the TV frame rate in the USSR is 25 frames/sec corresponding to the customary a-c frequency in use, 50 cycles. Experience has shown that films and soundtracks prepared at the 24-frame rate can be projected acceptably at the 25-frame rate. This permits use of somewhat simpler equipment than in the US where a conversion is required from a 24-frame/sec rate for film originals to the 30-frame/sec rate required by TV standards.

A compact cine-recording unit was also exhibited. It benefited from the close agreement between frame rate standards in the USSR TV and motion-picture systems.

Mobile Projection Units

Alma-Ata, the capital of the Kazakh Republic, was the center for one of the large distribution systems which utilized mobile projection units. The reason given for the use of these units was that there were many people in the Republic too remote from permanent theaters and TV stations to benefit from them. Accordingly, the State sent out mobile units to bring the pleasure and benefit of motion pictures to these small remote groups on farms, at mines or in other occupations causing people to live in small dispersed groups. The Republic was said to have three to four thousand permanent theater units, and about nine thousand mobile units. In spite of their number, we did not see any of the mobile units. However, we were shown a type of 16mm projector, designated the "Ukraina," equipped with a 400-watt incandescent lamp and provided with pickups for both photographic and magnetic sound records. This was said to be commonly used in these mobile units. Some comments about its construction are given later.

Studios and Associated Laboratories

As mentioned earlier, the four studios seen in operation account for about half the feature film production in the USSR. These four were located at Moscow and Leningrad, in the Russian Soviet Federal Socialist Republic; at Kiev, the capital of the Ukrainian Soviet Socialist Republic; and at Alma-Ata, the captial of the Kazakh Soviet Socialist Republic. Each of the other twelve Republics is said to have some local capacity for film production in the capital city. Some of these operations must be on a rather small scale, judged by the total production figures given. The original plans had included a visit to the studio facilities at Tbilisi, the capital of the Georgian Soviet Socialist Republic. These plans were cancelled to improve the travel schedule after it was stated that the studio was then "closed down for reconstruction." No figures were mentioned showing the output of this studio.

Feature film production in the USSR was estimated as about 120 for 1963. Further increase to about 150 per year is forecast for the near future, and there was a suggestion that this might be considered a saturation figure. That would provide, it was pointed out, three films per week for any theater needing changes at such frequency. Forty per cent of film production is reported to be in color, and sixty per cent in black-and-white.

Mosfilm (at Moscow), the largest studio in the USSR, accounts for some 30% of the feature film production for the nation. Five stages were usable at the time of the visit and two more were under construction. The largest of these had a floor area of twelve hundred square meters.

Lenfilm (at Leningrad) was currently producing pictures at an indicated rate of sixteen per year, about half that of Mosfilm. The work was being done on five stages. Two additional stages, under construction at a separate site about 30 to 35 minutes away by car, were forecast to be in operation a few weeks after the visit.

The Dovzhenko Studio (at Kiev) was started in 1928 and has produced a wide variety of films during the intervening years. The 1963 production rate of feature films was given as eleven or twelve, made with three stages. Three new units under construction were forecast for completion and initial use

early in 1964, doubling the studio capacity. Kiev is the capital of the Ukrainian Soviet Socialist Republic, as mentioned earlier, and original dialog is recorded in the Ukrainian language. Pictures chosen for showing in other parts of the country must have the dialog dubbed in whatever language is suitable for that area.

Some organization figures were obtained at Kiev. These showed that a staff of 1,500 people were employed there to provide for all aspects of activities of the Dovzhenko Studio — stage work, set and costume production; processing, etc. Forty actors are on regular salary. Extras are available from a list of 5,000 people, most of whom work regularly at other jobs.

Kazakhfilm (at Alma-Ata) was the smallest of the units visited. It had only two stages available for current use, but like the others had plans for expansion. We were taken to a very attractively located 40-acre site at the edge of the city where a new studio is planned. A three or four year period was suggested before our next visit if we wished to wait until we could see this new studio completed and in operation. Three or four films were to be completed as their 1963 production, all made originally in the Kazakh language.

Studio activities here were not limited to their feature film production but included work handled by separate units in the larger centers. For example, thirty to forty features per year from other Republics were dubbed into local languages for release. Local newsreels in five languages were produced and required fifty to ninety prints per week. Research and scientific films from local technical sources were also processed in the studio laboratories. The esprit de corps was notable here. The studio staff appeared outstanding in their enthusiasm and attitude toward their work. This was particularly impressive in view of the range of racial and, presumably, national backgrounds evident among the staff. There was another point of special interest in that this city had been the site of additional motion-picture activity during war years when it had been necessary to move such activity from exposed sites such as Moscow and Leningrad. For a period in the past, therefore, this city was probably the major center of film production in the USSR, but such is not its present status.

Fig. 11. Exterior of Kazakhfilm Studio at Alma-Ata.

Fig. 12. Directors and actresses and other staff members at Kazakhfilm Studio, Alma-Ata; Frank Capra is at the extreme right.

New Studio for Popular Science Films

While speaking of studios and plans for their expansion, mention should be made of the development under way at Kiev of a new unit for production of Educational and Popular Science Films. This is located on low, level land a short distance from the Dnieper River and a few miles from the city center. Construction has been started on buildings and roads of a total complex which will have a production capacity for about 100 educational and popular science films per year and, in addition, about 15 cartoon subjects. Three closed stages and outdoor shooting areas are planned including, we understood, a good sized tank for water scenes. It was mentioned that use was planned of 35mm equipment for taking with release as required on either 35mm or 16mm print stocks. So far as we could learn, these films are planned chiefly for adult training or education as distinct from films planned for incorporation into the early years of school training.

Studio Facilities

While it is impossible to speak of an average studio from such limited visits as this trip afforded, it is possible to outline general current practice as indicated by the facilities seen. Such practice included stages with free floor areas, up to 1,200 square meters and a ceiling height of about 18 meters (60 ft). Catwalks near the ceiling provided a working base for the many operations facilitated by overhead access. A high monorail system made it possible to move many heavy and awkward units to desired locations. These could be preassembled set units, or heavy lighting fixtures. Power for lights was distributed through overhead wiring and their operation was controlled from a switching console at the catwalk level by an operator who received instructions from the director on the set itself. Niches were provided in the walls at a height somewhat below the catwalk in which the lighting units could be stored when not in use.

Cameras

Continuing the discussion in the same

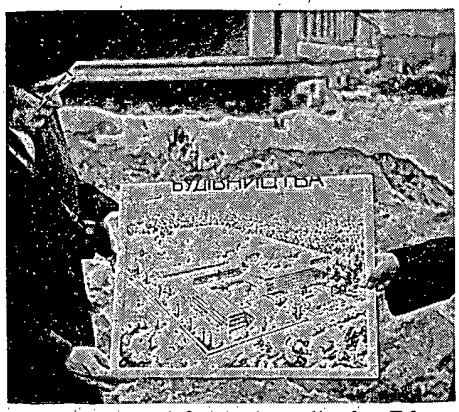

Fig. 13. Plan of finished studio for Educational and Science Films, Kiev, taken at the site.

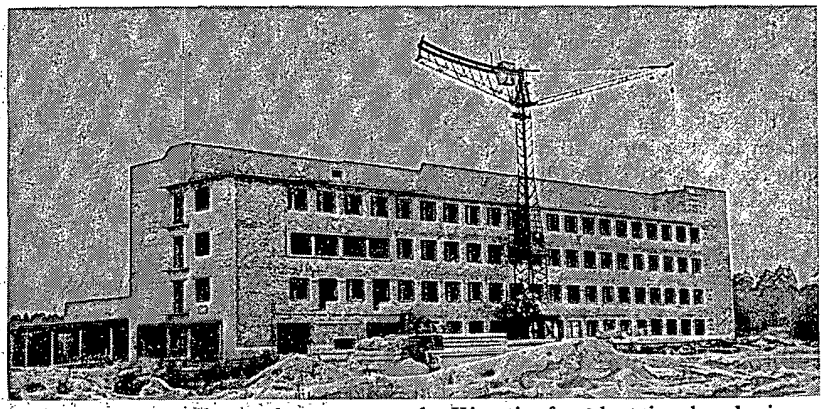

Fig. 14. The most advanced structure at the Kiev site for educational and science film production.

vein, one saw frequently a Druzhba 35mm camera mounted on a stand or modest dolly to take the pictures while the synchronized sound recording was being done in a separate recording room on fully coated 35mm magnetic film (Fig. 15; see also the paper by V. G. Komar, immediately following in this *Journal*). The Druzhba camera is housed for use on sound stages and includes a viewfinder which sees the picture through the taking lens by means of mirror segments on the shutter that permit the camera man to see the camera image during the "closed" portion of the shutter cycle.

Variations of this basic operation were encountered. While the Druzhba camera is clearly well thought of, it is by no means the only model of 35mm camera in use. The Rodina camera was in use where synchronous operation and sound recording were not required. A Rodina unit is shown on the tripod in this scene taken at the Moscow State School for Cinematography (Fig. 16). The camera hand held in this same scene was not identified, but a Konvas camera was seen at Lenfilm (Fig. 17).

At Lenfilm there was a special camera built for operation at a spot remote from the camera man. A photographic unit and an associated TV unit were mounted together and connected by cables with a kinescope and a control unit. Through the controls, the operator could operate the camera to give conventional results using the kinescope to give the visual image needed to follow operations. This was shown as part of the equipment for feature film production, but it is clear that this system could also be used where there was some element of hazard as well to a person actually at the camera location.

Pictures in "wide format" (70mm) were taken with a camera of Russian design and construction. The development of the 70mm system in the USSR has been carefully planned to provide prints which meet proposed international dimensional standards as needed for interchangeability, but the decision was made to use the same width of stock for camera use. This of course, is a departure from US practice, where the negative stock is a 65mm film carrying a perforation pattern common to both 65 and 70mm widths. The Russian 70mm camera, housed in its noise deadening housing, is quite a bulky and imposing unit.

It appeared that only in news work would one be apt to encounter 16mm equipment, but there too, we believe the 35mm units predominated.

Infrared Process Photography

On one stage, the infrared method was used for making traveling mattes for process combination shots. This set included an infrared background screen 36 ft wide by 18 ft high with 9,000 lamps uniformly distributed over the rectangle indicated which consumed 500 kw of power when lit. A plastic screen filter over the entire area absorbed the visible light to the extent that it appeared to glow only a dark red while transmitting a large percentage of the near infrared. Foreground action, well in front of the screen, was illuminated normally for the black-and-white or color photography planned. The camera contained two films held in register in the gate and a special dichroic beam splitter (see Fig. 6 in the paper by V. G. Komar, immediately following

Fig. 15. A Druzhba camera at Mosfilm, attended by the chief of the camera department.

Fig. 16. Test set at the State School for Cinematography, Moscow. A Rodina camera is on the tripod.

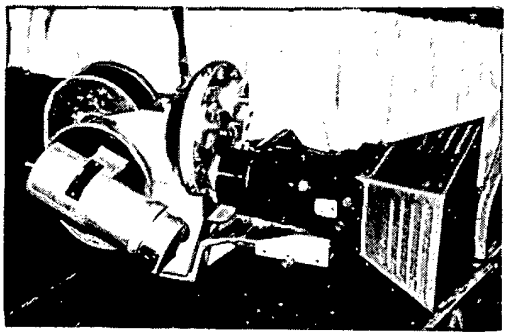

Fig. 17. The Konvas camera.

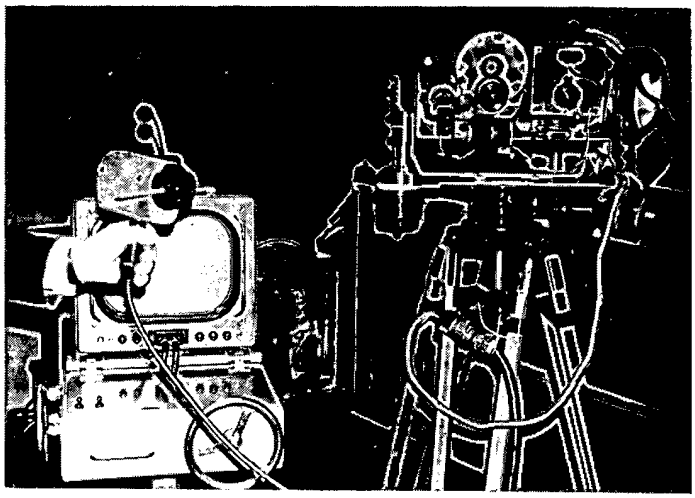

Fig. 18. Camera and control equipment with closed-circuit TV viewfinder for remote operation.

in this *Journal*). One film, of normal type, recorded only the visible region of the spectrum brought to it through the beam splitter from the foregound action only. The other film was sensitive to the infrared which it received through the beam splitter and recorded infrared radiation originating from the background screen except where that was covered by foreground elements and action. This foregound was negligibly weak in infrared, hence the image on this infrared sensitive film was an all-or-nothing type. Reversal processing of the infrared sensitive film produced a positive matte, which was used in conjunction with the action record on the other film to permit the separate photography of backgrounds without overlap of any foregound element.

Samples of the work shown indicated that the technical problems incident to this process had been met quite satisfactorily. In the finished print the major clue that it had been produced by this method lay in the high degree of image sharpness of both foreground and background, since lenses used at customary apertures would not give such a result.

Sound Recording

Single-channel sound is of course the simplest basic method for any sound recording at all and is well established in the USSR as it is in the USA. Original recording was done with magnetic tracks from which photographic tracks were made when required by the release program. Three other systems accepted in the USSR used four-, six- and nine-channel stereophonic records. The four-channel system was normally employed with their "wide screen" (35mm anamorphic) system. The six-channel system was the simple system used with "wide-format" pictures. The nine-channel system also used with this taking system was the basic system used to meet the special requirements of Kinopanorama or Circular Kinopanorama presentations. All these stereophonic systems depend on magnetic sound records at all stages of their production and use. Four- and six-channel records are carried by magnetic stripes on release prints but when nine-channel stereophonic sound is used, the necessary nine tracks are carried on a fully coated 35mm magnetic film and the reproducing unit is separate from the projector or projectors, but operated in synchronism therewith.

Each type of sound-recording system has it own problems associated with insertion of special effects and with dubbing of the dialog when the language is changed. The complexity of such operations is probably greatest for the nine-channel system. Only one room was seen completed and capable of operation with this system. This was located within the News Studio at Leningrad. A corresponding group of equipment units was in evidence at Mosfilm in Moscow, but they had not been assembled into a workable system. The room at Leningrad occupied the space of a moderate-sized theater. The screen covered one wall. A long

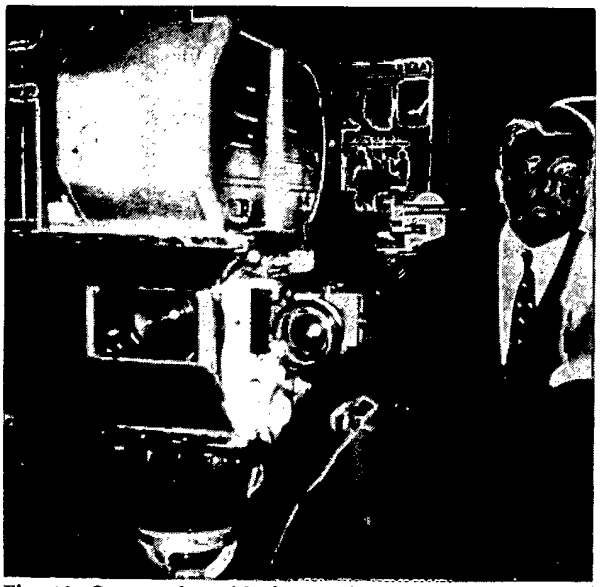

Fig. 19. Camera for wide-format (70mm) production, with B. N. Nonoplev, Chief Engineer of Mosfilm.

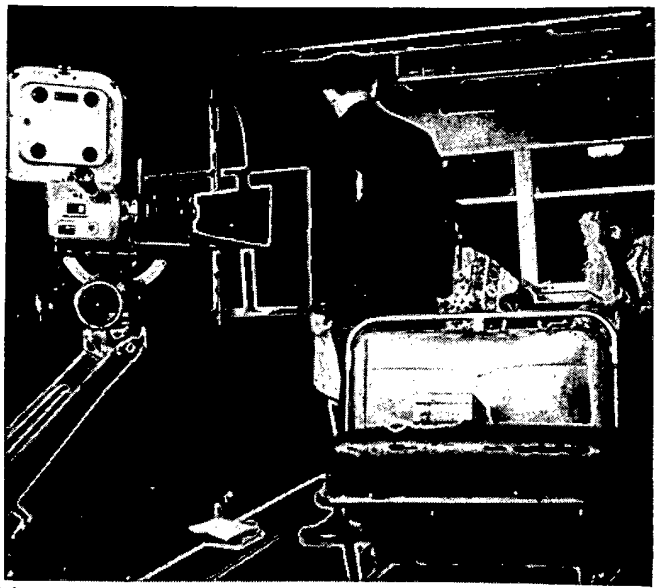

Fig. 20. Camera on set arranged for infrared process photography.

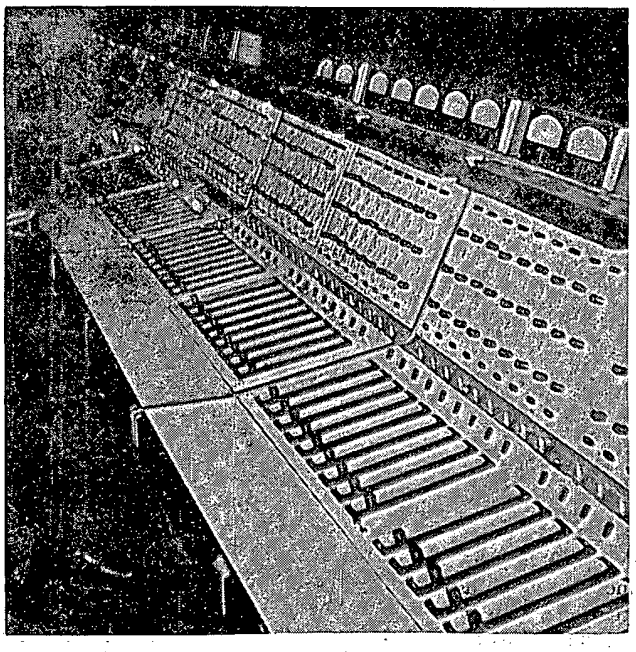

Fig. 21. Nine-channel control panel in the dubbing room provided at the Leningrad News Studio.

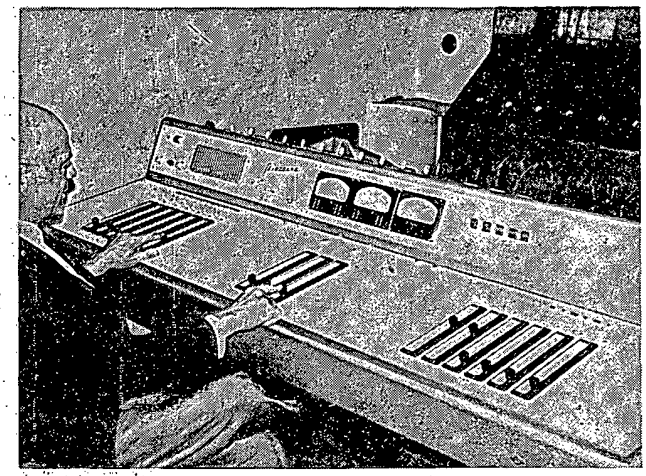

Fig. 22. Frank Capra at control console of a six-channel stereophonic dubbing room.

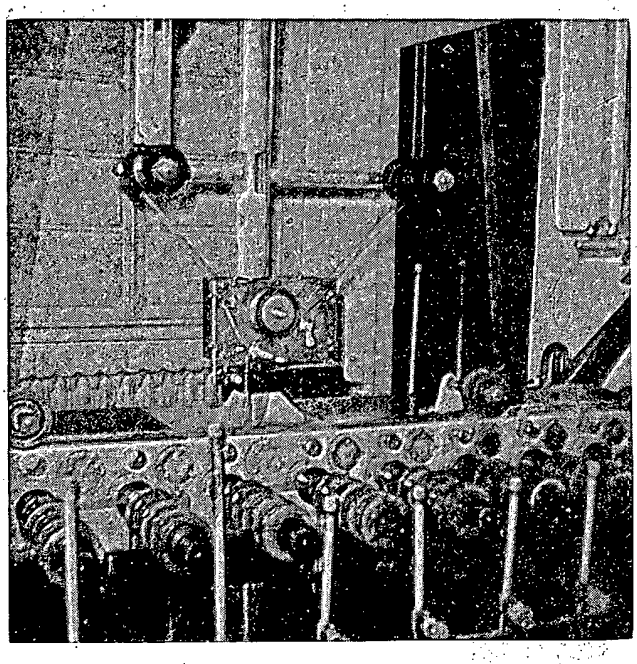

Fig. 23. Detail of top mechanism of color film developing machine.

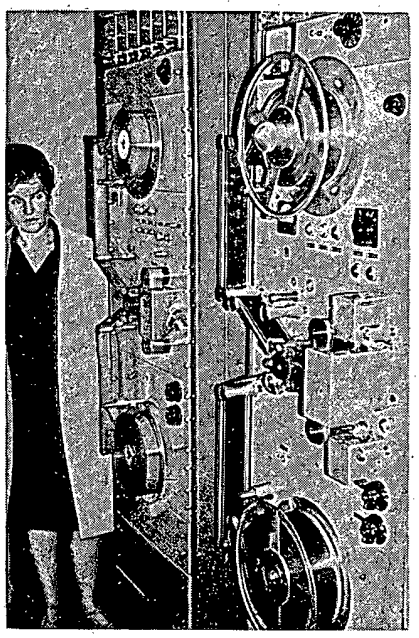

Fig. 24. Electroprinting soundtrack onto striped 70mm print film using the six-channel stereophonic system.

multichannel control console was located at the rear of the room, just in front of the projection booth. The rest of the floor area was available for the placing and operation of sound units as required to give the stereophonic perspective required.

The needs of six-channel and four-channel stereophonic systems were met in the same manner, and in fact, clearly appeared to be the antecedents of the nine-channel system. These older rooms were somewhat smaller than the nine-channel installation.

Single-channel work was, of course, least demanding and could readily be accomplished in facilities capable of the more complex operations.

Studio Processing Equipment and Control

Design of developing machines appeared quite conventional, the designs resembling Arri and Debrie machines in use elsewhere. Less stainless steel was in evidence than used on many US machines, but the plastics used in its stead seemed well chosen and adequate for their function. Pumps and piping, flow meters, heat exchangers and temperature controllers appeared conventional. No complete tabulation of through-put speeds was attempted, but the impression was gained that these had not been forced as high as now common in the USA. Processing of black-and-white and color negatives and positives was routine as required for the production program with 35mm and 70mm negative films and with 32, 35 and 70mm positive films. Duping procedures were also routine for black-and-white productions but manufacture, and processing of interpositive and internegative color films was not routine. At one studio laboratory (Mosfilm) color dupes were said to be made by reversal through use of Agfa Type M film.

It was stated that for black-and-white production the gamma level of the negative was usually held at 0.50 ± 0.05 with the positive gamma carried to the 2.5 to 2.8 region. This negative gamma is low in comparison to US custom.

As was noted before, when the release is to have stereophonic sound, the sound records can remain as magnetic tracks throughout. A step designated electroprinting is provided to put the final tracks on the appropriate magnetic stripes available and used for either four- or six-channel reproduction. Where the final release is to have a photographic record, soundtrack negatives can be re-

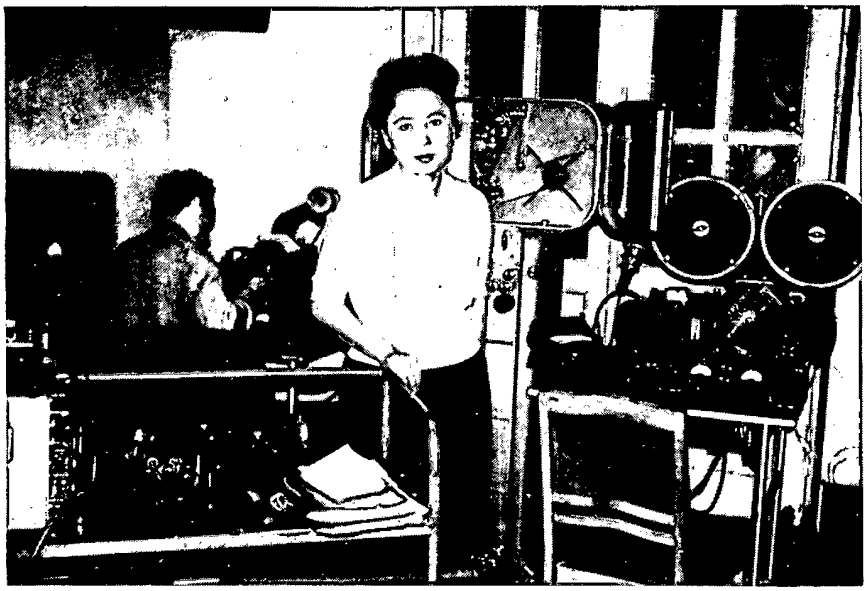

Fig. 25. Magnetic pick-up unit and photographic track recorder unit for production of photographic soundtrack negatives at Kazakhfilm Studio, Alma-Ata.

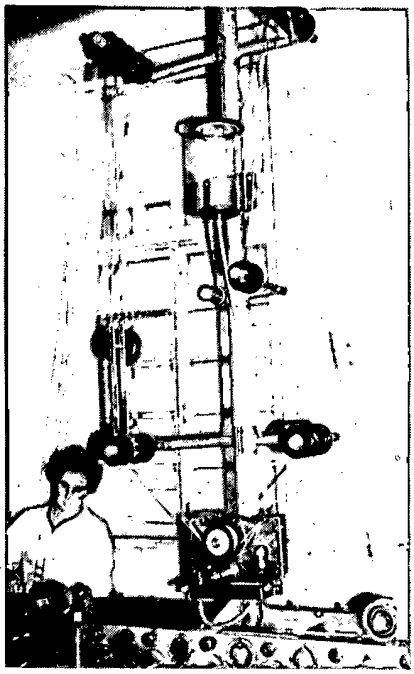

Fig. 26. Soundtrack applicator unit on a color processing machine at the Dovzhenko Studio, Kiev.

Fig. 27. Chemical laboratory at Mosfilm.

produced from the magnetic originals by conventional equipment types and, in the case of color films, the printed track can receive a conventional applicator processing step at the appropriate point in the processing cycle. The developing machine equipment permits choice of sulfide or redevelopment treatments as chosen for the stock and system in use.

The chemical aspects of process control were accomplished in laboratories with conventional glassware, burette stands, etc. In retrospect, there is no recollection of seeing electronic pH meters, but such equipment might well have been available and still not specifically noted, though the small number of pictures taken in such laboratory rooms do not happen to show them.

Sensitometry appeared to be based on step tablets as the exposure modulating device. The associated densitometers were chiefly of the conventional design indicated in the picture (Fig. 28). In only one case was an older style of visual type equipment noted in use, presumably being used there to meet some local situation of availability or convenience. Color densitometry was done with quite similar units equipped with filters for control of the spectral region chosen. Request was made for interlaboratory comparison of color densitometers and the delegation agreed to seek ways by which this could be done. At time of writing, this has not been completed, but it is expected that this will be made part of the test of color stocks and color print methods undertaken and outlined at a later point in this report.

Studio Printers

At the studio laboratories the printing equipment included quite a range of types, chosen for versatility. The problems associated with quantity print production are mainly in the hands of the Mass Printing (Release) Laboratories. Contact printing for black-and-white and color are, of course, primary operations. Control of color balance in the color negative to color positive step is usually obtained with "subtractive" compensating filters in the optical path. "Additive" light control, using apertures cut in an opaque mask was also shown.

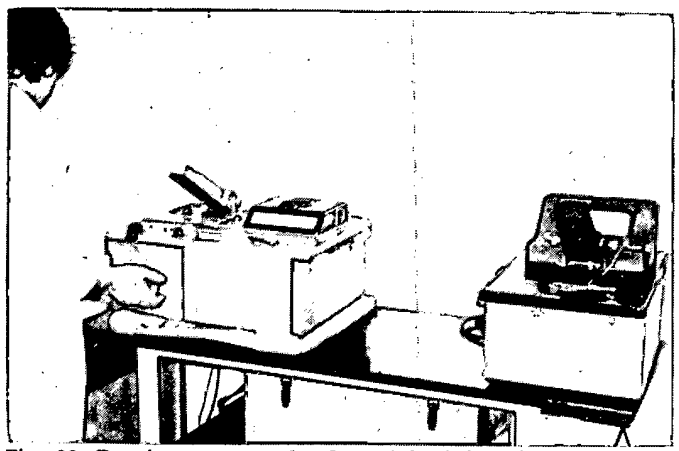

Fig. 28. Densitometers at the State School for Cinematography, Moscow.

Fig. 29. Densitometer used for color control work at Mosfilm.

Reduction printing from 35mm original to a double row of 16mm format images on 32mm stock was in common use. The geometry of the system required the use of 32mm film perforated 1 and 3 as distinct from US practice which uses 1 and 4 positions for film which is eventually used in 16mm sound prints. (The 1 and 3 perforation position places one row of perforations near an edge and one near the center of the 32mm film. The 1 and 4 perforation places one row of perforations near each edge of the 32mm film.)

Looking to the future, there was some opinion that the use of wide format (70-mm) for photography of feature films might increase considerably. In order to keep decisions on this point independent of provision of 70mm projectors in theaters, laboratory steps were planned to permit release in the wide-screen (35-mm anamorphic) format and also as the 4 × 3 format, expected to continue in use in TV from 70mm original negatives. Another related need, in some ways of more immediate interest, lay in the conversion of the wide-screen format (35mm anamorphic) to the 4 × 3 format for TV release. Optical printers to permit each of these conversions were shown. The printer for the wide-format to wide-screen conversion appeared to be a direct optical step printer with suitable anamorphic lens block introduced into the system. The conversions from either wide format or wide screen to the 4 × 3 format included the ability to follow action as the main center of interest moved across the screen.

Two types of equipment were seen. In one case, the wide-format picture was projected onto a small screen and a portion of that image rephotographed to yield the selected 4 × 3 action area. Selection of angles as designed and control of relative motions allowed the selected 4 × 3 format area to follow the action. In another form direct lateral motion of one part of the optical system of a much more conventional appearing optical printer was used to give the selection of printed area. In either case, preprogramming was used to allow an operator to determine the motions required to give the desired selection of action and a degree of automation was indicated for the actual printer control from the program determined.

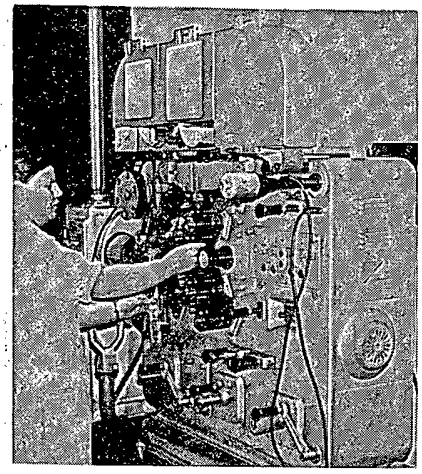

Fig. 30. 70mm printer at Dovzhenko Studio, Kiev; light control by "subtractive" filters.

Other Studio Equipment

Editing tables for the various formats were basically similar in design and gave the needed opportunity for synchronized picture and sound editing operations.

Splicing equipment followed conventional design.

Costume design and preparation was a part of each studio operation.

A filter manufacture and supply service was in operation at Mosfilm to meet the needs of camera men and laboratory workers. Samples seen appeared to be of good quality. A catalog showed a large selection of available filters including glass, dyed gelatine and interference types. In addition, it was stated that special filters are made to meet special needs not covered by the catalog listings.

Make-up was also manufactured at Mosfilm. The quality claim made was that "It is as good as Max Factor's," but the delegation had no opportunity to check that claim or judge the quality by any other standard.

At Lenfilm a small colorimeter was demonstrated which allowed measurement of make-up after application. It was stated that this unit was of particular value in assuring constancy of make-up shade during a prolonged period of shooting.

An optical printer of great versatility had been designed and built at Lenfilm to produce trick shots and special effects. The unit appeared so attractive that inquiry was made concerning its commercial availability. It was stated that its engineering design had been brought to the point that its manufacture in the USSR was planned. For formal answer to the question concerning its availability we were referred to the Ministry of Foreign Trade. Accordingly, a letter of inquiry was dispatched after return from the trip. The reply was definite — this equipment is not being made for export.

Another incident of the Lenfilm visit may be of particular interest to the members of the SMPTE. At the Library there, which is quite a sizable collection of books and periodicals, an SMPTE *Journal* was evident, but the cover was of unusual color. A few inquiries revealed that this was part of an edition being printed

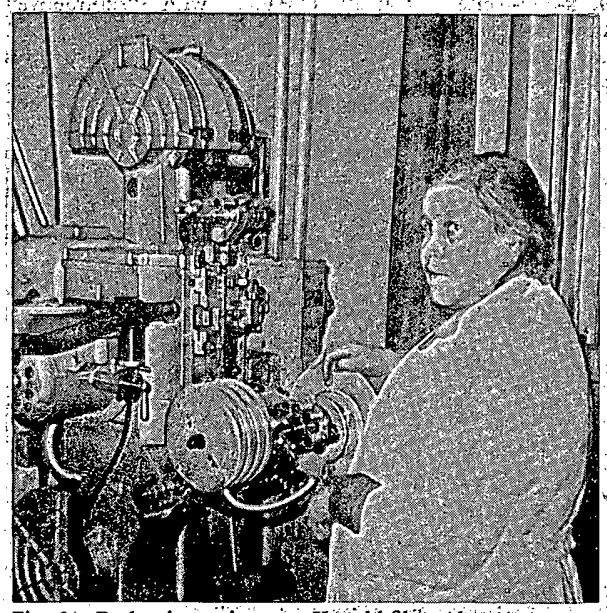

Fig. 31. Reduction printer at Kazakhfilm, Alma-Ata.

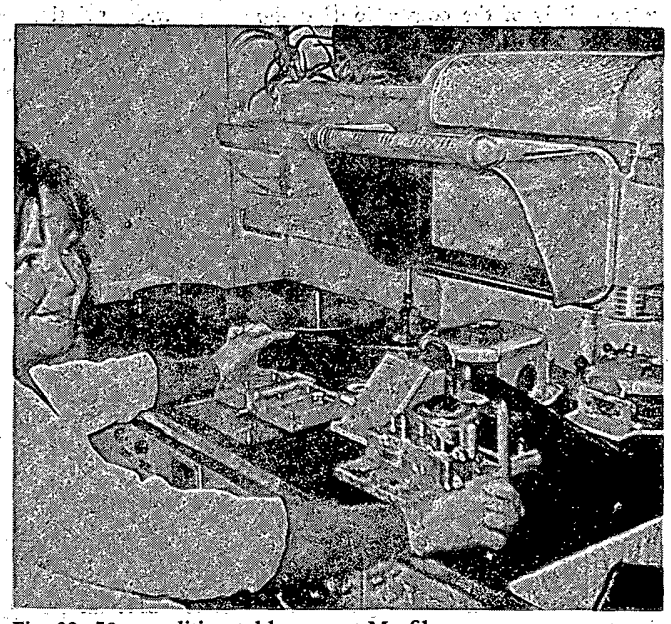

Fig. 32. 70mm editing table seen at Mosfilm.

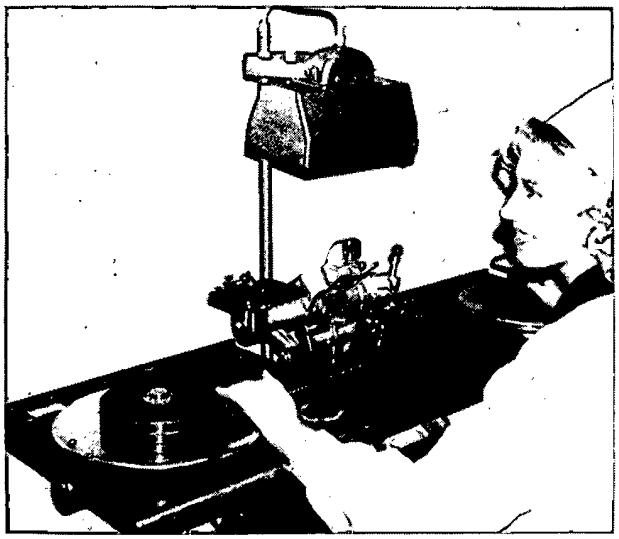

Fig. 33. Splicing table, Moscow Release Color Printing Laboratory.

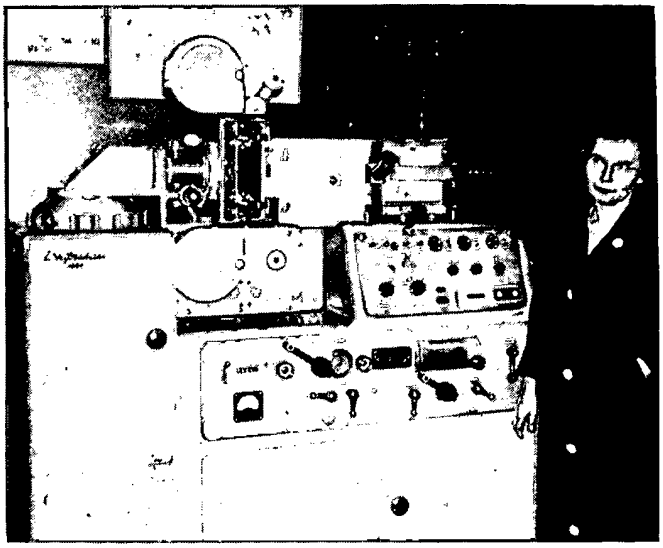

Fig. 34. Special effects printer at Lenfilm.

by photo-offset in the USSR from a copy obtained through normal subscription channels. It was stated that this was cheaper than taking an equal number of direct subscriptions. This event speaks for itself as evidence of the wide acceptance of English as a widely used technical language.

Color Release Printing Laboratories

Two methods of making color release prints co-exist in the USSR. The system which has the larger capacity uses multilayer color print stock while the system with smaller capacity uses imbibition dye transfer printing. Color release printing laboratories were visited at Moscow and Leningrad. Each of these laboratories was said to have a capacity of 40 million meters of 35mm release print per year for multilayer printing. In addition to the 35mm print capacity mentioned, the Moscow laboratory could produce 20 million meters per year of 16mm prints. No corresponding figure was obtained at the Leningrad laboratory. Imbibition printing, limited to 35mm, was done only at Leningrad where the 1963 production was estimated at 7 million meters and 1964 production was expected to be double that, or 14 million meters.

Multilayer print stock was used for four types of release print, 70mm, 35mm anamorphic, 35mm 4 × 3 format and 16-mm. The volume requirements for 70mm prints are still small and prints are supplied directly from studio laboratories. For the other three types, the studios turn over the necessary negatives, approved sample prints and sound records to the release laboratory which fills the bulk print orders. Orders for 1,000 prints were described as frequent with occasional demands for 2,000 copies. In this color field, necessary dupes are made at Mosfilm and the release laboratories work from the dupes so furnished or from original negatives when the size of print order warrants it. All 16mm printing seen was being done by reduction printing.

35mm printing was being done primarily on continuous printers which looked like the Model E printers of Bell & Howell manufacture. This appearance was more than coincidence and was accounted for by the fact that, during World War II a number of Model E printers had been furnished from the US for use in the USSR. It was stated that these units had been worn out in use, but the design had been adopted and new

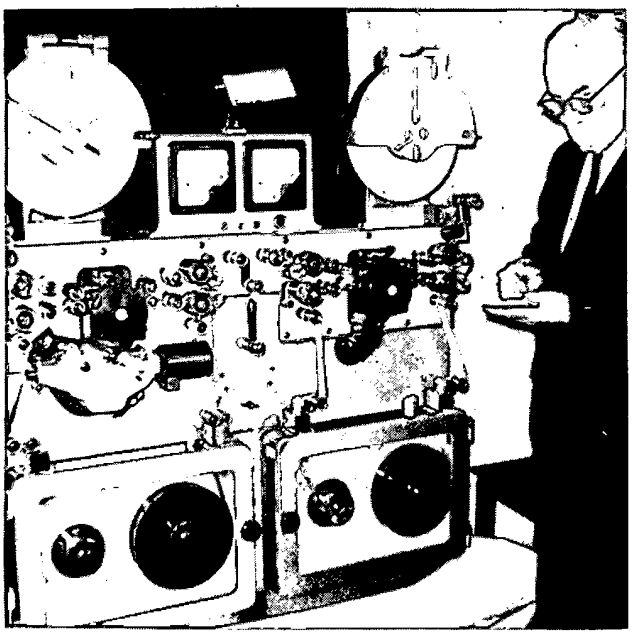

Fig. 35. Continuous printer, Leningrad Release Color Printing Laboratory.

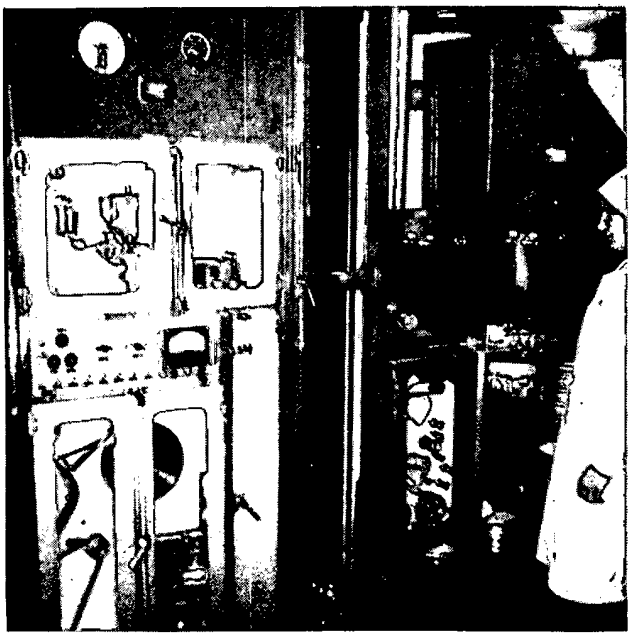

Fig. 36. Applicator used in magnetic striping of prints, Moscow Release Color Printing Laboratory.

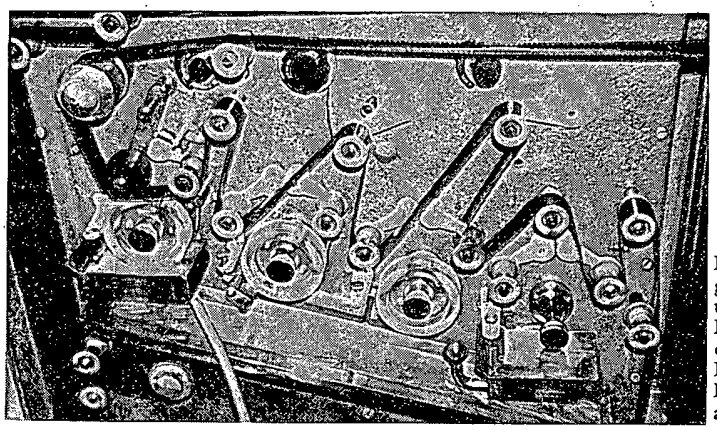

Fig. 37. Three glass wheels, used in the Film Restoration Machine, Moscow Release Color Printing Laboratory.

units built so that the ten printers of this type at Mosfilm and an unspecified, but presumably similar, number at Lenfilm were direct descendents of the original units.

Color balance control on these units was accomplished in routine use by "subtractive" color balancing filters. Experimentation was under way with an "additive" system using apertures of selected sizes in an opaque mask for light control. No opinion was expressed concerning quality differences observed with their application of these two control methods.

Processing was carried out with developing machines of conventional design. These machines were basically similar to those encountered in the studio laboratories, and made similar extensive use of plastics in their construction. The Moscow printing laboratory had fourteen machines operating typically at 2,000 ft/hour. One unit was being operated on an experimental basis at 3,000 ft/hour and used infrared heat and air impingement in the drying section to reduce machine size. The Leningrad laboratory appeared to be similarly equipped.

Application of the stripe for magnetic sound records required on many release prints was part of the function of these release laboratories. Equipment in use was operating at a stated speed of 6,000 ft/hour and applied a layer about 20 microns thick by a simple hopper-type coating operation. On 32mm stock, the striping pattern gave a narrow balance stripe as well as a normal width soundtrack.

Film restoration machines were provided to extend the useful life of films by reducing the visibility of scratches incidental to handling. The unit was quite compact and provided for the use of one to three treatments by glass wheel applicators (Fig. 37). Solvent treatments were mentioned to reduce the severity of base side scratches and an emulsion side treatment involving the application of a casein solution was indicated, though no specific formulas were given.

Dye Transfer Printing

The imbibition dye transfer printing process in operation at the Leningrad laboratory was used for 35mm 4 × 3 format pictures only. Cartoons were its major, possibly its only, regular product. The chemistry of the process had been developed basically at NIKFI (Scientific Research Cine Photographic Institute) with some supplementary work at the film coating factory at Kazan.

There was some hint, in the general discussion of the place of this system in the program of the USSR motion-picture industry, that it had its primary value as a means of supplementing limited production of multilayer color stock. This could explain its use, in spite of present sharpness and definition limitations evident on the screen. Of course, its long-range value would be enhanced if the quality level is improved over that presently obtained.

The success of such a system depends on several factors among them the availability of printers yielding matrices which will transfer the separate dyes in accurate register. Ostensibly, the printers in use in Leningrad should be adequate for this job. Transfer took place on registration wheels, possibly thirty inches in diameter. A total of six transfer units were provided, each designed for one transfer operation.

The raw stock used for the final print was silver bearing. Original exposure was on a continuous printer (based on Model E, Bell & Howell design) provided with a registration sprocket to control the placing of the key image in the film. Silver registration image and silver soundtrack were processed in the conventional manner before the dye transfer steps.

The six transfer machines mentioned thus provide for two production lines of three machines each to yield final color prints. The receptor film is dried and wound up after each transfer step in the order yellow, magenta, cyan.

This laboratory received original color negatives from the studios and made the color separation matrices required. The necessary differential hardening was produced by a pyro developer.

An automatic recording spectrophotometer operating in the range 400 to 700 millimicrons was exhibited as a control unit of major importance to the process.

Equipment Manufacture

Contact with equipment manufacturing facilities was limited to a visit to one factory (Kinap) located at Odessa. Motion-picture work here had started in the early thirties as a center for equipment repair and for manufacture of spare

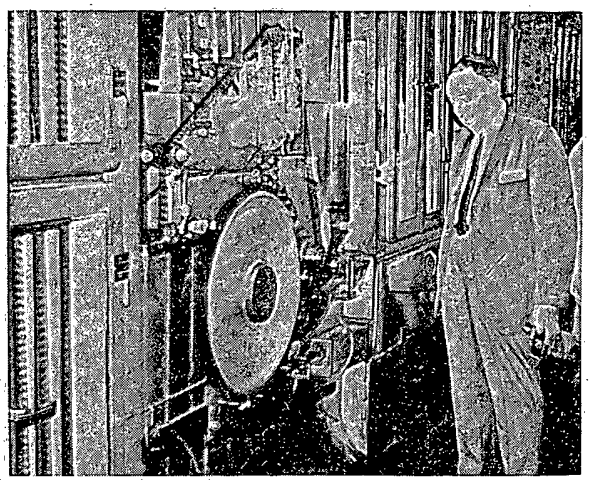

Fig. 38. Transfer wheel of a dye-transfer unit, Leningrad Release Color Printing Laboratory.

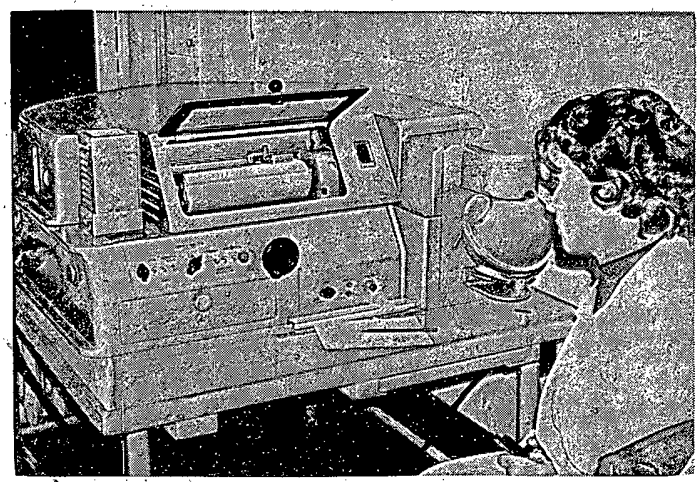

Fig. 39. Recording spectrophotometer used for color control in the Leningrad Release Color Printing Laboratory.

parts. The site was evacuated during the war, and the buildings were burned. It was rebuilt in 1946 and now is a main producer for some of the items needed by the motion-picture industry. More than fifty items are on their product list including projectors with light outputs from 150 to 30,000 screen lumens for 16, 35 and 70mm installations; camera booms and cranes; splicing equipment; film perforators; animation stands and other items of laboratory equipment (except developing machines); and theater screens. Some of these items were represented by descriptive brochures and others were available for direct inspection.

Three models of projectors were seen under construction.

One of these, the 16mm "Ukraina" projector was mentioned in connection with the mobile unit phase of motion-picture presentation. This projector was a moderately heavy unit with a 400-watt projection lamp and sound pick-ups for either optical or magnetic track. The lamp was designed for low-voltage use and had a rather heavy filament coiled into a flattened spiral which presented a nearly planar 4 × 3 source area to the condenser lens. An acceptably uniform field over the gate area was produced rather simply. Some curvature of field was evident for the projection lens in the unit seen most closely under test conditions. These units were assembled on an assembly line on which a projector was completed every five minutes of full operation.

The other projectors seen were being hand assembled, suggesting smaller output. The mechanisms could handle either 70mm or 35mm films. Projection lenses were interchangeable, to give proper results with wide format, wide screen or 4 × 3 format pictures. Arcs of different power were available and their KP5-A model was rated to yield 15,000 screen lumens from an arc operated at 120 amp with a wide-format (70mm) gate and lens system. Another unit designated KP30-A was of higher power, rated to give 30,000 screen lumens with an arc operating at 190 amp and 70mm gate and lens. These projectors utilized dichroic mirrors back of the arc to give maximum screen illumination with reduced gate heating. However, water-cooled jaws for the carbons, and water and air cooling at the film gate were combined to keep the system under control. All the 70mm projection seen was in color, but clips of 70mm black-and-white films were exhibited. It was not clear as to how these black-and-white films would behave in the gates of such projectors. The heat absorption of the silver deposits would surely be greater than that of the color films and there would be, accordingly, greater danger of unsteadiness of focus.

Many of the other units seen at this factory were quite conventional in appearance, including such items as a film perforator, a film synchronizer for handling films of matched lengths, and a microfilm copying table (which, of course, is not strictly a motion-picture item).

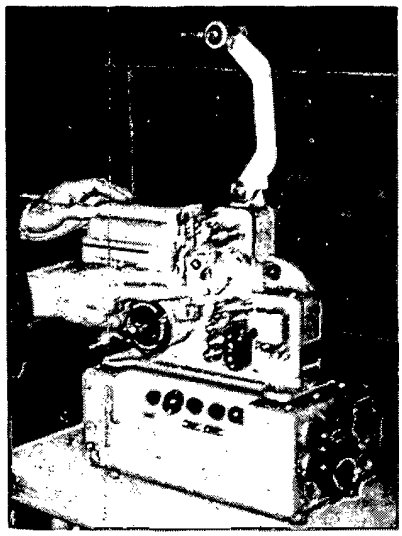

Fig. 40. The Ukraina 16mm projector, as manufactured at the Odessa Kinap.

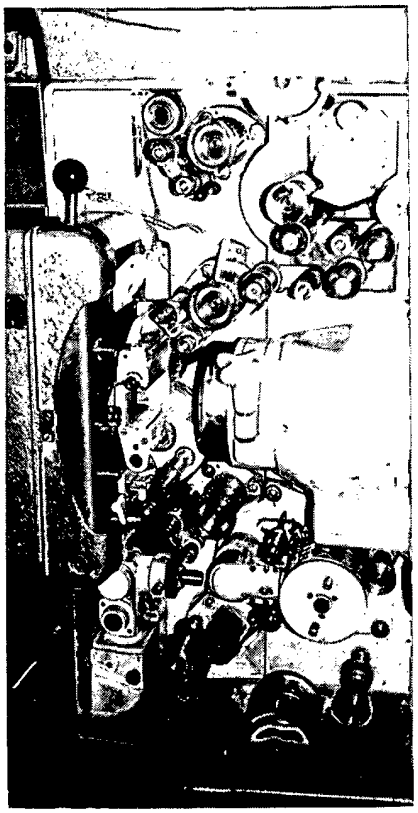

Fig. 41. Film transport system of 70-35mm projectors manufactured at the Odessa Kinap.

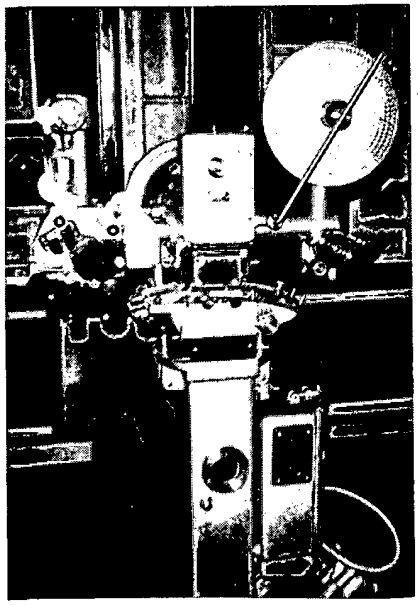

Fig. 42. Film perforating unit, one of the products of the Odessa Kinap.

Screens were manufactured by taking strips of original plastic some thirty inches wide and assembling them into continuous large areas. One type was a matte diffusing screen with a slightly figured surface. The component strips of this material were joined by a film welding technique using the heating effects of a high-frequency system. Another type of screen carrying a metalized surface and perforated to improve sound transmission was joined by adhesive tapes to form a firm butt joint. One thousand screens per year, distributed among eight different types, was indicated as the normal output.

An animation stand, seen in process of assembly, particularly attracted the attention of the delegation. The stand itself was substantially built and had the capacity for many different motions. The control was from an operating console and the combination created the impression that, when complete, it would be a very efficient working unit. No completed unit was seen during the visit, and the impression remains unchecked.

Equipment Design

Ideas for good equipment design could, of course, originate at various points. Each studio seemed to have some ingenious people trying to make improvements. However, it appeared to be the practice to funnel these ideas through the Central Design Bureau at Leningrad for consideration and final production design if accepted. It appeared that this Bureau studied some problems in their own right, without waiting for ideas from outside. Many of the design engineers working here were women and there was a general air of competence about the place.

The design work has included a wide range of equipment and the statement was made that over 150 different kinds of equipment have been developed here in the ten years of activity of this organization. Their work has included design of microphones, sound recording and re-recording equipment, developing ma-

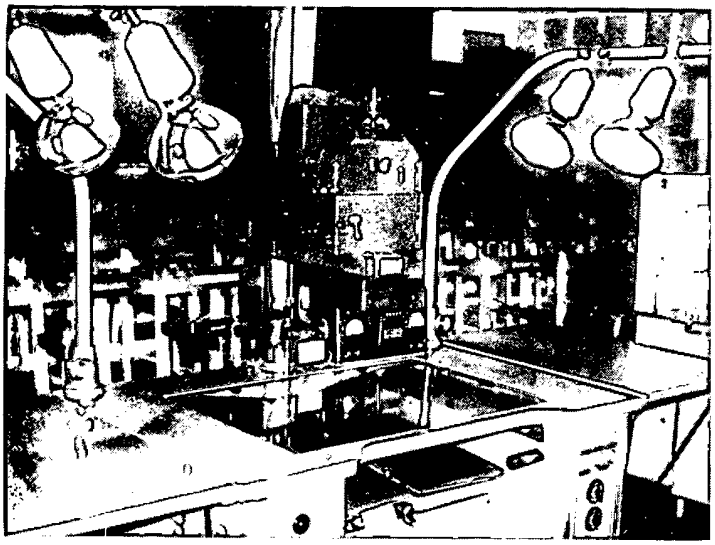

Fig. 43. Microfilm copying stand made at the Odessa Kinap.

Fig. 44. High-frequency screen welding unit used in the manufacture of plastic screens at the Odessa Kinap.

chines, and lenses for cameras, projectors and printers. Recently, equipment designs for wide-screen and wide-format presentations have occupied an important place in their program.

If only a few units of any particular item are required throughout the USSR, such as five or six, the entire requirement will be produced by the Bureau. Otherwise, the designs will be sent out to one of the "Kinaps" for production of the equipment.

Although we did not see any assembled spray processing equipment anywhere during our trip, we were told at Central Design that they do have a spray machine for black-and-white film at Novosibirsk which operates at 26 to 28 C and a linear film speed of 3,000 meters per hour. Nitrogen is used to prevent oxidation. Component parts for a machine of such design were shown us.

Other equipment is worthy of mention:

(a) A small microphone unit with built-in high-frequency radiator for cordless use appeared neat, light and workable.

(b) We were also shown a cardioid microphone, flat 100 to 8,000 cycles which had a narrow angle of sensitivity.

(c) A condenser microphone designed for nondirectional use in motion-picture studios was described as flat, 50 to 15,000 cycles.

(d) Nine-channel amplifiers, as used in nine-channel stereophonic recording and reproduction, were displayed.

(e) A new transistorized amplifier for general recording use was on their test bench.

(f) Use of printed circuits was in evidence.

(g) One unit for making 35mm 4 × 3 format prints from 70mm originals was shown in which action could be followed by mechanical movement of equipment elements.

(h) In their optical department they had recently redesigned a lens of 16mm focal length, *f*/3.0 for 35mm film usage to a considerably smaller unit operating at *f*/2.8. Performance data were not immediately available in full detail though "adequate" definition was claimed — with an axial resolution of 60 to 70 lines/mm.

(i) Anamorphic lenses were on display as used for 35mm wide-screen purposes

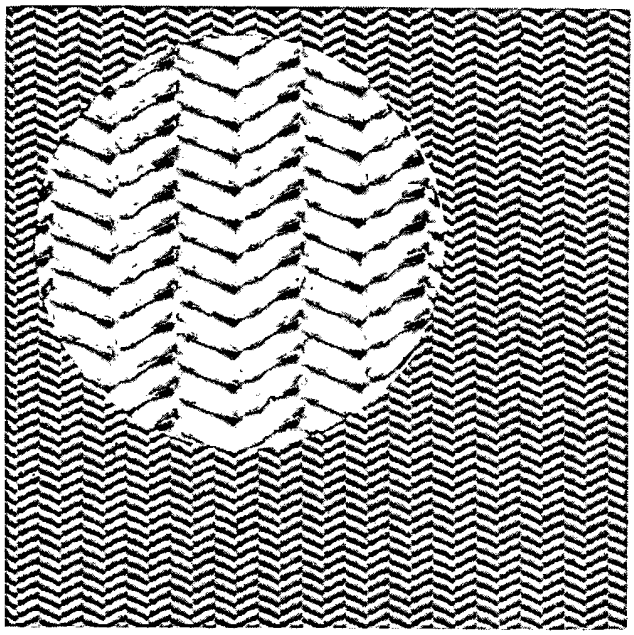

Fig. 45. Enlargements of the embossed pattern used on plastic screens.

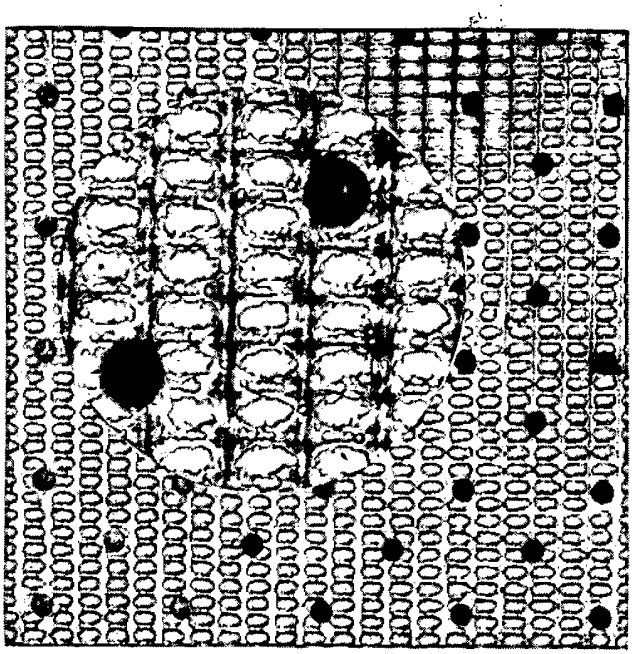

Fig. 46. Enlargements of the embossed pattern used on perforated metalized screens.

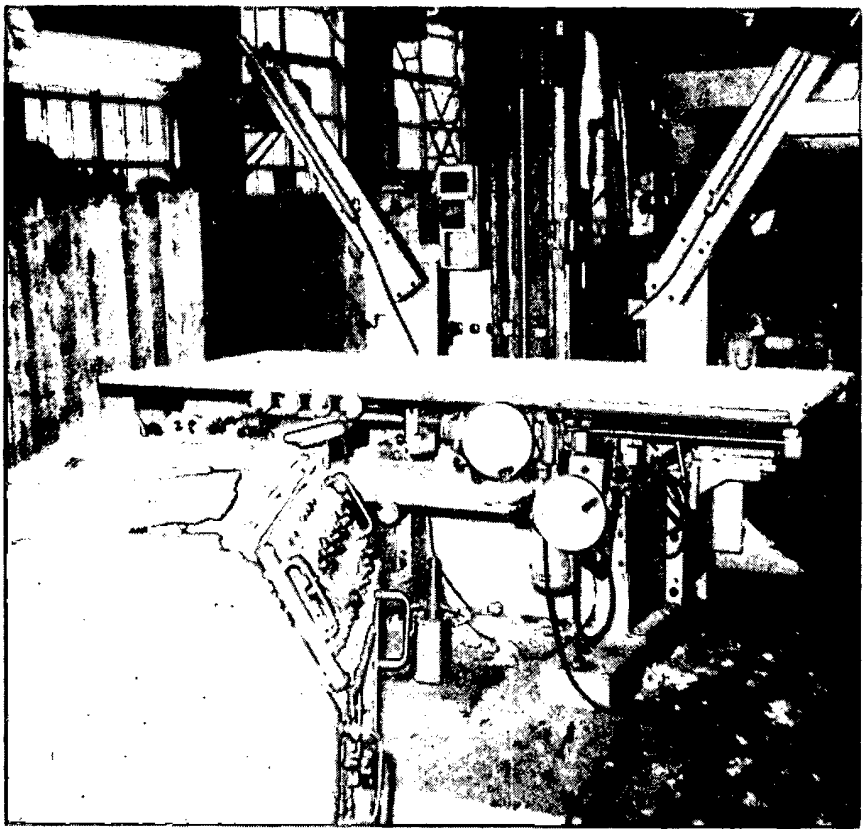

Fig. 47. Remote-controlled animation stand under construction at the Odessa Kinap. The control console is left foreground.

and one for a 1:1.25 squeeze for 70mm film.

(j) Their lens test benches appeared to be well-designed and well-built; whether constructed there or purchased was not determined.

(k) A zoom lens for 16mm professional use had a focal length range of 17.5 to 70mm with a maximum aperture of $f/2.4$.

(l) A 16mm transistorized magnetic film sound recorder was shown. This operated at 15 in./sec and was flat 50–15,000 cycles.

In a discussion of reward for invention, it was pointed out that in their system a person awarded a Certificate of Invention might receive a bonus payment up to 10% of its value as determined over a 5-year period. A person obtaining a USSR patent was said to have more control over the use of his invention, but would not share directly in extra rewards of the bonus type. If the patent was valuable to other countries, he might get money from them as reward for his invention.

Fig. 48. Microphone units in the engineering design office of the Central Design Bureau, Leningrad.

NIKFI (Scientific Research Cine Photographic Institute)

The visit to this research unit was one of the highlights of the trip. Dr. V. G. Komar heads a group of workers some of whom have been contributing for years to the photographic literature. Dr. Komar himself has been active in the motion-picture field and was part of the delegation from the USSR at the International Standards Organization meeting at Harrogate in 1958.

The total staff of the Institute was stated to be 1,300 people, 150 of them having research training of the PhD level, 300 having technical training, but short of the PhD level, while the remainder were assistants with lesser training.

This organization is the central USSR laboratory for photographic research. It clearly covers photography broadly including radiography, films for nuclear particle records, and general photography as well as motion pictures.

General planning of the research for motion pictures is under the guidance of a council of 40 to 50 leading motion-picture specialists (scientists and engineers) from the Institute and from vari-

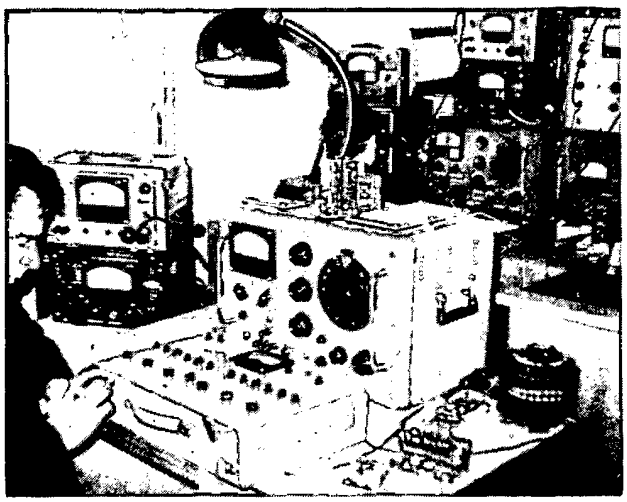

Fig. 49. Transistorized amplifier under test at the Central Design Bureau, Leningrad.

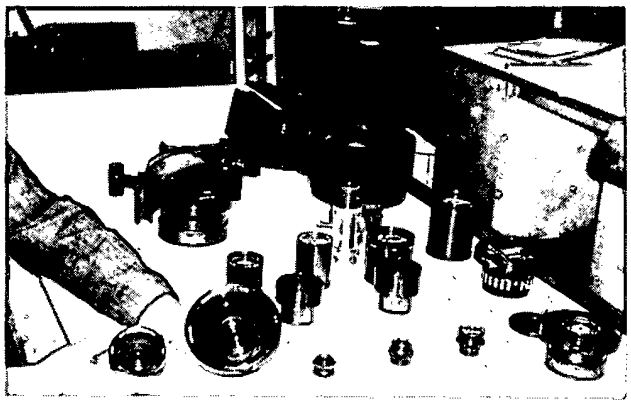

Fig. 50. Display of lenses designed at the Central Design Bureau, Leningrad. The small lens, lower left, is an $f/2.8$ redesign of the adjacent larger $f/3.0$ lens. Both are 16mm focal length for use with 35mm films.

ous studios. The day-to-day progress of the work is under the supervision of the department heads, working with the Director of the Institute.

Xenon sources for projection have been developed in the lighting laboratory and are in use with d-c sources for units of 0.5, 1.0 and 3.0 kw. A 1.0-kw unit for a-c operation (symmetrical electrodes) was also shown. Work is under way on a 5.0-kw lamp. Stated present lamp life is 1,000 to 1,500 hours on the 1.0 and 3.0 kw d-c units; 2,000 hours on the 0.5-kw unit and 500 to 600 hours on the a-c 1.0-kw unit.

A 16mm shutterless projector using the a-c type bulb was shown illustrative of equipment now in production based on their work. Reel capacity was 1,320 meters. Film pulldown was the claw-type and was said to have a wear life of about 2,000 hours. The unit was rated as giving 2,500 screen lumens.

The projectors at the Kremlin Palace of Congresses are rated as giving 45,000 screen lumens when projecting 70mm film. At NIKFI work is directed toward a unit to increase this to 60,000 lumens. They are working with 16mm positive cored carbons operated at 300 amps in comparison with 12mm carbons operated at about 200 amps for the 45,000 lumen installation. The reflector is an ellipsoidal mirror, 60 cm in diameter, with a 15-layer interference coating to give good visible reflection with reduced heat at the gate. Rotating carbons, water-cooled arc carbon jaws, water-cooled gate members and air blasts to help control the arc and cool the film in the gate were all in evidence.

In the NIKFI camera laboratory was one 70mm camera under test, intended for use at 120 to 140 frames/sec. Registration pins were used two perforations below the picture. We understand this is their standard location.

One of the 35mm beam splitting cameras used for their infrared method of process photography was evident. A 70mm version using the same principle was on a test stand. The increase of the geometrical complication for this size unit was very evident. Lens to film distance had to be increased very greatly because of the larger geometry. It is by no means certain that this will prove a practical system in 70mm. Presumably the camera lenses had to be specially designed to give the long back focal distance required.

The workers in the optics laboratory were familiar with the spatial frequency and transfer function methods of describing system performance. They used automatic equipment to produce plots that were identified as spatial frequency response data. The actual coordinates were not identified on the curves so produced.

One lens on display was rated as 12.5-mm focal length, designed to work as a wide-angle lens for 70mm photography. It was rated at $f/3.5$. No performance data were available. The front lens element was some 6 in. in diameter. Visually, the diaphragm looked appropriate to the rating indicated.

Electrical power circuitry studies included power stabilizers which were said to hold voltages to $\pm$ 1% for set lighting and projection lamp usage. Much use is made of rectified a-c for their arcs and xenon lamps.

The printer development laboratory equipment included a precision camera by which to produce special test films to be used in testing resolution and steadiness of printer systems. It was claimed that such test films could be made there for any format in current use.

The main responsibility of the sound laboratory deals with sound reproduction for cinematography. However, many theaters are used for multiple purposes, and accordingly theater acoustics and sound re-enforcement systems broadly are studied here too.

There are some 120,000 sound systems in the USSR and one of the problems ahead is the standardization and conversion of these units to transistorized types suited to theaters of the sizes chosen in their construction program. The work in this laboratory tends toward the development of basic information which will in turn be used by the Central Design Bureau (Leningrad) in equipment development and design.

The architectural acoustics laboratory has facilities for experimental study of sound characteristics in auditoriums from scale models. A scale of 1:40 was indicated as that usually used. With this scale model, tests were made at 20,000 cycles and interpreted as showing effects of shape, construction materials, fabrics and the like.

Film Stock Research at NIKFI

The announced goal of synthetic organic work at NIKFI is the production of the special organic compounds, dyes, color formers, etc., useful in photography. Enough glassware and equipment were in evidence to suggest that success or failure would depend on people, not equipment.

Gelatine studies are a specialty of a

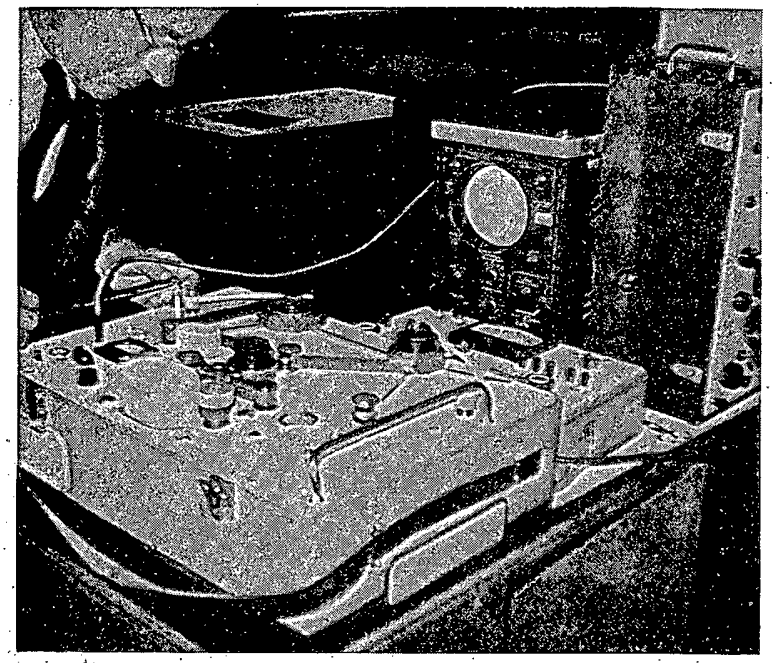

Fig. 51. Portable 16mm magnetic recorder at the Central Design Bureau, Leningrad.

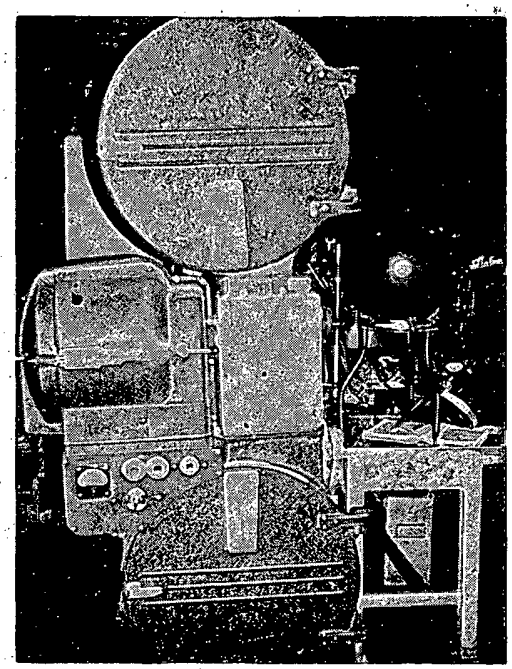

Fig. 52. 16mm shutterless projector with xenon arc source developed at NIKFI, Moscow.

laboratory at the Kazan film factory rather than in Moscow.

It was interesting to note two spectrophotometers set up for use that were indistinguishable, on casual observation, from a type sold a few years ago by the General Electric Co.

We entered the emulsion formulation laboratory only after discussion had developed the fact that we would be shown research equipment only and would not discuss formulations. This precaution was taken as it is believed quite unlikely that reciprocity in the US would extend beyond this same point in case of a visit of Russian scientists. Very small scale making equipment was shown in the one laboratory visited. It appeared that test quantities are coated on glass. A plate whirler was in evidence which might be used as an aid in coating small test plates.

In the sensitometric laboratory the routine step wedge test tablet is of the $\sqrt{2}$ of two type with 21 exposure steps. Each step is about 8mm square. The sensitometer most used gives 1/20-sec exposures and is arranged to permit easy insertion of any chosen filter into the beam.

Associated with the sensitometric test equipment was a resolving power camera claimed to give useful results up to 500 lines/mm.

A microphotometer, designated MF-4, was set up with automatic recording equipment. This looked rather light in construction in comparison with the rugged systems sometimes thought necessary for precision work at high magnification.

A reciprocity law sensitometer was set up for use, covering the exposure time range 10 sec to 10^{-7} sec. It appeared to be a compact, well-designed instrument with considerable use of pushbutton controls. It was indicated that this might be made available for sale but later inquiry through the Ministry of Foreign Trade elicited the information that no export of this unit is planned.

In the film base laboratory two small belt casting machines were in evidence. They were not in use at the time and nothing is known as to their capacity or their ease of control and operation. The work was directed toward the accumulation of basic information concerning the characteristics of film forming materials and the influence of composition and coating variations on the structure and properties of resultant films.

It was indicated that polycarbonates were under study for base use. Base samples tested had shown good tensile properties, as measured by break and shock tests. Work was continuing on the problem of subbing such base.

NIKFI work on color films is directed toward the completion of the introduction of masked color negatives and their subsequent further improvement from the first embodiment. Considering all circumstances, it was inevitable that the discussion touch on comparisons with Eastman color films. At present. the Russian group considers it unnecessary to push to as high saturation of colors as can be obtained with Eastman materials.

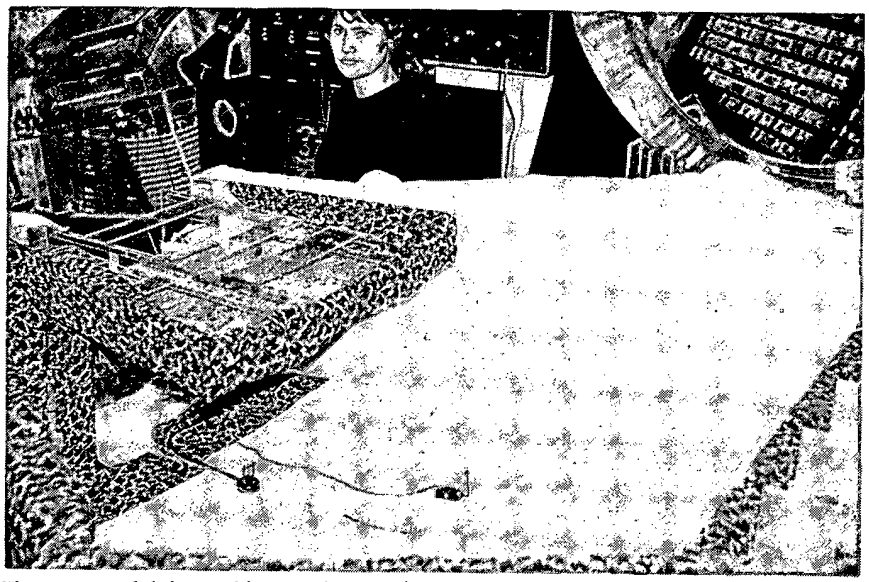

Fig. 53. Model in architectural acoustics laboratory, NIKFI, Moscow. This model represents the Rossiya Theater on a scale of 1 to 40.

International exchange of color negatives is a distinct possibility and developed samples of the masked Russian color negative were furnished the US delegation to develop information on printing and duping problems that may be encountered if such exchange occurs with the US. *WARNING: NITRATE BASE MAY BE ENCOUNTERED.*

The current Russian masked negative requires exposure cor esponding to about 35–40 ASA. Increased speed is an objective of research and it is expected that one stock will be developed for direct use with incandescent lamps which can be used with a filter at the same effective speed under daylight conditions.

Second Visit With the State Committee

The original plans of the delegation contemplated return to the US on Sunday, November 10, just three weeks after the arrival at Moscow. The State Committee for Cinematography requested that this part of the plans be changed to permit a second conference before departure. This change was made. During the meeting the State Committee invited comments on places where the delegation considered improvements possible. Two such points were made.

Nitrate film is still in use in the USSR for part of the 35mm film required. No label or edge mark was found designating such film as nitrate, though a match test of small pieces clearly showed the rapid burning rate characteristic of nitrate base. Studio and TV practices do not meet customary US standards for the handling and use of nitrate. The matter of personal safety may be a suitable subject for decision in the USSR alone but to the extent that films from the USSR are articles of commerce in international trade, there is a real international interest which is not well met by unlabeled nitrate film. Unless or until this matter is cleared up, all 35mm film from the USSR is suspect.

The statement was made that all 16mm and 70mm film is on acetate base.

The second matter brought to the attention of the State Committee was film cleanliness. A large proportion of the prints seen showed dirt, some of which was clearly print through from dirt on a negative. No film cleaning equipment was seen in the USSR beyond the restoration machine noted, which was not primarily a cleaner. Since return to the USA, the journal *Teckhnika Kino i Televideniya* has been found to contain articles about film cleaning processes and equipment. This material clearly antedates this visit — but was not shown to us at the sites visited.

Acknowledgment: All the delegates thanked the State Committee for the care which had been taken to push through the crowded schedule of this three-week visit. The assistance of M. Z. Wysotsky, Deputy Chief Engineer of Mosfilm, was cited as particularly valuable as he had taken three weeks from his regular post and done much to aid in securing the breadth of contact achieved.

Notes

In addition to the entire session at the 95th Technical Conference, V. G. Komar's paper which follows immediately in the pages of this *Journal* supplements the delegates' report especially as to cinematography.

Also of possible supplementary interest to some readers may be three articles which have been translated from the Russian and are available as manuscripts on loan from Society Headquarters:

(1) L. G. Golshstein, I. Ya Levin and T. I. Maksinrov, "Optical printer," *Tekhnika kino i televideniya, 3*, No. 10, 58–62, (1959).

(2) M. M. Lisogor, "The 'Rossiya' Universal Cine Theater," *Tekhnika kino i televideniya, 6*, No. 5, 1–8, (1962).

(3) I. B. Gordiichuk, "The present state of the manufacture of cine apparatus in the USSR," *Tekhnika kino i televideniya, 6*, No. 5, 3–19, (1962).

Cinematography in the USSR

By V. G. KOMAR

The status of the Soviet cinematography industry is reviewed and its organization, techniques, equipment and projection systems are discussed. Uses of high-speed photography in scientific research and the development of processes and equipment for photography in space research and the study of nuclear processes are touched upon briefly. The technical premises for international cooperation are reviewed; and the basis for the exchange of films is viewed as one of the most serious problems faced by the engineers of many countries.

Cinematography in the USSR is a large, complex industry that is in a process of development. From 1957 to 1962 the number of projection units (with paid admission) increased by 73% and by the beginning of 1963 had reached 120,400 units (32,000 of these for 16mm film); along with this, town theaters grew in number by 33% and amounted to 19,600.

Although the majority of the motion-picture units are state property, a considerable number are public property of the trade-unions and collective farms.

Despite the growth of cinematography and television, the demand still exceeds the supply. In 1962 total paid admissions exceeded 3.9 billion, which is 28% more than in 1957. In 1962 this averages out to 18 admissions per person: 21 for city dwellers and approximately 14 for rural inhabitants.

At present there are 39 motion-picture studios in the Soviet Union, 20 of them producing feature films. From 1957 to 1962 the number of full-length productions released annually was between 116 and 143 and feature films released numbered from 90 to 115, annually. The country's biggest Mosfilm studio produced from 22 to 26 feature films annually, in this period. A number of studios are now being reconstructed, hence the total capacity of the studios is expected to rise to some extent in the oncoming years.

About half the pictures distributed in the Soviet Union are imported, many of which are produced in Western Europe and America.

Owing to the large number of films exported and imported and to the many languages spoken within the USSR, film dubbing is of great importance. Dubbing is carried out in seven Soviet national languages and subtitle insertions in 25.

Because of the vastness of the Soviet Union and the large number of sparsely populated rural areas, it is necessary to print motion pictures in great release quantities—from 1,000 to 1,500 copies and in some cases up to 2,000 prints; therefore, there are independent film printing enterprises.

The output of film prints on 35mm within 1957–1962 increased by 29% and in 1962 totaled some 478 million meters (121 million in color). During the same time the output of film prints on 16mm film grew by 35% and amounted to 128 million meters (22 million meters in color).

ORGANIZATION

Since early 1963 cinematography has been controlled by the State Committee for Cinematography of the Cabinet Council of the USSR. Minister A. V. Romanov is president of this Committee and Eng. A. F. Barinov, vice-president of the State Committee for Cinematography, who is sponsor on cinematography industry.

In some Soviet Union republics in 1963 State committees for cinematography of the Cabinet Councils of these republics were set up to control the operation of the local organizations.

The major studios are under the direct control of the State Committee for Cinematography: Mosfilm, Lenfilm, Gorky-Studio, the central documentary studio, the popular science studio and printing enterprises. Subordinate to the State Committee for Cinematography are also the main cinematographic research, design and training organizations.

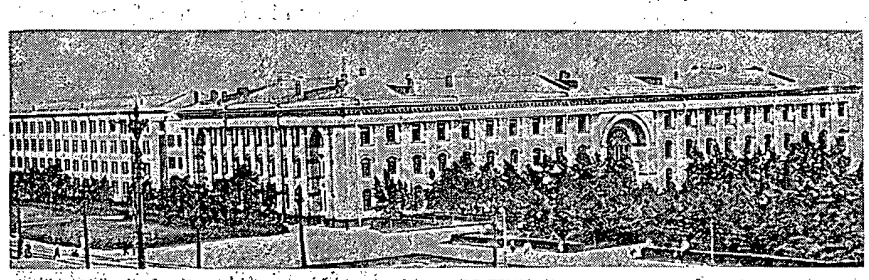

Fig. 1. Cinema and Photo Research Institute (NIKFI), Moscow.

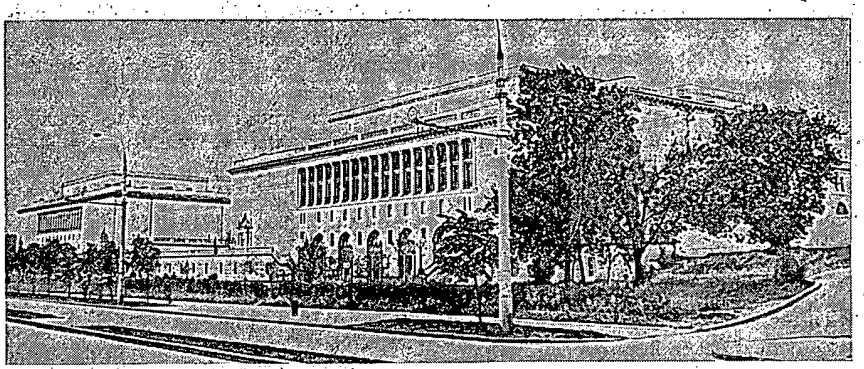

Fig. 2. Mosfilm Studio, Moscow.

Presented on May 8, 1961, at the Society's Convention in Toronto by Dr. V. G. Komar, Professor, Director of Cinema and Photo Research Institute (NIKFI), Leningradsky Prospect 47, Moscow, (USSR. Owing to delay in publication, changes have been made in the paper to bring it up to date. This revised manuscript was received on November 19, 1963).

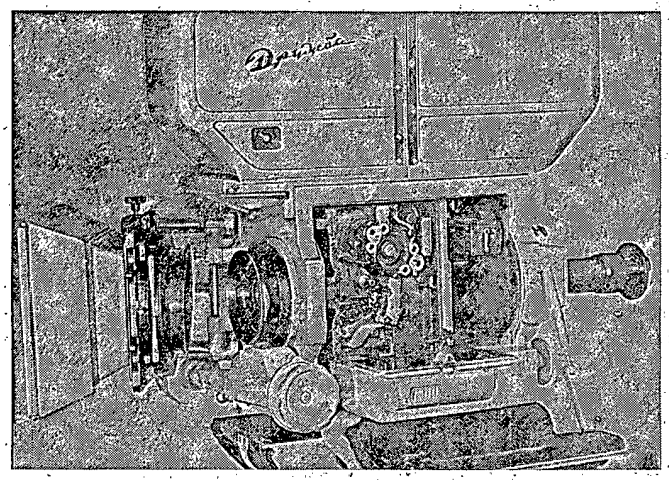

Fig. 3. Sound camera Druzhba for 35mm film.

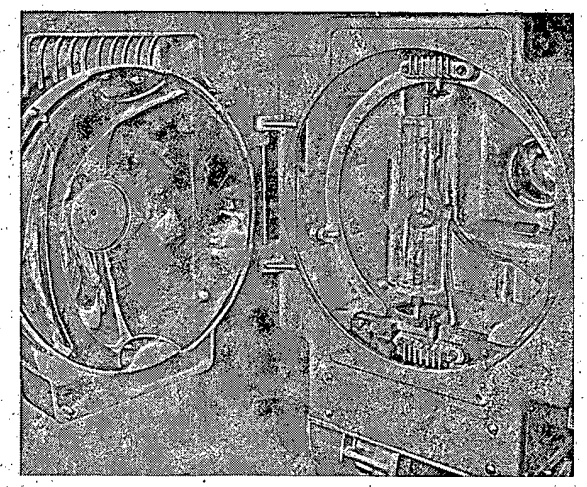

Fig. 4. Lighting unit with a 1-kw xenon lamp in the Sibir projector.

Basic research in motion-picture technique, light-sensitive material and processes is fulfilled in the Soviet Union by the Cinema and Photo Research Institute (NIKFI). This institute came into existence in 1929 and is located in Moscow (Fig. 1). There are branches which were established in 1957 by the largest raw-stock film works in Kazan (Tartar Autonomous Republic) and Shostka (Ukrainian Union Republic). NIKFI branches preferably engage in improving the technology of raw-stock film production and in the industrial application of new developments at the works.

Construction of new equipment is carried out mainly by the Central engineering bureau (TsKB), in Leningrad, the Moscow Cinema Apparatus engineering bureaus (MKBK), and the Special Cinema Equipment engineering bureaus (SKBK), in Odessa.

Many enterprises manufacture motion-picture equipments. The largest of them are the Leningrad Optical-Mechanical Works (LOOMP), the Moscow Moskinap Works, the Odessa Cinema Apparatus Works and the Samarkand Cinema Apparatus Works.

All work on the development of new cinematography technique is performed according to a common schedule so that research, design and industrial organizations cooperate in solving problems of motion-picture technique, light-sensitive materials and photographic processes.

Motion-picture engineers and technologists in the field of manufacture of motion-picture equipment and films as well as in film treatment are trained in the Leningrad Cinema Engineers' Institute (LIKI) and in other educational institutions where separate investigations in the given field are also carried out.

The State Committee for Cinematography sponsors, in addition to Mosfilm (Fig. 2) and other studios mentioned above, the publication of the monthly magazines *Tekhnika kino i televideniya* and *Kinomekhanik*. The edition of the journal of scientific and applied cinematography and photography is under the sponsorship of the Academy of Sciences of the USSR.

Besides state institutions there is the Cinematography Workers' Association, a public organization which is engaged in cinematography. The Science and Technology Department of this association is headed by Eng. B. N. Konoplev, who is also vice-president of the international motion-picture technical organization, UNIATEC. The Cinema Workers' Association and NIKFI are members of this organization. In November, 1962, they organized the 5th UNIATEC Convention in Moscow on the subject, "The Future of Cinematography Technique"; the convention played a positive role in international information exchange on developments in motion-picture technique and the avenues of further progress.

TECHNIQUES

Cinema equipment production started as early as 1923–1924 and the production of raw-stock film began in 1930–1931. By the eve of World War II Soviet industry had already produced equipment and films of many types and in quantities essentially covering the needs of cinematography. Ferment in the Soviet motion-picture industry was especially high during the years 1950–1962. Within this lapse of time raw-stock film production was increased 3.3 times.

A typical trend in today's cinematography technique development is the constantly increasing turnout of cinema apparatus and film.

Another trend may be stated as involving the design and production of the entire range of versatile types of equipment and materials for use in cinematography. Today the fact is that the motion-picture industry builds virtually all types of equipment installations and film materials required for production, release printing and projection.

Soviet industry builds various types of 35mm cameras: synchronous, silent, hand cameras and such for composite and trick photography. These accord to modern requirements. For instance, sound camera "Mir" (3KSS-model) excels other types. It weighs 66 kg and has a noise level under 29 db (with film and from one-meter distance). Good performances distinguish the 35mm sound camera Druzhba (Fig. 3). There is also production of 16mm and 8mm cameras. Industry produces lenses with 16mm to 300mm focal lengths for shooting onto 35mm film. Further productions are lighting equipment and special transport facilities for film shooting, film printing, film cutting and projection devices, sound recording and sound reproduction apparatus, etc.

It is a remarkable fact that during recent years, in which cinema techniques have advanced vigorously, the range of the parameters of cinema equipment has widened steadily so that it is now possible to present motion pictures in auditoriums of different seating capacities. In particular, the maximum light flux of Soviet-made projectors for 1950–1962 increased by 13 times and the acoustical capacity of theater sound reproduction units rose by 5 times. This made practicable the presentation of motion pictures in auditoriums ranging from those of very small dimensions to those that can accommodate 6,000 spectators and screen sizes ranging from the small to the very large used in modern cinematography projection systems.

This trend of greater projector light flux and higher acoustical power of sound reproduction equipment will continue because there is a demand for presentations on rather ample open areas to larger audiences.

Work done up to now for the motion-picture industry has been primarily for improving cinematographic image and sound quality along with raising pertinent economical indices. It is implied that in the accomplishment of this work cinematography is based on modern tech-

nological principles that are inherent in the achievements in related fields of science and technology.

The development of modern Soviet cinema technology is characterized by the growing utilization of the following facilities.

Xenon Light Sources

The advent of xenon lamps in the Soviet theaters in projection applications dates back to 1957. Since that time the operation of a considerable range of theaters with xenon lamps of one kilowatt has proved their merits: homogeneous and stable screen brightness, economy, lack of deleterious exhaust products, simple handling and long life (Fig. 4).

There has been two years' experience in projector operation with xenon lamps of 3 kw under theater conditions. Their effective light flux, with rotating shutters, amounts to from 11,000 to 12,000 lm. Thus, it is expected that soon the production of cinema projection equipment having light fluxes within the range from 700–1,000 lm up to 10,000–12,000 lm (for medium-sized theaters) will be changed over to xenon light sources.

Studies of lighting systems with 5-kw lamps have proved their potentiality for projectors with bigger light fluxes for larger auditoriums. Parallel to this, it has been found feasible to use for small auditoriums low-power xenon lamps of 0.5 kw.

It is interesting to mention the results of investigations of 0.8-kw water-cooled capillary impulse lamps with xenon. The light spectrum makes these lamps superior to known capillary impulse lamps with mercury and this is important for color film shows. A projection unit with xenon impulse lamps is undergoing a test run in a theater in Moscow.

Photoelectronic and Semiconductor Devices

The theaters of the Soviet Union use extensively photoelectronic multipliers for sound reproduction from prints with optical soundtracks. By 1950 the usual photocells in the projection units throughout the country had been replaced by photoelectronic multipliers, as a result of which it became possible to increase the amplifier input signal tenfold, to simplify it and to raise the reliability of the unit. In recent years work has been done to find out the feasibility of using germanium and silicon photodiodes for the purpose.

Such semiconductor devices as diodes and transistors are very promising for cinematography. The d-c supply for projector light sources in the USSR, beginning in 1949, was entirely re-equipped with semiconductor rectifiers with automatic current stabilization. At first, selenium rectifiers came into use, and nowadays we widely use germanium and silicon ones. Selenium and silicon rectifier units with stabilized arc light current were created for studio lighting purposes.

In the last few years new types of amplifier units have been designed comprising germanium and silicon transistors: units of 15 w for portable projection units (with a germanium photodiode without electronic tubes) and units of 25 w for stationary projection units (preamplifier and power stage amplifier), for synchronous sound recording onto 6.25-mm magnetic tape in newsreel shots at the speed of 19 and 38 cm/sec.

Ever greater numbers of types of amplifier equipment for sound recording and reproduction will be fitted out with transistors, instead of the tubes used.

Automation

Design work is carried out with a view toward automating various cinema processes to improve the quality of motion-picture photography, printing and demonstration and for better economical effect.

Automation in film production is intended to release directors, cameramen and sound operators as widely as possible from miscellaneous auxiliary operations and let them concentrate more freely on the solution of artistic problems. Systems which would be able, for example, to memorize at rehearsals and afterwards to reproduce exactly the movements of the cameras, the scene lightings, the sound accompaniment and so on, would be rather helpful in motion-picture production. In making film shots Soviet studios use remote on- and off-switching devices with memory elements to control the lights.

Research is underway to achieve full automation of film printing, treatment and examination when performing these processes at a single installation. Automation methods have been devised for such motion-picture shows in theaters which would provide automatic changeovers throughout the entire show from beginning to end. Wide introduction of devices serving these aims into cinema theaters is planned.

Acoustics and Electroacoustics of Large Auditoriums

Currently, large theaters are being built. In 1961 the theater Rossiya in Moscow (Fig. 5), which accommodates 2,500 people, was put into operation. In the same year the Congress Palace in the Moscow Kremlin was inaugurated, its auditorium comprising 6,000 seats. This house is multipurpose and serves for congresses, conferences, opera stagings, ballet performances, concerts, musical shows and film projection.

The designers of the novel sound amplification system and equipment in the big auditorium of the Congress Palace (engineers of NIKFI, TsKB and LOOMP) were awarded the Lenin Prize in 1962.

The above-mentioned equipment and the acoustics of this auditorium provide for a high quality of sound reproduction.

At present, several large cinema theaters and multipurpose auditoriums are being constructed in different cities of the country: for 3,000 and 4,000 viewers in Moscow, for 4,000 viewers in Leningrad and Kiev and for 3,000 in Tashkent. All big multipurpose auditoriums are investigated via preliminary models on a 1:40 ratio and 20-kc ultrasonic frequency. This has been proved practical in determining auditorium design, acoustical treatment and acoustical properties.

A method of ultra-acoustic modeling has been designed by NIKFI and is used to solve acoustic problems. This helps in investigating not only sound reflection patterns by short pulses but also in determining reverberation time.

Composite and Trick Shots

Film studios are making wider use of various composite shots for trick scenes to save production time and money. Most notable is the traveling matte method which uses an infrared-sensitive mask film and a trick camera which simultaneously passes two films through its film gate (Fig. 6). The actor is photographed in the normal manner against a background screen, through which infrared radiation passes from lamps behind the screen. Background and set details are shot separately. The two films are then put together. Many shots in pictures made by Mosfilm and other studios have been made by this method.

Attempts have been made to shoot a motion picture using a trick camera exclusively and photographs instead of real architecture for background (for instance, the picture *Man to Man*). This experience of an enhanced application of the process opens inviting possibilities of achieving considerably easier and cheaper motion-picture production.

Video-Tape and Video-Film Recording

Soviet TV stations utilize TV video recording devices with 70mm magnetic tape. Equipment and tape as well are made by Soviet industry and provide satisfactory quality so that the TV image which was recorded onto magnetic tape does not differ practically from the usual image on the screen of a TV set.

At TV stations the programs are also recorded on 16mm and 35mm film. To this end apparatus is used in which photography is accomplished from a kinescope screen with afterglowing. Devices are being tested for photographing a kinescope screen by means of cameras with rapid film pull-through which have certain advantages.

There is a project for making wider

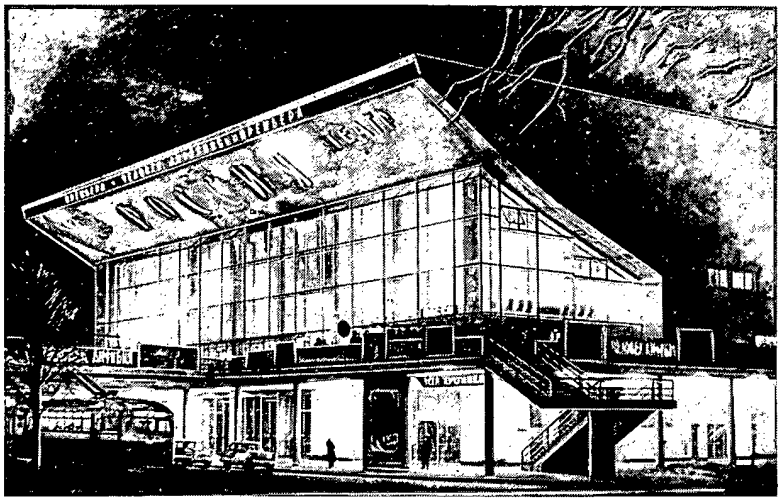

Fig. 5. Theater Rossiya, Moscow, demonstrates motion pictures on 35mm and 70mm film.

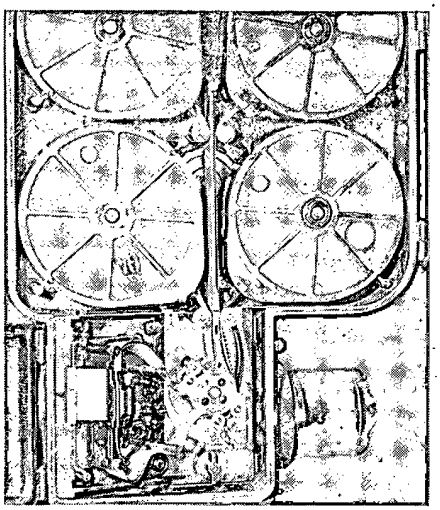

Fig. 6. Trick TKS3-camera for shots by the traveling matte method with infrared radiation.

use of the aforementioned methods operating with tape as well as with film for television program records.

Raw Stock

The raw-stock industry produces a variety of films. To meet the requirement of cinematography, today's production embraces color negative films of the previous maskless DS-2 and LN-3 sorts and of new ones with mask couplers: for daylight (DS-5) and tungsten (LN-5).

These materials, with mask couplers and a color positive film (TsP-9) with reversed layer position, have presented the opportunity to improve color rendition and image sharpness and, if necessary, to obtain brighter saturated colors. The experience with these films during the last few years justifies a further changeover of the country's entire color picture production to negative films with mask couplers.

It is planned soon to substitute in professional cinematography a new set of motion-picture stocks for the previous sorts. This set will comprise four negative film types of different sensitivity, while a negative and a positive dupe and a positive film will yield better image quality by virtue of improved gradation properties and sharpness, lower grain and higher physical-mechanical performances. A film from this set, VCh-type negative, having more than 400 ASA, is released by industry.

SCIENTIFIC RESEARCH

The photographic processes, cinema equipments and various sensitive materials of cinematography are increasingly being utilized as tools for scientific research. One example is the applications of high-speed photography. Speeds up to 100 million frames/sec have been accomplished. These were achieved by means of photographic lenticular rasters representing glass plates covered with a multitude of small optical elements (obtained from a sensitive collodium layer) of high optical qualities. The elements are closely spaced at intervals of a few hundred microns. Such finely structured photographic rasters permit, primarily, increasing still more the speed of photography; they are also applied to stereoscopy and color television.

Cinematography and photography have also been used by the Academy of Sciences of the USSR in cosmic space research and for the study of various nuclear processes. Special photochemical processes and equipment were used to photograph the back face of the Moon on October 7, 1959. A high-quality image was obtained on board the automatic station in spite of nongravitational conditions, considerable temperature variations and intense cosmic radiation. The image corresponded to the requirements of subsequent transmission to Earth by television methods.

Soviet industry puts out a wide assortment of photographic materials for scientific research which are designed for a great variety of wavelengths of different radiations. Imposing numbers of nuclear photographic materials are produced for the study of cosmic radiations and nuclear processes. Among them are hypersensitized emulsions comprised of gelatine substitutes. These possess good stability, a low fogging factor and high sensitivity up to 80–90 grains per 100 microns in the trace of a relativistic particle.

ASPECT RATIOS

The last nine years have seen a wider use of various motion-picture systems differing from the standard, ones with the classical aspect ratio of 1.3 to 1. Among them are: (1) wide-screen motion pictures using 35mm film with anamorphic optics, (2) wide-gage pictures on 70mm films, (3) Kinopanorama on three 35mm films, (4) Circular Kinopanorama (Krougorama) with 11 or 22 35mm films, (5) 3-dimensional (stereoscopic) films both according to the polarizing method and without the use of glasses, and (6) multiscreen projection (Polyecran).

Since cinema studios as well as most of the theaters are state property, we can carry out standardization more fully and the types of systems used are restricted to those of the best quality.

Wide-Screen Systems

Wide-screen cinematography based on 35mm film, anamorphic optics and four-channel magnetic sound has become popular since 1955. By 1962, ten such features had been released.

By the beginning of 1963 in the USSR there were about 2,700 motion-picture theaters equipped for wide-screen projection with anamorphic lens and stereophonic sound. Cinema theaters, where projectors with anamorphotics are to be installed, are also furnished with stereophonic sound reproduction equipment.

Nonanamorphic wide-screen cinematography with an aspect ratio of 1.65:1 to 1.85:1 is not practiced. This method is considered artistically inferior and without marked advantages over the standard method.

Further increase in the number of wide-screen theaters is planned. All new motion-picture theaters and film clubs having over 300–400 seats will be equipped for 35mm wide-screen projection.

Wide-Gage Cinematography

Three studios release 70mm pictures: Mosfilm in Moscow; Lenfilm in Leningrad; and Dovzhenko-Studio in Kiev. Within 1962–63 five 70mm pictures were released and in 1963 seven pictures were scheduled for production. Currently, the wide-gage feature *War and Peace* is being taken.

The above studios have 70mm cameras of various types: sound, silent, hand and

high-speed photography up to 90 frames/sec. 70mm projection units are employed for composite shots. A 70mm trick camera is being designed to photograph by the traveling matte with infrared radiation.

Four different release printers are available for printing dupes and release prints from 70mm negatives: contact printer for 70mm, one for printing wide-screen 35mm with anamorphic image, another for standard 35mm, and one for optical printing of Kinopanorama releases onto three 35mm films.

Optical machines permit the most important part of the frame to be chosen, during the printing process; however, the resulting prints appear to be somewhat inferior to the original in artistic quality. Nevertheless, these methods are considered of high practical importance from the economical point of view.

Production centers have been set up: one at the Leningrad Newsreel Studio for re-recording 4-, 6- and 9-channel stereophonic soundtracks, and another at the Kiev Film-Printing Plant for the release of such soundtracks on 70mm prints. These centers are fitted out with new equipment securing high-quality sound.

By the beginning of 1963 in the Soviet Union there were 13 cinema theaters equipped with apparatus for 70mm stereophonic motion pictures. This equipment comprises KP-15 and KP-30A projectors designed for the efficient light fluxes of 20,000 and 40,000 lm, respectively, with powerful arc lamps (Fig. 7). These permit showing 35- and 70mm films on 15- to 30-meter wide screens (Fig. 8).

A target has been set relating to further development of wide-gage cinematography and the inauguration of a large number of new theaters equipped with 35/70mm apparatus. The 70mm release is expected to increase gradually and to constitute an important part in the total release of feature films.

Kinopanorama

Since the development of Kinopanorama in 1957, 12 features have been made. The Kinopanorama has been a success in the homeland and abroad.

Eight Kinopanorama theaters operate in the Soviet Union and one with Soviet equipment was opened in Paris in 1959.

Since 1960 PSO sound cameras (Fig. 9) have been used in the Kinopanorama production. Filming is carried out on three 35mm films. It has a moderate weight (55 kg without the blimp), a low noise level (32 db) and provisions for rapid replacement of the optical elements comprising lenses of different focal lengths. These merits of PSO cameras made it possible for Y. Koun in 1961 to shoot the first Kinopanorama play film. It is supposed that before long the experimental shots of a panorama picture should be accomplished on 70mm film with subsequent optical printing to three 35mm films.

In comparing the Kinopanorama process using three 35mm films with that of the wide-gage on 70mm, it is noted that the former provides wider artistic prospects through its substantially larger shooting angle and greater frame area (by 1.85 times). Thus, increased angular dimensions of the screen, better image definition and better rendition of perspective are easily obtained. However, Kinopanorama technique is more complex. Therefore there are no projects envisaging the further development of Kinopanorama and pictures of this system will be released on a limited scale.

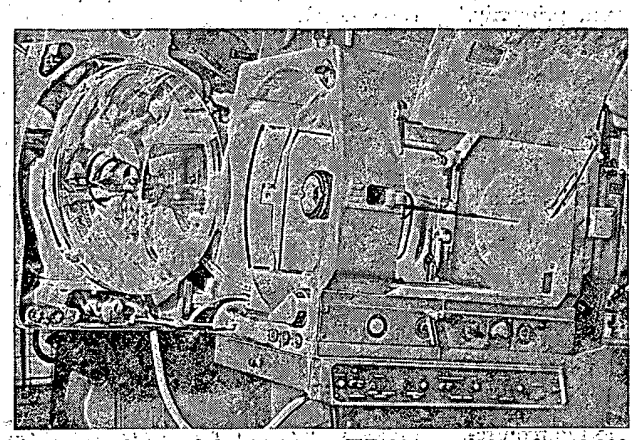

Fig. 7. Arc lamp of the 35–70mm KP-30A projector for 40,000-lm light flux (with shutter rotating).

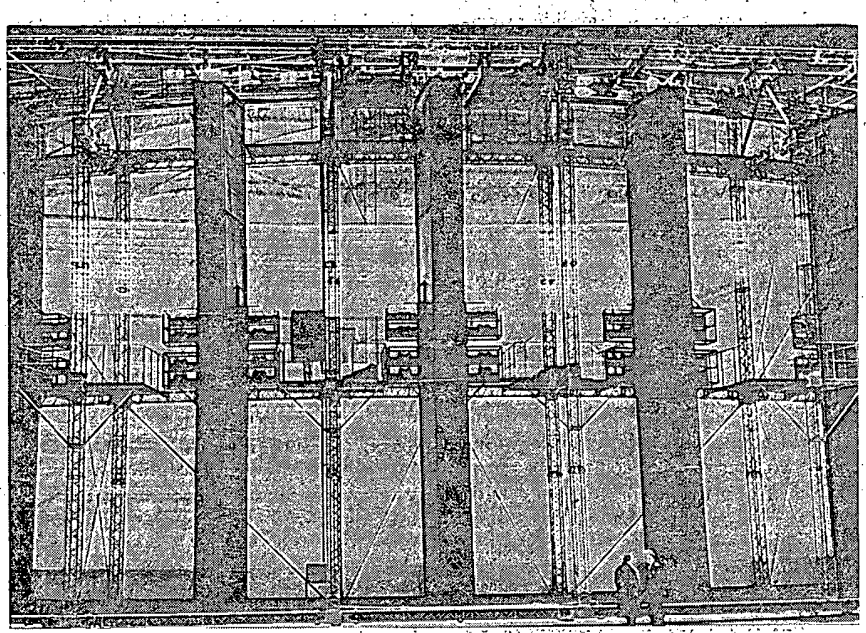

Fig. 8. Screen (28-m wide) and loudspeaker assemblies 12-m high installed in the Kremlin Congress Palace for wide-gage film projection.

Circular Kinopanorama

A Circular Kinopanorama theater has been operating in Moscow at the Exhibition of the National Economy of the USSR since 1959. In 1960 a similar theater was opened in Prague, Czechoslovakia, with Soviet equipment. The Central Documentary Studio filmed four programs for these theaters.

Since the length of the show is limited because it must be viewed standing and since it is impossible to see the whole picture because of its 360° scope, this system is shown only on a limited scale at exhibitions and in parks in only a few towns.

Three-Dimensional Systems

For several years, four stereo theaters have been operated without the use of glasses; and three theaters, on the polarizing method which uses glasses. Stereoscopic pictures are released regularly. In 1963 Mosfilm shot a wide-screen stereoscopic film intended for polarized projection.

Hence, these varieties of projection will continue, though on a limited scale. The necessity of keeping the audience motionless for the method using no glasses and of providing glasses for polarized presentations prevent wider application.

Multiscreen Cinema

Since 1960 the multiscreen method of

simultaneous projection on seven 35mm screens by seven synchronously operated projectors has been exhibited at the Exhibition of National Economy of the USSR. As with Circular Kinopanorama, it is planned to utilize multiscreen cinema on only a limited scale.

Trends

Experience has proved that the different forms of cinematography developed in the Soviet Union are not antagonistic. Each has its specific properties and offers different means for artistic expressiveness that justifies its existence and development. The systems currently in use are not considered to be the final word in cinematography.

The history of cinematography technique shows that the vital new forms are those which closely approximate the natural conditions of human beings. Consequently, the evolution of new forms will correspond to this fundamental principle.

The awareness of the general development trends of cinema technique ensures correct estimation of the possibilities of future advance and makes possible the proper guidance of research for discovering new forms of cinematography. Investigations are carried through in an effort to contrive entirely new forms that would give the audience a wider choice of cinema entertainments and to provide those in the profession with the technical means necessary for artistic freedom in the creation of motion pictures.

INTERNATIONAL EXCHANGE

Our cinematographic techniques and forms have been derived independently. Thus, there are some similarities and certain deviations from those of America and Europe. In order to establish a technical means toward motion-picture exchange, and to solve problems relating to the export and import of films, it is necessary to consider the fundamental parameters of the various systems.

In spite of some variation in film dimensions it has been found that the wide-screen system used in the Soviet Union — as to the dimensions and location of anamorphic image and of magnetic tracks on 35mm release prints — does not interfere with a mutual exchange between different countries.

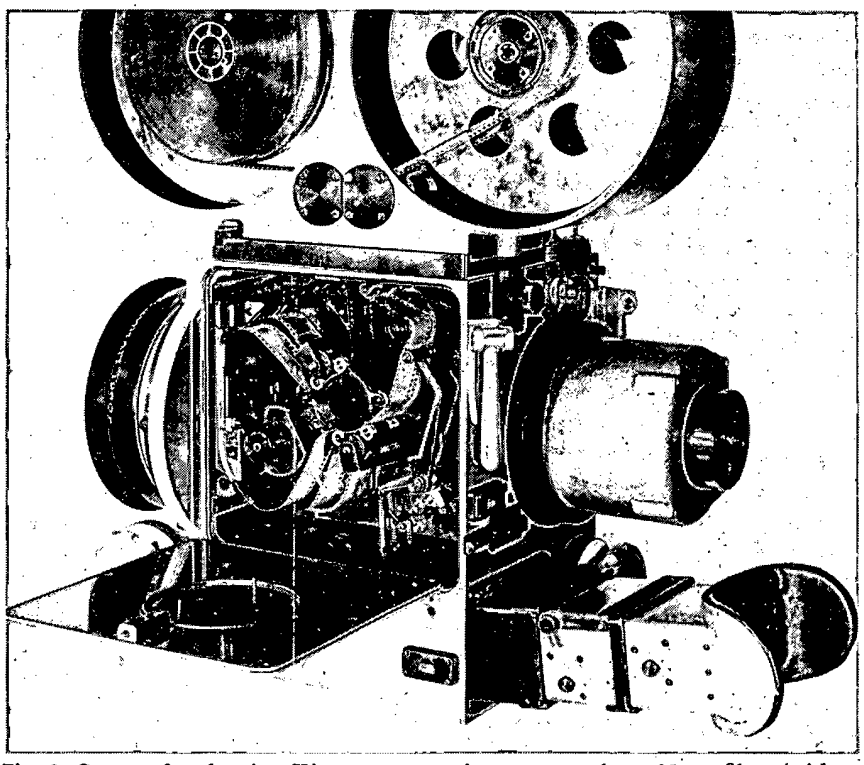

Fig. 9. Camera for shooting Kinopanorama pictures onto three 35mm films (without blimp).

On the basis of experience with wide-screen cinema, we have come to the conclusion that the use of a single aspect ratio of 2.35:1 on a film for release prints with both a stereomagnetic and an optical one-channel soundtrack is logical.

According to norms adopted in our country, wide-screen pictures with the 2.55:1 ratio will not be released.

The international practice with CinemaScope indicates, too, that the said unification is justified.

The wide-gage form which is currently used in the Soviet Union differs in some ways from Todd-AO, as, for instance, in the negative width, having 70 instead of 65mm, and so on; however, the film prints of both systems have an equal film width of 70mm, frame height with five perforations, an equal projection rate of 24 frames/sec and the same dimensions and location of the magnetic tracks which allows for exchanging film prints between countries.

Kinopanorama uses nine-channel stereo sound recording instead of the six-channel system used in Cinerama and and Cinemiracle. This creates better conditions for recording and improves the quality. However, considering that the export of films usually requires sound re-recording, the changeover from a nine- to a six-channel soundtrack does not create any difficulty. The dimensions and location of magnetic tracks are such that in theaters equipped for Kinopanorama, direct projection of Cinerama is possible.

The use of Circular Kinopanorama and Circarama is limited and, therefore, of less interest; however, also in this case the eleven available 35mm projectors for Circular Kinopanorama (the lower screen circle) correspond to the eleven 16mm for Circarama. Thus, with the required optical printing and sound re-recording, exchange is possible.

It is the opinion of the author that the creation of technical premises for international cooperation and exchange in the field of cinematography is one of the most serious problems faced by the engineers of many countries.

A Study of Noise in Television Camera Preamplifiers

By KOICHI SADASHIGE

Performance criteria on video preamplifiers for use with image-orthicon and vidicon camera tubes are formulated. Recent developments in transistors have produced units having a noise figure sufficiently good and a gain-bandwidth product sufficiently high to be useful in the design of all-solid-state TV cameras. Where the best possible signal-to-noise performance is essential, vacuum tube input circuits are still superior to transistors. A hybrid tube-transistor cascode circuit offers advantages.

A TELEVISION system is a special case of a pulse transmission system in which the pulse width, amplitude, rise and fall time and pulse shape can vary in a completely random manner. Such pulses are generated by the television camera tube, an optical-electrical transducer. After going through various transmission processes they are finally displayed on a kinescope.

The video preamplifier, which amplifies the feeble electrical pulses from the camera tube to a level suitable for transmission, is a vital link between the televised scene and the signal which is displayed on the viewing kinescope.

At present, except for some isolated exceptions, two types of television camera tubes are used throughout the world for both broadcast and closed-circuit applications. These are the image orthicon, a photoemissive device, and the vidicon, a photoconductive device.

Characteristics of Image-Orthicon Video Signal

The video signal from an image orthicon is characterized by its relatively high amplitude and contains the noise generated by the orthicon scanning beam. Since the output signal is from the electron multiplier, which can be considered as a current generator with high internal impedance, the source impedance viewed from the amplifier input stage is that of the load resistor.

Typical video signal current levels from the image orthicon operating under normal conditions are from 4 to 40 μa. The noise characteristics of the tube have been analyzed by various researchers.[1,6] The signal-to-noise ratio can be expressed as follows:

$$\frac{S}{N} = \left(\frac{I_{sig}}{2QB}\right)^{1/2} \left(\frac{T(\delta - 1)^{1/2}}{\delta + \frac{1}{\delta - 1} + \frac{1}{M}}\right)$$

where

I_{sig} = total photocathode current, amp,
T = transmission of target mesh, %,
δ = secondary emission ratio of photocathode side of the target,
Q = electric charge, 1.60×10^{-19} coulomb,
B = video bandwidth, cycles/sec, and
M = highlight modulation of return beam, %.

Since the signal-to-noise ratio is directly proportional to the square root of the reciprocal of the target electric charge, an obvious way to improve the signal-to-noise ratio is to increase the target-to-mesh capacitance at the expense of sensitivity either by increasing the size of the picture at the target, as in the $4\frac{1}{2}$-in. tube, or by decreasing the spacing between the two electrodes.

Table I shows the signal-to-noise ratio of various image orthicons along with their target-to-mesh capacitance values.[2]

With this information and the typical video output current values, we can compute a figure for the noise current output from the image orthicon. The value for 7389-A, a tube with high average signal-to-noise ratio, is approximately 0.050 μa.

Since the noise is essentially the beam noise, its power spectrum is essentially constant with frequency. Measurements of noise samples at various frequencies within the video band, using a narrow passband communications radio receiver, substantiate this assumption.[3]

Characteristics of Vidicon Video Signal

The mechanism of video signal generation from a vidicon is similar to that of any photoconductive sensor, as shown in Fig. 1.

The amplitude of the video signal output is governed by the polarizing potential applied to the target electrode (target voltage), providing that the faceplate illumination is not the limiting factor. Ultimately, it is limited by cathode emission and aperture response expected from the tube. Representative values of video signals for vidicons having different picture sizes are shown in Table II. If the signal current is increased beyond these figures, degradation of the aperture response will be observed. Other undesirable effects, such as geometric distortion and generation of spurious signal, may also be observed.

The beam noise, or white noise contained in the video signal generated by the vidicon, is very small by comparison with that of the image orthicon. Thus practically all the perceptible noise energy is contributed by the external video amplifier. This fact contributes to the difference in noise spectrum distribution patterns for image orthicon and vidicon.

Assume that full storage is taking place and there is no gain or loss of electrons at the target. The noise current from the vidicon, in amperes, can then be expressed as:

$$I_N = (2QBI_{sig})^{1/2}$$

where

Q = electric charge, 1.60×10^{-19} coulomb,

Table I. Comparative Characteristics of Image-Orthicon Tubes Showing Target-to-Mesh Capacitance and Signal-to-Noise Ratio.

Tube type	Tube diam., in.	Target-to-mesh spacing, in.	Target-to mesh capacitance, $\mu\mu$f	Sensitivity index§	Signal-to-noise ratio‖
5820-A	3	0.0022	100	5,000–10,000	40:1
7293-A*	3	0.0018	120	8,000–16,000	37:1
4415*	3	0.0018	120		35:1
8093-A*	3	0.0012	180	5,000–10,000	50:1
7513*	3	0.0007	300	3,000–6,000	55:1
7198†	3	0.150	2		10:1
7629‡	3	0.010	20	32,000–64,000	18:1
8092-A*,‡	3	0.010	20		18:1
7295-A*	$4\frac{1}{2}$	0.0022	300	approx. 5,000	55:1
7389-A*	$4\frac{1}{2}$	0.0010	600	approx. 3,000	78:1

* Field mesh type.
† Special high sensitivity tube with an extra wide spacing.
‡ Magnesium oxide target.
§ Based on exposure at knee of transfer characteristic curve and frame time of $\frac{1}{30}$ sec
‖ Ratio of peak-to-peak signal current over rms noise current.

Presented on April 24, 1963, at the Society's Conference in Atlantic City, N.J., by K. Sadashige, Broadcast and Communications Products Div., Radio Corp. of America, Camden 2, N.J. (This paper received in final form, January 30, 1964.)

B = bandwidth, cycles/sec, and
I_{sig} = total target current, amperes.

A typical value of the noise current for a bandwidth of 5 mc and peak-to-peak signal current of 0.3 μa (1-in. vidicon) is 0.0007 μa, giving a peak-to-peak signal to rms noise ratio of 430 to 1.

Design Criteria–Thermionic Tube Front End

Conventional thermionic tubes are rapidly being replaced by solid-state devices in television camera circuitry, especially in the video amplifier circuits. Solid-state devices have made remarkable progress in important video parameters such as gain-bandwidth product and noise figure.

A comprehensive review of design criteria using thermionic amplifier tubes is very instructive.

A typical arrangement for coupling the vidicon to a tube-type preamplifier is shown in Fig. 2. Here R_L is the vidicon load resistor which converts the current swing to a voltage swing. C_S is the total stray capacity across the input of the amplifier including the vacuum tube input capacity. R_N is the shot noise equivalent resistance of the amplifier. If the gain of the first stage is sufficiently high, it approaches the equivalent noise resistance of the tube used in the first stage:

$$R_N = \Sigma \left(R_{N1} + \frac{R_{N2}}{A_1^2} + \frac{R_{N3}}{A_2^2} + \cdots \right) \simeq R_{N1}$$

when $A_1 \gg 1$

1, 2, 3, ... = video amplifier stages No. 1, No. 2, No. 3, etc.,
R_N = equivalent noise resistance of the amplifier,
R_{N1} = equivalent noise resistance of the first stage,
R_{N2} = equivalent noise resistance of the second stage,
R_{N3} = equivalent noise resistance of the third stage,
A_1 = voltage gain of the first stage, and
A_2 = voltage gain of the second stage.

Because of the shunting capacity C_S the input voltage or current to the amplifier attenuates at a rate equal to 6 db/octave after the *corner* frequency ω_C, as set by the time-constant R_L and C_S. The attenuation in the signal and the noise inputs to the amplifier from the camera tube output is equal. A high-peaker amplifier stage having a gain-frequency characteristic identical to the inverse of the attenuation curve is inserted in the preamplifier to compensate for this loss of high-frequency video input. The noise generated by the first-stage tube, which is spontaneously added to the noise of the vidicon, can be expressed as follows:

$$E_{NA} = \left[4KTBR_N + 4KTR_N \left(\frac{4\pi^2 B^2 R_L^2 C_S^2}{3} \right) \right]^{1/2}$$

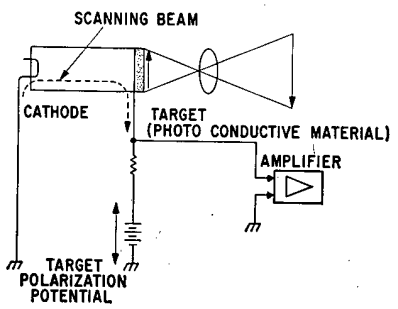

Fig. 1. Mechanism of video signal generation from a vidicon.

where K = Boltzmann's constant, 1.375×10^{-23} Joule/K, and
T = 300 K.

For the typical circuit values of $R_L = 50 \times 10^3$ ohms, $C_S = 30 \times 10^{-12}$ farad, and for first amplifier tube having an equivalent noise resistance of 100 ohms, the noise value expressed in current is 0.00008 μa.

Because of the high-peaker circuit, this value, if seen from the output of the amplifier, increases at a rate of 6 db/octave, starting at the corner frequency. At the low end of the video spectrum, where the noise is mainly contributed by the vidicon, the signal-to-noise ratio measured in a given bandwidth or point signal-to-noise ratio remains relatively constant. Beyond the frequency where equal amounts of noise are contributed by the vidicon and the amplifier —in this case, 1.0 mc/sec—the point signal-to-noise ratio decreases linearly at the rate of 6 db/octave. This relationship is shown in Table III and also in Fig. 3. Because of the amplitude-frequency distribution, this noise pattern is sometimes referred to as a triangular noise. It is interesting to observe that in the middle and lower frequency regions of the video spectrum, where visual acuity to noise is highest, the signal-to-noise ratio of a vidicon system is considerably superior even to the best image-orthicon signal-to-noise ratio.

The image-orthicon preamplifier is quite different from the one for the vidi-

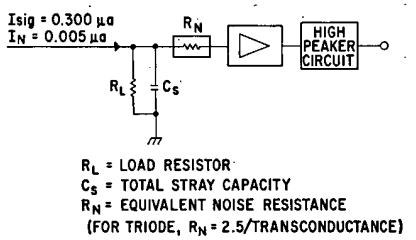

Fig. 2. Typical arrangement for coupling vidicon to tube type preamplifier.

Table II. Comparative Characteristics of Vidicon Tubes

Tube type	Bulb diam.	Picture diagonal	Signal current, μa.
4427*	0.50	0.30	0.08
7735*	1.00	0.62	0.30
8134†	1.00	0.62	0.30
8480†	1.50	1.00	0.40
8051*	1.50	1.00	0.40
ML-2058G*.‡	2.00	1.40	0.80

* Magnetic focus, magnetic deflection.
† Electrostatic focus, magnetic deflection.
‡ Tentative data.

Table III. Point Signal-to-Noise Ratio of a Vidicon Camera System. S/N is expressed in relative ratio of noise power in a given bandwidth to peak-to-peak video output voltage. Current values for both signal and noise are expressed in μa.

Frequency, mc	I_{NV}	I_{NA}	I_{NT}	I_S	S/N
0.1	0.0007	0.00008	0.00070	0.300	430:1
0.2	0.0007	0.00016	0.00072	0.300	420:1
0.4	0.0007	0.00032	0.00077	0.300	390:1
0.8	0.0007	0.00064	0.00100	0.300	300:1
1.6	0.0007	0.00128	0.00150	0.300	200:1
3.2	0.0007	0.00256	0.00260	0.300	115:1
6.4	0.0007	0.00512	0.00512	0.300	58:1

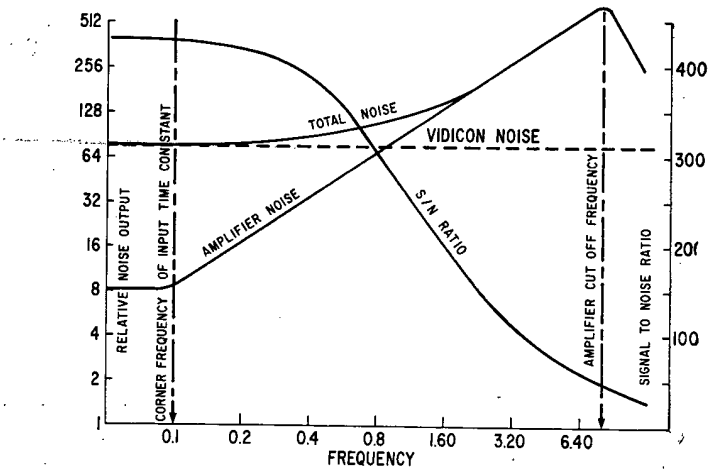

Fig. 3. Point signal-to-noise ratio of a vidicon system; frequency in mc/sec; relative noise output in power in a given bandwith.

Table IV. Point Signal-to-Noise Ratio of an Image-Orthicon Camera System With a Low Noise Input Amplifier Stage.

Frequency, mc/sec	I_N (Image Orthicon)	I_{NA} (1)	I_T (1)	I_S	S/N
0.2	0.050	0.00008	0.050	4.0	80:1
0.4	0.050	0.00016	0.050	4.0	80:1
0.8	0.050	0.00032	0.050	4.0	80:1
1.6	0.050	0.00064	0.050	4.0	80:1
3.2	0.050	0.00128	0.050	4.0	80:1
6.4	0.050	0.00256	0.051	4.0	80:1

Table V. Point Signal-to-Noise Ratio of an Image-Orthicon Camera System With a Relatively High Noise Input Amplifier Stage.

Frequency, mc/sec	I_N (Image Orthicon)	I_{NA} (2)	I_T (2)	I_S	S/N
0.2	0.050	0.0008	0.050	4.0	80:1
0.4	0.050	0.0016	0.050	4.0	80:1
0.8	0.050	0.0032	0.050	4.0	80:1
1.6	0.050	0.0064	0.050	4.0	80:1
3.2	0.050	0.0128	0.051	4.0	78.5:1
6.4	0.050	0.0256	0.056	4.0	71.5:1

con. The basic configuration of the preamplifier is very similar to the vidicon circuit. A difference is the location of the corner frequency, which is about 200 kc as compared to 100 kc for the vidicon. This is due to the lower value of load resistor normally used for the image orthicon.

It should be noted immediately that the value of the noise current for the image orthicon, typically 0.05 μa, is several orders of magnitude higher than the noise current generated by a high-transconductance input amplifier tube. Thus, providing a specially low-noise input circuit does very little to improve the overall signal-to-noise ratio for an image orthicon. The relationships are shown in Tables IV and V.

In Table IV the noise current is computed for a high-transconductance triode input circuit having an equivalent noise resistance of 100 ohms. In Table V the noise current is computed for an equivalent noise resistance of 10,000 ohms, a value for a medium-transconductance pentode. Degradation of the signal-to-noise ratio just begins to occur at the higher end of the spectrum. The all-important low- and midband performance is unaffected by this hundredfold increase in the noise resistance value. This explains why very little attention from the viewpoint of noise performance was given to tube-type front-end designs for the image-orthicon preamplifier.

Application of Transistors to Video Preamplifier

In general, transistor noise sources are categorized into four major areas. They are:

(1) Thermal Noise

Any conductor operating at a temperature other than absolute zero degree (Kelvin) generates noise, and it is caused by agitation of free electrons by thermal energy.

Average noise voltage,
$$E_N = (4RKTB)^{1/2}$$
Average noise current,
$$I_N = (4GKTB)^{1/2}$$

where

K = Boltzmann's constant, 1.375×10^{-23} Joules/K,
T = temperature, degrees Kelvin,
B = bandwidth, cycles/sec.
R = resistance, ohms, and
$G = I/R$.

In the case of the transistor, the thermal noise comes from the base spreading resistance r'_b.

(2) Shot Noise

Shot noise occurs whenever current flows because the arrival of electrons is completely random. The expression for the shot noise current, as expressed previously for the noise current of the vidicon tube, is as follows:

$$I_N = (2QBI_{DC})^{1/2}$$

where I_{DC} is the value of the direct current through the device.

One interesting fact is that the two diodes in a transistor, the emitter-base diode and the collector-base diode, develop shot noise in a coherent manner. This is because the shot noise in the two diodes comes from almost exactly the same carriers. In calculating the noise output, if the noise from the emitter is counted in full, then only the incoherent portion of the noise from the collector should be considered.

(3) Diffusion-Recombination Noise

This noise is generated when carriers are separated or recombined after going through a junction and if a net change in charge takes place.

(4) Flicker Noise

This noise is most commonly referred as $1/f$ noise because the noise power for a given bandwidth increases inversely with frequency. The exact cause for the generation of this noise is not yet fully explored.

Of these four noise sources, the first two, the thermal noise and the shot noise, are referred as white noise because the energy per unit bandwidth is constant throughout the radiation spectrum. These are the noise sources presently governing the high-frequency noise performance of transistorized video amplifiers.

Because of generally high current gain of contemporary high-frequency transistors, the third source, the diffusion-recombination noise, does not add much to the total noise and its output decreases very rapidly with frequency. Therefore, in the following discussion, referring to Fig. 4, the noise sources are simply classified into two categories, the white noise, which includes the thermal noise and shot noise, and the semiconductor noise, which is mainly the $1/f$ noise. The semiconductor noise increases the power in a given bandwidth inversely with frequency at a rate of about 3 db/octave below the corner frequency as shown in Fig. 4A. The current gain of the transistor, unlike that of thermionic devices, is not constant throughout even the limited video frequency spectrum, but decreases in the higher frequency region because of the inherent transistor time-constant. If this loss of gain in the higher frequency region is to be compensated, then the increase in noise output takes place beyond the corner frequency set by the device time-constant. This is shown in Fig. 4B. The amplitudes of both semiconductor and white noise from high-frequency planar units are low enough for them not to degrade the signal-to-noise ratio of the overall system if the input current from the image orthicon is at its normal high level.

The general practice is to feed the current from the image orthicon directly into an amplifier having a flat frequency-response without resorting to the use of a high peaker circuit.[5] By holding the input impedance of the amplifier to the neighborhood of 10 ohms, the corner frequency can be moved out beyond the useful video bandwidth. In this case no special compensation for the input time-constant is necessary.

There are two basic characteristics of transistors which can play an important part in the design of low-noise, wideband video amplifiers such as are necessary for a vidicon camera system.

First, the corner frequency for semiconductor noise as well as the upper corner frequency decreases as the collector current is decreased. Second, the amplitude of the white noise is a function of the collector current, and, for the low-noise region (collector current less than 500 μa), it decreases almost linearly with the collector current.

These conditions are shown graphically in Fig. 5 for two arbitrary values of collector current. This indicates that although the general shape of the noise energy distribution remains the same, it can be moved up or down through the video frequency band and the absolute value can be varied by varying the collector current.

By proper choice of collector current, the area under the curve, or the total noise energy in the video band, can be minimized. Some of the silicon planar transistors having a low base resistance and a high gain-bandwidth product exhibit a performance similar to that of a triode having a noise resistance of 300

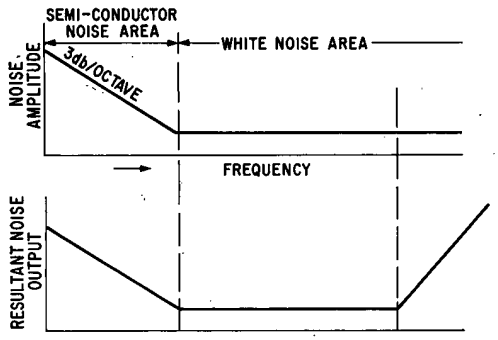

Fig. 4. Transistor noise distribution; both horizontal and vertical scales are logarithmic.

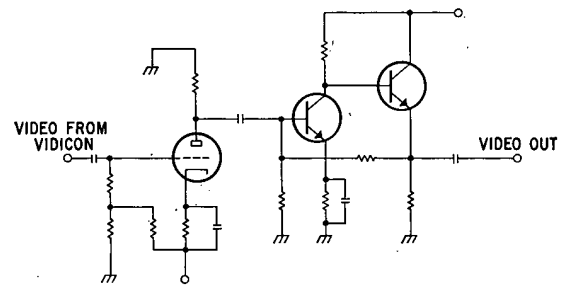

Fig. 6. Typical arrangement of the hybrid cascode input circuit.

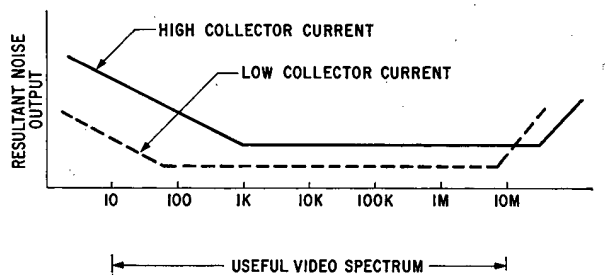

Fig. 5. Basic characteristics of transistors; both horizontal and vertical scales are logarithmic; frequency in cps.

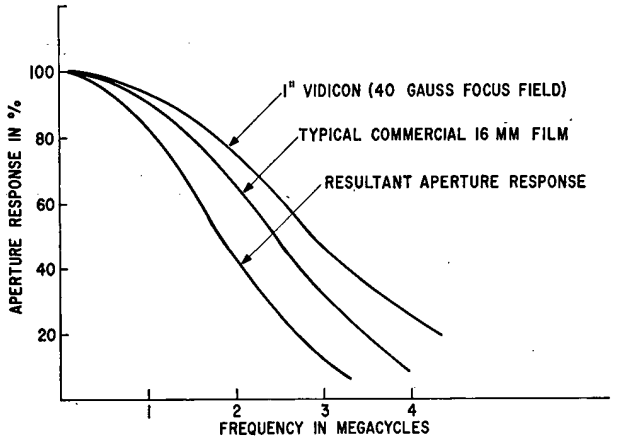

Fig. 7. Aperture response curve of a typical commercial 16mm film.

to 120 ohms, or a triode with 8,000 to 20,000 μmhos transconductance. By using a collector current value of 100 to 200 μa, the corner frequency of the semiconductor noise can be lowered below 100 cycles while the upper corner-frequency is maintained near 10 mc, making the noise distribution spectrum practically flat through the video band.

One of the interesting developments offered by transistors is a hybrid cascode input circuit. In this circuit configuration, the output current from the plate of the thermionic triode is fed into a feedback transistor amplifier having a very low input impedance. A typical arrangement is shown in Fig. 6. This configuration makes the voltage gain of the tube portion of the amplifier practically zero, thus also making the value of the Miller capacitance zero. Reduction of the input capacitance has a linear role in raising the corner frequency from which the high-peaker action must start. By changing the top half of the cascode circuit as in Fig. 6 from a tube to a transistor pair, the corner frequency can be raised by about 20% in the general electrical and mechanical arrangement used in a vidicon camera equipment. The resultant improvement in the signal-to-noise ratio, especially in the midband frequency area, is quite apparent.

Amplifier Requirements for Specialized Applications

There are a number of instances where a video amplifier having exceptional noise performance is required. For astronomical or space-object observation, the image-orthicon tube must quite often operate several lens-stops below its knee, yielding only a few tenths of microamperes of video signal current. The preamplifier for such an application must possess an inherent signal-to-noise ratio far greater than the unit used for conventional vidicon camera systems because the contribution of the noise from the camera tube is far greater in the image orthicon than in the vidicon, yet the amplitude of the signal current is comparable.

Another example is the vidicon film-camera system, especially if the 16mm motion-picture film is its main intended material.

16mm film, either color or monochrome, requires special attention for processing use in a television camera system. Because of its relatively wide density range from the highlight to the black, an additional gamma correction in the order of 0.7 is essential. The measured aperture response curve of a commercial 16mm film is shown in Fig. 7, indicating that response is down by approximately 10 db at 3 mc. Considering the fact that a 1-in. vidicon aperture response is down about 6 db at 3 mc, a total boost of 16 db at this frequency is necessary in order to restore picture sharpness.

It has been shown previously that a vidicon camera system operating with a 0.3 μa beam current and having an amplifier with a 100-ohm noise resistance has a signal-to-noise ratio of 200 to 1 at 1.6 mc and of 115 to 1 at 3.2 mc. With a 16-db boost applied at 3 mc, these figures fall to 70 to 1 at 1.6 mc. Gamma correction further degrades this figure. Within the last few years, a number of ultra-high-transconductance tubes have been developed for special applications such as telemetry receivers and wideband IF amplifiers. A transconductance figure of 50,000 μohms is realizable in these tubes, and by careful selection of plate and grid bias voltages to minimize the flow of grid current, an equivalent noise resistance in the neighborhood of 60 ohms can be obtained. The relative performances of various tubes in this category are listed in Table VI.[4]

Table VI. High Transconductance Thermionic Tubes for Video Amplifier Input Circuit.

Tube type	Plate supply voltage (E_b, volts)	Plate current (I_b, ma)	Transconductance (G_m, micromhos)	G_m/I_b	Equivalent noise resistance (R_N, ohms)
7308*	100	30.0	25,000	0.83	100
7586†	75	10.5	11,500	1.10	200
7586‡	75	21.0	23,000	1.10	100
7722§	160	24.5	33,000	1.35	80
7768	200	24.0	50,000	2.08	60
7788§	130	35.0	45,000	1.28	60
7963*	100	15.0	26,000	1.73	100

* Twin triode connected in parallel.
† Nuvistor.
‡ Two triodes connected in parallel.
§ Pentode connected as triode.

The signal-to-noise ratio realizable by an input circuit using such a tube in a hybrid cascode circuit is still approximately 4 to 10 db above the best figure attainable from an all semiconductor input stage.

Conclusions

In the foregoing discussion, only problems concerned with signal-to-noise ratio are considered. Other important amplifier characteristics are completely ignored. We feel that a relatively straightforward approach offers ready solutions to such problems as frequency and phase responses, amplitude linearity, heat dissipation and power consumption.

Even in the area of the signal-to-noise problem, we believe that in the near future, new semiconductor devices and refinement of circuit configuration can conceivably surpass the results now obtainable only with the best thermionic tube amplifiers.

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Some Photographic Studies of Optical Masers

By THOMAS J. PAVLISCAK

Three methods for recording properties of optical maser emissions are discussed. First, a series of 400,000-picture/sec records were made of the maser emission. Second, the polarization of a ruby optical maser was recorded with a unique high-speed photographic technique. Third, the coherence of maser emission was examined with a wavefront shearing interferometer and recorded with a conventional 35mm camera. These techniques and some initial observations that were made of maser emissions are described.

Although many high-speed cameras have been devised, a general purpose camera which is best suited for all applications has not been developed. Thus, in the field of high-speed photography many different and varied designs are in current use. Each has its respective advantages and disadvantages which preclude or limit its use for certain applications.

A fiber-optics camera, which was originally designed to take x-ray pictures, has proved to be a valuable instrument for recording maser emissions. It records series of 75 pictures at the rate of 400,000 pictures/sec with a resolution of 32,000 image elements. This camera, which was developed by J. S. Courtney-Pratt,[10] has two distinct advantages: (1) light is collected and transmitted with a high efficiency to a photographic plate with a consequent reduction in the light required by a factor of 10 to 100; and (2) the geometry of the design allows a minimum movement of the photographic emulsion to record separate images. As a result, the recording rate can be increased by a large factor.

This paper describes investigations made of the spatial distribution, polarization and coherence of maser emission. Only the spatial distribution and polarization were recorded with the fiber-optics camera; coherence was recorded with a conventional 35mm camera.

A Fiber-Optics Image Dissection Camera

An image dissection camera is one which records an image by sampling the light intensity at a large number of points uniformly spaced over the image. Hence, the picture is "dissected" into a large number of dots of varying intensity much as in a newspaper picture. Similarly the larger the number of dots per picture the better the picture quality. If the dots are very small, they can be separated by relatively large distances, but still provide sufficient information to produce a picture of good quality. Thus, many pictures (arrays of dots) may be recorded interspersed on a single photographic plate.

The dissection of the image can be achieved with a fiber-optic block, shown schematically in Fig. 1. The block is composed of an array of parallel light guides imbedded in an opaque matrix. Each light guide is a 0.001-in.-diameter, 1-in.-long flint glass fiber with a thin concentric sheath of crown glass which transmits light by total internal reflection along the fiber. Hence, light from an image on one side of the block is transmitted to a photographic emulsion on the opposite side via each of the fibers. By moving the photographic plate rapidly past the fiber-optic block, each fiber will trace a streak record of the variation of the image light intensity on the photographic emulsion. Individual pictures are composed of an array of dots recorded simultaneously, i.e., one dot from the streak record produced by each fiber. In order to select all those dots corresponding to one picture and exclude all others, the processed photographic plate must be aligned in the camera in precisely the position it occupied when it was exposed. Thus, the fiber-optic block will mask off all image elements not corresponding to a single picture. To aid in this alignment a small xenon flashlamp which produced a flash lasting 2 or 3 μsec (microseconds) was triggered in synchronism with the optical maser. Light from the flashlamp was allowed to fall in a narrow strip along one edge of the fiber-optic block. This produced a single set of sharply defined dots which greatly expedited the alignment of the photographic plate. With the processed photographic plate properly aligned, the camera mechanism can be operated slowly by hand so the recorded sequence can be viewed in slow motion or copied with any convenient camera.

Three models of a fiber-optics image dissection camera have been designed and built by J. S. Courtney-Pratt. The first could record 6 to 10 pictures with 20,000 image elements (40 lines of 500 dots per line), and the second could record 80 pictures with 1,800 image elements. The latest design can record 75 pictures with 32,000 image elements. The principal advantage in this design is the elimination of a mechanical shutter that is necessary in conventional high-speed camera design. A detailed discussion of the camera is given by J. S. Courtney-Pratt.[10]

Presented on October 17, 1963, at the Society's Technical Conference in Boston by Thomas J. Pavliscak, Bell Telephone Laboratories, Inc., 6200 E. Broad, Columbus 13, Ohio.
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Ruby Optical Maser

The light emitted by a pulsed ruby optical maser is widely known to occur in a series of short bursts called spikes. Each spike commonly has a duration of only a few microseconds, but the whole series of such spikes usually occupies an interval of 50 to 200 μsec, each time the ruby is pumped above threshold. Individual spikes of light are not of uniform intensity across the whole end face of the ruby. Possibly each filamentary spike represents oscillation in one mode. The study of these modes of oscillation would seem to require observation of the individual filaments in their natural sequence. Thus, high-speed pictures appear to be useful for recording the temporal and spatial variation of the light output.

The maser crystal used was a "pink" ruby rod containing approximately 0.05% Cr_2O_3, 0.57 cm in diameter by 5.09 cm long, with its C-axis* approximately 60° to the cylindrical axis. The rod ends were coated with silver in such a way that one end was opaque and the other a few per cent transmitting. It was held cantilever fashion along the axis of a General Electric FT524 helical xenon flashlamp. A 5,000-volt power supply was used to charge a 500-μf capacitor, which in turn discharged through the flashtube when a triggering voltage was applied. In addition, a 290-μh inductor was connected in series with the capacitor to protect the flashtube by limiting high current surges. As shown schematically in Fig. 1, the apparatus was arranged so that the maser emission emerged from the partially silvered end of the crystal and passed through a 6,950 A interference filter. It then struck an 11-cm lens, which focused an eight-times-enlarged image of the maser face on the fiber-optic block of the camera, where the emission was recorded on Kodak type I-F or IV-F microflat, 4 by 5 by 0.25-in., glass photographic plates.

Many series of high-speed pictures of the maser emission were recorded. Unscrambled records of these series were copied in turn with either a Contax 35-mm camera or a Bolex 16mm cine camera. A single enlarged unscrambled picture is shown in Fig. 2, and the odd-numbered frames of a 400,000-frame/sec sequence are shown in Fig. 3. Somewhat similar sequences of pictures of maser emissions have been made with a Beckman and Whitley, Model 102, framing camera at 500,000 frames/sec by Dayhoff and Kessler.[14] These pictures were recorded on 35mm film in a series of 80.

Examination of Fig. 3 reveals that individual spikes of light are emitted in a seemingly independent fashion, with the pattern of light varying in some erratic manner from picture to picture. In general, the patterns observed do not seem to have any simple geometric configuration, but the emission has been observed to sweep over the picture from one area to another; and certain frames, such as number 25 in Fig. 3, appear to bear semblance of an interference pattern. Series of pictures made by Dayhoff and Kessler with the Beckman and Whitley camera have revealed similar patterns in the emission, viz., "Bar"-type patterns that swept over the picture for a duration of essentially 5 μsec were observed.[14]

If events of very short duration occurred in the maser emission, it is conceivable that some may have been obscured by an integration of the light intensity on the photographic film, for the interval of time that is necessary to move one fiber diameter. Since approximately 2 μsec are required to move a fiber diameter, events of shorter duration may be obscured. Thus, the fiber-optics camera may not record all the details of the emission. On the other hand, the Beckman and Whitley camera will not record events occurring between frames; consequently, the time resolution of both cameras is limited to essentially 2 μsec. Since the individual spikes in the emission may have a duration of less than

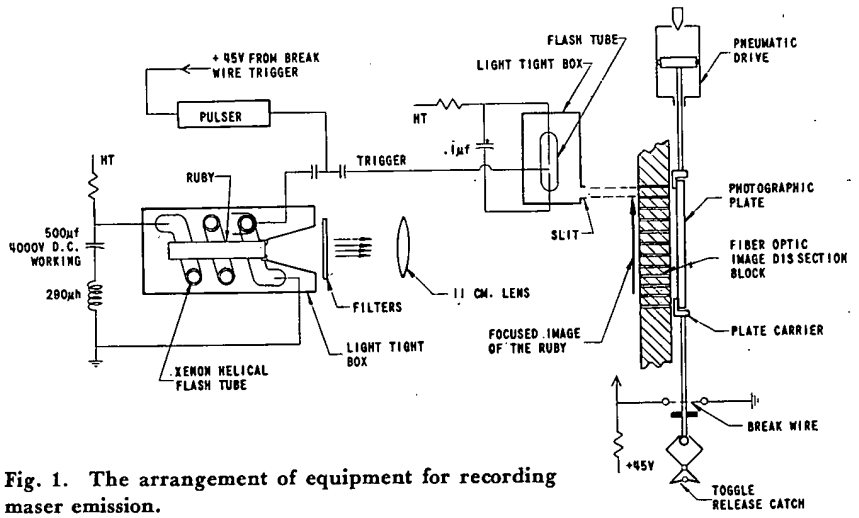

Fig. 1. The arrangement of equipment for recording maser emission.

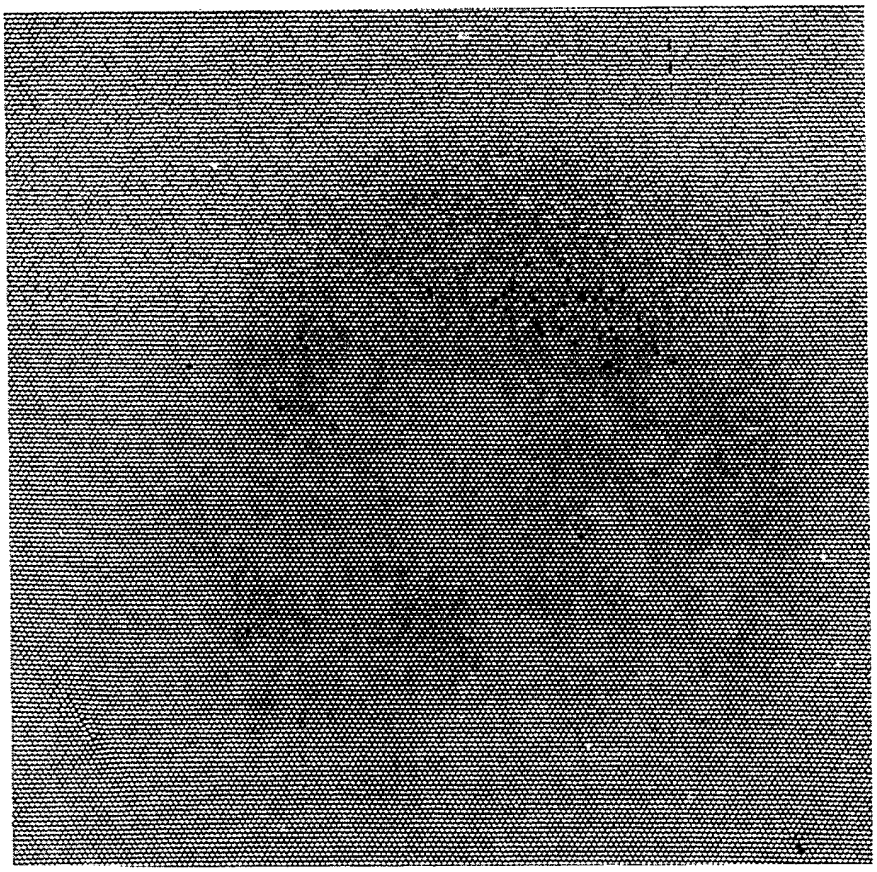

Fig. 2. A photograph of a maser emission obtained with a fiber-optics camera.

* The C-axis is the crystal orientation axis.

this, it is difficult to use these cameras to obtain a great deal of quantitative data about them. Nevertheless, both cameras provide good pictures of the vacillation of the emission for speeds of essentially one half million frames per second. In particular, the picture sequences taken with the fiber-optics camera and unscrambled with the Bolex 16mm camera can be shown in cine fashion and vividly illustrate the process.

Perhaps the only camera currently available that could obtain pictures with a greater time resolution is an image converter camera. Space Technology Laboratories, which produces such a camera, has recorded some optical maser pictures with exposure times of only 5 to 200 nsec (nanoseconds), and between 15 nsec and 10 μsec, picture separation. The primary disadvantage with this camera is that only three pictures can be recorded in sequence with present models. This restriction, which is imposed by the construction of the camera, might be somewhat reduced by current plans to provide the camera with a movable film. This would allow series of three pictures each to be made in sequence at a repetition rate of 2 kc/sec. Although this seems a little slow, the latitude of selection, allowed in exposure, and picture separation help to compensate for this disadvantage.

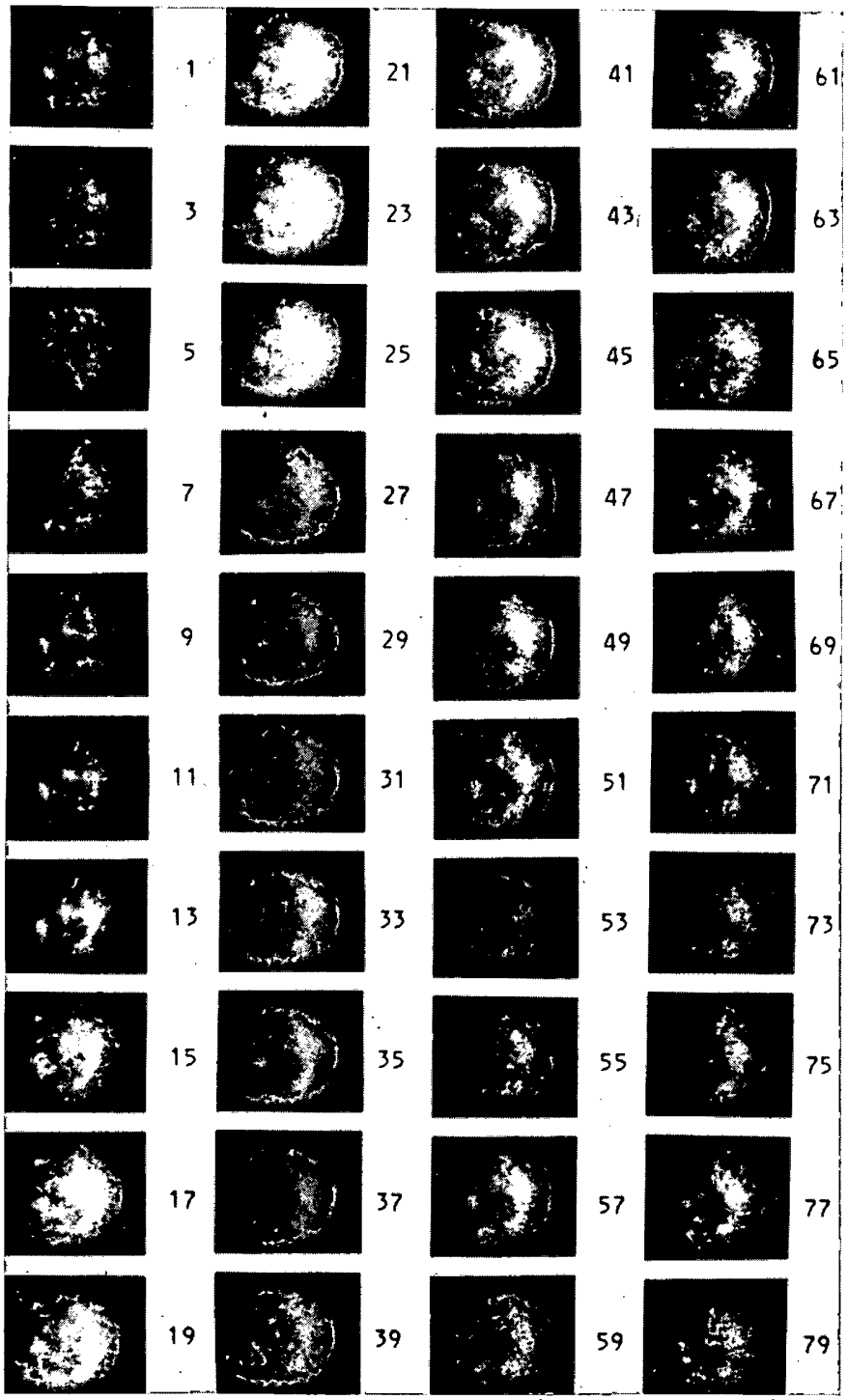

Fig. 3. A sequential record of maser emission obtained with the fiber-optics camera.

Many other possibilities exist for the recording of high-speed maser phenomena. For example, one might consider a Kerr cell used in conjunction with an image dissection camera. With this arrangement both the exposure and the exposure interval could be selected. However, this combination of devices is similar to that already utilized in the image converter camera. Thus, although many such arrangements of existing equipment could be combined, a real advantage may not be obtained. Many combinations of devices, which have proved useful in high-speed photography, have been discussed by J. S. Courtney-Pratt.[8,9,12,13]

Pictures that were recorded of the maser emission with the fiber-optics camera showed the general characteristics of the emission, but they were not fast enough to obtain clear records of the individual filaments and spikes. D. F. Nelson and others have emphasized that different rubies have different emissions.[23] The emission pattern is apparently a function of the crystal perfection and the flatness of the ends. Thus, although photographic records for many different crystals would be desirable, one would not expect to observe consistency from crystal to crystal.

Polarization Experiment

High-speed pictures of optical maser emission have not included any indication of the polarization of the emitted light. In order to study polarization as a function of space and time, sequences of pictures were made of the light after it had passed through a specially designed optical system. Since the emission time is so brief for a pulsed optical maser, a well-known device such as a Soleil Compensator cannot provide a continuous history of the polarization on the maser surface. To effect the desired response, a prism (Fig. 4) was conceived by J. S. Courtney-Pratt and constructed by the Karl Lambrecht Company of Chicago. It is composed of two identical quartz wedges of opposite rotations, i.e., righthand and lefthand quartz, cemented together with an optically inactive cement.

Plane polarized collimated light that is passed through crystal quartz, parallel to the optic axis, has the plane of polarization rotated in direct proportion to the thickness of the quartz traversed. This rotation is 15.75°/mm for a wavelength of 7,000 A. A narrow pencil of plane polarized light a_0, shown in Fig. 4, will pass through the length of the prism undeviated, since the amount of right-

hand and lefthand quartz traversed is equal. On the other hand, for a narrow pencil of plane polarized light to either side of a_0 (e.g., a_1 or a_2) the plane of polarization will be rotated in either the righthand or lefthand direction, in proportion to the difference between the amount of righthand and lefthand quartz traversed. The maximum rotation of 197° occurs at either edge, where a differential thickness of 12.5 mm exists. Thus, if the prism is illuminated by plane polarized light and viewed through a Polaroid sheet used as an analyzer, three lines will in general be visible. If the Polaroid sheet is aligned for maximum transmission in the absence of the prism, these lines wil correspond to transmission at the center of the prism where the plane of polarization is undeviated, and near the edges where the plane of polarization is rotated +180° and −180°. When the plane of polarization of the source is rotated, the three lines transmitted will be displaced to the right or left, respectively, for clockwise or counterclockwise rotation. Thus, if the polarization was rapidly varying, one could observe that fact by recording the rapidly varying horizontal displacement of the lines.

To determine the polarization of a narrow pencil of light, it is necessary that the light be diverged into a horizontal line, whose width is equal to the width of the prism. Thus, light will be transmitted through the prism polarizer combination at three points as previously described, and the position of the maxima and minima of intensity will indicate the polarization of the source. If a series of narrow pencils of light were aligned in a vertical line with respect to the prism, they could be examined simultaneously. Each of the narrow pencils along the original vertical line would be spread in the horizontal plane, and then would be transmitted through the prism as previously described. If the entire source were of the same polarization, the light transmitted by the prism polarizer combination would appear as three vertical lines. Conversely, if the narrow pencils were not of the same polarization, discontinuities or slopes would be visible in the transmitted lines. The relative horizontal displacement of these discontinuities would, thus, be indicative of the changes in polarization.

The property that makes the instrument particularly useful is the complete absence of any mechanical adjustment to determine changes in the polarization. A high-speed photographic record of the patterns transmitted by the prism provides a (continuous) history of the polarization of all points on a line source. Owing to its unique properties, the prism is particularly well suited to the study of the polarization of the emission from a ruby optical maser. In order to apply the technique, however, a slit must be used

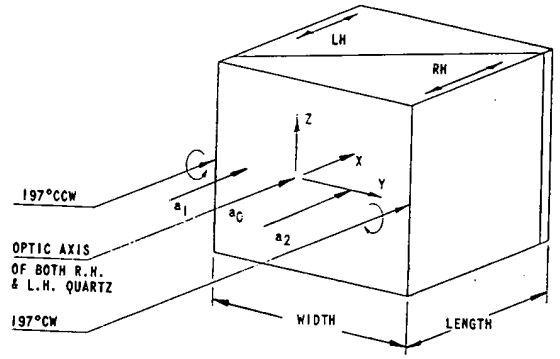

Fig. 4. Courtney-Pratt prism.

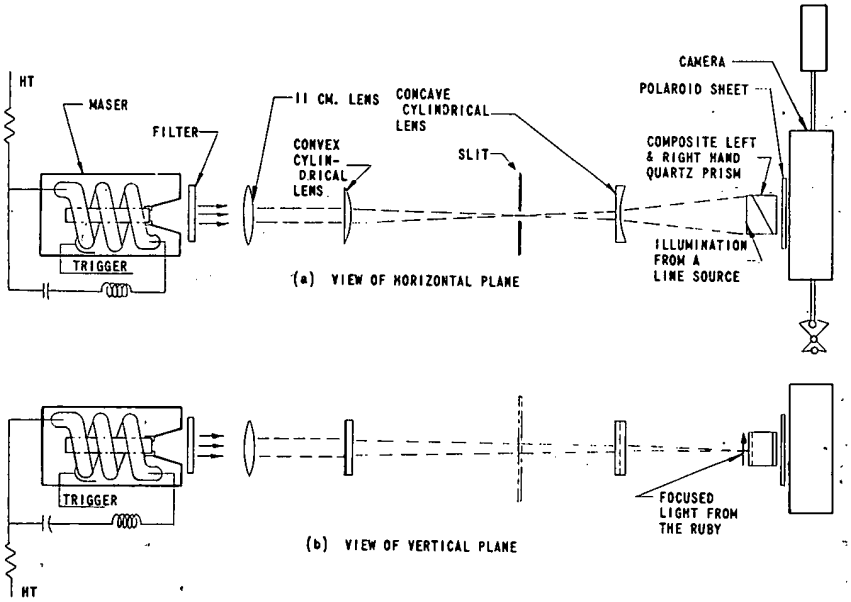

Fig. 5. The arrangement of equipment for obtaining polarization records.

to restrict the area of the maser under study to a line source. A slit for this purpose might properly be placed at the ruby surface, but the physical arrangement of the apparatus would make this inconvenient. Instead, the slit was placed in the optical system so that it is equivalent to one placed on the ruby. A sketch of the arrangement of the apparatus is shown in Fig. 5.

The system was arranged in such a way that only one selected line on the ruby surface was examined for polarization at a time. Figure 5(*b*) indicates that an image of the emission from the end face of the ruby is formed on the prism in the vertical plane by an 11-cm lens; the light in this plane passes through the cylindrical lenses parallel to the cylindrical axis so that it is undeviated. Conversely, in the horizontal plane—Fig. 5(*a*)—the light passes through the cylindrical lenses transverse to the cylindrical axis so that the light is deviated. Consequently, in the horizontal plane, light traversing the 11-cm spherical lens is focused on a slit by a convex cylindrical lens which restricts the emission to a line source. This light is then passed through a concave cylindrical lens which spreads the line to a width equal to that of the prism. With the fiber-optics camera properly positioned with respect to the prism, the polarization of the emission of many points along a line on the end face of the ruby can be recorded simultaneously.

The fiber-optics camera was used to record many sequences of polarization records, an example of which is shown in Fig. 6. These records showed little deviation from a single plane polarization for experiments made with a ruby whose C-axis was at 60° to the rod axis. Nelson and Collins have reported no deviation or departure for the whole of the emission in an experiment that used two phototubes and a Glan-Thompson prism.[23] Consequently, further study seems worth while, particularly with the ruby C-axis parallel (or nearly parallel) to the cylindrical axis. At the time this experiment was performed, additional investigations with crystals possessing different crystalline orientations were desired; however, suitable crystals were not available at that time. Initial plans also included investigations of the polari-

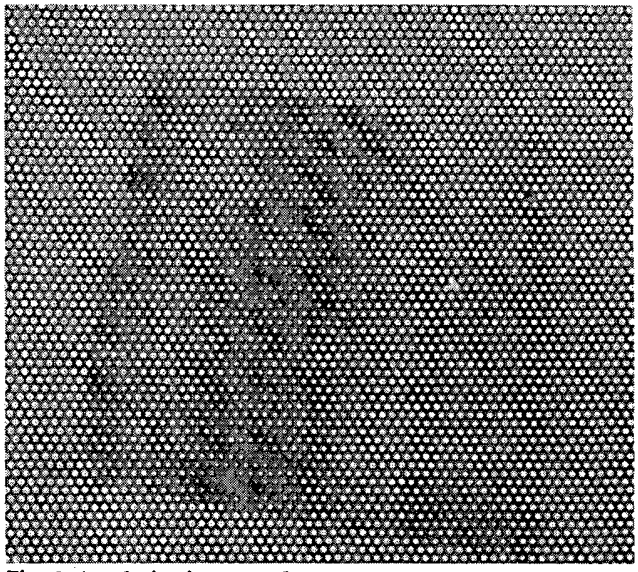

Fig. 6. A polarization record.

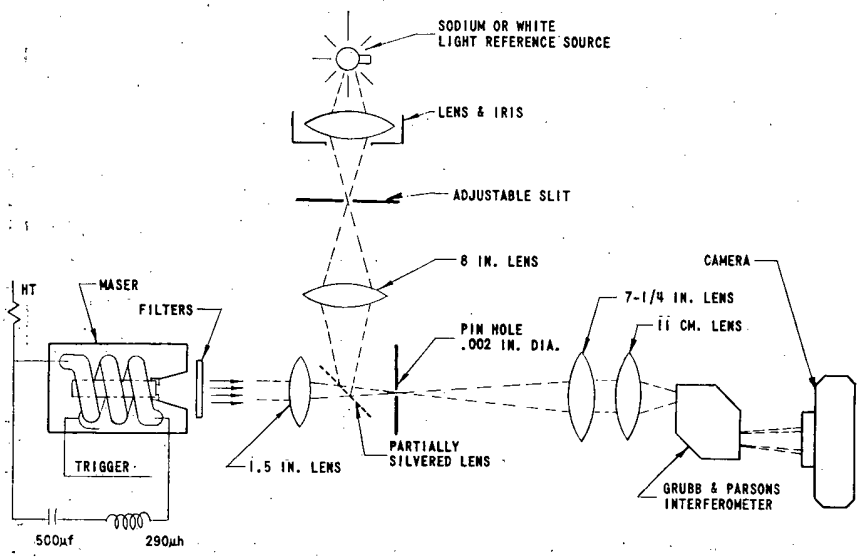

Fig. 7. The arrangement of equipment for an interference experiment.

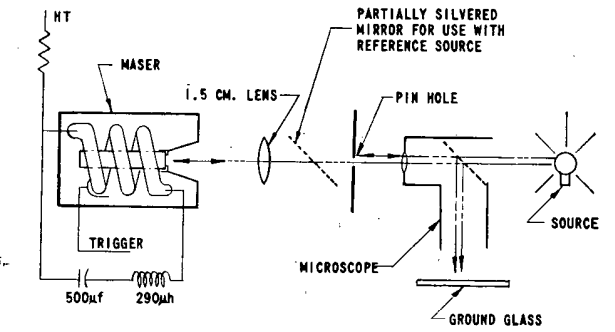

Fig. 8. The application of a microscope for aligning equipment.

zation of the neodymium† maser. The only alteration in the arrangement of the apparatus would be the substitution of an infrared polarizer sheet, type HR, in place of the ordinary polaroid which was used for the ruby. However, the difficulties encountered in obtaining good photographs of the infrared emission with the fiber-optics camera precluded such an investigation. In general, however, one would expect the neodymium emission to be unpolarized, since it is not crystalline in nature and hence would be expected to have no preferred direction for polarization.

It can be concluded that the emission from a ruby optical maser with its C-axis 60° to the rod axis is approximately plane polarized. The emission may have consisted of many spikes that originated from different quanta and are individually but not collectively plane polarized. Further study of polarization, particularly with the ruby C-axis parallel (or nearly parallel) to the cylindrical axis would appear to be useful.

† Neodymium is another of the many active maser materials.

Interference Experiment

Although various interference experiments have been performed with ruby optical masers, an experiment with a wavefront shearing interferometer has not been reported. A major advantage of the instrument is the property that an entire wavefront is superimposed upon itself with some lateral displacement, hereafter referred to as shear. As a result, the instrument allows one to test points on the entire wavefront simultaneously for coherence. The particular points on the wavefront that are tested are determined by the size of the shear adjustment. The instrument also has a second advantage, i.e., characteristics of the wavefront can be obtained from a computation performed on data provided in the interference pattern.[1,4,5,17] Other interference experiments which have been performed were not as versatile, e.g., a two-slit Young's interference experiment is limited to the study of selected points, rather than the entire emitting area of the maser.[24]

It was hoped that the experiment, with the wavefront shearing interferometer, would verify conclusions made regarding the distance over which the emission was coherent and, furthermore, would indicate its spatial distribution. The instruments used were Grubb-Parsons wavefront shearing interferometers, models WS1 and WS3. The WS1 was a fixed unit in which both shear and tilt were permanently adjusted to provide a shear angle and fringe separation of 0.01 radian. The WS3 instrument was provided with both a variable shear and tilt; shear was adjustable from 0 to 0.05 radian, and fringe separation was adjustable to a minimum of 0.0015 radian.

In order to employ the interferometer, an optical system was designed in which the interferometer could be calibrated with a reference source, prior to operating the maser. The optical arrangement is shown in Fig. 7. Emission from the maser was first incident on a lens of focal length 1.5 in. positioned approximately 3 in. from the crystal surface. (This distance was made as small as practicable to minimize the uncertainty in the light emission due to the diffraction spread of the beam.) A lateral uncertainty of about 0.006 in. in the point of emission resulted from the 3-in. separation. The 1.5-in. lens focused light on a pinhole which eliminated light due to oblique modes. The effectiveness of this restriction to unidirectional modes was, of course, determined by the size of the pinhole. Light passing through the pinhole was focused (by a combination of two lenses) on one of the surfaces within the interferometer. Interference patterns, in the sheared wavefront leaving the interferometer, were observed directly and recorded on a photographic emulsion.

A reference source, which was focused on an adjustable slit, was arranged at right angles to the ruby axis. Light passing through the slit was, in turn, focused by means of a partially silvered mirror on the same pinhole as that on which

the maser beam was focused. Thus, the light from either the reference source or the ruby could be selected at will, and passed in exactly the same manner through the interferometer.

In order to align the optical system, a microscope with a beam splitter was employed as shown in Fig. 8. Light from a convenient source was passed through the beam splitter and the objective lens in such a manner that an image of the pinhole could be viewed through the eyepiece; however, for convenience the eyepiece was removed and the image was projected on a ground glass. If the system is properly aligned, some light will pass through the pinhole and be reflected back from the silvered ruby surface so that it is coincident with the image of the pinhole. A final check of the alignment was made by triggering the maser and observing the ground glass for evidence of the ruby emission, at the position previously occupied by the image of the pinhole. The reference source and the beam-splitter position were then adjusted so that the path of the light emitted from the reference source was coincident with that of the ruby source. The microscope was then removed, and two lenses were added which focused the wavefront emerging from the pinhole, at a point where the interferometer could be placed. Finally, the interferometer was positioned on a platform that allowed micrometer adjustments along the X-, Y-, and Z-axes.

Initial interferometer adjustments were made while observing a sodium reference source. These adjustments were repeated, while viewing a white-light source, to equalize the path lengths within the interferometer; proper adjustment was indicated by the appearance of a central black fringe in the interference pattern.‡ Interference patterns were recorded on a photographic emulsion, held in a suitable position with respect to the interferometer, while the maser was operated above threshold. Many interference patterns were recorded with various shear settings so that coherence could be studied.

Several other studies of coherence have been made with other techniques, such as a Young's experiment.[24] Results from the Young's experiment indicated that the coherent emission was restricted to areas not greater than 0.5 mm distant from one another. Another experiment that has been performed consisted of the superposition of the emission from the opposite ends of a ruby maser.[19] One might expect that the interference patterns obtained with the wavefront shearing interferometer would be similar to this experiment because the maser emission consists of nearly plane standing waves. Consequently, the emitted light from either end of the crystal would have a fixed phase difference and would, therefore, be interferable. An examination of the interference patterns did indicate definite similarities.

It was hoped that the interference pattern, obtained with the wavefront shearing interferometer, would indicate the manner in which coherence existed in the ruby emission. If the emission was not coherent over the entire emitting area, the photographs might show patches of fringes on a fringeless field, thus indicating the spatial distribution of the coherent light. Such results would be useful in studying the origin of the oscillations. Another observation might be the appearance of discontinuities or bifurcations in the fringe patterns;

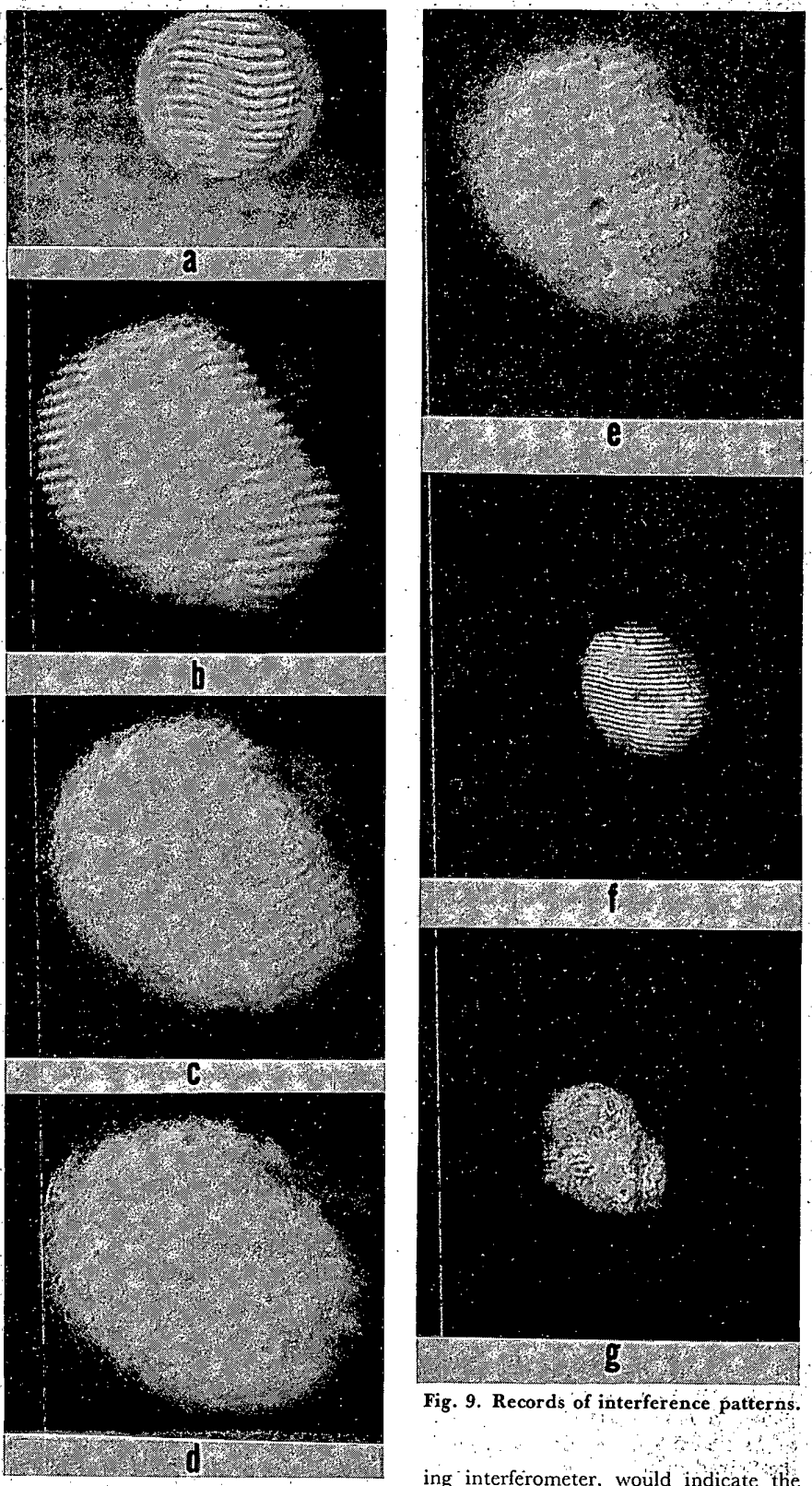

Fig. 9. Records of interference patterns.

‡ A rather annoying experimental difficulty encountered was the appearance of a third image in the interference pattern under certain conditions. Considerable difficulty was experienced in eliminating this image and obtaining proper adjustment.

this would indicate general boundaries where discontinuities in coherence existed. No evidence of either was obtained. However, contrast was observed to diminish to the vanishing point with increased traverse shift. This diminished contrast indicated that coherence does not exist for points too far apart.

For very small values of shear a rather uniform fringe pattern over the entire emitting area was observed as shown in Fig. 9(*b*). For large shears the resolution of the fringes was reduced, as shown in Figs. 9(*c*) and 9(*d*). In order to obtain maximum resolution of the fringes, it was necessary to eliminate "off axis modes" of oscillation, which tend to obscure the fringe pattern. Minimization of these modes was achieved by operating the maser just above threshold with the previously mentioned pinhole in place. Two different sized pinholes were used for the photographs taken; they were 0.5 mm (0.0197 in.) in diameter, and 0.04 mm (0.0015 in.) in diameter. Data taken indicated that the 0.5-mm-diameter pinhole is virtually useless for restricting the unwanted modes; whereas, the 0.04-mm-diameter hole was effective. The effectiveness of the 0.04-mm pinhole is demonstrated by the clear fringe pattern in Fig. 9(*f*) and the virtual absence of a fringe pattern in Fig. 9(*e*).

When the maser was operated below threshold, the fringes were observed to disappear, as we would expect, since natural fluorescence is not coherent. Figure 9(*f*), made with the small pinhole, shows no discontinuity in the interference pattern, thus indicating that the emission is coherent for a shear of 0.30 mm. In Fig. 9(*g*) the shear was increased to 0.51 mm, and a mosaic pattern with little evidence of coherence was exhibited. The circular patterns evident in Fig. 9(*g*) are probably diffraction patterns from the dust particles on the lens in the optical system. Photographs taken with shear settings greater than 0.30 mm but less than 0.51 mm showed a gradual diminishing in resolution and contrast until the fringes were no longer discernible. No sudden changes in fringe patterns were observed for a small change in shear. From the data taken, it was concluded that the emission was coherent for at least a distance of approximately 0.45 mm on the end face of the maser.

This identical experiment could be performed with a diffraction limited optical oscillator. Such a device has been described for which the output beam diverges less than twice the diffraction limit.[28] This arrangement eliminates the loop gain of the "off axis modes" and, consequently, provides a high Q for the axial mode of oscillation. Thus, a narrow beam with fewer divergent modes is obtained. The experiment could also be performed with a gas optical maser. Greater monochromaticity of the gas maser emission might allow examination of fringe patterns with very large shears. One might also consider performing this experiment with a Mach-Zender interferometer, rather than the Grubb-Parsons instrument; however, this was not done, since it did not seem to provide any real advantage.

It may be concluded that the coherence of the emission seems to be uniform over the surface of the ruby, when the areas considered are not separated by more than 0.45 mm, since no deviation from this has been observed. In addition, no sharp discontinuities in coherence were found to exist over the entire emitting area of the maser. These results agree with the results of Nelson and Collins.[24] Nevertheless, it seems advisable that additional data should be taken, to search more extensively for unique features which might be discernible in the emission. In particular, high-speed pictures of the interference patterns seem to be warranted.

Infrared Maser

An effort was made to obtain pictures of the emissions from an infrared maser with the fiber-optics camera using the same method described for the ruby maser. The particular material used was neodymium or specifically, 2% by weight Nd_2O_3 in barium crown glass, prepared by the American Optical Co.; primary emission for it occurs at a wavelength of 1.06 microns in the infrared. Several pictures were recorded on Kodak type 1-Z photographic plates. However, they exhibited poor resolution because of a surprisingly high infrared transmission in the sheath portion of the fiber-optic block. Consequently the pictures were of little use. This problem could be eliminated by using a fiber-optic block with sheath portions that are opaque in the infrared.

Conclusions

The application of three new photographic techniques for recording the properties of optical maser emission have been described. Some particularly noteworthy observations were made from the limited data that were obtained. First, the emission of a ruby optical maser with its C-axis oriented 60° to the rod axis is approximately plane polarized. Second, the emission of such a maser appears to be uniformly coherent across the end face of the maser. This coherence diminishes as the distance between the areas under consideration is increased. The apparatus used could not detect coherence for areas separated by greater than 0.45 mm.

Acknowledgment: I would like to express my appreciation to J. S. Courtney-Pratt for his help and encouragement during the various phases of the experiments. I would also like to thank J. W. McLaughlin for helping in the alignment and operation of some of the equipment and for unscrambling some of the sequences with the Bolex cine camera.

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A New Heat-Developable Motion-Picture Print Film

By NOEL R. BACON
and ROBERT B. LINDEMEYER

A dry photographic system applicable to the motion-picture, television and educational film industries. Metro-Kalvar, is described. The system is based upon the phenomenon of light scattering accomplished within a film of thermoplastic resin coated upon a base of transparent polyester. This basic system of photography utilizes ultraviolet exposure and heat development. Details about its departure from traditional motion-picture print materials and procedures are outlined. Developmental tests and equipment are discussed.

The Basic Kalvar Process

The Kalvar Photographic Process is based upon the phenomenon of light scattering, rather than upon that of light absorption as in conventional silver halide materials. The two cases are compared in Fig. 1, where the incident light is absorbed by the silver grains within the developed silver halide film and the incident light is reflected and refracted by the scattering centers within the developed Kalvar film. The film consists of a thermoplastic resin, coated upon a base of transparent polyester. Within the thermoplastic resin, which is normally coated to a thickness of slightly less than 0.0005 in., an ultraviolet-sensitive compound is uniformly dispersed. These molecules of sensitizer are shown as black dots in Fig. 2. Upon exposure to ultraviolet radiation, this photosensitive diazonium salt is decomposed, releasing nitrogen and other volatile products. The internal pressures created by these decomposition products within the thermoplastic vehicle constitute a "latent image" of internal stresses. Upon application of heat, the resin crystallites soften and the gaseous decomposition products expand. A reorientation and ordered recrystallization of the polymer into microscopic vesicles takes place. These vesicles, since they are of a different index of refraction than the surrounding medium, scatter light incident upon them and thus constitute the image. The light-scattering vesicles vary in size from less than 0.5 micron to 2 microns in diameter. Unlike the bubbles that might be formed in gelatin by a similar method, they consist of cavities enclosed by a shell of more highly ordered crystallites than the surrounding medium. As a result, the vesicles are highly resistant to environmental changes and mechanical stresses and provide an extremely stable image.

Sensitivity and Exposure

Kalvar film is not a camera stock. It is a comparatively low-speed material with primary photosensitivity in the near ultraviolet, peaking at 3,850 A. The amount of radiation required to produce maximum density at this wavelength is about 200 milliwatt-sec/sq. cm. The spectral response curve in Fig. 3 shows that the photosensitivity is not limited to a narrow peak but extends from below 3,500 to above 4,300 A. The film is not photographically sensitive to ordinary levels of visible light for short periods of time. Exposure times are determined only by the amount of time required to absorb the 200 milliwatt-sec/sq cm of actinic radiation. Times of less than 1/100 sec have provided adequate exposure. One user of substantial amounts of heat-developable microfilm working with a variable aperture, continuous contact printer-processor is currently operating at a speed of 170 ft/min.

Medium- to high-pressure mercury-vapor lamps which have a high intrinsic brightness, coupled with a desirable spectral output, have proved to be efficient light sources. A high-pressure air-cooled mercury-vapor lamp rated at approximately 1,000 w is currently employed on one of the developmental motion-picture printer-processors.

Latent-Image Stability

The temperature of the film during exposure should not exceed 110 F. Temperatures above this will result in a higher diffusion rate of the latent-image-forming gas, with subsequent reduction of the maximum density obtained.

Since the latent image is comprised of a given amount of gaseous nitrogen, it has a definite decay time dependent on the permeability of the emulsion's thermoplastic vehicle to nitrogen. The decay time can be adjusted by adding modifiers to the basic vehicle resin to increase or decrease its permeability. A current heat-developable microfilm has a latent-image diffusion time of less than 30 sec and is finding useful application as a reversal processed material. Metro-Kalvar motion-picture emulsions require approximately 8 hr for the latent-image gas to escape completely. Experiments show that the film should be developed within 3 min after exposure.

Since one of the film's major features is its simplicity of development by heat alone, this short latent-image life is no problem. All equipment provides for continuous development immediately following exposure and as an integral part of the machine. The inherent latent-image decay precludes the design of printing equipment employing the "down one side — back the other" configuration as

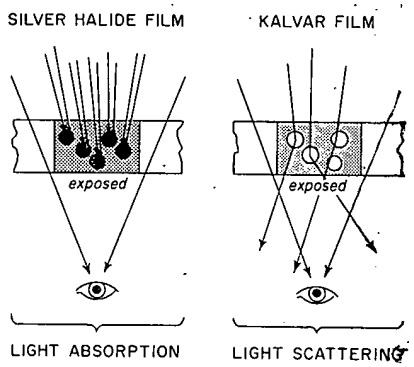


Fig. 1. Comparison of the two systems of photography.

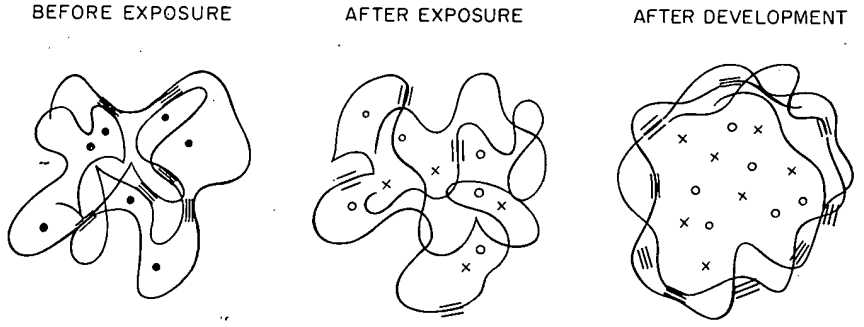


Fig. 2. Schematic of Kalvar Film's process.

Presented on October 15, 1963, at the Society's Technical Conference in Boston, by Noel R. Bacon (who read the paper) and Robert B. Lindemeyer, Metro-Kalvar, Inc., 550 Fifth Ave., New York, N.Y. 10036.

(This paper was first received on October 21, 1963, and in final form on February 3, 1964.)

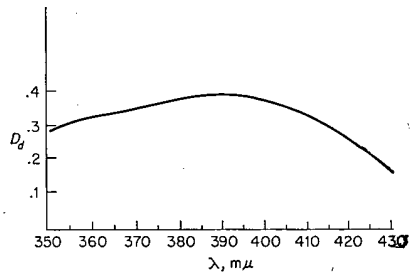


Fig. 3. Spectral response of Kalvar film.

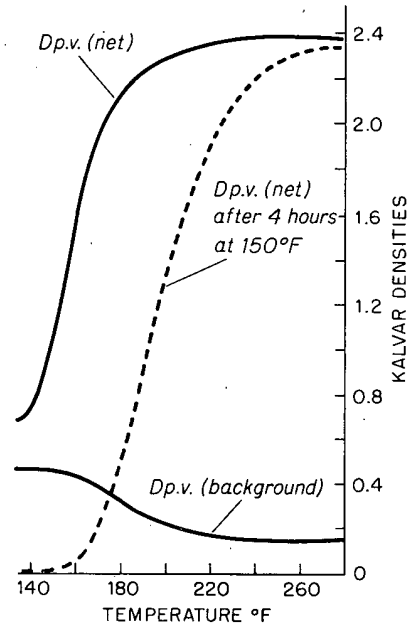


Fig. 4. Kalvar film densities with constant exposure and development time, varying development temperature. D.p.v. = density projection visual.

currently used in several 35/32mm high-speed motion-picture printer applications.

Development and Image Stability

Kalvar film is developed by heat. Any method of heating the film sufficiently will produce the image. A wide variety of techniques have been employed, including heated rollers, heated platens and even forced hot air. The calculated energy requirement to develop the image is approximately 0.635 watt-sec/sq cm/mil thickness of the film.

The gray scale of the light-absorption (silver) type of photographic image is a function of both exposure and development; the gray scale of the light-scattering type of image is primarily a function of exposure. To ensure optimum image characteristics and stability, development must be held within relatively narrow limits. Development times are closely related to development temperatures because total development occurs at a fixed heat level whether that level is reached in seconds or milliseconds. Experimentation has shown a requirement for the emulsion to come to a temperature of 240 F. This temperature was arrived at by comparing the three curves shown in Fig. 4. It can be seen that as the development temperature increases, the background density of the image decreases until approximately 220 F is reached. The upper curve, showing net visual projection density, increases rapidly to approximately 180 F, after which only limited increase is noted from higher development temperature. The dotted line, reflecting the relationship of development temperature to thermal stability of the image, is somewhat more critical. This curve shows the loss in net visual projection density after the developed film has been subjected to 150 F for 4 hr. Design and selection of development heat sources for the desired high-speed operation of the motion-picture printer-processors has required careful consideration of heat transfer characteristics and machine speed vs. dwell-time variables.

Current practice employs a revolving Teflon-coated aluminum drum with heat provided by a 500-w electric blanket laminated to the inside perimeter of the drum. A precision thermostat controls temperature to ±2 F of the desired setting.

Fixing and Image Stability

As with most photographic processes, a fixing technique for the heat-developed film provides for image permanence. After exposure and development the nonlight-struck areas of the film still contain undecomposed sensitizer. The fixing technique consists of exposing the film overall to ultraviolet light. Applying about four times the amount required for maximum exposure completely decomposes the residual sensitizer. The film must then be protected from temperatures in excess of 150 F for a few hours to permit the gas to diffuse completely from the film. The properly exposed, developed and fixed image is one of the most stable of all photographic images. The thermal stability of the image is closely related to the development temperature, as discussed earlier in this report.

Medium- and high-pressure mercury-vapor lamps, which have proved successful for initial exposure, function equally well for the overall fixing exposure.

Sensitometric Characteristics of Light-Scattering Films

As a consequence of the unique characteristics of these light-scattering films, the sensitometric units and standards currently used in silver halide photography do not apply directly to this type of photography. For example, the meter-candle-second exposure units used to express ASA speeds of silver materials are founded on the relative visibility curve of the human eye and obviously cannot be used for heat-developable films, which are sensitive to wavelengths outside the visible spectrum.

Similarly, the familiar sensitometric terms, such as density and contrast, must be redefined when applied to the properties of light-scattering materials. The degree of opacity of the exposed and developed Kalvar image can be measured in terms of diffuse transmission density as outlined in ASA PH2.19-1959. However, when light is incident on the exposed and developed film sample, part of the light is absorbed, part is reflected and part is transmitted; the transmitted and reflected light is highly scattered. The visual diffuse transmission densities of the film are quite low. In fact, the characteristic curve of a typical Kalvar motion-picture emulsion based on visual diffuse densities has an average gamma of 0.35 and a density range of about 0.60. To those unfamiliar with the light-scattering type of photographic image this immediately indicates an extremely low contrast material with limited density range.

For a photographic medium depending on light absorption, the diffuse density is close to the specular or projection density. This is not true for a light-scattering system as may be seen in the generalized schematic, Fig. 5. In any practical use, a photographic material is viewed or projected through an aperture of finite dimensions, here labeled *A*. In the light-scattering system a substantial portion of the transmitted light is scattered outside the angle over which light is collected by the effective aperture. At the same time, the effective density of the heat-developed film strongly depends upon the cone angle subtended by the light-gathering element, whether it be the eye, a projector lens or the photosensitive receptor of a densitometer. This is shown in Fig. 6 where the effective or projection density for various apertures is plotted against the logarithm of the exposure.

These characteristics have been taken into consideration in the design and development of new measuring techniques for the photometric evaluation and process control of Kalvar photography. The primary objectives in the development of these new techniques have been to provide measurements that will readily correlate with the traditions and experience of the photographic industry and that will accurately represent the product's capabilities in ultimate projection viewing.

This departure of ultimate use conditions from the conditions during diffuse density measurement is of concern in all types of photography. The American Standards Association Committee on Sensitometry is currently giving careful consideration to this problem. A recently created ASA Subcommittee, PH2-28, has been charged with the responsibility of revising the Diffuse Transmission Density Standard to include other types of density such as projection density. The

Kalvar Corporation is playing an active role on that subcommittee.

Practical Sensitometry and Control Techniques

Current techniques employed to provide sensitometric evaluation of various Kalvar emulsions and process control represent only a slight modification of procedures widely used in the photographic industry.

A sensitometer is used to expose strips for basic emulsion characteristic evaluation. This unit employs an ultraviolet light source carefully positioned in relation to a curved aperture containing a calibrated density modulated wedge.

Exposures are developed on a small laboratory hot-roller capable of maintaining set development temperatures to ±2 F.

Sensitometric strips are read on either a standard motion-picture densitometer providing visual diffuse transmission densities or a projection reading densitometer with modified aperture providing readings directly relatable to ultimate projection conditions. These readings are plotted in a standard H&D characteristic curve for routine evaluation of speed, gamma, density and exposure scales. These same readout and evaluation techniques are employed for process control where the sensitometric strips are exposed and developed on the Metro-Kalvar Motion Picture Printer-Processor under varying conditions of machine speed and light intensity.

Research and Development

The technology of silver halide photography has been evolving for over a hundred years. The light-scattering principle of image formation has been known for nearly the same length of time; but it is polymer chemistry that has provided the means to create light-scattering images in a practical way. Metro-Kalvar was formed by Metro-Goldwyn-Mayer and the Kalvar Corporation to adapt the Kalvar Process to the motion-picture, television and educational film industries.

Progress toward that goal has included basic research and formulation of appropriate film emulsions at the Kalvar Corporation in New Orleans and design, fabrication and testing of bread-board printing and processing equipment at the M.G.M. Laboratories in Culver City. The manufacture of a pre-production prototype 16mm printer-processor has begun at Calvin Productions in Kansas City. The specifications for this machine include a desk top model, an operating speed of 70 ft/min, separate sound and picture printing heads and 1,200-ft film capacities.

Research has been conducted on the problems of splicing the polyester-based films. The cements employed with conventional film splicing are ineffective with polyesters; however, tape splicing has been used with excellent results. High-strength values are retained, since the tape employed is also polyester.

Conclusion

In conclusion, it is appropriate to set forth the major advantages of the Metro-Kalvar System:

(1) With maximum sensitivity in the near ultraviolet region, the need for a darkroom is eliminated.

(2) It is a dry process, requiring no chemicals for processing, because heat alone develops the image.

(3) The basic formulation of materials provides for prolonged shelf life and convenient storage conditions.

(4) The unique structure and distribution of the light-scattering image affords high resolution, excellent image stability and grain-free projection characteristics.

(5) The combination of a predominantly thermoplastic emulsion and a tough polyester base provides for a scratch-resistant, long-wearing film.

(6) The standard 3-mil thickness of the high-strength polyester base allows 1,000 ft of film to be wound on a standard 600-ft reel.

(7) The combined process of exposure and development provides immediate access to results.

Discussion

George Lewin (Army Pictorial Center)*: Is it possible to put this Kalvar emulsion on conventional cellulose acetate base?

Mr. Bacon: It is.

Mr. Lewin: Do you arrive at the optimum exposure for your soundtrack by cross-modulation or inter-modulation tests?

Walter G. Eggers (M.G.M. Laboratories, Inc.): Conventional cross-modulation tests have not proven, at this moment, of any value as far as Kalvar film is concerned. The densitometry of Kalvar is a new field, and the numbers we derive from a densitometer that has been developed for Kalvar film are not meaningful in the same sense that silver halide densities are. When we try to draw a cancellation curve we are, in some cases, comparing apples against oranges, because the two densities; that is, the density of the silver optical transfer and the Kalvar print have to be measured by different parameters. We have, however, investigated this by means of listening tests. I might ask you a question: What did you think of the sound on this particular print?

* Deceased November 1963.

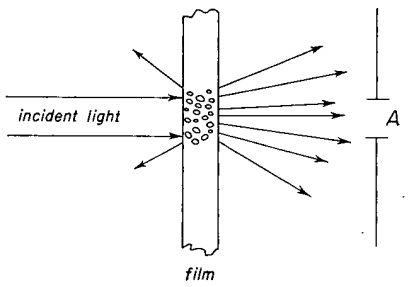


Fig. 5. Schematic of function of Kalvar density.

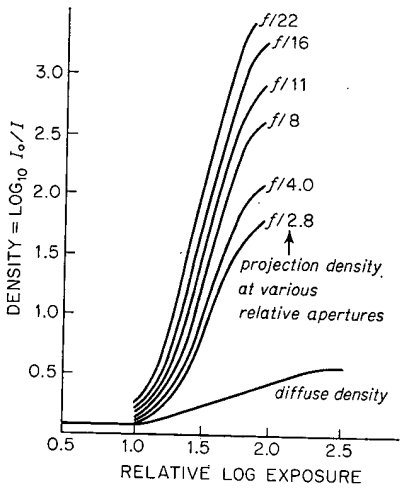


Fig. 6. Projection density as a function of aperture.

Mr. Lewin: Well, I felt that the sound was quite adequate. Was it area or density track?

Mr. Eggers: That's variable area.

Mr. Lewin: And is it reproduced with a conventional photoelectric cell?

Mr. Eggers: The conventional cell.

Mr. Lewin: Have you been successful with the variable-density track as well as area.

Dr. Robert T. Nieset (Metro-Kalvar): No work has been done on variable-density pursuits. You can see that, with the limited maximum density that we had, the dynamic range on variable-density recording with Kalvar would be pretty small at the present time. I'd like to add one other comment: since the soundhead always looks at the soundtrack with a much smaller physical aperture than does a projector lens, the control of exposure with relationship to sound and picture is not as critical as it would be in the silver case. The density of the soundtrack, because it's being used with such a small aperture, is always much higher than the density of the projected image.

Résumés / Resumenes / Zusammenfassungen

The Society is grateful to the following authors for supplying translations of their abstracts: T. J. Pavliscak—*French, Spanish German*; Koichi Sadashige—*German*. Special assistance by Jean-Paul Vallée is also acknowledged with gratitude.

La cinématographie dans l'U.R.S.S.

V. G. Komar [196]

L'auteur passe en revue la situation actuelle de l'industrie cinématographique soviétique, ainsi que son organisation, ses techniques, son matériel et ses systèmes de projection. On décrit brièvement les applications de la photographie à grande vitesse dans le domaine des recherches scientifiques, le développement des procédés et de l'équipement photographique dans les recherches interstellaires et l'étude des procédés nucléaires. Les conditions techniques de la coopération internationale sont examinées et la base pour l'échange de films est considérée comme un des problèmes les plus sérieux auxquels les ingénieurs font face dans de nombreux pays.

Etude sur les bruits des préamplificateurs de caméras de TV

Koichi Sadashige [202]

Les normes de rendement des préamplificateurs vidéo des caméras à tube image-orthicon ou vidicon sont bien établies. Les récents perfectionnements des transistrons ont permis la mise au point d'appareils dont le facteur de bruit donne assez de satisfaction et le produit gain-largeur de bande est suffisamment élevé pour que ces appareils puissent entrer dans la conception de toutes les caméras de TV constituées d'éléments solides. Cependant, lorsqu'il est essentiel d'obtenir le meilleur rapport signal/bruit, les tubes électroniques restent supérieurs aux transistrons pour les circuits d'entrée. Le circuit hybride à tubes et à transistrons en montage cascode offre aussi des avantages. (*Jean-Paul Vallée*)

Études photographiques sur les "Maser" optiques

T. J. Pavliscak [206]

On passe en revue trois méthodes d'enregistrement des propriétés des émissions faisant usage des phénomènes "maser" optiques. On a commencé par des enregistrements de l'émission à 400.000 photographies par seconde. On signale aussi l'enregistrement d'un "maser" optique à rubis au moyen d'une technique inédite de photographie à grande vitesse. Finalement, on examine la cohérence de l'émission due au phénomène du "maser" avec un interféromètre à découpage de la forme d'onde et on l'enregistre avec une caméra ordinaire à film de 35 mm. On décrit ces techniques et certaines des premières observations faites sur les émissions du type "maser."

Un noveau film de tirage cinématographique développable à la chaleur

Noel R. Bacon
et Robert B. Lindemeyer [213]

L'article décrit un système photographique de type sec Metro-Kalvar applicable aux industries de films cinématographiques, éducatifs et de télévision. Ce système est basé sur le phénomène de la dispersion de la lumière réalisé à l'intérieur d'un film de résine thermoplastique revêtu d'une base en polyester transparent. Ce système photographique de base utilise l'exposition aux rayons ultra-violets et le développement à la chaleur. Les auteurs expliquent en détail les principales différences par rapport aux matières et techniques traditionnelles de tirage des films cinématographiques. L'article décrit également les essais et l'équipement de développement mis en oeuvre.

Cinematografía en USSR

V. G. Komar [196]

Se revisa el estado actual de la industria cinematográfica en la Rusia Soviética y se discute su organización, técnicas, equipos y sistemas de proyección. Se mencionan brevemente los usos de la fotografía ultra-rápida en investigaciones científicas, así como el desarrollo de procedimientos y equipos para fotografía en la investigación espacial y el estudio de los procesos nucleares. Las premisas técnicas para la cooperación internacional son revisadas, considerándose que las bases para el intercambio de películas es uno de los más graves problemas que confrontan los ingenieros de muchos países.

Un estudio de los ruidos en los preamplificadores de cámaras televisoras

Koichi Sadashige [202]

Se formula el criterio acerca del funcionamiento en preamplificadores de video para uso en tubos de cámara imagen-orticón y vidicón. Los desarrollos recientes en transistores han producido unidades que tienen una cifra de ruidos suficientemente buena y un producto que tiene una relación de ganancia a anchura de banda suficientemente elevada para ser de utilidad en el diseño de las cámaras televisoras con luminosidad de la imagen por capas de material fotoconductor. Cuando el mejor rendimiento posible de señal a ruido es esencial, los circuitos de entrada de tubos de vacío son siempre superiores a los transistores. Un circuito híbrido de tubo-transistor en cascada ofrece algunas ventajas.

Algunos estudios fotográficos de los fenómenos ópticos del tipo "maser"

T. J. Pavliscak [206]

En esta obra se estudian tres métodos para registrar las propiedades de las ondas producidas por los fenómenos ópticos del tipo "maser." Primeramente se obtuvo una serie de registros de tales ondas a la velocidad de 400.000 fotografías por segundo. Luego, se registró la polarización de la luz de un "maser" óptico de rubí mediante una técnica fotográfica de gran velocidad, muy especial. Por último, se examinó la coherencia de la emisión con un interferómetro del tipo de división de la forma de onda y utilizando una cámara ordinaria de 35 mm. En el estudio mencionado se describen estas técnicas y se exponen algunas observaciones iniciales de los fenómenos aludidos.

Una nueva película de impresión cinematográfica revelable con calor

Noel R. Bacon
y Robert B. Lindemeyer [213]

Se describe un sistema fotográfico en seco, Metro-Kalvar, aplicable a las industrias de cinematografía, televisión y películas educativas. El sistema está basado en el fenómeno de dispersión de la luz que se efectúa dentro de una película de resina termoplástica revestida sobre una base de poliester transparente. En este sistema básico de fotografía se utiliza exposición ultravioleta y revelamiento con calor. Se bosquejan los detalles de esta innovación en los materiales tradicionales de impresión cinematográfica y se describe el procedimiento. Se discuten las pruebas y equipos de este desarrollo.

Filmwesen in der U.d.S.S.R.

V. G. Komar [196]

Der gegenwärtige Stand der sowjetischen Filmindustrie und ihre Struktur, Technik, Ausrüstung und Projektionsverfahren werden beschrieben. Kurze Behandlung der Anwendung der Schnellphotographie für wissenschaftliche Forschungszwecke und Entwicklung von Verfahren und Geräten zur Anwendung der Photographie für Weltraumforschung und in der Studie von Kernenergie-Vorgängen. Die technischen Voraussetzungen internationaler Zusammenarbeit werden untersucht und die Grundlagen für den Filmaustausch werden als eines der schwierigsten Probleme der Ingenieure vieler Länder beschrieben.

Untersuchung von Geräuschen in Fernseh-Kameras

Koichi Sadashige [202]

Die Arbeitsweise von Video-Vorverstärkern für den Gebrauch mit Image Orthikon und Vidikon Röhren ist formuliert. Kürzliche Entwicklungen in Transistoren riefen Verbesserungen in Geräusch-Pegel und Bandbreite-Fähigkeit hervor, genügend hoch um im Entwurf von Fernseh-Kameras von solchen Festleitern Gebrauch zu machen. Wo man die bestmöglichste Vorführung im Geräusch-zu-Signal Pegel verwenden muss, findet man dass Röhren immernoch der Transistoren vorgezogen werden. Eine Mischung von Röhren/Transistoren Schaltung ist vorteilhaft.

Photographische Untersuchungen optischer Maser

T. J. Pavliscak [206]

Es werden drei Methoden für die Aufzeichnung der Eigenschaften optischer Maser erörtert. Erstens, wurde eine Reihe von Aufzeichnungen der Maser Emissionen mittels 400.000 Aufnahmen pro Sekunde hergestellt. Zweitens, wurde die Polarisierung eines optischen Rubinmasers mittels einer einzigartigen Technik der Höchstgeschwindigkeitsphotographie aufgenommen. Drittens, wurde die Kohäsion der Maser Emission mittels eines die Wellenstirn schneidenden Interferometers untersucht und mit einer gewöhnlichen 35 mm Kamera aufgenommen. Es werden diese Verfahren beschrieben, sowie einige vorher durchgeführte Beobachtungen von Maser Emissionen.

Ein neues Verfahren für Kopierfilmentwicklung durch Wärmebehandlung

Noel R. Bacon
und Robert B. Lindemeyer [213]

Der Artikel beschreibt ein trockenes photographisches System, das Metro-Kalvar-System, mit Anwendungsbereichen in der Kinefilm-, Fernseh- und Lehrfilm-Industrie. Die Grundlage des Systems bildet der Lichtstreuungsvorgang, der innerhalb eines Filmes aus thermoplastischem Harz auf durchsichtiger Polyester-Basis durchgeführt wird. Dieses Lichtbildverfahren verwendet eine Belichtung mit ultravioletem Licht und Entwicklung durch Wärmebehandlung. Kurze Übersicht der Unterschiede gegenüber üblichen Kinefilm-Kopiermaterial und -Verfahren. Erörterung von Entwicklungsversuchen und -geräten.

standards and recommended practices

Approved American Standards

On January 13, 1964, the American Standards Association approved as American Standards three proposals. Two of those, PH22.38 and PH22.97, are in fact reaffirmations of the technical material in the earlier issues. The standards have been modified editorially to conform in style with more recently approved documents.

PH22.38-1964, American Standard Dimensions of Raw Stock Cores for 16mm Motion-Picture Film, specifies the dimensions of 2-, 3- and 4-in. cores normally used with raw stock. PH22.97-1964, American Standard Dimensions of 200-mil Magnetic Sound Record on 16mm Film Base, Perforated 1R-3000, specifies the location, dimensions and recording speed of the 200-mil sound record normally used in studio work. PH22.56a-1964, American Standard Nomenclature for Motion-Picture Film Used in Studios and Processing Laboratories (Sections 5–7), is a supplement to the first issue, PH22.56-1961 and adds Section 5, photographic sound; Section 6, Magnetic Sound and Section 7, Release Prints.

Individual copies of these standards can be purchased from the American Standards Association, 10 East 40th Street, New York, 10016.—*A.E.A.*

American Standard Dimensions of

Raw Stock Cores for 16mm Motion-Picture Film

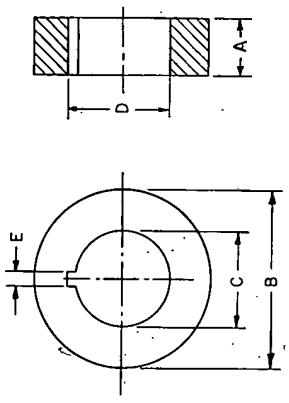
ASA
Reg. U.S. Pat. Off.
PH22.38-1964
Revision of PH22.38-1952
* UDC 771.332

1. Scope

This standard specifies the dimensions of 2-, 3- and 4-in. raw stock cores for 16mm motion-picture film.

2. Dimensions

The dimensions shall be as given in the figure and in the following table.



Dimensions		Inches		Millimeters	
A		0.627	max	15.93	max
		0.590	min	14.99	min
B	2 in.	1.968 ± 0.010		49.99 ± 0.25	
	3 in.	3.000 ± 0.016		76.20 ± 0.40	
	4 in.	4.000 ± 0.016		101.60 ± 0.40	
C		1.020 ± 0.008*		25.91 ± 0.20*	
D		1.177 ± 0.016		29.90 ± 0.40	
E		0.157 ± 0.008		3.99 ± 0.20	

* Bore C to fit freely to hub with a 1.000 + 0.004 − 0.000 in. (25.40 + 0.1 − 0.0mm) diameter.

3. Concentricity Allowance

The concentricity of the inside and outside diameters of the core shall be within 0.020 in. (0.51mm), one half of the total dial runout.

APPENDIX

(This Appendix is not a part of American Standard Dimensions of Raw Stock Cores for 16mm Motion-Picture Film, PH22.38–1964, but is included to facilitate its use.)

A nominal 4-in. core is manufactured, though not currently used as a raw stock core, which is used at present for film take-up on high-speed film printing and processing equipment. Such cores are used so as to minimize possible damage to film by reducing the initial starting torque necessary for windup. (This large core reduces the ratio of take-up tension from the outside of the roll to the inside of the roll, thus allowing greater film tension control.)

The keyway is provided as a means of driving the core for take-up or of providing holdback tension on a feed spindle. The dimensions of the keyway shall be adequate to clear a square-ended key.

The manufacturer may, at his discretion, reduce the cross-sectional area of the core, so long as it does not interfere with the stated dimensions, and in addition may provide a slot into which the film may be lapped in order to spool it snugly to the core. Such spooling is usually designated as "wound on." When the film is spooled on a collapsible mandrel and the core is inserted after spooling, it is usually designated as "core inserted." (This latter designation is not to be taken as referring to whether or not the end of the film is lapped into the core.)

In the spooling of film to be used in high-speed cameras, it is the usual practice to snub the film onto the core without lapping the end in a slot so that the end will not be crimped. Such a crimp passing through a camera mechanism at several thousand frames per second may seriously damage the mechanism.

The maximum value for Dimension A is the minimum width of 16mm film as described by related American Standards. The core should not be wider than the film in order to avoid difficulty with tight-winders, widely used in the industry, which have fixed flanges for guiding. Except for the slot and keyway, the periphery and bore should present smooth, unbroken surfaces.

Approved January 13, 1964, by the American Standards Association, Incorporated
Sponsor: Society of Motion Picture and Television Engineers, Inc.

* Universal Decimal Classification

Printed in U.S.A.
ASA1M2647/50

American Standard

Nomenclature for Motion-Picture Film Used in Studios and Processing Laboratories

(Sections 5-7)

ASA
Reg. U.S. Pat. Off.
PH22.56a–1964
Addenda to PH22.56–1961
* UDC 778.5:001.4

5. Photographic Sound

Note: All definitions in this section will be understood to be photographic unless the term "magnetic" is used.

5.1 *Photographic Sound.* Photographic sound is a sound record in the form of a photographic image.

5.2 *Sound Negative.* A sound negative is any film that, after exposure and subsequent processing, produces a negative sound record on the film. This sound record requires the steps of printing and processing of a second film in order to obtain a reasonably faithful reproduction of the original sound, by the conventional scanning system.

Note: The negative image may be obtained by exposure through a positive sound image; by direct recording; or, by the reversal process, from another sound negative.

5.2.1 *Original Sound Negative.* The original sound negative is the sound negative that is exposed in a film recorder and, after processing, produces a negative sound image on the film.

5.2.2 *Sound-Effects Negative.* A sound-effects negative is a sound negative upon which sound effects have been recorded. It is ordinarily held in library stock.

5.2.3 *Music Negative.* A music negative is a sound negative upon which music has been recorded. It is usually an original sound negative but may be a library negative.

5.2.4 *Sound Cut Negative.* A sound cut negative is a sound negative that is composed of sections of original sound negatives spliced in sequence.

Note: The sound cut negative is generally in exact conformity with the sound work print and produces a single sequentially spliced negative. The print of the sound cut negative provides all, or portions of, the re-recording print.

5.2.5 *Re-recorded Negative.* A re-recorded negative is a sound negative which is exposed by re-recording and, when processed, produces a negative sound track image.

5.2.6 *Sound Release Negative.* A sound release negative is a photographic sound negative in the form required for the final printing operation onto the release print raw stock.

Note: The sound release negative may consist of re-recorded negatives, intercut original sound negatives, duplicate negatives of sound records, etc., depending upon the choice of available material or the intended use of the print.

5.2.7 *Special Sound Release Negative.* A special sound release negative is a sound release negative made for the purpose of obtaining a sound track which has characteristics other than those obtained from the sound release negative.

Note: Three common forms of special sound release negatives are these listed under 5.2.7.1, 5.2.7.2 and 5.2.7.3.

5.2.7.1 *Special Sound Release Negative for Use in 16mm Release of 35mm Preprint Material.* The special sound release negative for 16mm release of 35mm original material is a photographic sound negative, either 35mm or 16mm, recorded with specific characteristics for reasonably faithful reproduction of the original sound on 16mm reproduction equipment. It may be re-recorded from a print of the 35mm sound release negative or from the 35mm re-recording print.

5.2.7.2 *Special Sound Release Negative, Foreign Release in English.* The special sound release negative for use in English version for foreign release is re-recorded from the re-recording print, except that the dialogue track is modified to remove American colloquialisms.

5.2.7.3 *Special Sound Release Negative, Foreign-Language Version.* The special sound release negative for use in foreign-language-version release is usually re-recorded using all of the re-recording tracks, except the dialogue track, for which is substituted a special synchronized dialogue track in the foreign language for which the release is being made.

5.2.8 *Sound Release Dupe Negative.* A sound release dupe negative is a duplicate negative of the sound record prepared specifically for printing the sound track of release prints.

5.3 *Sound Print.* A sound print is any positive obtained by printing from a sound negative, or direct positive recording, or, by the reversal process, from another sound positive. A sound print provides a reasonably faithful reproduction of the original sound through the conventional scanning system.

5.3.1 *Sound Daily Print.* A sound daily print is the first sound print made from the original sound negative for checking sound quality, technique, etc.

5.3.2 *Sound Work Print.* A sound work print is a sound print that usually consists of intercut sound daily prints, but may also include other sound tracks of sound effects or music, or both, on the same or separate films, with synchronism constantly maintained with the corresponding picture work print.

5.3.3 *Sound-Effects Print.* A sound-effects print is a sound print made from a sound-effects negative, or from another sound-effects print by reversal processing.

5.3.4 *Music Print.* A music print is a sound print made from a music negative.

5.3.5 *Re-recording Print.* A re-recording print is a sound print prepared specifically for use in re-recording to produce a re-recorded negative.

Note: A re-recording print may be a print from a sound cut negative, a specially intercut print, or a combination of both. It usually consists of several sound records on separate films that include dialogue, sound effects, music, or any other required material. The term is used interchangeably to designate the entire group of associated films or any individual film that is part of the group.

5.3.6 *Re-recorded Print.* A re-recorded print is a sound print from a re-recorded sound-track negative.

5.3.7 *Sound Check Print.* A sound check print is a sound print made from the sound release negative for the purpose of checking negative cutting, printing lights, sound quality, etc.

Note: When a sound check print is required, it is usually made prior to the first trial composite print.

5.3.8 *Sound Master Positive.* A sound master positive is a sound print on special film stock that is usually made from a sound release negative for the purpose of producing duplicate negatives of the sound record for release printing.

5.4 *Composite Print* **(See 3.2)**

[3.2 *Composite Print.* A composite print is a positive film having both picture and corresponding sound on the same film, which may be in editorial or projection synchronism.]

5.4.1 *Composite Daily Print* **(See 3.2.1)**

[3.2.1 *Composite Daily Print.* A composite daily print is made from an original composite negative or original sound and picture negatives, and is used for checking photography, sound quality, action, etc. It is in projection synchronism.]

Approved January 13, 1964, by the American Standards Association, Incorporated
Sponsor: Society of Motion Picture and Television Engineers, Inc.

* Universal Decimal Classification

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Declassified and Approved For Release 2013/10/28 : CIA-RDP80T00246A026400180002-8

6. Magnetic Sound

6.1 *Magnetic Sound Film* **(See 1.2)**

[**1.2** *Magnetic Sound Film.* Magnetic sound film is a film base having film perforations along one or both edges and bearing a ferro-magnetic coating, either completely across the film or in stripes, the coating capable of accepting and reproducing sound records. Note: Unperforated materials usually are referred to as magnetic tape.]

6.2 *Full-Coat Magnetic Film.* Full-coat magnetic film has the magnetic-coating compound applied across the film from edge to edge.

6.2.1 *Full-Coat Between Perforations Magnetic Film.* Full-coat between perforations magnetic film has the magnetic-coating compound across the film from perforation to perforation.

6.3 *Magnetic Striping.* Magnetic striping is a process by which a magnetic-coating compound is applied in the form of single or multiple stripes, having specific widths and placements, to either surface of a film base which may or may not have a photographic emulsion.

6.4 *Balance Stripe.* A balance stripe is a magnetic coating or coating of another material that is equal in thickness to, but may be narrower than, the stripe used for recording. It is applied along the opposite edge of the film. Its primary purpose is to equalize the effective thickness of the two edges of the striped film in order to obtain uniform winding. The stripe is sometimes used for the recording of additional sound or control records.

6.5 *Magnetic Original.* A magnetic original is the original or first sound record on a magnetic film.

6.6 *Magnetic Transfer.* A magnetic transfer is a magnetic sound record obtained by electrical re-recording of a magnetic original onto another magnetic film.

6.7 *Magnetic Master.* A magnetic master is a final edited or re-recorded magnetic sound record used for transfer to a magnetic release print or for transfer to a photographic sound negative to be used for manufacturing prints with photographic sound tracks.

6.8 *Magoptical Release Print.* **(See 7.4)**

7. Release Prints

7.1 *Release Print.* **(See 1.15.2)**

[**1.15.2** *Release Print.* A release print is a print made for general distribution and exhibition. It may be on films of 8mm, 16mm, 35mm or 70mm width. Some release prints are composed of two or more 35mm-width films which are projected simultaneously in lateral alignment.]

7.1.1 *Composite Release Print.* A composite release print is a print having both picture and sound records in projection synchronism on the same film.

Note: The sound record may be photographic, magnetic, or both.

7.1.2 *Domestic Release Print.* A domestic release print is a release print intended for distribution within the country where the print was manufactured and having dialogue in the language of that country. It may be a composite print or may have magnetic sound track or tracks on a separate film.

7.1.3 *Foreign-Version Release Print.* **(See 3.2.6)**

[**3.2.6** *Foreign-Version Release Print.* A foreign-version release print is a composite print in projection synchronism with dialogue made specifically for the particular language involved. Note: Sometimes superimposed titles in a different language are used on the print. A superimposed title consists of printed words (usually transparent) overlaying the picture image.]

7.2 *Anamorphic Release Print.* An anamorphic release print is a release print in which the picture image is compressed laterally, requiring a deanamorphosing lens on the projector to cause objects in the projected picture to have correct proportions.

7.3 *Wide-Screen Release Print.* A wide-screen release print is a print which has no anamorphosis but, when projected, produces a screen image having an aspect ratio greater than 1.33 to 1.

Note: Some prints are made from negatives exposed in a camera aperture having an aspect ratio of 1.33 to 1, but which have been composed for projection to yield a projected picture having an aspect ratio greater than 1.33 to 1. A wide-screen print may also be obtained from an anamorphic negative by deanamorphosing in the printing process.

7.4 *Magoptical Release Print.* A magoptical release print is a composite release print which has both magnetic and photographic (optical) sound tracks.

Index

Boldface numbers refer to paragraphs.

Declassified and Approved For Release 2013/10/28 : CIA-RDP80T00246A026400180002-8

American Standard Dimensions for

200-Mil Magnetic Sound Record on 16mm Film Base, Perforated 1R-3000

ASA
Reg. U.S. Pat. Off.
PH22.97—1964
Revision of PH22.97-1956
* UDC 778.534.425

1. Scope

1.1 This standard specifies the location, dimensions and recording speed of a 200-mil magnetic sound record on 16mm film base with perforations along one edge.

1.2 The film is normally used for sound without picture.

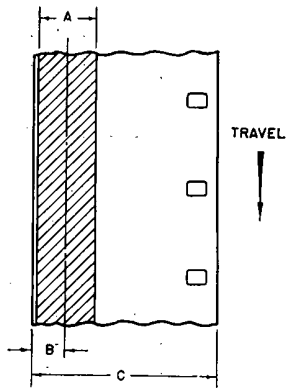
1.3 The dimensions of the magnetic coating are not specified here but are assumed to be wide enough to permit the placement of a sound record in accordance with this standard.

2. Sound Record

2.1 The location and dimensions of the sound record shall be as given in the figure and table.

2.2 The recording speed shall be 24 perforations per second (approximately 36 ft per minute).

2.3 With the direction of travel as shown in the figure, the magnetic coating is on the upper side of the film base.



Dimensions	Inches	Millimeters
A	0.200 ± 0.002	5.08 ± 0.05
B	0.103 ± 0.002	2.62 ± 0.05
C	0.628 nom	15.95 nom

3. Film Base

The film base used shall be of the low-shrinkage safety type, cut and perforated in accordance with American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953.

Approved January 13, 1964, by the American Standards Association, Incorporated
Sponsor: Society of Motion Picture and Television Engineers, Inc.

* Universal Decimal Classification

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A Note on a Simplified Striping Technique

By ALBOLGHASEM REZAI

Ed. Note: The following was obtained first as a correction of brief information in the May, 1963, *Journal's* Progress Report and further as a report on practical operation. At about the same time as these developments in Iran there were commercial developments in U.S.A.[1,2,3] These are no longer in effect.

Since 1952, a striping process devised by the author has been used in the Iranfilm Studios for dubbing into Persian, a practice that is very popular in Iran. An Iranian patent was granted the author in 1953. The process is simple and economical. The machine can be put together using only these components: six to eight 16mm rollers (or 35mm rollers, depending on the work to be done); a plate on which these rollers can be mounted; an arm to hold the tape spool; a small container to hold the cementing liquid; and a guide roller to guide the tape into the cementing liquid and onto the film.

The plate with rollers mounted on it (Fig. 1) can then be placed in front of a projector (on a spool or something similar) in such a position that the supply arm of the projector can feed the film into the machine and take it back easily and smoothly (Fig. 2).

The $\frac{1}{4}$-in. tape can be cut to the proper width in many ways. The crudest but easiest method is to use two right angles, some cardboard, part of a razor blade and two nuts and bolts. By putting the cardboard in between the angles, a groove is made as wide as the tape; then a bit of razor blade is inserted in the cardboard dividing the groove into two parts, one part being as wide as the stripe of tape required (Fig. 3). The $\frac{1}{4}$-in. tape can then be mounted on a rewinder and pulled through the groove while a small pressure is applied on it near the razor blade. Using more than one razor slitter will, of course, increase the number of stripes made.

For our studio work we have designed a more efficient cutter which operates automatically and can cut the tape in up to five stripes in one operation (Fig. 4).

The cut tape, wound on a spool of the same width, is then placed on the supply arm of the device with the end passing through the cement container, under the guide roller, and stuck on the film with the base side of the tape up. The projector must be started immediately, otherwise the liquid cement may dissolve the base and cut the tape. The base is removed within one to three feet from the point where the tape sticks to the film. It comes off easily and within a few seconds the operator should know the best place at which to remove the tape base.

On this simplified device the base should be pulled off by hand, but on our studio model it is removed automatically (Fig. 5).

One advantage of this system is that the width of the stripe can be varied from $\frac{1}{16}$ to $\frac{1}{4}$ in. The location of the stripe is also easy to adjust or change. By screwing the guide roller in or out, the operator can choose the tape's position on the film. If a balancer is required on the other side of the film, all that is necessary is to mount two tape spools on the supply arm and have two grooves on the guide roller.

In order to show how simple the mech-

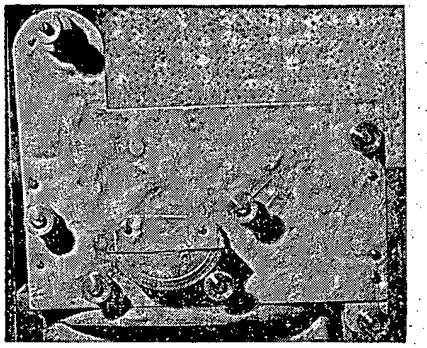


Fig. 1. Plate with rollers mounted on it. The guide roller of the tape is inside the cement holder.

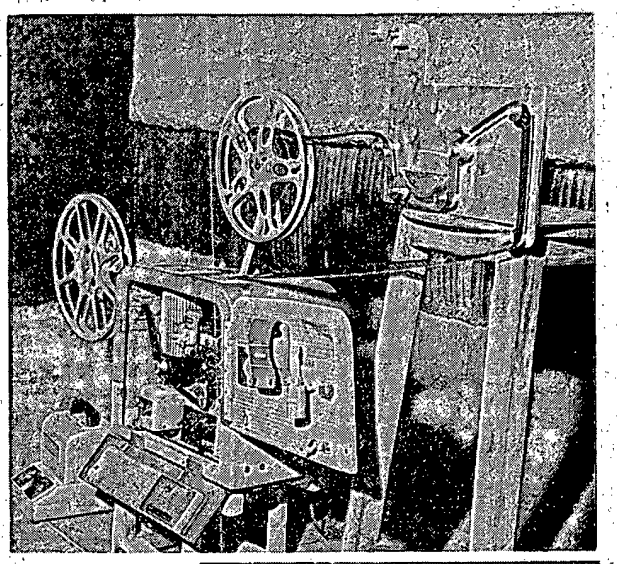


Fig. 2. The supply arm of the projector feeds the film into the machine and takes it back on the take-up.

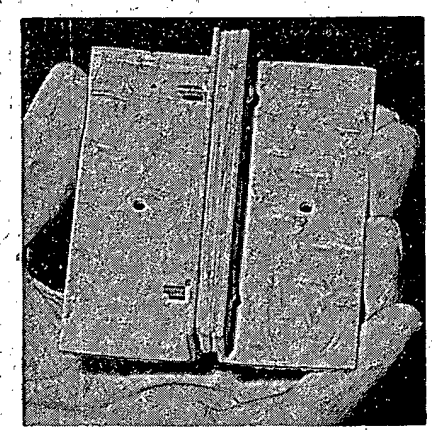


Fig. 3. Cardboard fitted between two angles to make a groove as wide as the tape.

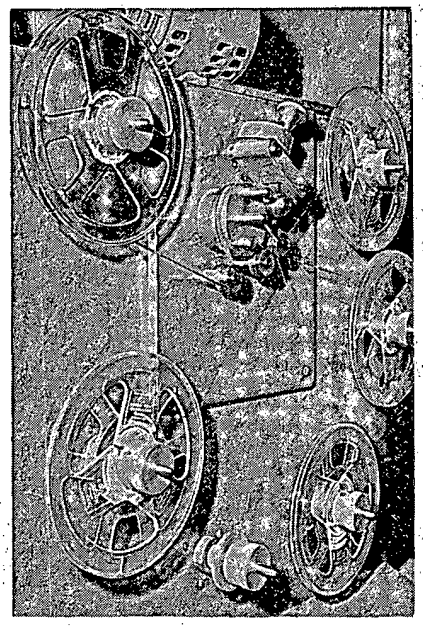


Fig. 4. Slitting machine used in studio work.

From a communication on August 10, 1963, by Albolghasem Rezai, who is Director of Iranfilm Studios, Khiaban Bagar, Kouche Semnan, Teheran, Iran.

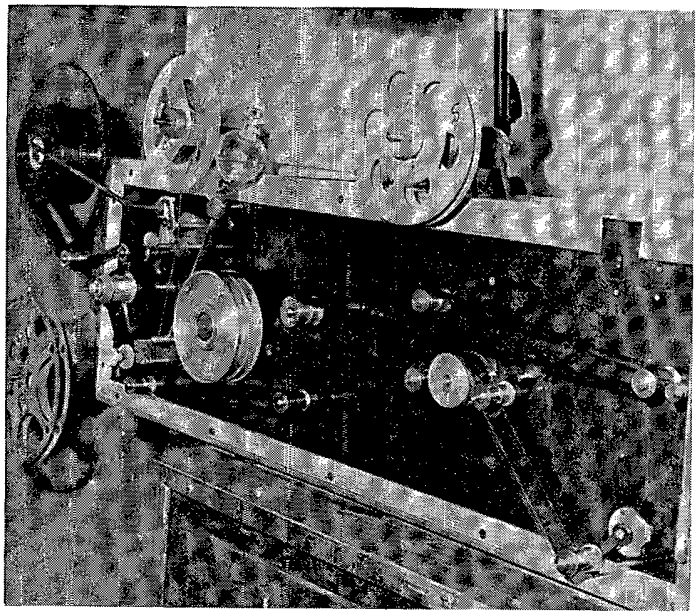


Fig. 5. Removal of tape base by machine — a studio model.

anism can be, a very elementary model has been made. The cement holder is a 100-ft film can cut from the middle and soldered together. The rollers are ordinary 16mm projector rollers. The arm can be anything as long as it can hold the tape spool.

Another unusual thing about this process is that the stripe can be applied on either side of the film, emulsion or base, with the same ease and without any special treatment such as taking the emulsion off the film. A different cement should be used for each side. For the base side using Scotch Tape 111, the formula is:

100 parts chloroform
60 " acetone
30 " alcohol

For the emulsion side using the same tape, the formula is:

20 parts phenol heated until it melts
4 " shellac
5 " thinner

10 parts of the above is then mixed with 8 parts acetone and 20 parts of chloroform.

While the "homemade" device described above is not intended to take the place of more elaborate equipment for professional use, it has been entirely adequate for our purposes. Its very simplicity is its most important quality. Since it does not require special tape or complicated equipment, it can be used by anyone.

References

1. Andrew H. Persoon, "Magnetic striping of photographic film by the laminating process," *Jour. SMPTE, 60:* 485–490, April (Pt. II) 1953.
2. U.S. Patent 2,628,929, Feb. 17, 1953, Minnesota Mining & Mfg. Co. (This was special magnetic tape coated on a temporary base, with a layer of heat- or pressure-sensitive adhesive on top to permit transferring the coating to film and stripping off the tape base.)
3. "New laminated soundtrack," *Home Movies*, p. 202, June 1957. (The article cites eight Canadian and U.S.A. film laboratories then equipped to use the laminated tape.)

Letters to the Editor — Sound-Delay Systems

Dear Sir:

I read with interest the paper on the Disc-O-Sound Delay System (Time-Delay System for Sound-Picture Syncing) by Henry Dussault, in the November 1963, *Journal*.

There is certainly a need for a method of editing single-system sound film and recording the sound opposite the picture does simplify the editing of sound film; however equipping cameras and projectors with special delay units could become cumbersome and it seems to me that a simpler method could be devised. This would involve the adaption of a conventional tape recorder to handle 8mm film. The guides would have to be slightly widened and the heights of the heads varied for centering on the magnetic soundtrack, and an additional playback head ($8\frac{1}{2}$ in., i.e., 56 frames) installed ahead of the recording head. The output of this playback head would then be fed to the recording head through the regular amplifier unit.

After the film which was exposed in a conventional single-system magnetic recording camera has been processed in the film laboratory, but before it is cut, using the method suggested here, it is run through the tape recorder, starting at the end of the film. This would move the sound 56 frames forward to a position opposite the corresponding picture material. It then may be cut and edited as in Mr. Dussault's system. After this step, the film would then be run through the tape recorder from the beginning to the end (after shifting the heads to the opposite edge of the film) which would move the soundtrack to its proper position 56 frames ahead of the picture, and the film would then be ready for projection on any conventional sound projector.

The first time the film is passed through the tape recorder the sound will of course be played back and recorded backwards but this should not present any difficulty as most prerecorded tapes are made this way. The exact speed that the tape recorder is run is not of any particular importance as long as the frequencies produced do not fall outside of the frequency response of the recording amplifier or the heads as the magnetic soundtrack will be passing both the playback and recording heads at exactly the same speed.

I believe that such a system has certain advantages over the Disc-O-Sound delay system. Using the method I have proposed, any single-system magnetic sound camera or projector can be used without the need of adapters; the dub to move the soundtrack is made under laboratory conditions, not in the field; and only one piece of equipment (the adapted tape recorder) is used to move the track both backward and forward between editing.

December 23, 1963

Fred Wunder
135–21 Francis Lewis Blvd.
Jamaica 13, N.Y.

Dear Sir:

I found Mr. Wunder's comments on my paper on the Disc-O-Sound system very interesting. I am favorable to critics and appreciate criticism as a stimulus to ideas leading to improvement. I believe, however, that Mr. Wunder has overestimated the disadvantages of bulky equipment and considerably underestimated the real advantages of a system which permits immediate editing, and immediate projection with sequences interchanged as desired.

Obviously, such a system, whether adapted to conventional

or custombuilt equipment calls for a certain increase in size and weight of machines, but its usefulness has been demonstrated. The time-delay system has been designed specifically to eliminate certain disadvantages such as the need for expensive double-system recorders; synchronous motors; re-recording in the laboratory; the sound-picture gap; and the cutting off of "unconcerned" picture or sound in splicing.

The method preferred by Mr. Wunder, which involves the adaption of a tape recorder for film use, requires additional recordings and still leaves the picture-sound staggered on the projection film and does not take care of eventual cuts and splices. Mr. Wunder's idea is good, but it is not a new idea. In fact, similar methods have been in use for almost 30 years, while the time-delay system has been specifically designed to overcome the disadvantages of the double system.

It is my personal opinion that the time-delay-equipped camera can be regarded as its own sound process laboratory able to deliver a ready-to-edit, trouble-free film.

I have been gratified by the response to my paper. So far, I have received six letters from readers of the *SMPTE Journal*. A television station wishes to purchase a set of time-delay adaptors for newsreel work. I appreciate these expressions of interest, and especially I appreciate criticism, such as Mr. Wunder's, for the opportunity it affords to evaluate the time-delay system by comparison with other systems.

December 30, 1963

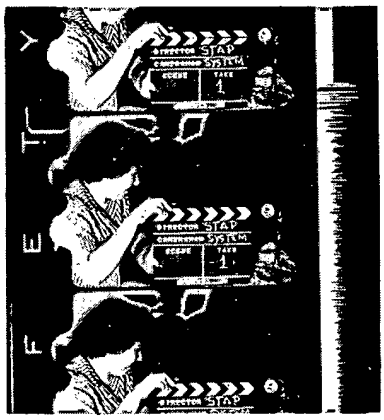
H. Dussault
11 St. Jude Blvd.
St. Zotique, Soulanges
P.Q., Canada

Dear Sir:

I have read Mr. Dussault's interesting paper, "Time-Delay System for Sound-Picture Syncing." It seems very similar in many respects to the one developed by me and patented under No. U.S. 2,729,454, January 3, 1956.

The patent "related to sound motion-picture film and projection thereof and in particular motion-picture film wherein each picture frame carried its own soundtrack and wherein a picture and sound relating to the picture are projected simultaneously." The system was designated Simultaneous Sound-Track and Picture System or STAP System. Mr. Dussault's Disc-O-Sound Delay System seems to have basic similarities to the STAP System. In the Disc-O-Sound Delay System the elements of the delaying mechanism are incorporated into the recording camera or projector, while the STAP System uses an independent or additional delayer recorder.

An important advantage of the STAP System is that



there is no need to introduce any modification to present sound recording on film equipment (optical or magnetic). The system has been tested successfully, first with one Cine-Voice camera and later with one Auricon Pro-600 camera, without modifications.

The arrangement provides for quick audio playback to check errors and unwanted sounds after each take and for full recording of all takes for future references or use, should the optical recording spoil by overmodulation, too low contrast developing, burning off of lamp, etc. The original recording on tape still remains. It also permits fast and accurate editing of the track and the picture of the original film. (Once a negative is edited it should be printed in projection sync to obtain release prints.)

The system is ideal for newsreel work and for low cost productions where no background music is to be used. Another advantage is that commercials can be taken off kinescope productions without interfering with the program.

For a good many years I worked on the idea of producing a film such as that obtained through the STAP System. In the early days I tried a disc, a drum and a tape loop, ending up, however, by using a recorder capable of producing both the delaying effect and a recording on tape to permit immediate playback after each take to detect errors or unwanted sounds.

Herewith is an example of one of the early tests made by the author; it's an enlargement of one take with a Cine-Voice camera.

February 17, 1963.

Max Mejia Vides
Juan Mora 445 Col. Costa Rica
San Salvador, El Salvador, C.A.

Erratum

Rudolf A. Stampfl and William G. Stroud, "Automatic picture transmission TV camera system for meteorological satellites," *Jour. SMPTE, 73:* 130–134, Feb. 1964.

On p. 133, caption for Fig. 8 (due to rearrangement of page make-up for forms at press time, engravings were transposed after clearance by the authors, to cause the cloud photograph reproductions to be wrongly identified):

For: **(left below) reproduced on Muirhead D700 S; (below) reproduced on Fairchild Scan-a-Fax.**

Read: **(left below) reproduced on Fairchild Scan-a-Fax; (below) reproduced on Muirhead D700 S.**

Addendum: The following Discussion was omitted from the pages of the February *Journal:*

Discussion

LeRoy M. Dearing (L. M. Dearing & Associates): What could you tell us about the spectral response of the particular storage vidicon on the APT camera?

Dr. Stampfl: The sensitivity of cameras used to televise cloud pictures from outer space is adjusted to reject the blue light and to have maximum sensitivity in the near infrared. This region lies in most cameras at 0.5 microns. This camera carries a filter which rejects the blue and lets the near infrared pass, approximately from 0.5 to 0.75 microns.

Addendum

J. Robert Mann, Jr., and Norman Leigh, "Electrical installation techniques for a large film production center," *Jour. SMPTE, 72:* 863–868, Nov. 1963.

These acknowledgments and credit were omitted from the paper:

Acknowledgments: Architects for the MPO Grand Central Studios were Herbst & Rusciano of New York City who were responsible for the design of the entire project and its many special facilities. Julius Goldfarb was Professional Engineer for the project.

95TH SMPTE Technical Conference

Ambassador Hotel
Los Angeles
April 12–17

Technical Conference Sessions

On the following pages is the Advance Program of technical papers. It is the largest and most comprehensive of recent years. *Program Chairman* **John M. Waner** has been responsible for seeking out many special papers. These papers, in addition to those garnered by the Topic Chairmen, have provided a very full program that will richly reward those who can attend. The Outline of Program on the following page shows the format of this most substantial technical conference.

Ladies' Program

A full and exciting Ladies' Program for the 95th Technical Conference has been organized under the chairmanship of Mrs. William E. Gephart, Jr., with Mrs. Robert G. Hufford as co-chairman. Ralph E. Lovell of 3M Co., as Conference Assistant Arrangements Chairman, will assist the committee.

The Ladies Hospitality room will be set up in the Garden Room of the Ambassador beginning on Sunday afternoon. Ladies attending the conference are advised, however, that their registration must be done at the Conference Registration Desk in the foyer of the Ambassador Ballroom, where tickets for the Monday Get-Together Luncheon also may be purchased.

These special events are scheduled for the ladies:

Monday: Two-hour sightseeing trips in private cars after the Get-Together Luncheon, followed by a Get-Together Tea.

Tuesday: Trip to the famous mission of San Juan Capistrano, followed by luncheon at Laguna and time to browse in the shops at Laguna Art Center.

Wednesday: Free day.

Thursday: Dutch treat luncheon, followed by excursions first to the new Hollywood Wax Museum, then to Disneyland.

Friday: Tour of the Walt Disney Studios, where a picture will be seen in production, followed by luncheon.

Many of these events will be free to the ladies through the courtesy of several firms. These firms will be noted in the Ladies Program.

Official hostesses besides Mesdames Gephart and Hufford will be Mesdames Herbert E. Farmer, Ted Fogelman, Jack P. Hall, Wilton R. Holm, James W. Kaylor, Neal Keehn, George Kendall, John P. Kiel, Ralph E. Lovell and Harry Teitelbaum.

Equipment Exhibit

Visitors to the 95th Conference will see the largest and most varied display of professional equipment ever shown under SMPTE auspices. Until now, the previous Los Angeles meeting, in 1962, constituted a record in this respect, but this time, under the expert guidance of the *Exhibit Chairman*, **George Kendall** (Moviola Mfg. Co., Hollywood), every available inch of space in the two large exhibit rooms adjacent to the sessions auditorium was reserved more than six weeks before the date of the meeting.

For details of the equipment that will be on display in the 81 booths set up in the Sunset and Belvedere rooms see the Exhibit Directory beginning on page 238 of this *Journal*.

Tentative Schedule of Committee Meetings

Wednesday, April 15

8:00 A.M. (Breakfast) Publications Advisory
9:30 A.M. Board of Editors
10:30 A.M. Papers
12:30 P.M. Editorial Luncheon

Engineering Committees which will meet during the week are tentatively listed below. The final schedule will appear in the Convention Program. All Committee Members will also be notified by mail.

Monday, April 13

10:00 A.M. Laboratory Practice
2:30 P.M. Color

Tuesday, April 14

10:00 A.M. Instrumentation and High-Speed Photography
2:00 P.M. Sound

Wednesday, April 15

10:00 A.M. Television
2:00 P.M. Film Projection Practice

Thursday, April 16

10:00 A.M. 16 & 8mm
2:00 P.M. Film Dimensions

Advance Program

This Program is as complete and accurate as was possible at press time. It may contain errors, and some changes and additions are expected before the Final Program is printed for the Conference. For example, the process of clearance, required for certain papers, may result in unforeseen delays prior to final scheduling. If very brief Conference attendance has to be planned to hear only one session, or a specific paper or papers, members are advised to inquire the week before the Technical Conference by telephoning the Society Headquarters in New York (212 TN 7-5410) or Program Chairman *John M. Waner* at Eastman Kodak Co. in Hollywood (213 HOllywood 9-3101).

Outline of Program

Sunday
10:00–4:00 Registration

Monday
8:00 Registration
9:00 Motion Pictures, Television and Education
12:15 Get-Together Luncheon — Guest Speaker
2:30 Television Engineering and Production
7:45 Television Engineering and Production

Tuesday
8:45 CONCURRENT SESSIONS
Laboratory Practices
Television Engineering and Production
12:15 High-Speed Photography Luncheon
2:30 Instrumentation and High-Speed Photography
8:00 Soviet Motion-Picture Industry

Wednesday
8:45 Equipment Papers and Demonstrations
1:45 CONCURRENT SESSIONS
Sound Recording and Reproduction
Instrumentation and High-Speed Photography

Thursday
8:45 CONCURRENT SESSIONS
Special Photographic Effects and Cinematography
Instrumentation and High-Speed Photography
1:45 Special Photographic Effects and Cinematography
8:00 Time-Lapse Photography

Friday
8:45 Small-Format Films
1:45 Projection Practices

Association of Cinema Laboratories

Spring Meeting, April 11, 1964
Ambassador Hotel, Los Angeles

8:00 Breakfast Meeting for ACL Board of Directors — Garden Room.
10:00 Meeting of ACL Members — Regency Room.
12:00 Luncheon — Colonial Room.
2:00 Equipment and Techniques Forum — Regency Room. (This Forum is open to SMPTE members.)

SUNDAY—APRIL 12

10:00–4:00 Registration

8:00 A Pre-Release Feature Film

MONDAY MORNING—APRIL 13

8:00 Registration

9:00 MOTION PICTURES, TELEVISION and EDUCATION

An Experimental 8mm Film Production Workshop for Teachers

LOU T. WISE, *Toronto (Ont.) Board of Education*

The Toronto Board of Education, Teaching Aids Department, is conducting an 8mm film production workshop for 35 teachers. The objectives are four: to encourage teacher production of 8mm films peculiar to individual requirements; to promote programs of student film production; to encourage teachers to suggest ideas for 8mm single-concept films to be produced in the Teaching Aids Department; and to encourage wider use of motion pictures in the classroom and, through involvement in production, a greater awareness of the effectiveness of films.

Considerations in the Establishment of a Television Instructional Communication System

KEN WINSLOW, *University of California, Berkeley, Calif.*

Rapidly developing television technology offers a solution for some of the communication problems of education. Specific application of a television technique requires consideration of many design, application and utilization alternatives. Administrative, academic and physical points of departure are considered. Origination, distribution, display and delay functions, and voice, picture and control services of a television instructional communication system are considered and grouped by operating elements. The resulting analysis is reviewed as to architecture and engineering, standards, staffing and cost.

A Branching Teaching Machine Incorporating Sound Motion Pictures

DONALD G. PERRIN, *University of Southern California, Los Angeles*

A research project at USC required a teaching machine to present sound motion-picture information in a stop-start manner with the capability of branching to different sequences on the basis of the student's response. Four projectors allow immediate access to the branches, while relay logic maintains synchronism between the units. The unit, which employs standard film production procedures and off-the-shelf equipment, is low in cost and simple to program.

A Method for Time Compression of Instructional Television Materials

JAMES LOPER, *California State College at Los Angeles*

An experimental study in the visual and aural comprehension of compressed speech required the development of techniques for synchronization of sound and picture elements. Original video-tape recording, electronic film transfer, skip-frame printing, and compressed audio tape recordings are used in the process. Samples of original and compressed material are presented.

Filming of Speech Therapy Clinic Sessions Via Tape to Film Process

LAWRENCE J. SCHRAM, *Orange County Schools, Los Alamitos, Calif.*

The California Speech and Hearing Association produced 6 five-minute films of clinic sessions with speech handicapped children. Shown at the CSHA Conference, the films provided quality sight and sound reproduction by utilizing a tape to film process. Thus the association was able to produce a thirty-minute black-and-white film with sound at a minimum cost. The use of two cameras, plus the ability to do retakes almost immediately, eliminated the need for film editing and provided a more relaxed setting for the children.

Auto-Instructional Technology and the Motion-Picture Engineer

LEO PERSSELIN, *Aerospace Corp., Los Angeles*

The technology of teaching machines and programed learning refers not so much to special kinds of hardware as to how hardware can be put to use. This is clearly reflected in the way today's proliferation of teaching-machine hardware shows an increasing emphasis on use of the motion picture. Devices commercially available and under development utilize as many as four motion-picture projectors in synchronous operation. This emphasis strongly suggests that the creative motion-picture engineer stands in the same relationship to the field of automated instruction as he does to other major areas of applied motion-picture technology.

Professional or Amateur Television?

CHARLES A. CALLACI, *Anaheim City School District, Anaheim, Calif.*

A professional broadcasting approach is necessary for efficient communication in educational television. This approach can only be made through professional standards for equipment and facilities, personnel and procedures. Where educational TV operations have limited funds for equipment and flourish, the on-camera personality is of utmost importance.

12:15 Get-Together Luncheon

Guest Speaker:
WILLIAM DOZIER
President, Greenway Productions, Inc.
Beverly Hills, Calif.

MONDAY AFTERNOON

2:30 TELEVISION ENGINEERING and PRODUCTION

The Plumbicon TV Camera Tube

E. F. De HAAN, *NV Philips Gloeilampenfabrieken, Eindhoven, The Netherlands*

The Plumbicon TV camera tube is basically a vidicon with a photoconductive layer of microcrystalline lead monoxide. The tube is 20 cm long and has a useful sensitive area 2 cm in diameter, and resolution is claimed to be comparable with that of the 3-in. image-orthicon. The Plumbicon is being used in experimental color TV cameras in The Netherlands and England.

The Electronic Lap-Dissolve

FRANK BAIRD-SMITH, JR., *National Broadcasting Co., Burbank, Calif.*

After a brief review of the history of electronic lap-dissolve mechanisms, the principles and embodiment of an advanced design utilizing balanced emitter-followers feeding light-controlled resistors are discussed.

Test Device for Closed-Circuit and Broadcast TV Camera Systems

GIDEON FIAT, *Photo Research Corp., Hollywood*

The Spectra TV Optoliner is a test instrument that provides measurable and reproducible illumination at known levels and color temperatures. Integrated illumination and interchangeable test patterns, mounted to tolerances of 0.002 in., are self-contained. Optoliner permits accurate comparisons of performance of TV camera systems.

Stabilization Techniques in a New Video Processor

ROBERT A. DISCHERT and NORMAN P. KELLAWAY, *Broadcast and Communications Div., Radio Corp. of America, Camden, N.J.*

The video processor of the RCA TK-22 film chain utilizes a gain control system that contributes materially to the overall stability of the camera chain. Included in the processor is a clamp, clipper, gamma correction, remote control of gain and black level, and a control system that stabilizes the entire process.

Review of Telecine Systems

D. R. MORSE, *British Broadcasting Corp., London*

The Non-Additive Mixing of TV Signals

W. L. HURFORD, *Radio Corp. of America, Camden, N.J.*

A new approach to the problems of the generation of self-keyed inserts, special effects, and lap dissolves is presented. The present additive method of producing video dissolves is contrasted with the non-additive technique, and the many operational advantages which may be obtained by the extension of the non-additive mixing idea to title insertion are described. This technique also lends itself to the generation of special effects in the same equipment used for dissolves and keyed inserts, thus making possible a single device for the performance of all three functions.

MONDAY EVENING

7:45 TELEVISION ENGINEERING and PRODUCTION

Empirical Correction Factors for Television Filming

EDWARD P. ANCONA, JR., *National Broadcasting Co., Burbank, Calif.*

Visual characteristics of the image from a television film are influenced by the projector, the TV camera tube, video operation, the receiver, and home viewing conditions. A tutorial discussion, oriented to the background and experience of the cinematographer rather than the electronic technician, is given of these factors. Empirical corrections that should enhance the art and effectiveness of television film images are suggested.

The Color Television Dilemma: A Technical Survey of Color TV Systems

JOSEPH ROIZEN, *Ampex Corp., Redwood City, Calif.*

The very nature of color television is so complex that a number of solutions to the problem can yield relatively similar results. Since its introduction in the United States, the NTSC color TV system has been subjected to considerable competition from other systems claiming to be simpler, cheaper or more precise. There are technical details that separate the NTSC's 525-line system from its 625-line counterpart, and from the specific modes of operation of the color systems being proposed for European television, such as the line-sequential French (SECAM) system and the phase-alternating (PAL) German system.

Field-sequential color television for broadcast applications has not been completely discarded. Dr. Camerena of Telesistema, Mexico, is currently conducing experimental transmissions with a bi-color TV system using a rotating filter on a monochrome camera. Pickup and display devices for color TV developed abroad will also affect future color systems.

Considerations in Color Film Production for Color Television

JOHN M. WANER, *Committee Chairman*

A joint subcommittee of the Television and Color Committees has been working to establish recommended practices for density and contrast range for color films for color television. During the subcommittee's work it became evident that optimum control of release print density range could be achieved only if the original photography were carefully controlled; therefore, it was felt essential to provide an appendix to the recommended practice which would discuss in some detail the "Considerations in Color Film Production for Color Television."

Certain factors in color TV film transmission and reception make it desirable to control the characteristics of the color print, and the degree and type of controls which can be applied are affected by properties of the color film. The density range of the color print is most effectively and economically controlled in the staging and photography, rather than in the final printing. Reflectance of fully illuminated scene elements which are to be reproduced with good detail should be held between recommended maximum and minimum limits to control the "reference white" and "reference black" of each scene, and face tones should be properly related to these limits. For a fully lighted day interior scene, a lighting ration of 2:1 is recommended. Higher ratios may be used for special effects and night scenes.

Setup of Color Monitors by Instrumentation

ALEX QUIROGA, *National Broadcasting Co., Burbank, Calif.*

The television control room might be regarded as the equivalent of a motion-picture screening room. For the screening room, precise standards regarding screen brightness and color temperature (degrees Kelvin) are prescribed by the ASA. The FCC also suggests precise standards to balance the color monitors. Many of the present setup techniques fall short of meeting these standards because of psychophysical viewing conditions, which are described. Subjective evaluation is eliminated through an instrument that measures low and high lights on the TV receiver.

Film Requirements for Color Television

W. H. CHEEVERS, *British Broadcasting Corp., London*

An Economical and Simplified System for Color Television

GUILLERMO GONZALEZ CAMERENA, *Telesistema Mexicano, S.A., Mexico City*

A bicolor, field-sequential TV system has been planned with the primary purpose of obtaining full-color television by the most economical means possible, and at the same time resulting in a more simplified and practical system. The system is demonstrated with video tape and an adapted receiver.

TUESDAY MORNING—APRIL 14

CONCURRENT SESSIONS

8:45 LABORATORY PRACTICES

An Editing Bench for Industrial Film Production

GEORGE W. TRESSEL and STANLEY J. ANDREWS, JR., *Argonne National Laboratory, Argonne, Ill.*

A unit editing bench serves as the basic building block for a flexible industrial film editing room. The bench, a self-contained, free-standing unit, incorporates multiple-track sound equipment, as well as most of the equipment normally desired for industrial editing. Dimensions have been chosen to create privacy and a comfortable work center. The bench incorporates a sound wall that acts as a partial room divider and lends itself to changing space and location problems.

A Modern Concept of Optical Printer Construction

HAROLD A. SCHEIB, *Cinema Research Corp., Hollywood*

To satisfy present-day operating requirements, recently developed construction techniques were employed in building a new type of optical printer. Many problems of high manufacturing costs and awkward equipment maintenance were eliminated by utiliz-

ing commercially available components for the drive system and assembling them in modular fashion. A variable-speed motor drive, an electronic programing system, a large, stable optical bench, and an automatic fader mechanism complement the operating versatility of the unit.

Use of Xenon Flashtubes as a Light Source in Color and Black-and-White Scene Testers

CARL W. HAUGE, EDWARD H. REICHARD and LEONARD L. SOKOLOW, *Consolidated Film Industries, Hollywood*

The Cinex Exposure Tester has been widely used for many years to make timing tests from black-and-white negatives. By replacing the incandescent lamp in this tester with a xenon flashtube, with its capacitor-discharge power supply and resulting stable and reproducible light output, a superior testing machine has been developed. The exposure gate has been modified to contain a series of neutral density steps matched to the printing machine lights; for color, a selected range of color filters is added to the neutral densities. The resulting intensity-scale tests closely match printing-machine exposure times, thereby resolving film reciprocity differences normally present in Cinex tests.

These modified units have been used for several years in black-and-white testing with 30 w/sec to the xenon lamp. By increasing this input to 300 w/sec, the tester is adaptable to color scene testing.

An Automatic 35mm "A & B" Composite Color Printer

SIDNEY P. SOLOW and EDWARD H. REICHARD, *Consolidated Film Industries, Hollywood*

A high-speed color printer for making composite prints from 35mm original color negatives is described. The printer, operating at 120 ft/min, incorporates fades and dissolves in the prints without the use of duplicate effects-negatives. Scene-to-scene color and intensity changes, as well as variable length effects, are monitored by means of a transistorized radio frequency proximity cue detector.

The lamphouses, readers and fader systems, with slight modifications, are of the latest Bell & Howell design, similar to those used in the B & H Additive Printers. A single light valve is employed for intensity control, and color control is accomplished by a system of multiple-layer, single-frame color filters. The lamphouses are designed for future installation of two more light valves and dichroic mirrors, should conversion to additive color printing be desired. The printing machine is controlled by a punched paper tape that programs predetermined intensity changes and fade lengths.

A New Medium-Speed Reversal Color Film for Motion-Picture Use

H. W. VOGT, *Photographic Technology Div., and* T. J. MURRAY, *Research Laboratories, Eastman Kodak Co., Rochester, N.Y.*

Eastman (or Kodak) Ektachrome MS Film is a daylight-balanced, reversal color film for 16mm and 35mm motion-picture and instrumentation use. Film structure, sensitometric characteristics and recommended printing methods are discussed. Measurements reported include granularity, modulation transfer function and reciprocity failure characteristics. Standard processing yields optimum quality at an exposure index of 64. Process modifications also make possible the use of effective exposure indices from 16 to 256. For special engineering applications, an effective exposure index as high as 1,000 can be obtained, but with considerable loss in quality. A picture demonstration is presented.

A History of Spray Processing

RALPH D. WHITMORE, JR., *Oxberry Corp., New Rochelle, N.Y.*

Spray processing has been commercially successful since the middle thirties when it was first used at DeLuxe Laboratories in New York. Since that time, many laboratories have installed spray equipment and in some cases have completely eliminated immersion processing. Some of the data resulting from the industry's extensive research on spray processing are discussed.

Lubrication of Motion-Picture Film

FREDERICK J. KOLB, JR., and EDWARD M. WEIGEL, *Manufacturing Experiments Div., Eastman Kodak Co., Rochester, N.Y.*

Projection performance of processed motion-picture film is improved by lubrication whereby the coefficient of friction is controlled within the range that gives steady, reproducible positioning of successive frames with the least strain on the perforations. Printer effectiveness can also be improved by lubricating the negative to facilitate a constant pitch relationship to the raw-stock, and to minimize minor abrasions. In spite of extensive research work on film lubrication and the wide experience gained over the years, considerable misunderstanding of this subject still exists. The pertinent background is reviewed, processes and materials for lubrication are examined, and several procedures of proven effectiveness are described.

Photographic Evaluation Parameters

SAMUEL BOUSKY, *Ampex Corp., Redwood City, Calif.*

Photographic science terminology is reviewed as an outgrowth of silver halide background, with present-day extension to encompass (1) increased variety of non-silver halide processes, (2) transition to more fundamental physical concepts and (3) modification to analytical methods of communication and information theories. Although theoretical developments and mathematical derivations are avoided, simplified transitions are indicated from such established parameters as exposure index, resolution, latitude and granularity to the more recent concepts of energy sensitivity, spatial frequency response, dynamic range and signal-to-noise ratio.

CONCURRENT SESSION

8:45 TELEVISION ENGINEERING and PRODUCTION

Operational Adjustment of Picture Monitors in Television Studios

C. A. SIOCOS, *Canadian Broadcasting Corp., Montreal*

Results are given of surveys and subjectives tests made seeking a consistent method for the day-to-day adjustment of picture monitors in order to secure relatively constant picture conditions. Expressions are derived giving the desired degree of uniformity of ambient light falling on a row of monitors and others giving the white-to-ambient and black-to-ambient luminance relations producing the highest degree in similarity of appearance between monitors in different ambient light. Considerations regarding the practical application of the above expressions are also discussed. These considerations include guide posts derived from a survey of operational preferences of many practicing technicians.

CBC Vidicon Telecine Operating Standards, With Particular Reference to the Gray-Scale Characteristic

S. F. QUINN and J. BOWIE DICKSON, *Canadian Broadcasting Corp., Montreal*

The various factors influencing the choice of vidicon operating parameters for telecine are considered together with the consequent vidicon light-transfer characteristic. Measurements have been made on the components affecting the overall telecine gray-scale characteristic, which has been computed graphically. Further computations have been made using the telecine characteristic and a typical film print-through characteristic, and the resultant curve is shown to be similar to that of the image-orthicon camera. The usefulness of a gray-scale slide in general telecine operation is shown to be limited by shading errors.

New Animation Production Techniques Using Video Tape

MILT ALTMAN, *National Broadcasting Co., Burbank, Calif.*

Recent developments in the field of video-tape recording make it possible to create animation effects. These are accomplished by recording images on a single-frame, "stop motion" basis.

The recorded images can be artwork, three-dimensional objects, live action, or a combination of the three. Various aspects of an electronic animation system are discussed, with emphasis on its value as a new production tool. Examples of animation using the new system are shown.

The TP-66 16mm TV Projector

A. E. JACKSON, *Broadcast and Communication Div., Radio Corp. of America, Camden, N.J.*

A 16mm film projector designed to cover present and predicted future needs of broadcast television is described. A system of rapid sound stabilization has been developed to eliminate the need for pre-roll. Automatic loop restoration, servo-driven screen brightness control and pulse-operated control circuits make the projector suitable for use with automated systems.

A New Television Switching Equipment

H. MIRZWINSKI, *Marconi Co., Ltd., Chelmsford, England*

With the growth of television there has been an increasing demand for larger and more sophisticated switching equipment. The use of relay or semiconductor matrices is not economical in cost or space with increased size. In a search for an alternative switching element, the choice fell on the standard type of Post Office uniselector or stepping relay. The unit and its advantages are described.

New Solid-State Sound-Mixing Equipment for Television

D. B. MANNING, *Marconi Co., Ltd., Chelmsford, England*

Modern television studios call for more and more microphone channels. Sound-control desks have, therefore, become increasingly complex. The introduction of transistorized modules has enabled the production of compact designs giving full facilities. A typical transistorized sound-control desk is described and subsequent developments are discussed.

Image-Orthicon Operation

EARL FARIS, *American Broadcasting Co., Hollywood*

The critical, complex, little understood and controversial image-orthicon operation is further confused by the characteristics of the increasingly used 4 1/2-in. tube. This study includes a partial investigation of the "saturated target" and "linear" modes of operation with a review that includes "redistribution" and "spurious signal" phenomena and a comparison between the commonly used 3-in. 5820 (7293 screen-mesh version) and the 4 1/2-in. 7295. The various operating modes of the 7295, including the linear mode with its limited light-contrast capability that requires control of set reflectance and lighting, are explored.

TUESDAY NOON

High-Speed Photography Luncheon

Guest Speaker:

H. E. BAUER, Douglas Aircraft Co., Santa Monica, Calif.

Economics of Photooptical Instrumentation

The economic value of photooptical instrumentation analysis has long been recognized by the aircraft, missile and space-vehicle industry. It is proposed that engineers may significantly increase their effectiveness in developing and utilizing photooptics by applying certain economic disciplines that are now available. These techniques have been developed through the efforts of industry and the government to improve the effective management of major development programs. Typical of such techniques are value analysis, PERT-time and PERT-cost. The modern engineer must update himself not only in his technical specialty but also in economic and management specialties.

TUESDAY AFTERNOON

2:30 INSTRUMENTATION and HIGH-SPEED PHOTOGRAPHY

"Seeability" and Resolution in Space Reconnaissance

CHARLES R. JEFFS, JR., and KINGDOM KERR, *Douglas Aircraft Co., Santa Monica, Calif.*

Reconnaissance of the earth from space platforms located at an altitude of 100 miles may be impractical if only resolution criteria are used. The results of Cooper's flight during the Mercury program indicate that preconditioned resolution leads to a reconnaissance capability that may be defined as "seeability." Factors affecting "seeability" and attempts to reduce the confusion of "seeability" with resolution are discussed.

Photographic Instrumentation for Reentry Measurements

W. G. PLANET, *Barnes Engineering Co., Stamford, Conn.*

Photographic instruments have aided immeasurably in the acquisition of data during the reentry phase of ballistic missile tests. These include ballistic cameras for trajectory determination, spectral cameras for chemical and thermal studies, and an assortment of non-dispersive, high-resolution or high-speed cine cameras for spatial and aerodynamic studies. Some typical photographic systems used on these tests and details of their choice by function and performance capabilities are discussed.

New Frontiers in Ultra-High-Speed Photography

K. R. COLEMAN, *Atomic Weapons Research Establishment, Aldermaston, England*

Use of Time-Lapse Motion-Picture Photography in the Study of Cloud Dynamics

C. E. ANDERSON and L. R. KOENIG, *Douglas Aircraft Co., Santa Monica, Calif.*

Many characteristics of the formation and development of clouds may be profitably studied by photography. The application of time-lapse photography to the acquisition of data concerning the dynamical properties of clouds is reviewed. Tools of acquiring, reducing, and interpreting data are discussed. Time-lapse photographs of developing convective clouds are shown.

Use of Color Film in Manufacture of Large-Area Color Map Transparencies

E. E. GRIFFITH, *Technicolor Corp. of America, Burbank, Calif.*

Large (36-in. by 36-in.) color transparencies are being manufactured for use as land mass simulation. Information is coded in each of three color images to permit simultaneous readout of three information channels. Factors in the selection of the color film for this unusual application are discussed. There are highly specialized procedures for the printing, processing, retouching, and cementing of color maps. Problem areas in manufacture, including crosstalk, register, and printed-in defects, are discussed.

Instruction in Photooptical Instrumentation

D. B. HOWARD, *Douglas Aircraft Co., Santa Monica, Calif.*

The history of one of the first practical courses in photooptical instrumentation offered in this country is traced. The great demand for such instruction is noted.

TUESDAY EVENING

8:00 PANEL PRESENTATION
Soviet Motion-Picture Industry

DEANE R. WHITE, *SMPTE Engineering Vice-President;* WILLIAM E. GEPHART, Jr., *Governor, SMPTE;* and ETHAN M. STIFLE, *SMPTE Executive Vice-President*

As reported briefly in the December 1963 *Journal* and quite extensively in the March 1964 *Journal,* a delegation of the SMPTE officers noted above and Frank Capra, the motion-picture director-producer, visited the USSR as a delegation forming one unit of the Cultural Exchange Program negotiated between the Soviet Union and the United States. The visit dealt with the technical aspects of motion-picture production and presentation, as developed in the USSR. Eighteen sites were visited in five cities: Moscow, Leningrad, Kiev, Odessa and Alma-Ata. These included studios, theaters, processing laboratories, an equipment factory, a television station, a design bureau and a research center. Much of the equipment seen was quite similar to corresponding items in the USA and elsewhere. A few units showed independent design features that appeared interesting.

Many photographs were made of units seen; these photographs describe the equipment in greater detail than could be done by words. Samples were obtained of processed color negative, color negative raw stock (masked) and color print raw stock now in use in the USSR. The report is given in three parts:

(1) Plans for the trip; changes suggested in Moscow; cooperation received in making the visits scheduled; incidents of the trip; observations and general conclusions;

(2) Technical description of equipment, illustrated with many color slides; and

(3) Report of tests made on Soviet color film—particularly, raw stock samples and processed color negatives—obtained on the trip. Screen quality is shown with US color prints made from Russian negatives.

After these presentations, the delegates will be available to answer questions from the audience.

WEDNESDAY MORNING—APRIL 15

8:40 EQUIPMENT PAPERS and DEMONSTRATIONS BY EXHIBITORS

New ColorTran Light (Paper and Demonstration)
HERBERT A. HOLLANDER, *ColorTran Industries, Burbank, Calif.*

Model 120S Arriflex Sound Blimp for Arriflex-35 Cameras
VICTOR JAMES, *Arriflex Corp. of America, New York*

Remote Control Lenses for Vidicon Cameras, With and Without Automatic Diaphragm Control, and Zoom Lenses for Professional Motion-Picture Cameras With and Without Viewfinders (Paper)
WALTER STEUER, *Zoomar, Inc., Glen Cove, N.Y.*

Luminance Standard and Precision Log-Linear Photometer (Demonstrations)
HAROLD P. FIELD, *Gamma Scientific, Inc., San Diego, Calif.*

Eclair GV-35 High-Speed Camera With Transistorized Speed Control; Eclair GV-16; Gear Head (Demonstrations)
J. P. CARSON, *Eclair Corp., Los Angeles, Calif.*

New Special-Effects Optical Printer for Motion Pictures, Including Related Devices and Innovations (Paper)
HAROLD A. SCHEIB, *Research Products, Inc., Los Angeles, Calif.*

Two New Models of "Vista-Sell" Projectors (Demonstration)
HOWARD TURNER, *DuKane Corp., St. Charles, Ill.*

The Palmer Television Film Recorder and a New 16mm 2400 ft Modular Magazine (Paper)
JOHN CORSO, *W. A. Palmer Films Inc., San Francisco, Calif.*

16mm "JAN" Projector Modified for Use With a 450-w Xenon Light Source (Demonstration)
FRANK H. RIFFLE, *Carbons, Inc., Boonton, N.J.*

Atlas Portable Projector (Demonstration)
WALTER E. MCCORMICK, *Atlas Projector Corp., Culver City, Calif.*

New Modular Optical Printer and 16mm High-Speed Film Inspector (Paper and Demonstration)
ROBERT TROY, *Oxberry Corp., New Rochelle, N.Y.*

New Improved Model 224-A Photooptical Data Analyzer (Demonstration)
R. H. LAWRENCE, *L-W Photo, Inc., Van Nuys, Calif.*

Underwater Camera Housings and Underwater Lighting Equipment—SeAQUArtz (Demonstrations)
CLIFFORD SAWYER, *Birns & Sawyer Cine Equipment Co., Inc., Hollywood, Calif.*

Transist-O-Sound Wireless Microphone for Television Newsreel Sound on Film (Paper)
DOM CAPANO, *S.O.S. Photo-Cine-Optics, Inc., New York*

New Transmission Densitometer 0—4.0, With Certified Kodak Status "M" Printing Density Filters and Visual Filter for Soundtrack (Demonstrations)
FREDERIC MCCURDY, *Macbeth Instrument Corp., Newburgh, N.Y.*

Development of Lawlette Film Processing Machines (Paper)
F. W. SYLVESTER, *Newman & Guardia Ltd., England*

WEDNESDAY AFTERNOON

CONCURRENT SESSIONS

1:45 SOUND RECORDING and REPRODUCTION

Cinerama Theatre Acoustics
M. RETTINGER, *RCA Broadcast & Communication Products Div., Burbank, Calif.*

Acoustic problems arising in hemispherical enclosures are discussed, and then the acoustic design and the results of acoustic measurements of the recently completed Cinerama Center Theatre in Hollywood are described. This theater features a "geodesic dome," or quasi-hemispherical vault.

A Simple Approach to the Quality-Control Problems of 16mm Variable-Area Soundtracks for the Smaller Studio and Laboratory

GORDON WILLIAMS, *Walt Disney Studios, Hollywood;* and MICHAEL STRONG, *World Wide Pictures, Sherman Oaks, Calif.*

Commercial negative and print tolerances produce some prints with unacceptable sound quality, so additional control is necessary. 6,000-cycle cross-modulation tests are found to give more accurate control than the conventional 4,000-cycle tests. Use of a short, one-shot cross-modulation test on the negative and a simple cross-modulation distortion meter, designed for operators with no special training, indicates both direction and amount of density correction necessary to obtain optimum results.

An Improved Method of Level Control for Broadcasting and Recording

JAMES F. LAWRENCE, JR., *Teletronix Engineering Co., Los Angeles*

An improved audio compressor-limiter system has been developed, making use of a new linear optical attenuator. The shortcomings of existing systems are overcome by producing light instantly and in direct proportion to audio level through the use of electroluminescence. The light controls amplifier input level by means of a photo-conductive cell. There is no distortion due to limiting, and the attack time for the system is 10 μsec.

The Performance of Photographic Soundtracks on Eastman Color Print Film, Type 5385, With Special Reference to 8mm Usage

J. G. STREIFFERT and J. F. FINKLE, *Research Laboratories, Eastman Kodak Co., Rochester, N.Y.*

It is shown that a top-layer dye soundtrack reproduced with an S-4 type photosurface compares very favorably with multilayer dye-plus-silver tracks. With high-quality reduction printing and reproducing equipment, substantially the same performance can be achieved at equivalent wavelengths and track widths on 8mm film as on 35mm. Tracks on 8mm film made to be scanned with a slit 0.020 in. in width have been found to have more than adequate commercial quality if proper attention is given to sensitometric conditions and dirt and damage control.

A Prefabricated Acoustical Window

RALPH LANE and CLYDE TUCKER, *Miller Sliding Glass Door Co., Burbank, Calif.*

A new prefabricated acoustical window maintains an hermetic seal and provides a chambered frame assembly. The window has a minimum certified rating of sound transmission Class 48, and will receive any type of glass from 7/32 to 1/2 in., including heat-absorbing, one-way mirror, tinted and safety glass.

Simplified Blooping, Synchronization, Camera Drives and Slating

LOREN L. RYDER, *Ryder Sound Services, Inc./Magnetic Sales Corp., Hollywood, Calif.*

New techniques for blooping, synchronizing, camera drives and slating are now available. Advancement into the new techniques may be made in steps, but each step must fit into an overall, feasible pattern. The relative merits of several systems are discussed, and specific recommendations are presented.

CONCURRENT SESSION

1:45 INSTRUMENTATION and HIGH-SPEED PHOTOGRAPHY

Pinhole Optics

JOHN M. FJELD, JR., *Douglas Aircraft Co., Santa Monica, Calif.*

A space-flight simulator is being designed that utilizes closed-circuit television cameras that translate along a track and view a model. As the distance from the cameras to the model changes, conventional glass lenses would require continual refocusing. A pinhole requiring no refocusing was considered and was found by experiment to produce quite adequate images for this application. Thus the pinhole assumed an important part in a large-scale space simulator. The problem of finding the optimum diameter for the pinhole is discussed. Several mathematical methods for determining an optimum pinhole diameter are presented. The basic theory and the primary assumptions for each method are discussed, and the results of the various methods are compared.

Pinhole Optics and Simulators

A. H. GALLAS, C. A. GILBERT and A. B. HITTERDAL, *Douglas Aircraft Co., Santa Monica, Calif.*

A description of the operational advantages gained by use of pinhole optics in the design of a visual flight simulator is presented. Television engineering problems associated with the use of pinhole optics, particularly with regard to the scene lighting required, are outlined. The trade-off between a common lens system and a pinhole lens system is discussed. The need for unique manufacturing and quality control methods to produce satisfactory pinholes also is considered, along with some associated problems in designing peripheral visual display equipment. Finally, a theory of the choice of pinhole focal length and aperture size is discussed.

Physical Characteristics of Xenon Flashtubes

FRANK S. BARNES, *University of Colorado, Electrical Engineering Dept., Boulder, Colo.*

The physical characteristics of xenon flashtubes are reviewed. In particular, the spectral output of xenon lamps is discussed in terms of watts per unit wavelength for different wavelengths and current densities. Attention is given to the effects of varying the pressure, length and diameter of the flashtube on the total light output, and the conversion efficiency of electrical to optical power. Additionally, the influence of the exciting pulse shape on the conversion efficiency is described, along with some problems in impedance matching for the driving source.

Reconnaissance and Surveillance Photography

JEROME S. GOLDHAMMER, *Chicago Aerial Industries, Barrington, Ill.*

Current capabilities of photo-reconnaissance and surveillance techniques are neither as limited as commonly believed pre-Cuba nor as omnipotent as claimed in the lay press post-Cuba. Photo capabilities and limitations are compared with the performance potentials of other possible reconnaissance sensors, such as television, infrared and radar. Choices of sensors for specific needs are indicated, and growth possibilities are discussed.

Photography in Astronomy

R. M. CAMERON, *Douglas Aircraft Co., Santa Monica, Calif.*

Astronomy was one of the first sciences in which photography was used as a prime means of qualitative and quantitative analysis. However, photography in astronomy is filled with problems of great magnitude—figuratively and literally. The intensity and spectral range encountered in studies ranging from the Sun to the faintest stars and galaxies within reach of the larger telescopes require meticulous considerations of the spectral and sensitometric characteristics of photographic emulsions. Highlights of problems encountered are discussed along with past and current techniques employed in astronomical photography. Anticipated advancements in techniques also are discussed.

Time-Lapse Photography of Chromospheric Phenomena

JOHN FRITZEN, *Lockheed California Co., Burbank, Calif.*

In an observatory monitoring the chromospheric phenomena visible in the hydrogen alpha emission of the Sun, a telescope, together with an 0.5A filter and camera, is used for time-lapse photography. The resultant films are separated or recombined through the use of standard optical printing techniques for the study of various solar events.

Photooptical Instrumentation in Medicine

IRVING REHMAN, *University of Southern California, School of Medicine, Los Angeles*

Photooptical instrumentation, with special reference to techniques and problems in medical photography, is briefly reviewed. Specialized instrumentation in endoscopy, infrared, ultrasonics, photomicrography and electron microscopy is discussed, along with instrumentation, recording and monitoring problems in cineradiography and other x-ray techniques. The application of closed-circuit TV in medical training, surgery and research also is discussed.

Automatic Lens Design Illustrated by a 600mm, f/2.0, 24° Field Lens

BERLYN BRIXNER, *University of California, Los Alamos Scientific Laboratory, N.M.*

Representative prescriptions, together with performance evaluations, are given for six designs in a sequence developed to improve performance of an eight-element, ballistic missile camera lens. The lens was redesigned with the LASL computer program, which analyzes lens performance statistically by multiple ray tracing and minimizes image defects by the least squares method. The design giving best performance uses ordinary low-index glasses. This work was done under the auspices of the U.S. Atomic Energy Commission.

WEDNESDAY EVENING

6:45 Cocktail Party, Banquet and Dance

THURSDAY MORNING—APRIL 16

CONCURRENT SESSIONS

8:45 SPECIAL PHOTOGRAPHIC EFFECTS and CINEMATOGRAPHY

Traveling-Matte Photography and the Blue-Screen System

WALTER BEYER, *Universal Pictures Corp., Universal City, Calif., and Chairman of Research and Education Committee of American Society of Cinematographers*

Traveling-matte systems available for feature film production are summarized. The blue-screen system as it is presently used, including all specifications for equipment and photography on the set, is discussed in detail. Emphasis is given to use of the blue-screen system with transparent subjects and fast-moving objects.

Technique for Composite Motion Pictures

JOSEPH WESTHEIMER, *Westheimer Co., Hollywood*

A method for making composite motion pictures for black-and-white presentation is described and illustrated. This technique, which employs the use of the blue-screen traveling-matte system, provides a greater degree of flexability to the producer, with a saving of both time and money. Demonstration material consists of illustrations from current television film shows and commercials.

Demonstration of Modern Composite Cinematography

LINWOOD G. DUNN, *Film Effects of Hollywood, Inc., Hollywood*

Excerpts from the 70mm Technicolor Ultra-Panavision production, *It's a Mad, Mad, Mad, Mad World,* are shown to illustrate modern techniques in photographic effects. A composite scene that required twenty-one exposures in the camera is shown in breakdown form. Other examples of special-effects cinematography also are shown.

A New Rear-Projection Process

A. ARNOLD GILLESPIE, *Metro-Goldwyn-Mayer, Inc., Culver City, Calif.*

Standard rear-projection process uses "center-line" single or superimposition projection of background plates on a translucent screen. M.G.M.'s new "laced" process uses extracted halves or thirds from a single original negative and "spread" projectors. Two or three extractions are used to make a single photographable background, the segments having been "laced," or blended together. Considerable gain in quality and scope is reported with the new process.

An Aerial-Image Unit for Industrial Animation

GEORGE W. TRESSEL and STANLEY J. ANDREWS, JR., *Argonne National Laboratory, Argonne, Ill.*

The aerial image unit is a valuable tool for inserting diagrams in industrial motion pictures. The principal problems associated with such a unit are design of the field lens for minimum spherical aberration, and critical alignment of the optical train. High-quality projection lenses and large aperture are also necessary to prevent color fringing caused by the condenser system.

Electronic Control Unit for an Industrial Animation Camera

GEORGE W. TRESSEL and STANLEY J. ANDREWS, JR., *Argonne National Laboratory, Argonne, Ill.*

Industrial animation involves specialized camera controls inasmuch as a minimum of cell-by-cell animation is used. Instead, a great deal of cyclic, scratch-off, and build-up animation is involved. An electronic control unit with parallel time-delay controls greatly simplifies these operations. The usual elaborate animation camera log is replaced with a simple cue sheet. The board includes control for an aerial image unit with provision for multiple framing. Visual indicator controls provide an immediate check for camera modes and conditions to minimize possible error.

Considerations in the Design and Construction of a 360° 16mm Ten-Camera Rig

JACK BEHREND, *Behrend's, Inc., Chicago*

A number of cameras are coupled for the synchronous photography of a 360° field. Special consideration must be given to the selection of these cameras as well as their mechanical coupling, optical integration, the structure of the assembly and electrical controls. Some of these alternatives are strongly influenced by the script and reliability considerations. The relationships between photography and projection also play a part in the philosophy of the design.

Variable-Beam Reflector Spotlight for Quartz-Iodine Lamps

ROBERT E. LEVIN, *Sylvania Electric Products, Inc., Lighting Div., Salem, Mass.*

A variable-beam spotlight utilizing the compact quartz-iodine lamp has been developed. Significant gains in optical performance and reduction of size and weight over conventional units are realized. The small source size permits new forms of reflector optics to replace the conventional lens systems. The theory of design and operation are discussed, and the photometric performance is reported. The system is planned for use in cinematography, television and related areas.

CONCURRENT SESSION

8:45 INSTRUMENTATION and HIGH-SPEED PHOTOGRAPHY

Photographic Flame Analyses

JOHN H. WADDELL, *Douglas Aircraft Co., Santa Monica, Calif.*

The photography of self-luminous subjects has always created problems. Among these subjects have been missile launchings,

nuclear explosions, arc welding and burning hydrogen. Each of these types of luminous bodies has individual characteristics, and a logical pattern for these analyses requires a knowledge of brightness and spectral characteristics of the flame, color and neutral filters and film sensitivity. A hydrogen flame is practically invisible but when photographed on infrared-sensitive film through a deep red filter, the flame becomes observable. Another example is the photography of arc welding where puddle formation can be photographed, as well as the ionization of the arc at the electrodes. The technique here is to vary the exposure—each phenomenon being studied at a different exposure. The exposure may vary 30,000 times to secure the necessary spread.

Jump and Weave in High-Speed Motion Pictures

JOHN H. WADDELL, *Douglas Aircraft Co., Santa Monica, Calif.*

High-speed motion pictures have a tendency to jump or weave when they are projected. Several causes for this tendency are suggested: (1) Ambiguous American Standards for the perforation of film. The tolerance summations are not equal when using T-2E against 1 + 2C. This discrepancy is compounded by the film manufacturers' hesitancy in giving camera designers their working standards. (2) Pitch variation in the film, which is reflected by slippage on the film on the sprocket at high velocities and accelerations. These velocities may be up to 300 ft/sec, which may be reached in 0.4 sec. It is impossible to design a sprocket tooth that will fill the perforation, and to design 12 teeth 0.3 in. apart in engagement. (3) The use of "green" film, *i.e.*, film that is still maldimensioned after development, in the projector. Processed film should cure for 48 hours before projection.

Accurate Coded Timing-Light Generator

ROGER BOY De La TOUR, *Douglas Aircraft Co., Santa Monica, Calif.*

Photographic techniques are extremely useful in the study of fast phenomena or transient conditions. In such studies, it is necessary to know precisely the time elapsed during the different phases of the phenomenon. If more than one high-speed camera is used, it is important to correlate the time indications for all cameras, so that simultaneous photographs can be assembled.

The easiest way to record time is to mark it on one edge of the film by means of a time-coded light. An accurate coded timing-light generator, giving precision of a fraction of a millisecond, has been built and is described. It is capable of coding many cameras simultaneously at distances of many hundreds of feet. The master unit is triggered by a crystal-controlled oscillator. Transistorized multivibrators generate the timing for the length of the different pulses indicating the seconds, the tenths, hundredths and thousandths of seconds. A transistorized switch applies 350 v to a NE 51H neon bulb. Slave units are used at each camera location. They can work on dry batteries and are fully transistorized. The complete system is composed of the decimal system above, marking one edge of the film, and of a real-time digital master connected to the real-time slave units and lamps that mark the opposite edge of the film.

An Automatic Camera Tracking System

W. J. GIBSON and D. H. SMITH, *Douglas Aircraft Co., Santa Monica, Calif.*

An automatic camera tracking system is one in which the servo control loop is closed by the optical light path. Deviations from the optical axis of the object being tracked result in error signals derived from the television signal. The error signals are used to command a change in camera mount position so that the object being tracked remains on the optical axis of the tracking system. Either negative- or positive-contrast objects may be tracked.

Analysis of Stress Wave Propagation by Photoviscoelastic Techniques

CHARLES W. FERGUSON, *Douglas Aircraft Co., Santa Monica, Calif.*

An experimental procedure for determining stress wave action in a dynamically loaded model structure is developed. A high-speed framing camera is used to record dynamic fringe patterns in photoviscoelastic materials. The theory of linear viscoelasticity is then used to relate fringe time histories to stress (or strain) histories. The materials used for the models exhibit linear viscoelastic behavior. Response to load is a function of rate of load application. Theoretical analysis of complex viscoelastic structure materials is usually difficult, and in some cases, not possible. The need for a quantitative experimental technique for the assessment of such structures clearly exists. Results of research indicate that quantitative photoviscoelasticity techniques are feasible.

A Cine Spectrograph for Reentry Measurements

BERNARD D. PLAKUN and WILLIAM C. SCHUPP, *Barnes Engineering Co., Stamford, Conn.*

The cine spectrograph records a reentry event as a consecutive series of spectrographic records. Wavelength and time resolution, wavelength coverage and running time are the principal performance factors. Frame rates of from 10 to 30 frames/sec and a capacity of 1800 frames are considered adequate for reentry observations. Spectral performance is affected by target size and the accuracy of target tracking. A dispersion element using a pierced grating and prism combination enables considerably improved spectral resolution over a grating alone.

High-Speed Photoinstrumentation for a Hypersonic Wind Tunnel

ROBERT L. LEIGHTON, *United Aircraft Corp., East Hartford, Conn.*

Applications of high-speed cameras and short-duration light sources to measure pressures, forces and flow patterns in a high-velocity (up to Mach 25), short-duration (10 msec) wind tunnel are described. Details of the measuring techniques are given, including the optical layouts, lighting, synchronization methods, data reduction procedures and measurement accuracy.

Far-Infrared Photography

A. T. IRELAND, *Douglas Aircraft Co., Santa Monica, Calif.*

Because film does not retain its sensitivity at far-infrared wavelengths, pictures are obtained through the use of other detectors. Methods of obtaining such pictures are outlined. Limitations of the equipment and results are discussed. Several practical applications are mentioned, slides are shown of results obtainable, and equipment is demonstrated.

THURSDAY AFTERNOON

1:45 SPECIAL PHOTOGRAPHIC EFFECTS and CINEMATOGRAPHY

The Mitchell SSR-16

EDMUND M. DI GIULIO, *Mitchell Camera Corp., Sherman Oaks, Calif.*

There is a growing need in television news-gathering for a 16mm, single-system sound camera that is lightweight and silent, with low wow and flutter, yet still retains professional pin-register quality. The solution of many of the problems generated by these stringent and often contradictory requirements is described.

Electronic Cam: A Production Method for Television and Feature Films

ALFRED JETTER, *Bavaria Atelier G.m.b.H., Munich-Geiselgasteig, Germany*

Background of the Electronic-Cam system of producing motion pictures for television is outlined, and current applications of the system in several installations are discussed. Particular reference is made to the application of Electronic Cam to films for color television.

A Portable Industrial Motion-Picture Kit

GEORGE W. TRESSEL, STANLEY J. ANDREWS, JR., and DANIEL S. GIROUX, *Argonne National Laboratory, Argonne, Ill.*

A 500-pound kit incorporates complete field equipment for a highly mobile motion-picture group. Nine uniform cases are sufficiently small and light so that they may be shipped by air and easily handled by one man; yet they contain cameras, accessories, and facilities for tapping power and lighting large pieces of industrial hardware. Tests have led to equipment that delivers maximum light output with flexibility. Using this kit, two three-man units have photographed 90% of the footage for the Atomic Energy Commission's Geneva Conference film program.

35mm Camera Apertures, Composition Areas and Printed Picture Sizes As They Affect Theatrical and TV Presentations

WALTER BEYER, *Universal Pictures Corp., Universal City, Calif., and Chairman of Research and Educational Committee of American Society of Cinematographers*

Present 35mm composition discrepancies between wide-screen and television production are outlined. A solution is proposed and illustrated through slides and motion-picture film.

A Universal 35mm Film Format

SIDNEY P. SOLOW, *Consolidated Film Industries, Hollywood*

Present-day 35mm motion pictures are photographed to be exhibited either in "wide-screen" (1.85 to 1) or in anamorphic "scope" (2.35 to 1). The former always, and the latter frequently, wastes film area and projection light. A universal, mildly anamorphic compromise that would display all of the available image area and utilize all of the projector illumination is advocated. Other advantages are discussed.

Practical Tests Chart for Studios

C. W. BAKER and E. W. KAGE, *Research Laboratories, Eastman Kodak Co., Rochester, N.Y.*

In present motion-picture work, no standard "lily" or gray scale exists for determining exposures and color balancing for printing. A new 6-patch chart that is designed in various sizes for different-sized motion-picture sets and may be used with both color and black-and-white film is described. The chart is made from inexpensive, commercially available materials. The materials have been tested for batch-to-batch quality and have good color stability, as illustrated with spectrophotometric curves of fading tests.

The reason for the choice of six patches is shown with typical sensitometric curves for these films: Eastman Color Negative Film, Type 5251; Ektachrome Commercial Film, Type 7255; and Eastman Double-X Panchromatic Negative Film, Type 5222. The use of a scene luminance meter with the chart for the determination of camera exposures is described and illustrated. The method of lighting the chart and its placement in several sets also is described and illustrated.

Panel Discussion on Exposure Control

HAL MOHR, *President, American Society of Cinematographers, Moderator*

Exposure Control Devices and Their Use in Original Photography

HAROLD P. FIELD, *Gamma Scientific, Inc., San Diego, Calif.*

Thoughts on spot photometry as applied to motion-picture and TV scene lighting, including some observations on color characteristics, flare, and polarization in spot photometers, both with regard to exposure determination and luminary (brightness) ratio measurements, are presented.

Exposure Control and Stray Light Component

JAMES W. HARRIS, *New Zealand National Film Unit, Wellington, N.Z.*

Stray light needs more attention. Though too much will degrade the image, enough will give overall threshold exposure, which may explain the success of some "magic eye" systems. While existing exposure-control systems all have weaknesses, experience with visual judgment of reflex finder brightness suggests that this is a system which could be made reliable, the need being for a standard brightness or image to be placed alongside the normal ground-glass image. The equipment necessary for this could also provide means of increasing effective emulsion speed by a revival of pre-fogging technique. An Appendix is submitted suggesting a new standard by which cameras could be rated for their stray light component.

Peculiarities of Telefilm Exposure Control

HAROLD WRIGHT, *Canadian Broadcasting Corp., Ottawa, Ont., Canada*

The telefilm medium has exposure-control problems peculiar to that medium. The telecine transfer creates electrical tone-scales, and transmitter modulation requirements place severe limits on tone-scale excursions in the "white" direction. Thus, high-luminance areas in a scene, of little photographic significance, take on a significance far out of proportion to their subjective or aesthetic effect. This significance can be determined, and accommodated, if exposure is controlled by a narrow-angle, telescopic spot-photometer type of exposure meter.

A Compromise Solution: A Reflectance Meter That Incorporates Exposure-Control Advantages of the Incident-Light Meter

BURTON J. ASKOWITH, *Martin Company, Orlando, Fla.*

Accepting the premise that optimum exposure control is a function both of direct incident light (E) and of reflected light (B), it can be shown that the required change in aperture or exposure (Δ A) may be expressed as the sum of two terms, one related to the incident-light meter (M_E), the other to the reflected light meter (M_B):

$$\Delta = f(M_E)\,\Delta E + f(M_B)\,\bar{r}\,\Delta E$$

(The term $\bar{r}$ is the average scene reflectivity.)

Data are shown to indicate that a practical reflectance meter can be built to approximate this sum, using the combined visible and near-infrared reflected light in spite of the variability of the infrared ambient relative to the visible.

THURSDAY EVENING

8:00 TIME-LAPSE PHOTOGRAPHY

Time-Lapse Photography at Moody Institute of Science

IRWIN A. MOON and F. ALTON EVEREST, *Moody Institute of Science, Santa Monica, Calif.*

The techniques of time-lapse photography have added much to the understanding of physical and biological phenomena. Instrumentation for time-lapse applications to specific subjects over the past twenty years are reviewed. There are two broad categories of equipment: that for the camera-controlled exposure used extensively for outdoor situations, and that for intervalometer-controlled exposure for artificially illuminated subjects. Photomicrographic time-lapse arrangements normally fall under the second category.

Some Medical Applications of the Cinematography of Cells

C. GEORGE LEFEBER, *Pasadena Foundation for Medical Research, Pasadena, Calif.*

The use of time-lapse cinematography for biological research is introduced with an example of the well-known technique employed to record the opening of a flower. By way of introducing how animal tissues are studied, the dissection of a salamander to produce a living culture is illustrated. Lung cells from this animal show four phenomena which could not have been understood without cine techniques: Rapid outgrowth of cells, food intake, movement of enzyme-bearing mitochondria, and cell division. Human cells from a thyroid cancer add other activity features: wrinkling and rotation of nuclei. Various cine setups are illustrated, including instruments for recording cell changes produced in perfusion chambers from double microscopes to permit film comparisons of treated and untreated cells. A scanner and electron recording device for the analysis of the contractile motion of certain brain cells are shown.

FRIDAY MORNING—APRIL 17

8:45 SMALL-FORMAT FILMS

An Improved 8mm Film Cartridge

ARTHUR C. MUELLER, *Bell & Howell Co., Chicago*

A cartridge for use in a double-8mm camera simplifies threading, eliminates the need for rethreading for the second-half run, requires less camera power to operate, and aids in obtaining sharper pictures.

Automation for 8mm Single-System Sound

HANS NAPFEL, *Fairchild Camera & Instrument Corp., Plainview, N.Y.*

Many advances have been made to automate the 8mm camera. These range from motor drive, through automatic exposure, to power zoom. Approaches to simplification of the sound-recording aspect and general operation of a single-system 8mm sound camera are explored.

Factors Affecting 8mm Sound Print Quality

E. A. EDWARDS and J. S. CHANDLER, *Film Services Div., Eastman Kodak Co., Rochester, N.Y.*

The balance of functions in obtaining high-quality 8mm release prints is described. Experimental results relating to both picture and sound quality are presented.

System Modulation Transfer (SMT) Acutance: An Objective Method for Rating Picture Sharpness

EDWARD M. CRANE, *Research Laboratories, Eastman Kodak Co., Rochester, N.Y.*

The areas under the modulation transfer curves of all components in a photographic system, including the observer, are adjusted for magnification and combined into a formula for "system modulation transfer (SMT) acutance." When film is the variable, proposed standard curves may be used for equipment and observer. Values of SMT acutance range from 70 (passing) to 100 (excellent), and they differ by one unit if a sharpness difference is just perceptible to a critical observer.

Sharpness Calculations for 8mm Systems

J. E. PINNEY, *Research Laboratories, Eastman Kodak Co., Rochester, N.Y.*

A method for computing sharpness ratings for color films based on modulation transfer function data has been described by Crane. Good agreement was found between computed sharpness ratings and qualitative judgments of sharpness for several 8mm color print systems. Hypothetical improvements to a model 8mm system illustrate how the potential sharpness of a system may be estimated and system improvements planned.

Optical Printing With a Small-Diameter Light Source

JAMES D. CLIFFORD, *Photographic Technology Div., Eastman Kodak Co., Rochester, N.Y.*

A concentrated-arc lamp has been used in a typical optical printer to print 8mm color internegatives from 16mm color originals, with considerable increases in sharpness compared with conventional light sources. Engineering requirements and operational characteristics are discussed and exploratory experiments in the use of the light source for other printing applications are described.

Economical 8mm Commercial Prints

C. LOREN GRAHAM and WILLIS L. STOCKDALE, *Photographic Technology Div., Eastman Kodak Co., Rochester, N.Y.*

An economical system for producing quality 8mm commercial prints is described and demonstrated with appropriate motion pictures. The proposed system features contact release printing. Contact release printing is made feasible by significantly improving the quality of the internegative by an improvement in printing technique. This improvement is accomplished through modification of a typical optical printer.

FRIDAY AFTERNOON

1:45 PROJECTION PRACTICES

Usage and Special Applications of the 70mm Release Print

WALTER BEYER, *Universal Pictures Corp., Universal City, Calif.*

Statistics on 70mm installations are presented, and technical aspects of 70mm drive-in installations are treated in detail. Special applications of the 70mm print as an image carrier also are discussed.

The Cinerama Single-Lens System

GERHARD LESSMAN, *Cinerama, Inc., Los Angeles*

Cinerama, a three-lens process for projecting a 146° true field of view upon a deeply curved screen subtending a large audience angle of view, has two drawbacks resulting from the fact that it is a mosaic projection process. It is almost impossible to maintain perfect registration and picture steadiness between adjacent projected fields or to project the three fields with even illumination and color balance. It is shown to be theoretically feasible to produce the "Cineramic" effect using a single-lens camera and projection system with the conventional deeply curved Cinerama screen. A single-lens system now has been developed and put in commercial use for projecting any so-called wide-screen picture onto a Cinerama screen with appropriate corrections for the perspective transformations involved. This system comprises a special rectifying optical printer lens which transforms the rectilinear perspective of a conventional negative, with or without anamorphosis, into a positive print with appropriate perspective modifications for projection onto deeply curved cylindrical screens. Special projection lenses have been designed to compensate for the

perspective and projective requirements of projection onto curved screens. A camera lens with a 146° field of view has also been designed which, when properly utilized for motion-picture production in the Cinerama single-lens process, will totally simulate the original three-lens system.

Motion pictures taken with the single, wide-angle lens camera with appropriate utilization of auxiliary cues to depth perception are in all respects equal to the traditional three-lens Cinerama projection but without the defects of the mosaic process.

Carbon Arcs for 16mm Film Projection

C. E. HEPPBERGER, *Arc Carbon Div., Union Carbide Corp., Chicago; and* E. A. BOWEN, *Arc Carbon Div., Union Carbide Corp., New York*

The characteristics, operating data and performance of a high-intensity carbon trim for the projection of 16mm film are described. The color quality, magnification, optical speed, power of the projection lamp, intensity and distribution of the screen light are discussed. Earlier papers are reviewed, and projection improvements consistent with pending trends in illumination are suggested.

Xenon Projection Lamps: A Resumé

DON V. KLOEPFEL, *General Film Laboratories, Hollywood*

Constantly increasing use of the xenon lamp as a projection light source in review rooms prompted a survey which would indicate some of the lamp's distinctive characteristics under typical operation. Data supplied by the survey are presented.

Xenon Light Sources for 16mm Projection

EDWARD LACHMAN and FRANK H. RIFFLE, *Carbons, Inc., Boonton, N.J.*

New xenon light sources have been developed for 16mm motion-picture and small-format slide projection. Modification of a well-known projector is described and operational results evaluated. Additional xenon sources in standard lamphouses also are described.

The New Siemens "2000" 16mm Projector

HORST MASCHGAN, *Siemens & Halske A. G., Berlin, Germany*

The Siemens "2000" Projector, manufactured for over a decade, has been succeeded by a model with these features: Maintenance-free operation; reduced weight; improvements and simplification in layout for easier service; increase in light output; inclusion of a small, transistorized amplifier in the existing modular construction system; improvements of various parts for increased reliability and ease of operation.

Atlas Portable Projector

WALTER R. McCORMICK, *Atlas Projector Corp., Culver City, Calif.*

A portable projector capable of reproducing pictures of all aspect ratios, using magnetic soundtrack and picture, or optical soundtrack and picture, or composite prints with optical sound, is described. The design includes new applications of tight loop sound head, lamphouse techniques, projector drive mechanism, stop-start and reverse, and remote control.

New Test Film Catalog

The Society's 1964 Test Film Catalog was mailed recently to past purchasers of test films. The new catalog, copies of which are available from SMPTE Headquarters, incorporates the latest listings, along with price changes that became effective on January 1, 1964.

The catalog lists sound and picture test films for television, and for 70mm, 35mm (standard, wide-screen and anamorphic), 16mm and 8mm equipment. These films are used by manufacturers for design and inspection; by television engineers; by theater projectionists and other persons responsible for "in service" maintenance of projectors and sound systems; by equipment dealers for demonstration purposes, and by audio-visual equipment users for quick performance checks.

Every Member a Membership Committeeman

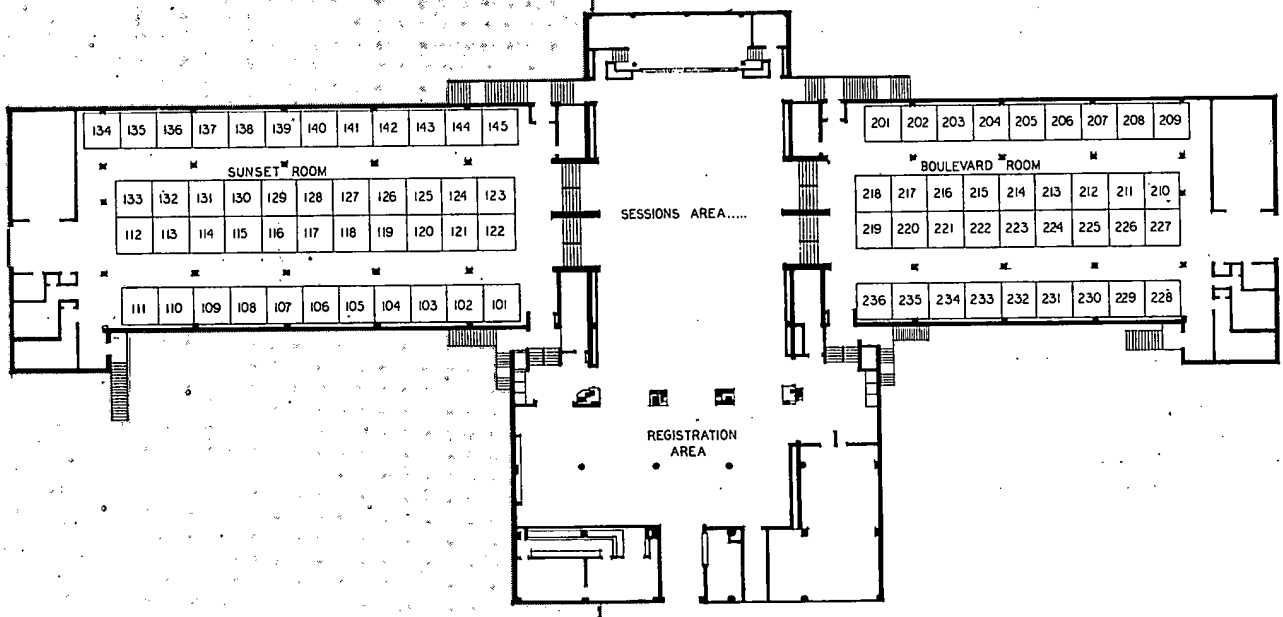
The Society's National Membership Committee strongly urges every member to remove the tear-out application blank from the January issue of this Journal and use the form to sign up an associate as a member. Your Committee can contact only a small percentage of prospective members. By bringing others into the Society, *every member* can help maintain SMPTE in its position of leadership.—Edward A. Winkler, *National Membership Chairman*, c/o Eastman Kodak Co., 200 Park Ave., New York, N.Y. 10017.

Equipment Exhibit

Los Angeles Technical Conference

Displays and demonstrations of all the important new developments in equipment for:

Cinematography—Color and New Photographic Materials—Motion Pictures and TV for Education—Small-Format Films—Instrumentation and High-Speed Photography—Space Technology—Medical Photography—Laboratory Practices—Projection Practices—Sound Recording and Reproduction—Television Engineering and Production



95TH SMPTE Technical Conference

EXHIBIT OPEN APRIL 13–16, 1964

Ambassador Hotel, Los Angeles

Exhibit Directory

Amega Corporation Booths **230, 231**
11817 Wicks St., Sun Valley, Calif.

Ampex Corporation Booth **111**
401 Broadway, Redwood City, Calif.

Exhibiting: Ampex 4-head videotape television recorder with special pre-recorded taped material from the National Association of Broadcasters Convention.

Personnel: Bob Day.

Arriflex Corp. of America Booths **201, 202**
257 Park Ave. South, New York, N.Y.

Exhibiting: Complete Arriflex-16 and Arriflex-35 lines, and Siemens 16mm sound projector line. New items: Arriflex 16M with new 1200′ magazine and universal fiberglas blimp; Arriflex-35 Model IIBGS with built-in sync generator and automatic clapsticks system, and special blimp; 1000′ adaptation stand for Arriflex-35.

Personnel: Paul Klingenstein, Victor James, Michael Zois, Abbott Sydney, Asa Wruck (Export Mgr., Siemens & Halske).

Atlas Projector Corp. Booth **232**
10834 Washington Blvd., Culver City, Calif.

Exhibiting: Atlas Portable 35mm Projector Models 962 & 963—all aspect ratios, magnetic or optical soundtrack and picture, or composite prints with optical sound; Atlas Laboratory Viewing 35mm Projector Model 186; Atlas Replacement 35mm Sound Head Unit Model 3100.

Personnel: Walter R. McCormick, Jr., Robert Spector.

Bach Auricon, Inc. Booth **108**
6950 Romaine St., Los Angeles, Calif.

Exhibiting: New "Angenieux-Bach" 12 to 120 zoom lens, custom designed for Auricon 16mm camera; complete lines of 4 models of Auricon cameras; double-system optical-sound on film recorder; new all-transistorized "Filmagnetic" recording system for Auricon cameras with interchangeable, rechargeable batteries; Auricon tripods, microphone boom, etc.

Personnel: Peter Waldeck, William Straube, Gary Koester, Howard Stephens.

EXHIBIT HOURS

Monday, April 13	**2:30–8:00**
Tuesday, April 14	**11:00–8:00**
Wednesday, April 15	**9:30–4:00**
Thursday, April 16	**11:00–6:00**

Admission to the Exhibit will be by Registration Badge or Exhibit Pass. Passes may be obtained free of charge at the Registration Desk.

Bell & Howell Co. Booths **143, 144, 145**
7100 McCormick Road, Chicago 45, Ill.

Exhibiting: Visual readout display of additive color printing systems for continuous printing as well as step printers; new program tape checker and duplicator (Design 6173 D) with correction or insertion feature.

Personnel: J. L. Wassell, S. R. Kurtzweil, G. Foster, J. Terry, C. Zichterman.

Birns & Sawyer Cine Equipment Co. Booth **129**
6424 Santa Monica Blvd., Hollywood, Calif.

Exhibiting: B&S SeAQUArtz Underwater Lights, portable 30-v and 110-v models; underwater camera housing for Arriflex-16 and -35; stop-motion projector; camera sound barneys; camera heater barneys; fishpole sound booms; Omnitar telephoto lenses; hi-hats for Arriflex-16 and -35; nickel cadmium batteries for Arriflex-16 and -35 and battery chargers; instant splicing blocks, 16/35mm; ball socket adapters and fluid head adapters; Trickstar lenses; Tridown triangle.

Personnel: Jack Birns, Clifford Sawyer, Charles Lipow, Gary Boren, Hal Ray.

Cinema Beaulieu Booth **207**
941 Westwood Blvd., Los Angeles, Calif.

Exhibiting: Beaulieu RC 16 16mm Camera; Beaulieu MCR 8 8mm Camera.

Personnel: Harry Mazur, Otto Herskovic.

Cine Electronics Systems, Inc. Booth **206**
225 East 46th Street, New York, N.Y.

Exhibiting: 450-w xenon light adaptation in a portable 16mm projector, with power pack and ignition system; new condenser block for large-size front or rear screen still projection at short distances; Xenosol-3 lamphouse.

Personnel: Stewart W. Jones, Seymour Kazmeroff.

Cinerama Camera Corporation Booth **229**
11930 W. Olympic Blvd., Los Angeles, Calif.

Exhibiting: New automatic iris control for Cinerama Camera Corp. Monitor Series Photographic Recorders, unit responds to light intensity changes over field of view of objective lens. HS-35A Photographic Recorder; 300 FPS, dual pin registration, integral boresight with reflex viewing, 8-speed transmission, integral control box.

Personnel: Guy H. Hearon, Burton Berniker, Breen Lansford, Karl Gensike.

ColorTran Industries, Inc. Booth **203**
630 S. Flower St., Burbank, Calif.

Exhibiting: Advanced group of pre-boosted high-intensity quartz-iodine lighting systems and electronic controls; new ColorTran feather-light quartz-iodine focusing lights, back lights, strip lights, and stands.

Personnel: Herbert A. Hollander.

Andre Debrie of New York Booth **234**
14-29 112th St., College Point, N.Y.

Exhibiting: TIPRO Optical Printer, QUAD 8 for the simultaneous printing of four 8mm images onto a single strand of 35/8mm-5R film; MATIPO 35 Contact Step Printer; 16mm single system "CS 16" camera (magnetic sound); 16mm double band projector for TV applications; 35mm Aiglonne America for in-plant processing of 35mm movie and microfilm; Sonocolor SFC2 Magnetic Striping Machine for application of magnetic varnishes to film.

Personnel: R. J. Harrington, M. Nanocchio.

DuKane Corporation Booth **222**
St. Charles, Ill.

Exhibiting: Full line of sound filmstrip projectors including the Micromatic and Flip-Top projectors; new Vista-Sell continuous flow filmstrip projector.

Personnel: Howard V. Turner, A. F. Hunecke.

Eclair Corporation of America Booths **225, 226**
8078 Woodrow Wilson Blvd., Los Angeles, Calif.

Exhibiting: Eclair Products: 300 studio reflex camera, 1000 ft. film capacity; GV-35 hi-speed camera; GV-16 medium speed camera; Camematic 35mm instrumentation camera; Camerette 35mm camera with techniscope or normal (4 perforation) operation immediately interchangeable; Cameblimp; Gyroflex tripod, silent combination gyro and gear and free head with immediate declutching from one mode to another; Crab dolly. Perfectone recorders.

Personnel: J. P. Carson, Harold Dreyfus, Lea Benedetti.

Filmline Corporation Booth **215**
43 Erna St., Milford, Conn.

Exhibiting: New ND-100 Filmline portable 16mm negative/positive continuous film processor designed and engineered for major networks, completely self-contained, built of stainless steel; features friction drive with built-in overdrive system feed-in, take-off and controls at one end. Complete with replenishing system, impingement drybox, Filmline micro-venturi squeegee, spray-rinse between developer and hypo; produces at 60 fpm or 4 min. dry-to-dry cycle with one man operation.

Personnel: Edward B. Krause, John Koteas, John Grady.

Frigidheat Industries Booth **134**
P.O. Box 6037, Nashville, Tenn.

Exhibiting: New automatic thermal units for precision temperature control of processing chemicals: Model 30A-5 designed for small volumes of from 5 to 50 gallons; Model 60A-12 designed for larger volumes of up to 150 gallons of solution.

Personnel: J. O. Ewing, Mrs. J. O. Ewing.

ARRIFLEX® 35

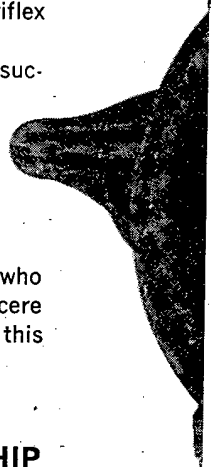
CELEBRATES ITS

Literally born a classic, the first Arriflex 35 became commercially available in 1939. This brilliantly conceived professional motion picture camera inaugurated a new era in cinematography. The ingenuity of its original mirror-shutter reflex system is today's most imitated feature... both a tribute to, and an acknowledgement of Arriflex's leadership.

Its many exclusive features plus lightweight compact design, ruggedness and economy of operation have provided Theatre, Television, Industry, Science and Education with their most important and versatile cinematographic tool. More than any other motion picture camera, Arriflex has made possible the "new wave" of cinematography that was the cover subject of Time magazine's recent article, "Cinema as an International Art". Arriflex was singled out in this regard.

We take pride in having contributed to the success of Arriflex in the U. S. during the past decade, and extend our heartiest congratulations on this 25th Anniversary to its originators, Dr. Robert Richter, Dr. August Arnold and Mr. Erich. Kaestner chief design engineer.

And to the thousands of Arriflex owners, who have given meaning to its capabilities: Sincere thanks for your invaluable contribution to this memorable occasion.



IMPORTANT IMPROVEMENTS THAT MAINTAIN ARRIFLEX 35's LEADERSHIP AS TODAY'S MOST ADVANCED PROFESSIONAL MOTION PICTURE CAMERA

Arriflex's familiar silhouette has remained basically unchanged through the years because of its masterly original design. But many internal improvements and additions have been incorporated during the last ten years to keep pace with the demands of modern technology and motion picture industry requirements.

Among the most important improvements are:

NEW! Reflex shutter with approximately 180° shutter opening.

NEW! Magazines with larger capacities for color film and new improved film take-up mechanism.

NEW! Cardioid cam-driven transport claw for high precision film movement.

NEW! Variable shutter.

NEW! Signal generator with electric "clap-stick".

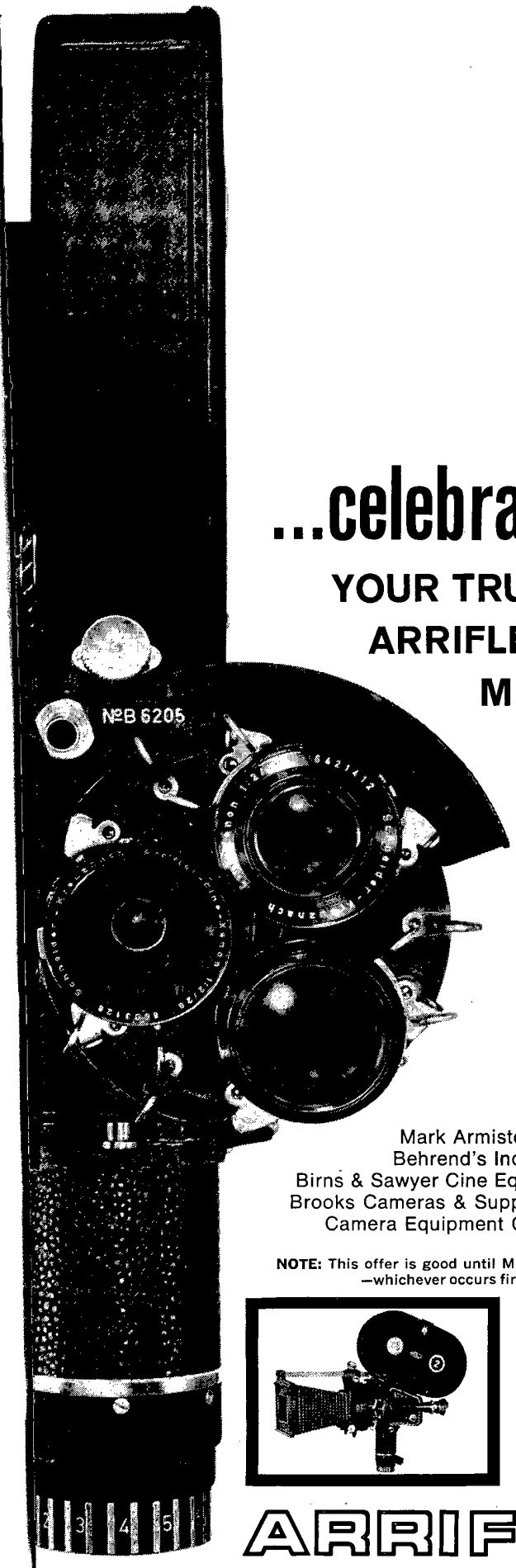
NEW! Stronger variable speed handgrip motor with "forward" and "reverse" switch.

NEW! Transistorized governor-controlled motor.

NEW! Adjustable matte box with leather bellows.

NEW! Comprehensive accessory system, from sound blimps to time-lapse mechanisms.

ARRI®



...celebrate with us!

YOUR TRUSTY **OLD** ARRIFLEX 35 MIGHT BE WORTH $2,500.00

If you are the owner of an old Arriflex 35 "that has seen its day", take advantage of our 25th Anniversary Offer.

We will accept up to 25 old Arriflex 35's, REGARDLESS OF OPERATING CONDITION, in trade against a new model and allow you $250.00 towards the purchase price.

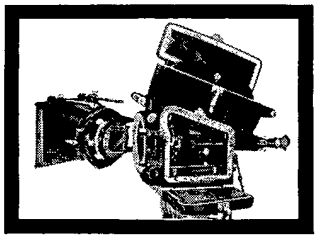
AND, IF YOURS HAS THE EARLIEST ORIGINAL SERIAL NUMBER, of the traded-in cameras, WE WILL REFUND YOUR ENTIRE PURCHASE PRICE up to a total of $2,500.00!

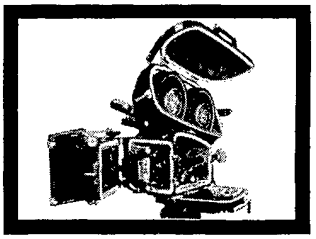
So, if you have been thinking about a new Arriflex 35, take advantage of our 25th Anniversary Trade-In Celebration. Your traded-in Arriflex might be worth $2,500.00, or at the very least, $250.00 if you act fast!

PARTICIPATING DEALERS:

Mark Armistead, Inc., *Hollywood*
Behrend's Incorporated, *Chicago*
Birns & Sawyer Cine Equipment, *Hollywood*
Brooks Cameras & Supplies, *San Francisco*
Camera Equipment Company, *New York*
Camera Mart, Inc., *New York*
Camera Sales Center, *New York*
Florman & Babb, *New York*
SOS Photo-Cine-Optics, *New York*
Village Camera Shop, *Detroit*

NOTE: This offer is good until May 1, 1964, or until twenty-five old Arriflex 35 cameras have been traded-in —whichever occurs first. List of names and serial numbers of trade-ins will be furnished on request.





ARRIFLEX CORPORATION OF AMERICA
257 Park Avenue South New York, N.Y.10010

Gamma Scientific, Inc. Booth **216**
5841C Mission Gorge Rd., San Diego, Calif.

Exhibiting: A-500 FL luminance analyzer for TV lighting problems, and the A-500 EC luminance analyzer for photographic application, hand-held, high-definition photomultiplier spot photometers; 700M log linear photomultiplier photometer for general purpose light measurement with a fiber optics probe and monochromator, incident light, and telephotometer heads; Model 200 luminance standard, a highly stable and accurately calibrated luminance source.

Personnel: H. P. Field, R. H. Akin.

Gordon Enterprises Booths **119, 120**
5362 N. Cahuenga Blvd., North Hollywood, Calif.

Exhibiting: Complete line of motion picture and photoinstrumentation equipment; Kenyon gyro stabilizers; Fastax high speed cameras.

Personnel: Alan Gordon, Grant Loucks, Roy Low, Sid Bugelholl, Ted Lane, Andy Lempke.

Gryphon Corporation Booth **101**
P.O. Box 854, Burbank, Calif.

Exhibiting: HB-2 air squeegees for film processing machines; Model S stop-motion flashlight for darkroom inspection and maintenance use; Gryphon processing-machine film inspection viewer; Gryphon combination 16/35mm film roller constructed of type 316 stainless steel; Gryphon film splicer using tape to make butt splices in various sizes and styles by simple adjustment.

Personnel: Harlan L. Baumbach, Mel W. Jones.

Karl Heitz, Inc. Booth **224**
480 Lexington Ave., New York, N.Y.

Exhibiting: Kinoptik Apochromats from 1.9mm *f*/1.9 (197°) to 500mm *f*/5.6, including new 9.8mm *f*/1.8 for 35mm movie and TV cameras; Robot 35mm motorized cameras including new 18m with built-in 24-v motor and perfect 4-sprocket hole registration; Camex Reflex 8mm cameras with behind-the-lens CdS meter for continuous monitoring while filming; Alpa 6c 35mm single-lens reflex camera; Tessina motorized 35mm subminiature reflex.

Personnel: Jack Pill, Bill Bontrop, Ted Lipton.

Frank Herrnfeld Engineering Corp. Booth **131**
5716 Camille Ave., Culver City, Calif.

Exhibiting: Model 1503 Color Densitometer; Model 1531 Constant-Time, Variable-Intensity Sensitometer; Model 1557A 16mm Continuous Printer; Model 1566 16 to 8mm Reduction Printer; Model 1583 Constant-Power Take-Up Motor.

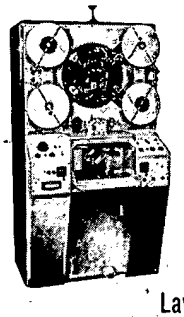
Personnel: Frank Herrnfeld, Oscar A. Garbino.

Hi-Speed Equipment, Inc. Booth **127**
73 Pond St., Waltham, Mass.

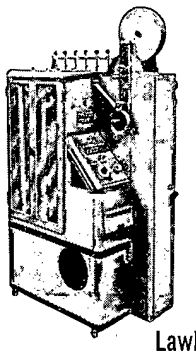
Exhibiting: Pictures and slides of Hi-Speed products for the photographic laboratory, including film processing equipment.

Personnel: Alex Bagdasarian, James Donovan, Bert Gade.

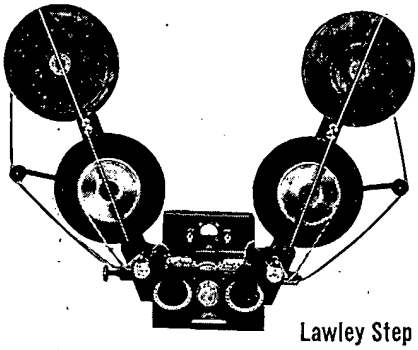
NEWMAN and GUARDIA sell international



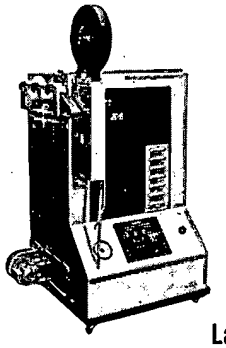
Lawley Optical Printer



Lawley Junior Processor



Lawley Step Printer



Lawlette Processor

Newman & Guardia have exported Lawley Laboratory Equipment all over the world during the past 10 years. Wherever there is a need — in film and TV studios, in Government Departments and the Armed Forces — for the processing and printing of film of any gauge, in any quantity, negative / positive, reversal or colour, there you will find Lawley Laboratory Equipment.

In addition to Great Britain Lawley Equipment has been supplied to:

Booth No. 118

Finland	Denmark	U.S.S.R.	Belgium
Norway	Germany	Portugal	Turkey
Sweden	Poland	Malta	Kenya

France	Italy	Sierra Leone	Nigeria
Iraq	Cyprus	Hong Kong	Singapore
Gibraltar	Ghana	Sardinia	New Zealand

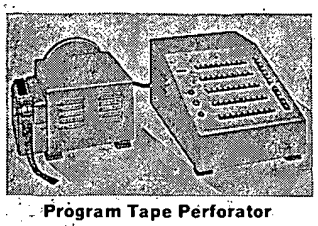
Malaya	South Africa	Australia	Switzerland
Jamaica	Canada	U.S.A.	Mauritius
Egypt	India	Eire	Jugoslavia and 6 other countries.

NEWMAN & GUARDIA LTD · HARLOW · ESSEX · ENGLAND · A MEMBER OF THE BEARD AND FITCH GROUP

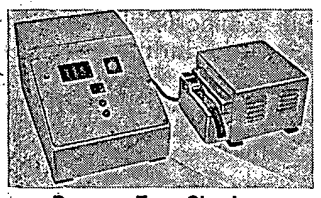
NEW HIGH SPEED ADDITIVE COLOR PRINTING

WITH INCREASED QUALITY AND AUTOMATIC CONTROL

Bell & Howell modern research and engineering has produced this completely new additive color printing system, that permits you to deliver color prints with a color accuracy and fidelity never before possible. The new Bell & Howell Model "C" additive color printer assures color stability and control through the use of dichroic mirrors which separate a single 1,000 watt light source into the three primary beams. For scene-to-scene correction, each primary beam can be modulated through 50 steps in values of .025 Log E. In addition twenty-four points of .025 Log E values of exposure are available manually, to allow for any necessary emulsion corrections.



Program Tape Perforator



Program Tape Checker

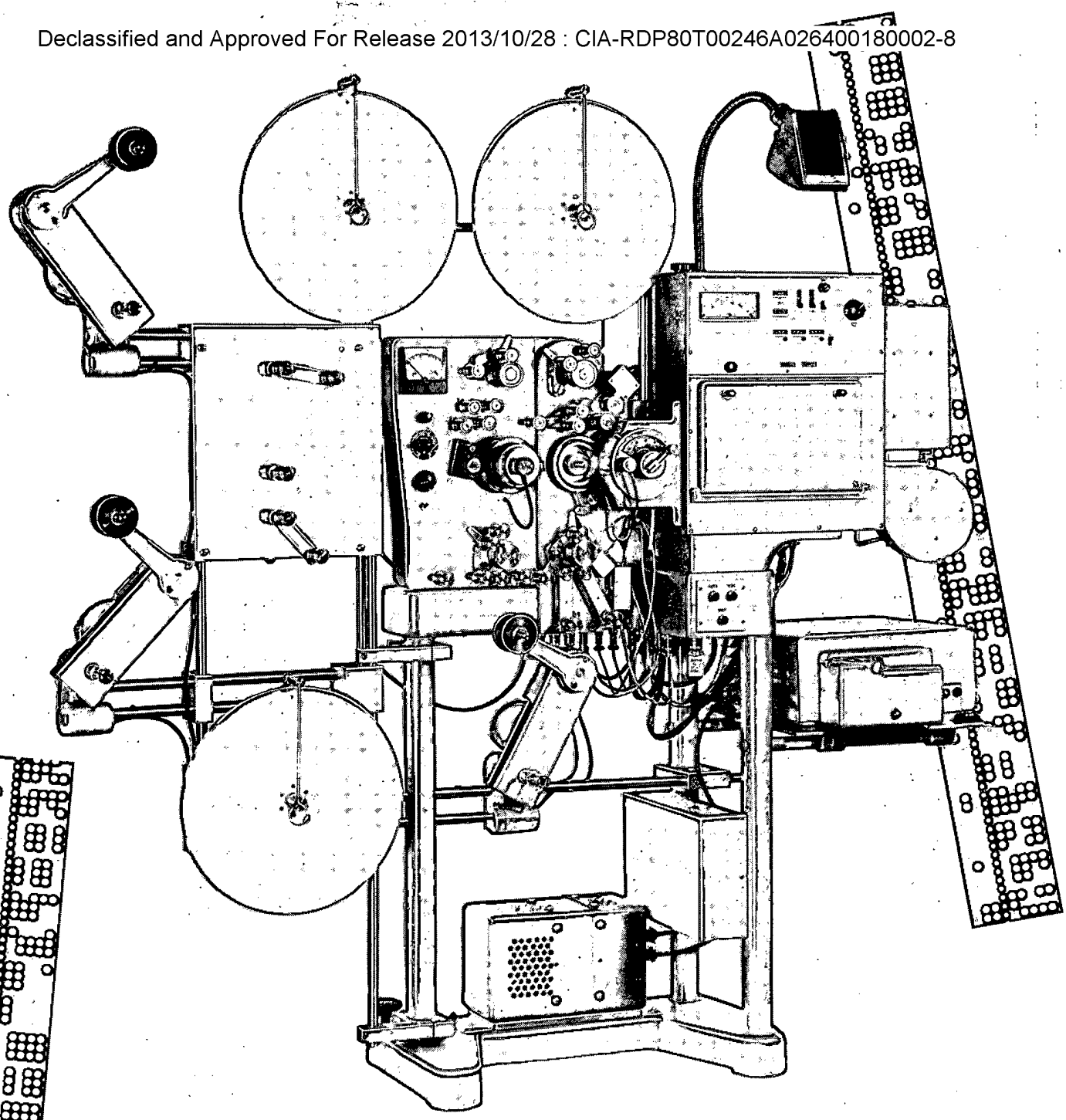
The pre-selected color timing information is easily and quickly pre-programmed on standard computer tape, which automatically controls the Model "C" Printer. Besides scene-to-scene color changes, fade lengths of 16-24-32-64-96 frames and zero close for extended scenes are also coded on the program tape to allow the production of release prints from original negatives at 180 feet per minute. All printing information can be double checked from the punched tape by an accessory tape checker-duplicator.

Other features are 2400-foot capacity . . . Single 1000-watt lamp (optional 750 and 1200), proximity reflector type . . . Edge light printing separately controlled at aperture . . . Instruments internally illuminated . . . Slow-start circuit to prevent film damage . . . Internal air pressure.

Accessories include 1000-watt rectifier . . . 16mm, 35mm and 35/32mm soundheads and RF cue kits.

Bell & Howell

PROFESSIONAL EQUIPMENT DIVISION
7100 McCORMICK ROAD
CHICAGO 45, ILLINOIS



MODEL "C" FEATURES—Ability to make scene-to-scene color corrections . . . Six fade lengths (16-24-32-48-64-96) separately controllable by pre-punched program tape . . . Zero close to allow extended scene printing . . . Over 2000-foot capacity . . . Single 1000-watt lamp proximity reflector type . . . Edge light printing separately controlled at aperture . . . Instruments internally illuminated . . . RF cue system available as accessory to supplement standard notch cue . . . Slow-start circuit to prevent film damage . . . Internal air pressure . . . Pre-wired for sound head installation . . . Automatic stop in case of negative break.

ACCESSORIES—Tape checker-tape duplicator unit (6173C), 1000-watt rectifier (6160), RF cue kits (6395) and 16mm, 35mm, 35/32mm soundheads.

OTHER MODELS AVAILABLE—Model "MB" automatic high speed printer, for black and white or color printing (where scene-to-scene color corrections are not required). This model is pre-planned and pre-drilled for up-dating to the Model "C" at any time.

Both Model "C" and Model "MB" are available for the following sizes 16mm, 35mm, 35/32mm, 65/70mm, 70mm type I, and 70mm type II.

Demonstration Film Available

A three minute color sound film has been prepared demonstrating the additive color system of motion picture printing. Examples of color correction are shown, as well as demonstrations of the unique new light valves combined with tape controlled operation. To preview this film write or phone James L. Wassell, Director of Marketing, Bell & Howell Company, 7100 McCormick Road, Chicago, Illinois 60645, (312) OR 3-3300.

Hollywood Film Company Booths **140, 141, 142**
956 Seward St., Hollywood, Calif.

Exhibiting: High speed inspection projectors; edge numbering machines; tape, overlap, repaid splicers; ultrasonic splicers; fade and light change printer units; tab applicators; Pyral magnetic stripping machine.

Personnel: Harry Teitelbaum, Ben Teitelbaum, Warren Strang, Lillian Kaye, Jim Bost.

Houston Fearless Corporation Booth **115**
11801 W. Olympic Blvd., Los Angeles, Calif.

Exhibiting: PD-9 motor driven pedestal for black-and-white or color TV cameras; PD-3 pedestal for camera capacities up to 285 lbs; hi-hat for motion-picture or TV cameras; cradle heads for pedestals, tripods or hi-hats; new cam head with interchangeable cams with a horizontal tilt lock in the neutral tilt position.

Personnel: Bert Rosenberg, Gail Hildreth, Keith Walker, Art Kjontvedt, Ed Stephens.

Kollmorgen Corporation Booth **221**
347 King St., Northampton, Mass.

Exhibiting: Representative sampling of the Kollmorgen projection lens line including the Snaplite projection lens.

Personnel: J. E. Brogan, L. Salig.

L-W Photo, Inc. Booth **208**
15451 Cabrito Rd., Van Nuys, Calif.

Exhibiting: New Model 224-A photo-optical data analyzer for viewing and analyzing 16mm motion picture film with variable speed to 24 frames per second, immediate stop, single frame, all modes forward and reverse, built-in viewing screen, frame counter and electro-magnetic drive system.

Personnel: Bob Lawrence, Sam Bowerman.

Macbeth Instrument Corporation Booths **210, 227**
P.O. Box 950, Newburgh, N.Y.

Exhibiting: Model TD-204 transmission densitometer, custom built (0-4) equipped with Kodak Status "M" printing density filters and visual filters for sound track; Model TD-102 (0-4) color transmission densitometer; Model TD-100 (0-3) black and white transmission densitometer; Model RD-100 color reflection densitometer; xenon short arc (XBO Series) lamps; xenon water cooled (XBF Series) lamp; mercury high pressure (HBO Series) lamps.

Personnel: Frederic McCurdy, Peter A. Jensen, Warren B. Reese, Harvey Ellis.

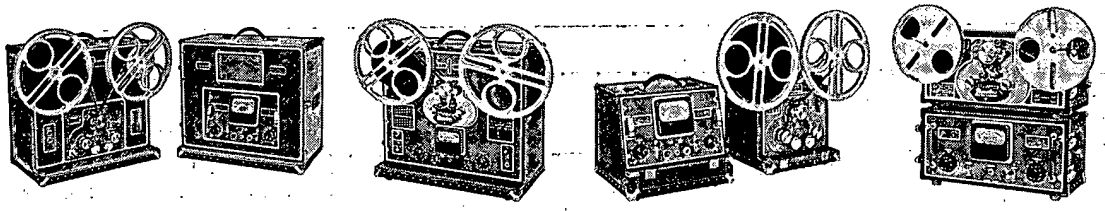
Magnasync Corporation Booths **213, 214**
5547 Satsuma Ave., North Hollywood, Calif.

Exhibiting: Magnetic recorders/reproducers for motion-picture production in 16mm, 17½ mm and 35mm featuring the Magnasync 602 Series Recorder adapted for transferring ¼" sync-pulse material to magnetic film; complete magnetic film dubbing/interlock equipment with looping facilities, including studio type G-960 Consolette; ½" multichannel communications recorder/reproducer for 24-hour program source surveillance.

Personnel: Bob Dickinson, Jim Green, Ted Diamond.

AGAIN . . .

see the PROVEN synchronous magnetic film Sound Recording Systems at the S. M. P. T. E. show!



MAGNASYNC
SYNCHRONOUS
Magnetic FILM RECORDER

Magnaphonic
SOUND SYSTEM

MAGNASYNC
CORPORATION

A subsidiary of Monogram Industries, Inc.
5547 Satsuma Avenue, North Hollywood, California
Phone: (213) TRiangle 7-5561 • Cable "MAGNASYNC"

Send for detailed literature

Magnetic Sales Corporation Booth **114**
1147 North Vine St., Hollywood, Calif.

Exhibiting: Professional synchronous tape recorders for motion pictures and TV: Stellavox with Ranger or Pilote synchronizing heads, dryfit rechargeable batteries, wired for sync reproduction, bloop power, remote start and stop, and automatic mixing; Nagra three speed (15", 7½", 3¾") with Neo-Pilote synchronizing heads. Ryder synchronizing and blooping devices: synchronizing transformers, camera sync generators, blooping oscillators and remote start control for recorders and resolving equipment for Siemens projectors.

Personnel: Leon D. Selznick, Loren L. Ryder, Ronald R. Cogswell.

Metro-Kalvar, Inc. Booth **204**
550 5th Ave., New York, N.Y.

Exhibiting: Metro-Kalvar 35mm filmstrip printer-processor; Metro-Kalvar 16mm motion picture printer-processor producing in normal light at a speed of 75 fpm; samples of spliced Metro-Kalvar film products.

Personnel: R. B. Lindemeyer, N. R. Bacon.

Meyer Reed, Inc. Booths **132, 133**
1624 N. Cahuenga Blvd., Hollywood, Calif.

Exhibiting: Ascorlights; Pathe motion picture cameras; Sinar products; color analyzers.

Personnel: H. Joe Meyer, Travis Reed, Cec Sly.

D. B. Milliken Company Booth **102**
131 N. 5th Ave., Arcadia, Calif.

Exhibiting: New items: Kinescope recording camera; automatic exposure control accessory for Milliken standard high-speed line. Complete line of 16mm high-speed motion picture cameras and accessories.

Personnel: T. H. Truesdell, L. F. Meyer, R. C. Kiteley, C. G. Holzapfel, G. A. Crandall.

3M Company Booth **135**
2501 Hudson Road, St. Paul, Minn.

Exhibiting: "Scotch" Brand Video Tape No. 379; 3M Company's new video tape No. 388, designed to permit "stop-motion" on helical scan recorders capable of such.

Personnel: Robert Ferderer, A. J. Blower, E. M. Bruno.

Mitchell Camera Corporation Booth **130**
666W. Harvard St., Glendale, Calif.

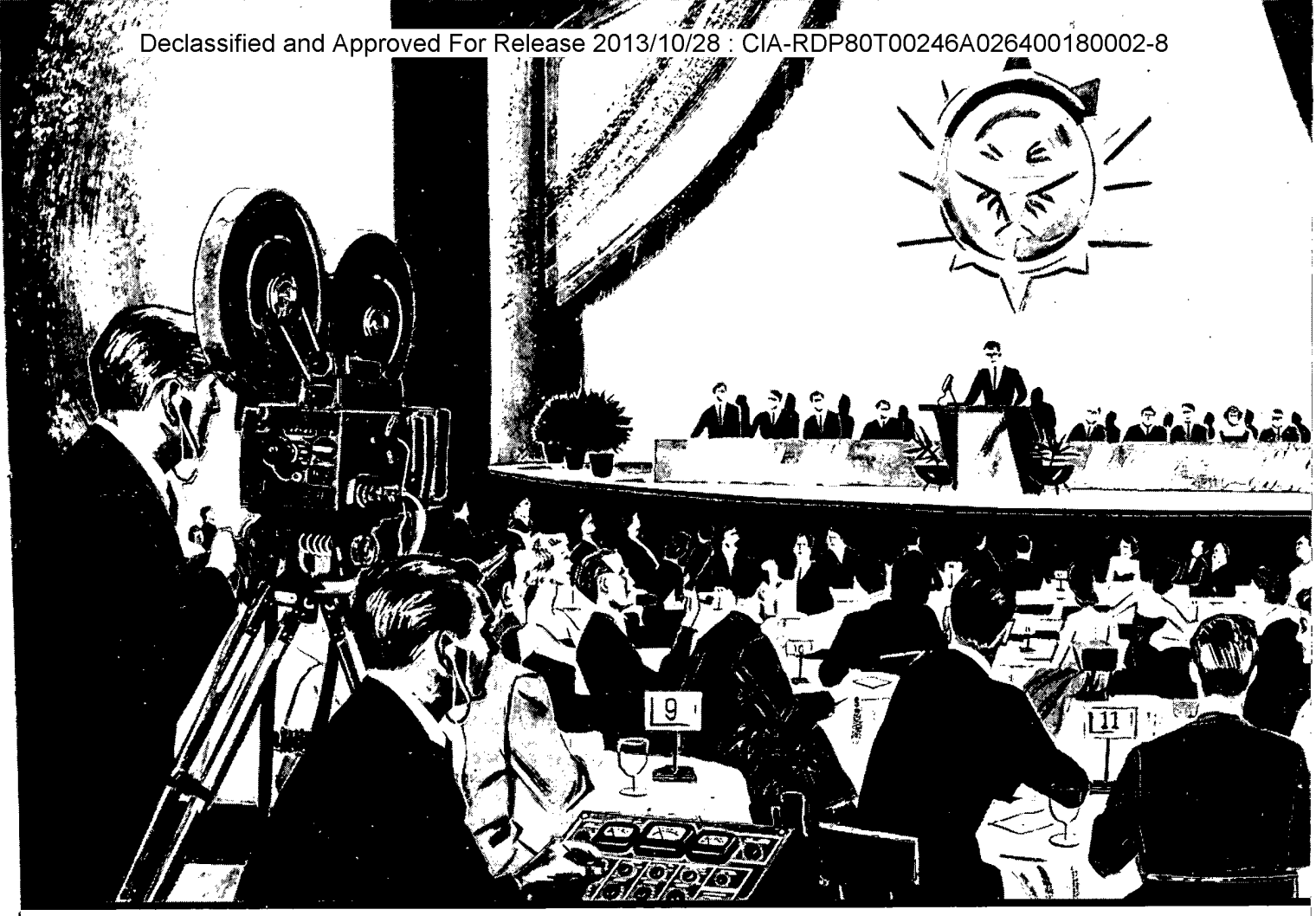
Exhibiting: Mitchell SSR-16 Reflex Motion-Picture Camera; Mark II 35mm Camera with Sound Blimp; professional 16mm motion-picture camera modified for high-speed photography.

Personnel: R. Bruce Hill, Edmund Di Giulio, Donald Tucker, Les Brown.

Mole-Richardson Company Booth **113**
937 North Sycamore Ave., Hollywood, Calif.

Exhibiting: New quartz lighting equipment; incandescent lighting equipment; arc lighting; lighting control.

Personnel: Larry Parker, Howard R. Bell.



Use the Quiet Running AURICON 16mm Sound-On-Film Camera...

NEVER DISTURB THE AUDIENCE WITH CAMERA NOISE!

Does the scene above look familiar? You may be interested to know more about its significance relative to your sound recording needs.

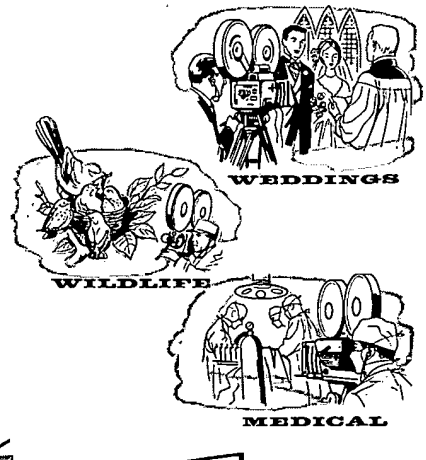
Here is Auricon Professional 16mm Motion Picture Sound Camera Equipment, operating right in the middle of an audience — actually within inches of the surrounding spectators! Yet, despite the complex precision mechanisms that are recording a full-color picture and every whispered word of the speaker on the rostrum, not even a murmer of distracting camera noise is heard by the audience. This quiet, dependable recording of 16mm Sound-On-Film Talking Pictures is the special engineering "magic" of Auricon!

Except for the red signal lights glowing on the Auricon Sound Camera, the audience has no way of knowing that the Camera is running. In fact, even the click of the on-off switch has been muted!

Auricon Cameras are versatile and easy-to-handle because there is no bulky, sound-proof enclosure "blimp" such as all other 16mm cameras use when recording sound.

Professional Producers and Cameramen choose Auricon to shoot pictures synchronized with Optical or Magnetic "Double-System" recording equipment, or to record "Single-System" sound on the same film taking the picture. Write us about your sound recording equipment needs today!

All Auricon Cameras are sold with a 30 day money-back guarantee.
You must be satisfied!



Write for your free copy of this 74-page Auricon Catalog

VISIT US AT BOOTH 108, SMPTE SHOW

BACH AURICON, Inc.

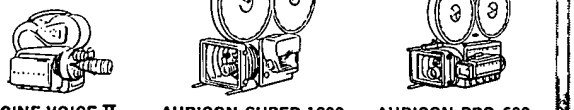
6946 Romaine Street, Hollywood 38, California

HOllywood 2-0931

MANUFACTURERS OF SOUND-ON-FILM RECORDING EQUIPMENT SINCE 1931

Auricon Hollywood

16MM SOUND-ON-FILM CAMERAS



CINE-VOICE II	AURICON SUPER-1200	AURICON PRO-600
$998.50 & UP	$5667.00 & UP	$1871.00 & UP
100 ft. Runs 2¾ min.	1200 ft. Runs 33 min.	600 ft. Runs 16½ min.

Motion Picture Printing Equipment Co. Booth **126**
8107 N. Ridgeway Ave., Skokie, Ill.

Exhibiting: New Peterson single and double head contact printers in 16mm and 35mm. Accessories: semi-automatic shutter; push button shutter; four speed fade unit; sound printing head; printer light probe; Peterson R. F. Cueing System; patch applicator.

Personnel: Walter Peterson, Bruce Peterson, William Morris.

Moviola Manufacturing Co. Booths **235, 236**
5539 Riverton Ave., North Hollywood, Calif.

Exhibiting: Bench editing arrangement for video tape, including hand rewinds, power rewinds, and sound reader equipped with timer counter; Moviola's new editing table with latest model hand rewinds incorporating greater efficiency braking attachment and swivel base; Moviola automatic power rewinds for coring and rewinding 16mm, 35mm, and 70mm film automatically; library readers for reviewing 16mm film at high speed or sound speed; Moviola crab dolly and film editing machine; bench editing arrangement for 16mm film with motor drive for synchronizers to transport track at sound speed.

Personnel: Mark Serrurier, Al Romoli, Bruce Dalton, George Kendall.

Neumade Products Corporation Booth **112**
250 West 57th St., New York, N.Y.

Exhibiting: New items: Super "X" power film rewinder; imprinted non-emulsion colored film leader. Storage facilities for film, video tape, audio tape, disc records, filmstrips, slides; film handling equipment.

Personnel: Lee E. Jones, Robert E. Hempel, Ronald N. Jones.

Newman & Guardia Ltd. Booth **118**
Edinburgh Way, Harlow, Essex, England

Exhibiting: Processing machines: Lawlette color model, smallest machine permitting color film processing to professional standards, rearrangement of tank links allows nearly all color films to be processed; Lawlette high-speed model for high-speed and documentary film processing. Continuous printer.

Personnel: S. G. Fitch, L. H. Howes.

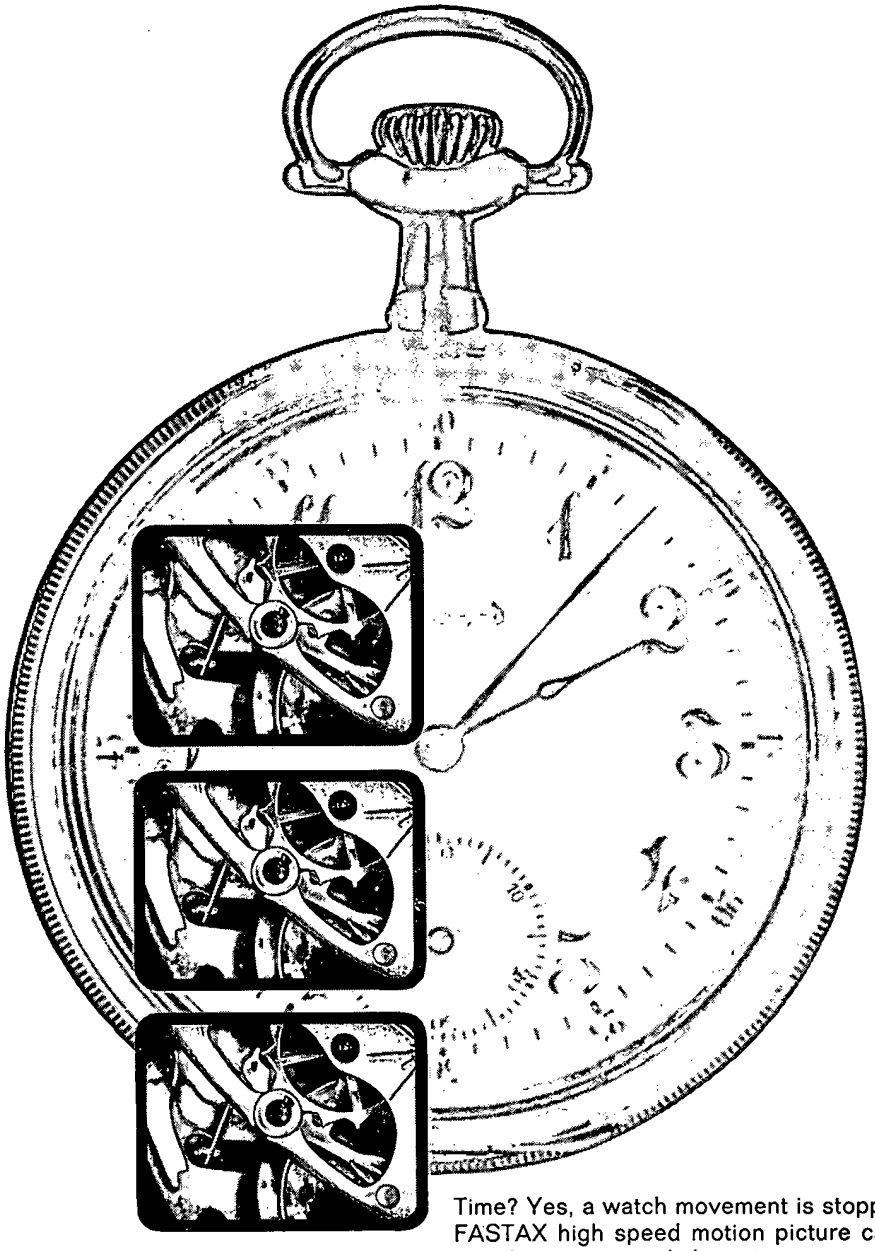
Oxberry Corporation Booth **105**
38 Hudson St., New Rochelle, N.Y.

Exhibiting: Inspection projector: Oxberry Model 40-B 16mm high-speed film inspector permits rapid inspection of film continuously at variable speeds, forward and reverse, with optical rotary intermittent to eliminate damaged sprocket holes; Oxberry Series 100 portable film processor for 16mm or 35mm black-and-white film, small low cost developing machine designed to give highest quality compatible with size limitation, 12" wide, 18" long, 2' high.

Personnel: Ralph D. Whitmore, Jr., Robert Troy.

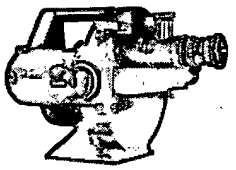
W. A. Palmer Films, Inc. Booth **110**
611 Howard St., San Francisco, Calif.

Exhibiting: Palmer television film recorder including



TIME STOPPED COLD!

Time? Yes, a watch movement is stopped **cold** by a Wollensak FASTAX high speed motion picture camera. When these pictures are projected there is no question what is happening. High speed photography was the way engineers saw motion of the escapement when it engaged pins on the fork . . . made certain there was no bounce.



FASTAX camera studies are helping solve motion, vibration and stress problems in electrical, mechanical, chemical, medical and physical fields.

See for yourself how speeds up to 18,000 pictures per second absolutely stops action. Clip the coupon for action.

REVERE-WOLLENSAK DIVISION
563 HUDSON AVE., ROCHESTER 21, N. Y.

Please send me your

☐ Brochure F100 on High Speed Photography.
☐ Folder showing camera models and capacities.

Name _____

Company _____

Address _____

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Revere-Wollensak Division 3M COMPANY

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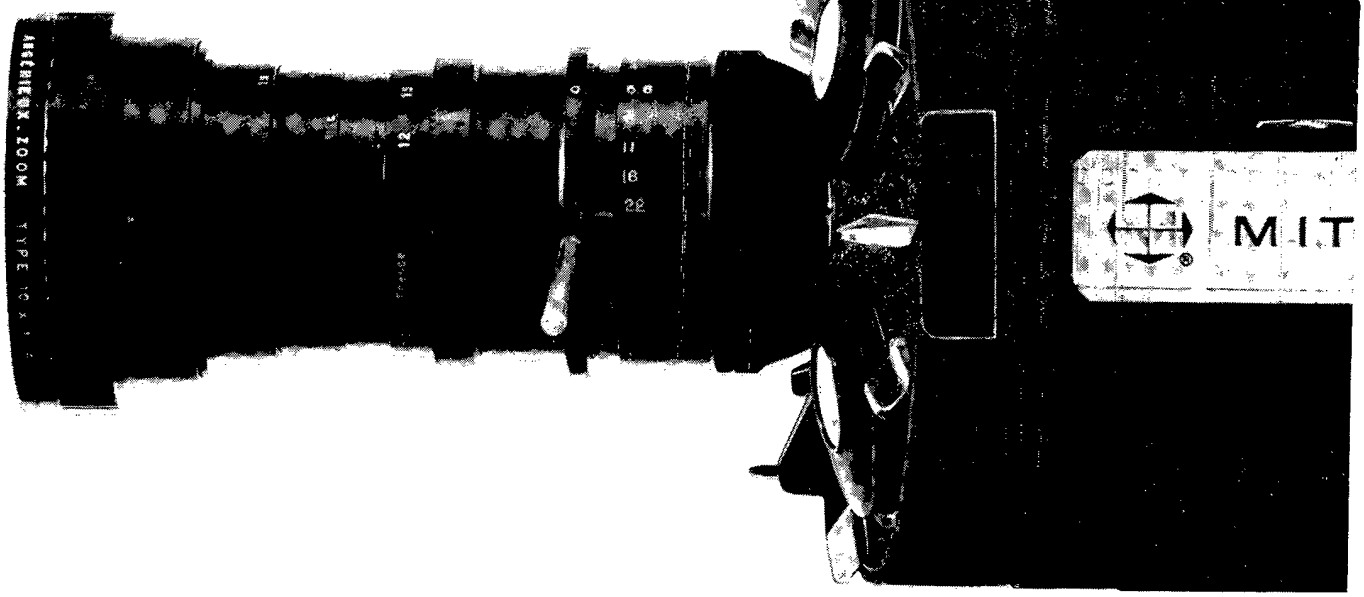
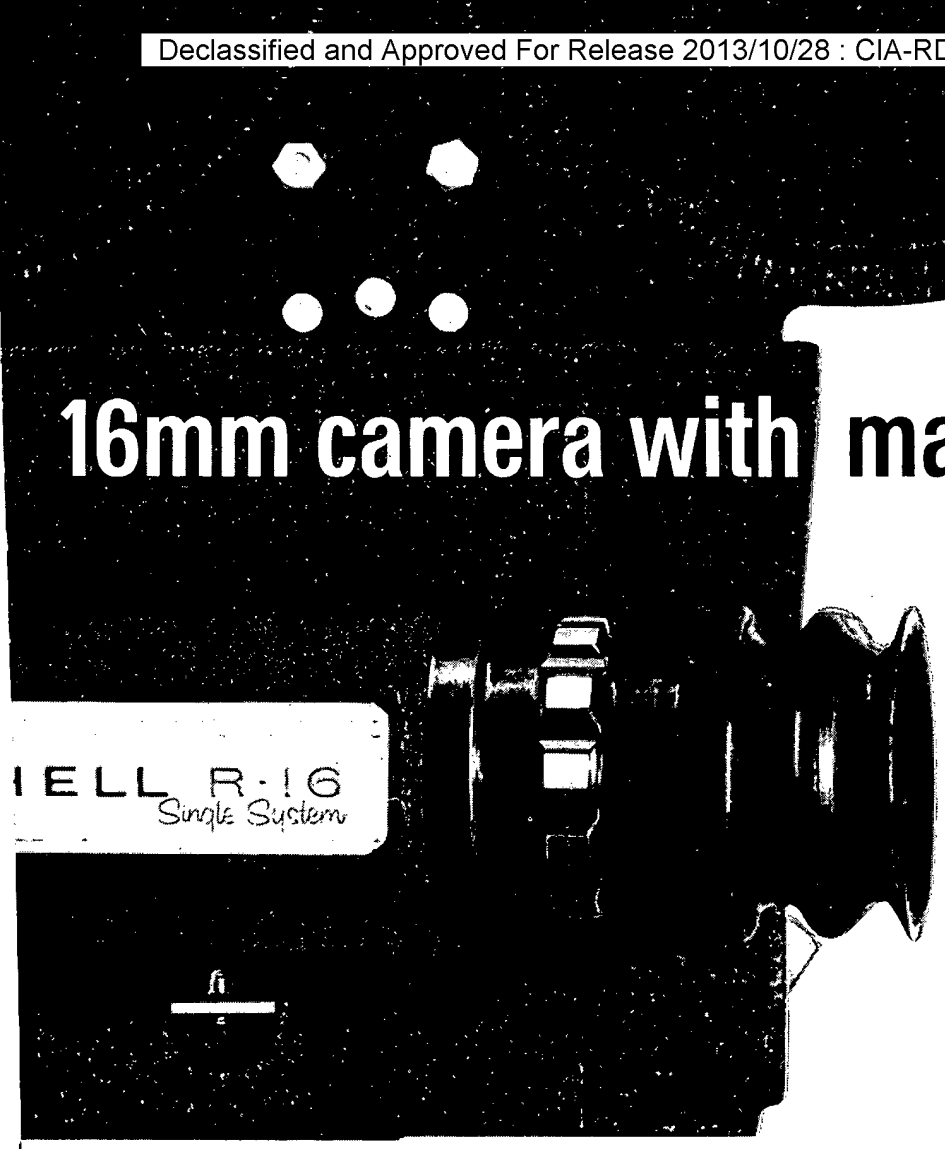


Totally new and totally *Mitchell!* The remarkable SSR-16 combines famed Mitchell pin-registered precision with superb reflex viewing and single-system magnetic sound—in a professional camera that is truly lightweight, portable, flexible and simple to operate. Hand-held or tripod-mounted, the SSR-16 is ideal as a general purpose camera, and virtually noiseless. It is *unsurpassed* for on-the-sp sound filming: news, sports, documentaries, military combat, special events. It accommodates standard 16mm 400-ft. and 1200-ft. magazines and the majority of standard films, lenses, mounts, and accessories. It's available with interchangeable motors, and with a pic sync for conversion to double system sound. For high quality professional film work, the SSR-16 is in a class by itself—in the finest Mitchell tradition! Write for illustrated brochure.

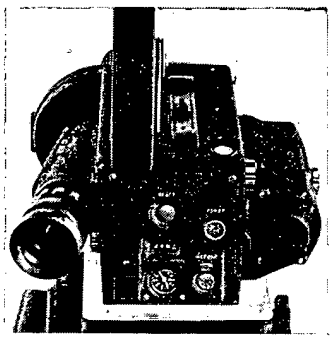
NEW MITCHELL SSR-16

SEE THIS REMARKABLE DEVELOPMENT AT THE 95TH ANNUAL SMPTE TECHNICAL CONFERENCE/APRIL 13-16, AMBASSADOR HOTEL, BOULEVARD ROOM, LOS ANGELES, CALIF.

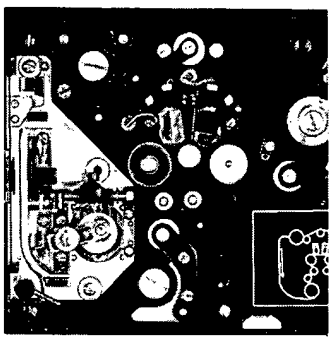
16mm camera with magnetic sound



Through-the-lens-viewing. Focus tube reflex viewfinder has 10X magnification eyepiece, coupled to rotating 170° focal plane shutter with 1/51 fixed exposure time at 24 fps. Bright image is larger than aperture. Three-lens turret accommodates many standard lenses and zoom lenses with quick-change mounts.



Professional controls. All controls are located at rear of camera, including on-off switch, 4-digit footage counter and reset, film tach, buckle trip reset, and quick release connectors for power and sound. SSR-16 operates on light weight, rechargeable battery pack or external AC power supply.



Mitchell movement. Film threading is quick and easy with only three drive sprockets. All guides and locks are interlocked with compartment door to prevent misthreading. Single registration-pin and single pull-down claw hold film within a frame-to-frame tolerance actually better than available film perforations.

Magnetic sound recorder. Operates with any 100 mil prestriped film. Separate 12-lb. unit provides 2 microphone inputs plus high impedance channel with input channels independently controlled in mixer. Full monitoring and playback capability included as well as self-contained power supply.

SINGLE SYSTEM REFLEX

Mitchell Camera Corporation, 666 West Harvard Street, Glendale, California

camera, monitor and sound recording unit producing 16mm film from broadcast or closed circuit transmission, or tape playback; Palmer 2400′ Magazine.

Personnel: William Palmer, Stewart Macondray, John Corso.

Photo Research Corporation Booth **109**
836 N. Cahuenga Blvd., Hollywood, Calif.

Exhibiting: New Spectra TV Optoliner for vidicon image orthicon and color TV camera systems, provides test instrument for standardization of TV systems and self-contained illumination and inter-changeable test patterns, mounted to tolerances of 0.002; Spectra Miniature TV Camera.

Personnel: Karl Freund, James K. Branch, Gideon Fiat.

Photo-Sonics, Inc. Booths **138, 139**
820 So. Mariposa St., Burbank, Calif.

Exhibiting: 70mm full frame (2.25″ × 2.25″) camera—180–360 fps; 70mm full frame (2.25″ × 2.25″) camera high-speed intermittent, 10 to 80 fps; 70mm ballistic synchro camera; 35mm high-speed rotary prism camera; 16mm high-speed rotary prism camera, 3 models; 16mm thin line, underwater high-speed camera; tracking mount.

Personnel: John Kiel, Darrell Lassiter, R. W. Lorenzen.

Plastic Reel Corporation of America Booth **218**
612 Blvd. East, Weehawken, N.J.

Exhibiting: 8mm plastic film reels—all sizes; 16mm plastic Reels-Plio-Magic film reels, 50′–2200′; 8mm & 16mm Reel-Paks, reel and can combination, 50′, 200′ & 400′; 16mm and 16/35mm processing spools; bushings.

Personnel: Walter Elterman, Allen Braverman.

Precision Laboratories Div. Booth **217**
Precision Cine Equipment Corp.
928-930 E. 51 St., Brooklyn, N.Y.

Exhibiting: Precision Sound Readers, optical and magnetic; Precision Unitized Synchronizers; power film slitters; film slitter and editing equipment, including editing tables.

Personnel: Irwin R. Sheldon.

Prestoseal Manufacturing Company Booths **121, 122**
37-12 108th Street, Corona, N.Y.

Exhibiting: New items: Automatic film/tape splicer for 16mm-35mm film with push button control, interchangeable splice programmer, and built-in splice tester, models for magnetic film and video tape, choice of butt, reinforced or overlap splicing; Splicing console with remote variable speed control winders, editing light and storage. Standard splicers: Hercules Intermix reinforced for splicing dissimilar film bases; Miracle Model Butt-weld.

Personnel: Leonard A. Herzig, Hans E. Baumayr, M. Michael Cerick.

Producers Service Company Booths **123, 124, 125**
1145 N. McCadden Pl., Hollywood, Calif.

Exhibiting: The new Acme triple head special effects optical printer equipped with electro-mechanical

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servo systems that operate the automatic follow focus for both the camera and the aerial image projector; Acme 16/35 combination cameras and projectors; adaption of the Bell & Howell additive color head to step printing.

Personnel: Mike McGreal, Oscar Jarosch, Howard Pearson.

Quick-Set, Inc. Booths **103, 104**
8121 N. Central Park, Skokie, Ill.

Exhibiting: New models: Gibraltar cradle heads for movie and TV work; vibration-free dollies with special jack screws for lifting wheels off floor. Super Quick-Set, Samsom, Hercules, and Gibraltar complete line of tripods, pan heads, dollies, etc., for photographic, television, remote control, high-speed or instrumentation usage; units capable of handling loads from 5 to 200 lb on pan heads and elevators, and 500 on tripods. The units include ¾ and full length, with or without elevators, pan-heads incorporating friction and/or geared controls, power and hand operated pedestals and consoles. Accessories include Pelco adapters, special apparatus for easier attachment of heavy cameras, and Lo-Hi units.

Personnel: A. J. Briglia, Paul Mooney.

Red Lake Laboratories, Inc. Booth **128**
564 San Xavier Ave., Sunnyvale, Calif.

Exhibiting: 16mm High-Speed Motion-Picture Cameras and Accessories: 16mm × 100′ Hycam, variable from 10 to 8500 pps for full-frame 16mm and 20 to 17,000 pps for 8mm model; new 16mm × 400′ Hycam, variable from 16 to 10,000 pps for full-frame 16mm and 32 to 20,000 pps for 8mm version.

Personnel: Robert D. Shoberg, Ted F. Meyer, Jr.

Research Products, Inc. Booth **136**
716 N. LaBrea Ave., Hollywood, Calif.

Exhibiting: New custom built optical effects printer for Acme 70mm, 35mm, 16mm, or 8mm projectors and cameras. Engineered to meet any specific type of work, the basic printer encompasses a new modular, replaceable drive system, unlimited sequencing for skip frame printing, a new type lamp house and projector head assembly.

Personnel: Harold A. Scheib, Jack Glass.

Revere-Wollensak Div., 3M Company Booth **223**
725 Hudson Ave., Rochester, N.Y.

Exhibiting: High-speed photography and radar boresighting equipment: Fastax high-speed cameras; Mirrotel radar boresights; related photo-instrumentation products.

Personnel: Fred M. Emens, Richard J. Wollensak, Robert B. Herden, Charles B. Wade, Thomas H. Bowman.

S.O.S. Photo-Cine-Optics, Inc. Booth **220**
602 W. 52nd St., New York, N.Y.

Exhibiting: Tel-Amatic closed circuit TV transistorized camera; Sound Seal portable fiber glass blimp for the Arri 16mm camera; Transist-O-Sound wireless microphone system for television news sound on film reporting; S.O.S. Tel-Amatic 16mm con-

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tinuous contact printer; two position transistorized mixer for Auricon sound-on-film amplifiers; S.O.S. Tel-Animaprint hot press.

Personnel: Alan C. Macauley, Jan T. Macauley, Dom J. Capano.

Spindler & Sauppe, Inc. Booth **209**
2201 Beverly Blvd., Los Angeles, Calif.

Exhibiting: Complete line of selectroslide automated 2 × 2 in. slide projection equipment including projectors for manual, remote forward/reverse, remote digital readout of the slide number, and remote random access operation; 2 models designed for multiplex and uniplex operation in closed-circuit and broadcast television.

Personnel: Norman A. Sauppe, Paul Weichhart.

Stancil-Hoffman Corporation Booth **219**
921 N. Highland Ave., Hollywood, Calif.

Exhibiting: New magnetic film recorders: Model S6 for 16 or 17-1/2mm with low power consumption for field operation and silicon NPN low noise transistors in the amplifier systems; Model S7 heavy duty unit with synchronous and electrical interlock drive.

Personnel: William V. Stancil.

Stewart Filmscreen Corporation Booth **205**
1161 W. Sepulveda Blvd., Torrance, Calif.

Exhibiting: Stewart seamless projection screens: Ultramatte front projection screens for theaters and review rooms; Stewart T-Matte Blue and Stewart Hi-Tran screens for rear projection and motion-picture production; Stewart TV-Blue for TV background projection; rigid rear projection screens for in-wall and console installations; Porta-Pro portable screens; complete framing systems; examples of World's Fair installations.

Personnel: La Mar Roy Stewart, Marshall E. Stewart, Roy C. Stewart, Patrick H. Stewart.

Sylvania Electric Products, Inc. Booth **233**
730 3rd Ave., New York, N.Y.

Exhibiting: Complete line of existing Sylvania professional lighting equipment for studio and location use including the redesigned battery portable unit; new items; iodine lamps.

Personnel: Edward A. Gilchrist, Richard H. Lindeberg, George Mulcahy, Dr. Robert Levin.

Traid Corporation Booth **137**
17136 Ventura Blvd., Encino, Calif.

Exhibiting: Consolidated Systems Corp. gun camera line: Models KS-27B, KB-3A, KD-7; new daylight load 100 ft. magazine for gun cameras. Vanguard motion analyzer with automatic readout to Clary printer; Automax data recording cameras; PhotoSonics high-speed cameras Models 16mm-1B and 16mm-1B/AC; new "G" load Adtrol timing light generator for high-speed cameras.

Personnel: Robert King, Dick Freeborg, Carlos Elmer, Mike Schuster.

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Treise Engineering, Inc. Booths **211, 212**
1949 First St., San Fernando, Calif.

Exhibiting: Film processing machine; film sprockets; waxer; spools and spool bearings; sound track applicator; air squeegees; heat exchanges.

Personnel: J. Carl Treise, Paul Sparre, Ken Bell.

XeTron Div., Carbons, Inc. Booth **228**
400 Myrtle Ave., Boonton, N.J.

Exhibiting: Complete XeTron line of xenon lamphouses and power supplies: JX modification kit to convert Jan projector for xenon operation with 450 watt bulb; CX-9 lamphouse for small format slide, 16mm and 35mm projection; "300" lamphouse with 900 or 1600 watt bulb for 16mm or 35mm projection; "400" lamphouse with 1600–2500 watt bulb for 35mm or 70mm projection; Christie-XeTron power supplies.

Personnel: Frank H. Riffle.

Zoomar, Inc. Booths **116, 117**
55 Sea Cliff Ave., Glen Cove, N.Y.

Exhibiting: Zoom lenses for motion picture cameras: Angenieux 16mm and 35mm; and new 24–240mm with viewfinder for Mitchell NC and BNC cameras; remote controlled for Vidicon cameras including new zoom lens with zoom range of 1:20 (15–300mm focal length for Vidicon cameras, and 12–240mm focal length for motion picture frame). Electric zoom drives for 16mm and 35mm motion picture lenses.

Personnel: Walter Steuer, Claire Redman, Martin Miller.

Education, Industry News

The Inter-Society Color Council will hold its 33rd Annual Meeting May 4–5 at the Statler Hilton Hotel, New York. Committee reports will be made during the first day of the meeting and a symposium on the general subject of Color in Education has been arranged for the second day by the Council President, William J. Kiernan. Symposium moderator will be F. L. Wurzburg, Jr., Speakers, and their subjects, will be George Kay, Color Education in Art; Samuel Schenberg, Color Education in Science; Randall M. Hanes, Color: A Guide to Basic Facts and Concepts; and Prof. Isay A. Balinkin, Two Worlds of Color — Or One. Further information is available from Ralph M. Evans, Inter-Society Color Council, Eastman Kodak Co., Photographic Technology Div., Bldg. 65, Rochester, N.Y. 14650.

The 1964 IEEE International Convention will be held March 23–26 at the Hilton Hotel and the Coliseum in New York. Theme of the Convention will be "A Glimpse of the Future." An attendance of more than 75,000 engineers and scientists from 40 countries is expected. An total of 320 papers covering latest developments in every area of electrical and electronics engineering is scheduled for the technical program, which includes 64 technical sessions. A high point of the program will be a special evening symposium on "Modular Magic" to be held March 24. A panel of outstanding authorities, moderated by Patrick Haggerty, President of Texas Instruments, Inc., will discuss the impact of processes and techniques for fabricating microelectronic integrated circuits. Chairman of the General Committee is G. W. Bailey. Technical Program Committee Chairman is Ferdinand Hamburger, Jr. Information about the IEEE Convention is available from The Institute of Electrical and Electronics Engineers, Inc., Box A, Lenox Hill Station, New York 21, N.Y.

The First International Conference of Women Engineers and Scientists will be held June 15–21 in New York. It is sponsored by the Society of Women Engineers and the theme will be "Focus for

the Future—Developing Engineering and Scientific Talent." Director of the Conference is Dr. Beatrice A. Hicks, President and Director of Engineering, Newark Controls Co. Information about the Conference is available from Elsie Eaves, Public Relations Chairman, 18 Third Ave., Port Washington, N.Y. 11050.

The 1963 Science Technology and General Dictionary Catalog is published by Associated Technical Services, Inc. (A.T.S.). The catalog serves as a reference to and source of hundreds of currently available technical dictionaries in 35 languages from all over the world. English editions of 23 outstanding Russian, Hungarian, and Chinese books in bio-sciences, engineering and chemistry are also listed. The catalog is available from Associated Technical Serivces, Inc., Dictionary and Book Division, 855 Bloomfield Ave., Glen Ridge, N.J.

Special translating services are also available. Recent emphasis in translating is on papers in Japanese and Russian containing research data on electrophotography (xerography), photography, photochemistry, etc. A.T.S. was established in 1949 by a chemical engineer and a chemist to provide an exclusively technical translation and literature research service. A.T.S. has a specialized technical reference library of several thousand volumes and also maintains close liaison with associates and sources throughout the world for patent and literature searches as well as for procurement of hard-to-get scientific material published abroad.

The Sixth National Electromagnetic Compatibility Symposium sponsored by the Professional Technical Group on Electromagnetic Compatibility of the IEEE will be held June 23–25 in the Los Angeles area. The theme will be Down-to-Earth EMC in the Space Age. Information is available from the Technical Program Chairman, John A. Eckert, Dept. 3441/32, Northrop Norair, 3901 West Broadway, Hawthorne, Calif.

A Department of Space Science and Applied Physics has been established by the Catholic University of America with programs of study leading to post-graduate degrees in the areas of Space Science; Fluid Mechanics and Heat Transfer; Aerospace Engineering: and Applied Physics. The new program is intended to integrate scientific theory and technology. The curricula will balance instruction in science with training in the skills of experimentation and inventive technology. Research conducted under faculty supervision includes work in such areas as plasma behavior in geophysics and space physics; basic problems of blood flow and non-Newtonian fluid mechanics; and radiation heat transfer. Laboratories in Plasma Space Science; Space Propulsion; and Fluid Physics have been established. Further information is available from Dr. C. C. Chang, Head, Department of Space Science and Applied Physics, The Catholic University of America, Washington, D.C. 20017.

A Symposium on cineradiography in the medical and biological sciences, organized by the medical group of the Royal Photographic Society of Great Britain, will be held March 18, with facilities and hospitality provided by the CIBA Foundation. About 25 speakers will discuss problems associated with cineradiography. There will be representatives from the Faculty of Radiology, British Institute of Radiology, Society of Radiographers, Institute of British Photographers medical group, and the Royal Photographic Society of Great Britain medical group. This Symposium is an exploratory one, and if the findings warrant it an international symposium will be considered. A technical report covering papers and discussions will be issued within one month of the Symposium. Copies of the report will be available upon request from: The Hon. Publicity Officer, Medical Group of the Royal Photographic Society, 16 Princes Gate, London, S.W.7, England.

Also scheduled is the annual Exhibition of the Medical Group of the Royal Photographic Society of Great Britain which will open March 3 at Tavistock House, Tavistock Square, London, W.C.1. The exhibit will be on display to April 20.

The British Film Producers Association, 49 Mount St., London, W.1., England, has issued a report on the National Productivity Year Conference held during November, 1963, in Eastbourne. Among conclusions drawn from papers and discussions as set forth in the report are included such statements as: "The Film Production Industry is not a production-line factor . . . Nevertheless, work study as an aid to productivity appeared to be as important in this (cinema) industry as in any other industry . . . The sales side must be of sufficient strength and attraction to ensure an adequate financial return to the production side . . . There is a need in this industry for the removal or relaxation of trade union restrictive practices, which are related to production techniques and equipment of many years ago . . . ."

Harry F. Olson, Director of the Acoustical and Electromechanical Research Laboratory of the RCA Laboratories, is the recipient of the John Ericsson Medal of the American Society of Swedish Engineers. It was presented to him at the annual banquet, held Febuary 8, in New York. The medal is presented every second year and alternately to a Swedish citizen or an American citizen of Swedish extraction in recognition of outstanding and valuable contributions in the field of acoustics.

Dr. Olson is a Fellow of the SMPTE and the recipient (1955) of the Samuel L. Warner Memorial Award. On that occasion he was cited for outstanding achievements in "audio engineering, including his work on the velocity microphone, the duocone speaker for high-fidelity sound reproduction, and for his contributions to the development and improvement of phonograph pickup and recording equipment, underwater sound equipment, and sound motion-picture and public address systems." Among other honors he has been awarded the Modern Pioneer Award of the National Association of Manufacturers (1940); John H. Potts Medal of the Audio Engineering Society (1952); John Scott Medal of the City of Philadelphia (1956); and Achievement Award of the IRE Professional Group on Audio (1956).

Dr. Olson holds more than 90 U.S. Patents on devices and systems in the acoustical field. He is the author of three books, *Acoustical Engineering*, *Dynamical Analogies*, and *Musical Engineering*, as well as numerous papers on scientific and technical subjects, among them (with co-author John Preston), "The Electrostatic Uniangular Microphone," in the November 1958 issue of the *Journal*.

Norwood L. Simmons has been appointed General Manager of the West Coast Division of Eastman Kodak Company's Motion-Picture Products Sales Department. He succeeds John L. Courcier, a veteran of 45 years in the film industry, who died January 6. He joined Kodak in 1937 at the Kodak Park Works in Rochester, N.Y. For the next four years he was associated with the company's film manufacturing operations. In 1941 he moved to the West Coast Division in Hollywood. In 1954 he was appointed Chief Engineer of the Division; in 1958 he was appointed Assistant Manager and in 1960 he became Manager. In 1963 he was appointed Manager of Engineering

Services and his appointment to the post of General Manager was made effective January 17. Vaughn C. Shaner succeeds him as Manager of Engineering Service, West Coast Division.

Sidney Dimond has resigned his professorship in the Boston University School of Public Relations and Communications to devote his time to Creative Associates, Inc., 176 Newbury St., Boston, a firm he founded 11 years ago to produce historical programs, documentaries and educational programs described as "sounds on tape and record." Mr. Dimond is especially interested in educational programs for highway safety. In 1956 he produced *This Is Impact*, a series of recordings containing comments made by accident victims and relatives of highways fatalities, of excuses offered by apprehended speeders, and of sounds such as the clang of a jail door shutting behind a drunken driver. The recording won the National Headliner's Award as the best American radio series of 1958 and the National Safety Council's Public Interest Award. He also did a tape called *How to Stay on the Highways* which is used widely in high schools throughout the United States.

Harlan L. Graham, Jr., has been appointed General Manager of the Du Pont Photo Products Dept., Wilmington, Del. He succeeds George H. Loving, who was killed in the airplane disaster near Elkton, Md., December 8 (*Journal*, Jan., 1964, p. 60). Mr. Graham, who began his career in Du Pont's Parlin, N.J., plant about 25 years ago, transferred to the company's Wilmington headquarters in 1950 as Assistant to the Director of Production, and then became Assistant Manager at the Rochester, N.Y., plant and later at Parlin. While at Parlin, he was active in the establishment of the "Cronar" polyester film plant. He was appointed Director of Sales in 1958 and about a year ago he was made Assistant General Manager of the Photo Products Dept. He is succeeded in that post by Joseph A. Dallas. Mr. Dallas has been Director of Manufacture for the Du Pont Explosives Dept. since 1960, and has held other important production and sales positions during a 30-year career with the company.

W. E. Pohl has been appointed a Vice-President of Technicolor Corp. A recipient of four Academy Award Scientific Achievement plaques, Mr. Pohl has been importantly associated with Technicolor's technical activities in many capacities for 34 years. In this new capacity he will continue the duties and responsibilities of Technical Director of the Motion Picture Division and, in addition, will assume the direction of the Corporation's Systems and Procedures program. The author of a number of technical papers, two that have appeared recently in the *Journal* are "The Manufacture of 8mm Prints at Technicolor," pp. 606–607, Aug., 1961; and "Large Area Negative Printing," pp. 72–73, Feb., 1959.

Gale Livingston has been appointed President of the Westrex Division of Litton Industries. He was formerly Vice-President and General Manager of the Westrex International Division. He will maintain headquarters in Hollywood. Mr. Livingston has been with Litton Industries since March, 1962. He has held various management and executive positions and for many years was Executive Vice-President of an international pharmaceutical firm.

Harold R. Day has been appointed manager of the Thermoplastic Recording Project of General Electric Co., Schenectady, N.Y. Dr. Day joined General Electric Co. in 1952 and was with the Research Laboratory until early in 1963 when he transferred to Syracuse as Technical Director — Deformable Films for Defense Systems Department. Later in the year he was named Consultant in Thermoplastic Recording for the Electronics Laboratory.

John A. Leermakers has been elected a Vice-President of Eastman Kodak Co. and has been appointed Director of Kodak Research Laboratories. Dr. Leermakers joined the Research Laboratories in Rochester in 1934 after two years at Harvard University as National Research Fellow. From 1934 until 1938 he did research on cellulose acetate dyes, optical sensitizing, the properties of photographic gelatin, and film emulsions. He was appointed supervisor of experimental emulsion making in 1938 and in 1944 he became

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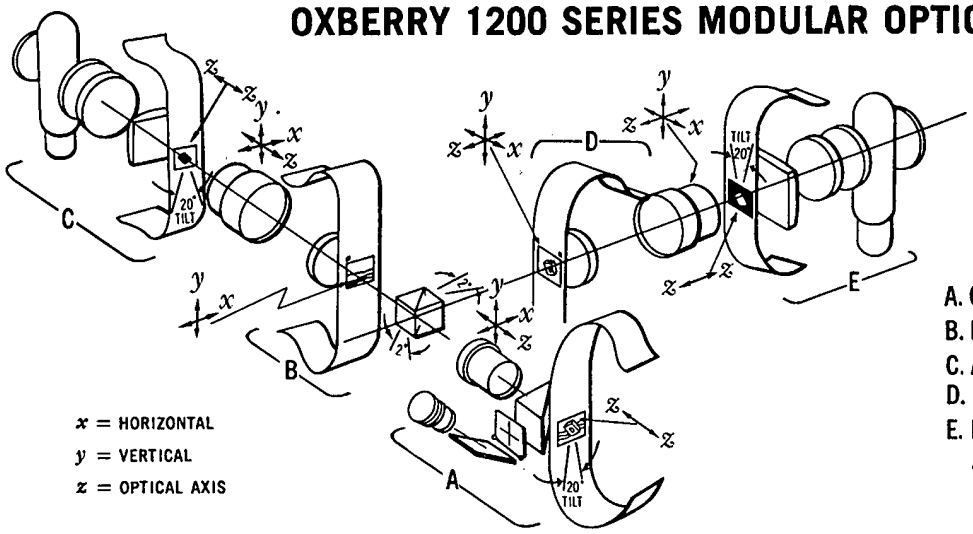

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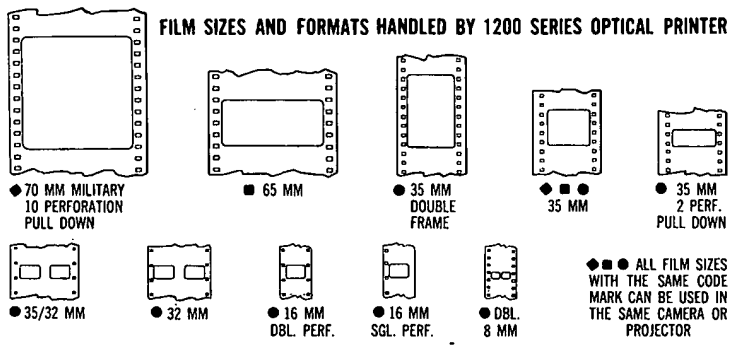

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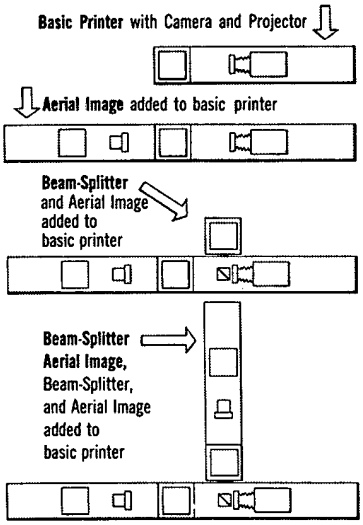

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technical assistant to the Director of the Research Laboratories.

Edwin W. Templin has been appointed Chief Engineer of D. B. Milliken Co. Formerly with Westrex Co. as Chief Engineer, he has been responsible for the design, development, production and application of studio and scientific recording. Much of his recent work has been in miniaturized systems for aerospace applications. In his new post he will head a rapidly expanding engineering program which includes the doubling of the firm's engineering facilities and the tripling of research and development facilities.

James D. McLean, who recently resigned as President and Chairman of the Board of Highway Trailer Industries, Inc., of Chicago, has formed a development firm dealing with general management, product development, marketing and engineering problems in the electronics, aerospace and transportation industries with offices at 760 N. La Cienega Blvd., Los Angeles 69. Mr. McLean has served as President of General Dynamics/Electronics, President of Hoffman Laboratories, Inc., and Vice-President and General Manager of Philco's Government and Industrial Division. He is presently a Director of Struthers Scientific and International Corp. of New York.

Joseph W. Alinsky has been appointed to the newly created post of Manager of Engineering, Video Products, for the GPL Division, General Precision, Inc., Pleasantville, N.Y. He was formerly Manager of Engineering at Thompson Ramo Wooldridge, Dage Division. In his new post Mr. Alinsky will have the responsibility in the technical area of adding to the GPL Precision television line, expanding video and video-related controls for industry, and investigating aerospace television designs using microelectronic techniques.

A. C. Keller, Director, Switching Apparatus Laboratory at Bell Telephone Laboratories in New York, has been elected to the Board of Directors of the Waukesha Motor Co., Waukesha, Wis.

Robert B. Lindemeyer has been appointed Director of Technical Services for Metro-Kalvar, Inc., 550 Fifth Ave., New York. He has been with the firm since September, 1963, and prior to that he was with American Machine and Foundry Co., of Santa Barbara, Calif., where he held a managerial post. He was graduated in 1958 from Iowa State University, where he had held the Joseph Weed Television Scholarship and where he had worked in various capacities with the University's Film Production Unit. Following graduation he taught a course in "Films for TV" at American University in Washington, D.C. He then served as an officer in the U.S. Navy attached to the U.S. Naval Photographic Center in Washington, D.C., where he was first a producer/director and later was appointed Officer-in-Charge of the Television Kinescope Films Production Facility of the Air Force Systems Command, a position he held until 1962.

Two new appointments have been announced by Photoronics Corp., 36-17 Prince St., Flushing 54, N.Y. Richard A. Hayes has been appointed Vice-President of Engineering and H. B. Voorhest of Anaheim, Calif., has been appointed Applications Sales Engineer for the West Coast. Mr. Hayes is a recognized authority in the field of electrooptics. He was formerly with General Dynamics, Fort Worth. Mr. Voorhest was formerly with Perkin-Elmer Corp.

William B. Allen has been appointed Manger of Engineering of the Video and Instrumentation Div. of Ampex Corp., 401 Broadway, Redwood City, Calif. He was formerly Manager of the Electronics Laboratory, Ballistic Missile Div. of Hughes Aircraft Co., Los Angeles. In his new post he is responsible for the development of Ampex magnetic recording equipment for television broadcasting, space exploration, defense, industry and medicine.

N. Donald Ringsred has been elected President of the Alexander Film Co., Colorado Springs, Colo. He has been associated with the firm since 1945. After 12 years in the Colorado Springs office, he moved to Detroit as a sales representative for the firm. For the present he will maintain headquarters in the firm's new

offices in Maple Office Center, Birmingham, Mich. The announcement also stated that the firm planned an expansion of its sales force for added emphasis on such services as the firm's film distribution center and the laboratory.

Three new staff appointments have been announced by Thomas H. Fraser, President of Fraser Productions, San Francisco. Hubert Salisbury has been appointed Manager of the Cinematography Department and Ray Nolan has been appointed Manager of the Editing Department. Bettie Griswold has been appointed Traffic Manager. Mr. Salisbury was formerly associated with the film industry in Great Britain and Mr. Nolan was formerly with the National Film Board of Canada as director, editor and cameraman on various documentary film projects.

James L. Caddigan has been appointed Director of Broadcast Services of the Weather Corp. of America, 611 Olive St., St. Louis, Mo. 63101. Mr. Caddigan's previous posts have included Director of Programing and Production of Du Mont television network and Vice-President of Odyssey Productions. In his present post he will be in charge of liaison between the broadcasting clients and the firm's professional meteorologists.

Film bookings by the American Medical Association during 1963 showed a gain of 16.8% over the previous year, according to a recent report from Ralph Creer, Director of Medical Motion Pictures and Television. This is the 11th consecutive year that the AMA film library has reported increased use of its 400 films. Greatest increase in film bookings was to nursing schools and the next greatest increase was to para-medical schools. Increases in bookings were also reported by medical schools and civilian hospitals.

Films made available without charge by General Motors Corp. to schools, civic groups, churches, service clubs, youth groups and other organizations are listed in a catalog available from General Motors Corp., 1775 Broadway, New York 19. The 1964 film catalog lists 48 16mm sound films which take the audience behind the scenes in industry and cover a variety of other subjects ranging from safety and driver education to sports and the fundamentals of science and mechanics. GM films were shown before 460,000 audiences last year, totaling more than 19 million persons. In addition there were 143 television showings.

The eighth Tiros satellite, launched in December, is equipped with a specially designed television camera to take pictures of cloud cover, storms, and other meteorological events which will be transmitted back to ground stations. The pictures will be recorded by facsimile rather than on film. Although not of the same quality as the film pictures they are expected to provide as much information as is needed for meteorological analysis. The new TV system (known as APT (Automatic Picture Transmission)) has been installed in the new Tiros and APT ground stations have been established at some 50 locations throughout the world, including NASA stations at Washington, D.C.; Wallops Island, Va.; and Fairbanks, Alaska. The new Tiros and its seven predecessors were designed and built by the Radio Corp. of America under the technical direction of the Goddard Space Flight Center of the National Aeronautics and Space Administration. Tiros satellites have been described in papers in the *Journal*, including "A Narrow-Bandwidth Video-Tape Recorder for Use in a Satellite," by Joseph A. Zenel (pp. 818–820, Nov., 1960); "Interpretation of Cloud Pictures From the Tiros Meteorological Satellite," by John H. Conover (pp. 21–25, Jan., 1962); and "Design of Satellite Tape Recorders After Tiros I," by A. D. Burt, S. P. Clurmana nd T. T. Wu (pp. 787–791, Oct., 1963).

Relay II, second in the Relay series of experimental communications satellites designed and built by Radio Corp. of America's Astro-Electronics Division, is a low-altitude active communications satellite, basically the same as its predecessor, Relay I. Certain changes have been incorporated

with the objective of determining the potential longevity of a communications satellite of this type. Changes include an improved solar array; elimination of timer; unpressurized traveling wave tube; improved power circuitry; and desensitized command circuitry.

The 25th anniversary of the introduction of the Arriflex-35 has been recognized by Arriflex Corp. of America, 257 Park Ave. South, New York, N.Y. 10010, by the announcement of a "trade-in celebration." According to the announcement, "any old Arriflex-35" will be worth a "sizable amount of cash," if traded in on a new model. The announcement noted that although there have been numerous important improvements, the exterior design of the camera has remained basically unchanged. As a feature of the anniversary celebration, the person trading in an Arriflex-35 will receive a credit of the original purchase price up to $2,500 on a new model.

Photographic services for the National Aeronautics and Space Administration and Lunar Landing Program will be provided by the Research and Development Division of Technicolor, according to a recent announcement. The firm will provide complete management services for the installation, operation and management of a photographic laboratory to be constructed at the new Launch Operation Center at Merritt Island, Fla.

The Technicolor 8mm Instant Movie Projector will be distributed in Japan by Yashica, Inc., according to an agreement announced by Technicolor Corp. The Japanese firm specializes in the manufacture and distribution of photographic equipment.

Potter's Photographic Applications Co., Mineola, N.Y., has been appointed distributor in the New York Metropolitan area for the Amphicon 190 and 200 television projectors. The projectors, which feature big-screen projection (up to 8 ft wide with the 190 model and up to 15 ft wide with the 200 model), are manufactured by Dalto Electronics Corp., Norwood, N.J. An earlier model, the Amphicon 108, is described in the February, 1961, issue of the *Journal* (p. 139).

The 3M Company has started production at its new magnetic products plant in Camarillo, Calif., according to a recent announcement. The plant covers 125,000 sq ft and is equipped to produce 3M's entire line of audible range, instrumentation and video tapes. The new plant has facilities capable of increasing total production of the division by nearly 50%, the announcement stated.

Red Lake Laboratories, manufacturer of the Hycam High-Speed Motion Picture Camera and other photoinstrumentation equipment, has moved its office and factory from Sunnyvale to 2971 Corvin Dr., Santa Clara, Calif. The new quarters will provide a substantial increase in engineering space, the announcement stated.

Andre Debrie Mfg. Corp., subsidiary of Belock Instrument Corp., 14–29 112 St., College Point, N.Y. 11356, has been appointed exclusive U.S. distributor for Sonocolor of Paris, which manufactures a magnetic striping machine for all sizes of motion-picture film. A recent adaptation of this machine is capable of applying four magnetic stripes simultaneously on the 35/8mm-5R film stock used in the Debrie "quad" printer (*Journal*, p. 917, Nov., 1963).

Evershed Power-Optics Ltd., 214 Harlequin Ave., Brentwood, Middlesex, England, has been appointed exclusive agent in the United Kingdom for equipments manufactured in the United States by Bach Auricon, Inc., according to a recent announcement. It was also announced that existing service facilities for Auricon equipment will be augmented at the firm's new factory in Brentwood.

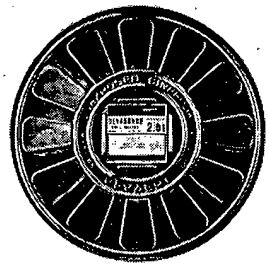
Clifton Precision Products Co., Clifton Heights, Pa., manufacturers of flight control synchronizers, computing resolvers, synchros and subminiature servo motors, has been acquired by Litton Industries, 336 N. Foothill Rd., Beverly Hills, Calif.

SMOOTH...

Two of the most difficult problems in sound recording have been made easier.
Polished Gevasonor Magnetic Film Type 2.01 minimizes dust collection, and lowers wear on sound heads.

The iron oxide surface of Gevasonor Type 2.01 has been especially polished, which guarantees :

1 Closest possible contact between film and sound heads ; improved uniformity of reproductions.
2 Minimum wear on sound heads ; assures consistent quality of high-frequency reproduction.
3 No dust build-up on sound heads ; produces better recording quality.



Gevasonor Magnetic Films :

Type 2.01 : full coated in 16, 17.5 and 35 mm width ;
Type 2.02 : of higher sensitivity than the normal film Type 2.01 (+ 5 decibel) with less distortion (0.5 per cent) ; used for special work ;
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Type 2.11 : 35 mm magnetic film with clear edges.

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In Canada : PHOTO IMPORTING AGENCIES LTD., 345 Adelaide Street, Toronto 2B, Ontario

5197

Publicem

Also announced was the acquisition of Advance Data Systems, a firm which is developing revenue control systems for the transportation, entertainment and distribution industries. Clifton Precision Products will become a division of Litton's Components Group; Advance Data Systems will become a division of Litton's Business Machines Group.

Traid Corp., 17136 Ventura Blvd., Encino, Calif., has been appointed national distributor for Vanguard Motion Analyzers (*Journal*, p. 743, Sept., 1962). Vanguard Analyzers are used in medical research, reduction of oscilloscope data, evaluation of flame, missiles, high-speed mechanisms, vibration, shock and similar work requiring analysis of film.

Zoomar International Inc., Glen Cove, N.Y., has announced an arrangement made with Bell & Howell Co. for the sale of Angenieux lenses thoughout the United States for the Bell & Howell lines of 16mm motion-picture cameras. The lenses include the 12–120 zoom lens, *f*/2.2, with reflex viewfinder as well as fixed focus lenses in "C" mount for the model 70 series cameras.

Purchase of RCA studio equipment at a price of more than $1\frac{1}{4}$ million has been announced by Subscription Television, Inc. The firm is currently establishing a home cable television service in the Los Angeles and San Franciso metropolitan areas. The equipment, to be installed in its studios, is capable of transmitting live, tape or film programing. Transmission, utilizing the new equipment, will be directly to the homes of subscribers with signals carried through cables installed by local telephone companies. Included in the purchase are four TR-22 transistorized TV tape recorders; six TK-26 vidicon color-film camera chains with twelve 35mm and two 16mm projectors and two TS-40, 3-channel video and audio master control switching consoles. All equipment has full color capability.

A display of art, photography, and animation art from the studios of Reid H. Ray Film Industries, 2269 Ford Parkway, Saint Paul 16, Minn., was exhibited during February at the College of St. Thomas. The display included 16 black-and-white photographic enlargements, 14 color transparencies, 30 color art lay-outs, and 8 black-and-white motion-picture art samples. Featured in the display were 8 photodeviations, a recent innovation in photographic processes.

Association Films, Inc., 347 Madison Ave., New York, N.Y. 10017, has acquired an operating interest in Industrial Film Maintenance, a Canadian film service organization located at 135 Peter St., Toronto, Ont., according to an announcement issued jointly by the firms. The new firm will be called Association-Industrial Films. Association Films was founded in 1911 and is one of the largest nontheatrical and TV distributors in the world, the announcement stated. Industrial Film Maintenance is engaged in television commercial film procurement, distribution, syndication, film editing, sponsored motion-picture distribution and TV monitoring services.

Technicolor Corp. has announced purchase of 36,000 sq ft of property adjacent to the Technicolor motion picture plant in Hollywood. The need for additional space is necessitated by continued expansion plans, the announcement stated. The new property will be used mainly for the enlargement of the Engineering Department preparing for the firm's entry into the television processing field.

Four newly appointed distributors for the Technicolor 8mm Instant Movie Projector are Charles Beseler de France, S. A., Paris, for France; Centro Audiovisual, S.A., Madrid, for Spain; Meijlink N.V., Rotterdam, for the Netherlands; and Scan Print AB, Stockholm-Solna, for Sweden, Norway and Finland. Contracts were arranged by Robert Kreiman, General Manager of Technicolor's Commercial and Educational Branch, during a recent European trip.

Mitsui & Co. of Tokyo, Japan, has been appointed exclusive representative in Japan for Prestoseal Manufacturing Corp., 37-12 108 St., Corona 68, N.Y. Prestoseal specializes in the design and manufacture of editing and splicing equipment for motion-picture film, microfilm, magnetic and computer punch tape.

A new audio-visual division, established by Photo-Consultants, 12 E. 37 St., New York, N.Y. 10016, will specialize in the production of films and slidefilms. The new studio and production facilities will be under the direction of Murray Duitz.

The Maier-Hancock Hot Splicer, the professional film splicer distributed by Traid Corp. since 1960, will be sold exclusively through the Maier-Hancock Sales Co., 14106 Ventura Blvd., Sherman Oaks, Calif., a newly formed division of Maier-Hancock Corp., according to a recent announcement. Manager of the new division is Arthur H. Bolt.

Agfa AG., Leverkusen, Germany, and **Gevaert Photo-Producten N.V.,** Mortsel/Antwerp, Belgium, have announced that the industrial activity of the two firms will be combined in a single economic unit and will include the entire industrial activity in the scientific, technical, commercial and financial field. Since formal mergers across the frontiers are not yet legally possible, the economic unit will be realized through the formation of a new Belgian and a new German operating company. Agfa and Gevaert will each hold 50% of the shares of both operating companies. Activities of the two operating companies will begin July 1. In pursuance of the formation of this unit, Agfa will take over several companies of the German photographic industry affiliated to its parent company Farbenfabriken Bayer AG., Leverkusen, in particular Leonar-Werke AG., Hamburg; Mimosa GmbH, Kiel; Chemische Fabrik Vaihingen/Enz GmbH, Vaihingen/Enz; and also the 50% Bayer subsidiary Perutz-Photowerke GmbH, Munich.

Abstracts

Abstracts of papers appearing in other journals, chosen for their importance and timeliness, are published in the *Journal* from time to time. Most of these abstracts are translations, chiefly from the U.S.S.R., and are made available to the *Journal* by the Research Laboratories of the Eastman Kodak Company. As a rule, translations are made of the foreign language abstracts, not of the paper itself. The respective complete original texts can be consulted at some libraries. Current issues of *Tekh. Kino i Telev.* can be consulted at, or borrowed from, the Society's Headquarters Office.

Those requiring definitive and thorough searches of current literature and patents are referred to *ABSTRACTS of Photographic Science & Engineering Literature* (*APSE*), published monthly by the Engineering Index, Inc., 345 East 47 St., New York, N.Y. 10017, with the editorial cooperation of the Society of Photographic Scientists & Engineers.

The subject areas are grouped below:

- Cameras and Equipment (Except High-Speed)
- Cinematography (Underwater)
- Film and Its Properties
- Film Processing (Color)
- General
- High-Speed Photography
- Lamps and Lighting
- Projection
- Sensitometry
- Sound Effects
- Television
- Tests and Measurements

CAMERAS AND EQUIPMENT (Except High-Speed)

Noise and Steadiness in 35mm Motion-Picture Cameras, *Brit. Kinemat., 43:* No. 3, 94–96, Sept., 1963.

At a meeting held on September 11, the Camera, Special Effects, and Processing Committee of the British Film Producers Association discussed noise and steadiness in 35mm motion-picture cameras. The discussion centered around register pin cameras of the Mitchell or Newall type.—R.F.F.

Improvement in the Distribution of Exposure Over the Frame in a Camera With Focal-Plane Shutter (In Russian), N. T. Zakaznov, *Optiko-Mekhanicheskaya Promȳshlennost'*, 46–51, No. 1, 1963; *Tekh. Kino i Televideniya, 7:* 86, Sept. 1963.

The problems of a theoretical basis for improving the distribution of exposure over the frame are discussed. It is concluded that a reduction in the unevenness of exposure over the frame in cameras with focal-plane shutters would have to be brought about by the greatest possible increase in the path of travel of the shutter in combination with the use of a spring drive.—S.C.G.

The Distribution of the Effective Exposure in Photographic Cameras (In Russian), E. T. Dubatovko, *Optiko-Mekhanicheskaya Promȳshlennost'*, 36–45, No. 1, 1963; *Tekh. Kino i Televideniya*, 86, Sept., 1963.

Problems are discussed connected with the distribution of the time of the passage of the light. This quantity is defined as the time during which light passes through a given point of a plane in which the exposing elements (discs, blinds, etc.) move. It is shown that with small dimensions of the cross section of the light beams in the plane of the shutter the distribution of effective exposure is the same as the distribution of the time of passage of the light.—S.C.G.

CINEMATOGRAPHY (Underwater)

Underwater Pinpoint Photography, Harold E. Edgerton, *SPIE Journal, 2:* No. 1, 3–5, Oct./Nov., 1963.

Lowering a camera to a position just above the sea floor is a critical operation. The "pinger" method of camera-to-bottom positioning has proved to be an excellent technique. A sonar transducer on the camera sends one sound signal directly to the surface, and another to the bottom. The bottom signal, reflected from the sea floor, rises to the surface where its delayed arrival time is measured against the camera signal beamed to the surface. An Alden recorder is used to record direct or reflected signals received.

FILM AND ITS PROPERTIES

A 16mm Title for Overlay Printing, R. F. Ebbetts, *Brit. Kinemat., 43:* 69, Aug. 1963.

Fine-grain motion-picture positive film is recommended as a material on which to obtain, by reversal processing, titles with clear letters on a dark ground of density above 3.0.—G.I.P.L.

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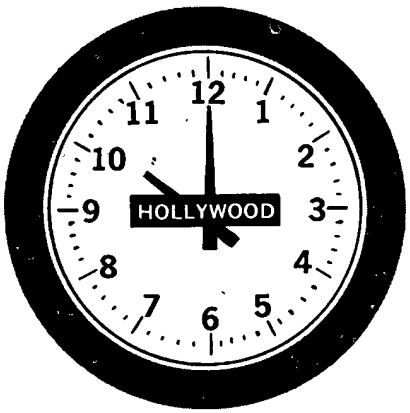

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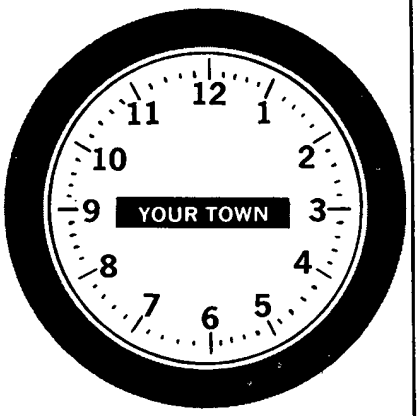

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2-8

FILM PROCESSING (Color)

The Control of a Color Process, C. T. Davies, *Brit. Kinemat., 43:* No. 3, 84–93, Sept., 1963.

Apart from the very necessary ancillary processes of fixing, bleaching, hardening and dye stabilization, the processing of a color film involves the relatively complex chemical reactions necessary for dye formation. Factors subject to direct control in the laboratory may be listed as follows: (1) Temperature of the solutions; (2) Concentration of the reactive chemicals in the solutions; (3) The rate at which the chemicals are replenished; (4) Machine speed, i.e., time of immersion; (5) Relative humidity and temperature of the drying cabinet; (6) Control of printer illumination; and (7) Mechanical control.

GENERAL

Graphite Pore Structure Evaluation by Serial Section Kinematography, J. W. Stammers, *J. Phot. Sci., 11:* 351–354, Nov./Dec. 1963.

The method and techniques employed in the investigation of the pore structure of graphites by serial sectioning combined with cinemicrography are discussed. Some of the simpler problems associated with the working of graphite samples to a good finish and yet with reasonable speed are also reviewed.

Effect of Magnetic Blowing on the Arc Quenching Period in Alternating Current Circuit-Breakers, D. Domonkos, *Periodica Polytechnica—Elektrotechnik, 66:* 125–147, No. 2, 1962.

Magnetic arc blowing plays an important part in a large group of low voltage circuit-breaker switch gear. The induction of the blowing magnet enhances the rate of growth of the voltage across the arc and decreases the back-striking voltage. In the quenching of the arc the back-striking as well as the thermal relations are of importance. The arc can be quenched at very low currents when, after back-striking, the conditions that would maintain it disappear.

With a given blowing magnet the arc duration is expressed by

$$t = AI^{-0.5}$$

Constant A varies almost reciprocally with the number of blowing magnet turns. At critical current the duration of the arc is 3 to 4 times that measured at maximum current density.

HIGH-SPEED PHOTOGRAPHY

Effective Exposure Time in High-Speed Cameras (In Russian), G. I. Belinskaya, *Zhur. Nauch. i Priklad. Fotografii i Kinematografii, 8:* 370–74, No. 5, Sept./Oct., 1963.

Two determinations of effective exposure time in high-speed cameras are considered. One determination, which provides for a time parameter called the "effective exposure time," starts out from the operation of the light shutter, depending only on the optical-mechanical characteristics of the apparatus. In the second determination, a time parameter called the "real exposure time" by the author (more correctly "photographically effective exposure time") is proposed. This parameter depends both on the operation of the shutter and on the properties of the photographic material. The first definition of the time parameter is introduced as the basic characteristic of the shutter, while the second is the characteristic of the combination of shutter and photographic material.

Formulae are derived for determining the photographically effective exposure time by utilizing the whole of the characteristic curve of the material. These formulae are used for setting up nomograms which allow the determination of photographically effective exposure times. Calculated effective exposure times for different shapes of shutter aperture are given.—S.C.G.

LAMPS AND LIGHTING

Working with the Xenon Light Source of the "Sibir'" Motion Picture Projector (In Russian), V. Krivtsun, *Kinomekhanik,* 33–36, Apr., 1963.

The constructional details of the xenon-arc light source of the Sibir' motion-picture projector are discussed. Recommendations are given for the adjustment of the light source and the reflector. A description is given of the power supply.—S.C.G.

for information only,

a new color film:

Declassified and Approved For Release 2013/10/28 : CIA-RDP80T00246A026400180002-8

Elimination of Emulsion "Melting" on 76-mm Film Prints (In Russian), B. Korovkin, *Kinomekhanik*, 32–34, Mar.) 1963.

The increased light flux in two Soviet 16mm projectors has presented problems. The air flow in the film gate is inadequate to prevent evaporation of moisture from the emulsion, which condenses to form drops of hot water which damage the film where they fall on it. The measures which have been taken to overcome this difficulty by redesigning the film gate are described.—S.C.G.

Modern Light Sources for Motion Picture Projection (In Russian), G. Irskiĭ, *Kinomekhanik*, 25–32, Mar.) 1963.

A review is given of modern types of arc lamp, including the xenon arc, and of new types of incandescent lamp with mirror envelopes.—S.C.G.

PROJECTION

Performance of 16mm Portable Sound-and-Picture Cinematograph Projectors, *B.S.I. News*, 27, Dec., 1963.

Specifies certain requirements for 16mm portable cinematograph projectors with optical and/or magnetic sound reproduction, such as are used for audiences up to 200 people. It does not deal with the details of mechanical and electrical design except in so far as these may affect performance or convenience in use. It specifies such requirements, and prescribes such tests, as will ensure a satisfactory picture and sound performance, safety, and film life.

SENSITOMETRY

Practical Motion Picture Sensitometric Control, L. J. Wheeler, *Brit. Kinemat., 43:* 36–51, Aug., 1963.

A simplified method of sensitometric control has been established and tests show that, to obtain consistent results, the following points must be watched: (a) Batch-to-batch variations in developing solution concentration; (b) variation in volume of "unit-packed" developer supply; (c) accurate dilution of the concentrated solution; (d) batch-to-batch variations in photographic speed of the film stock, particularly telerecording Type 8374; (e) exact setting of lamp voltage in the sensitometer; (f) constant checking of the developer temperature in the processing machine; (g) precise adjustment of film loop length in the developing solution; (h) accurate control of processing-machine speed; (i) accurate calibration of the densitometer each time it is used and repeated calibration during long periods of constant use; (j) accurate interpretation of density measurements and careful plotting of these measurements.

Under present conditions and including all operationl tolerances, films nominally processed to a gamma of 0.65 are held within ±0.04, while films nominally processed to a gamma of 1.0 are held within ±0.06.—G.I.P.L.

SOUND EFFECTS

Radiophonics in the BBC, F. C. Brooker, *BBC Engineering Monograph, No. 51:* 5–19, Nov. 1963.

The term "radiophonics" is taken (in the BBC at any rate) to mean the production of sounds from natural or artificial sources to convey the mood of a broadcast program, but not the creation of musical compositions as such. This monograph describes the BBC's Radiophonic Workshop, the type of work which it undertakes, and the equipment used to create the desired sounds. Since the end product is almost invariably a tape recording, much of the equipment is necessarily concerned with the manipulation of tape recordings using fairly standard equipment. However, in order to carry out some of these manipulations, several ancillary pieces of equipment have specially developed and these are described. The electronic gunfire effects generator is also described, although it is not strictly a part of the equipment of the Radiophonic Workshop; it was developed for direct, or "spot," effects in studios some years before the workshop came into being.

TELEVISION

The Calibration of VHF and UHF Field-Strength Meters by Means of a Standard Field Generator, B. J. Spencer. *Marconi Review, 26:* No. 149, 171–181, Second Quarter 1963.

Experience has shown the need for extreme care in the checking and calibration of field-strength meters in order to achieve satisfactory overall accuracy. In general there are two methods of calibration. In one of these the constants of the individual parts of the apparatus are measured, e.g. gain of aerial, feeder attenuation, receiver response, etc. These constants are then lumped together so that the field in which the aerial is immersed can be determined from the receiver response.

The second is known as the "standard field method," in which the aerial is immersed in a known field and the apparatus is calibrated as a whole. The method may be subdivided according to the way in which the field is determined. The field may be measured using a standard aerial and detector, and this may be called "the standard receiver method." Alternatively the field may be determined from the path geometry and measured ground constants, using a standard transmitter. This is the "standard generator method," which is described.

If independent level standards are employed in calibrating a field-strength meter by standard field and step-by-step methods, and the results agree, considerable reliance can be placed upon the instrument.

Determination of the Power Radiated From a Long-Wave Aerial by Field-Strength Measurement, G. Millington and B. J. Spencer, *Marconi Review, 26:* No. 149, 132–143, Second Quarter 1963.

At low frequencies for which an aerial structure may be only a small fraction of a

The old-fashioned "mix-and-mess" of bulk chemicals can go right in the ash can. Hunt research brings you a totally new concept for processing B & W cine reversal film, **CINE LIQUID CONCENTRATES.** A complete all liquid system for reversal processing, it takes the guesswork out of "mix-it-yourself" chemistry and does away with the waste of bulk chemical inventories. The Cine Liquid system includes ■ **Cine Liquid 1, Reversal First Developer,** ■ **Cine Liquid 2, Reversal Bleach Solution,** ■ **Cine Liquid 3, Reversal Clearing Solution,** ■ **Cine Liquid 4, Reversal Redeveloper.** At last the problem of developer degradation has been overcome through the exclusive Hunt patented Developer Activator*. By simply adding the Hunt Developer Activator* to Cine Liquid 1 (First Developer) or Cine Liquid 4 (Redeveloper), the user is guaranteed a ready-to-use factory-fresh solution regardless of how long the concentrate has remained in inventory. When using Cine Liquid Concentrates, you'll find them in easy-to-handle 5-gallon Cubitainers, each of which produces 20 gallons of consistent working reversal chemicals. Insure a successful finish to the processing cycle by using Flash-O-Graph®, the perfect companion fixer for this system. For more detailed information write for Photographic Information Bulletin No. 11.

*U.S. Patent 3038801—Foreign Patents Pending

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wavelength in height the radiation resistance may be small compared with the loss resistance comprising the conductor and earth resistances. It is then difficult to find the radiated power accurately from measurements of the input power and terminal impedances. If the field set up at a distant point is seriously below the value assumed in designing the transmitter and aerial system, it is difficult to know whether the discrepancy is due to a poor estimate of the radiated power required, or to uncertainties in deducing the radiated power from measurements made at the transmitter. This article deals with the measurement of the actual radiated power by a field-strength survey in a region around the transmitter using a specially designed transitorized measuring set under conditions where simple Hertzian dipole theory for a plane perfectly conducting earth can be applied.

The Plane of Polarization as a Factor in VHF and UHF Broadcasting, M. W. Gough, *Marconi Review, 26:* No. 149, 117–131, Second Quarter 1963.

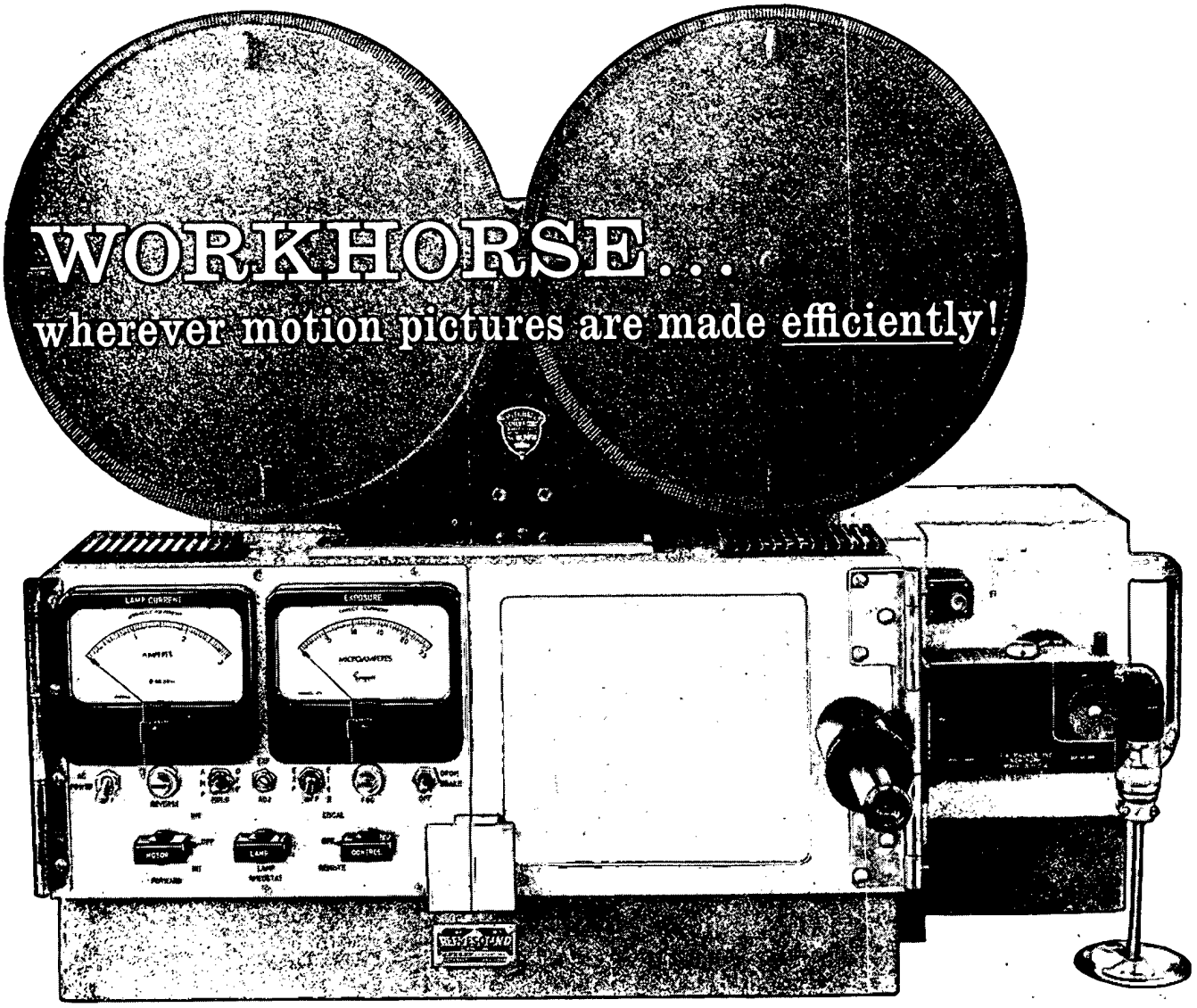
The prevailing preference for the use of horizontal polarization in the vhf and uhf bands both in broadcasting systems and in point-to-point links has prompted a critical appraisal of the consequences of this policy from the propagation viewpoint. Attention is focused on those regions within the visual range where destructive interference between direct and surface-reflected waves may cause deep nulls wherein the field-strength is much below the desirable "free space" value. Consideration of representative frequencies in the broadcast bands I-V inclusive shows that the use of vertical polarization—rather than horizontal—can confer a substantial increase in field-strength in the nulls (particularly for oversea paths), under practical conditions.

Long-Range Interference in Band III, C. E. Parkinson, *Marconi Review, 26:* No. 149, 107–116, Second Quarter 1963.

An analysis of field-strength measurements, recorded in Hereford, of Mendlesham and Chillerton Down I.T.A. transmissions is given, as a means of assessing the probable levels of co-channel interference which would be experienced by an ancillary television station broadcasting in Channel 11. The results are compared with those from similar surveys which have been summarized in C.C.I.R. Document 64. The correlation between the incidence of high signal levels and anticyclonic weather conditions is demonstrated.

Vertical Aperture Correction Using Continuously Variable Ultrasonic Delay Lines, *BBC Engineering Div. Monograph,* No. 47; May, 1963.

Part I of this monograph describes the principle of operation, construction, and calibration of a simple vertical aperture corrector which has been made possible by the use of ultrasonic delay lines. The performance of this aperture corrector and some of the problems involved in the design of an operational version are discussed. The method of calibration is based on a 'Calibration Factor' obtained



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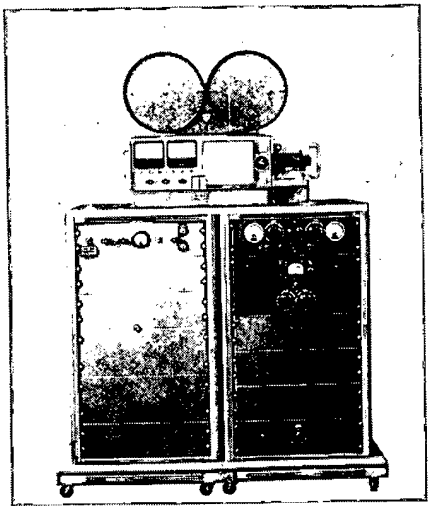

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by a simple and convenient pulse procedure. It is shown that the steady-state amplitude/frequency characteristic, and also the effect of the aperture corrector on signal-to-noise ratio, can be determined from this factor.

In Part II the construction and characteristics of an ultrasonic delay line using mercury as the transmission medium are discussed in some detail, and an experimental variable delay unit suitable for a 405-line television system is described. There is an account of the difficulties encountered in constructing the video delay unit and some indication is given as to the possibility of extending the use of the line to television systems requiring a higher video bandwidth. In addition to its use in the vertical aperture corrector, such a unit may have other television applications.

Radio-Wave Propagation and the Planning of VHF and UHF Sound and Television Services, G. A. Vickers, *The Marconi Review, 26:* No. 149, 55–92, Second Quarter 1963.

The importance of the detailed planning of vhf and uhf sound and television services if the desired service area is to be achieved within the limited number of available frequency channels and without causing undue co-channel interference is stressed. After a summary of the chief features of radio-wave propagation in these broadcast bands, the field strength requirements for satisfactory reception are reviewed and the relative performance in the three television bands is contrasted.

Since the planning requires a knowledge of the relationship between the radiated power and the field strength at each receiving locality, the various available methods of establishing this relationship are discussed, with special reference to the theoretical or "paper" method used extensively by the Marconi Company. A description is given of the estimation of co-channel interference levels and the preparation of predicted coverage maps, and the article ends with a review of some of the many practical aspects of the planning, including the selection of transmitting sites.

Field-Strength Surveys of VHF and UHF Broadcast and Television Service Areas, G. A. Isted, *Marconi Review, 26:* No. 149, 93–106, Second Quarter 1963.

Notwithstanding the high degree of accuracy attained by prediction techniques in determining the probable performance of vhf and uhf television and broadcast services, practical measurements of field-strength still have most important functions to perform. This article describes principally the techniques used for final measurement surveys; this is followed by a discussion of pilot surveys with the aid of a balloon. The apparatus used for mobile and fixed long-term surveys is described, and some discussion is devoted to calibration, maintenance and automatic recording. The effect of fading signals on the measurements is also discussed, and means are described to meet the problem. The reporting procedure is an important feature of a practical survey, and this is dealt with in the article.

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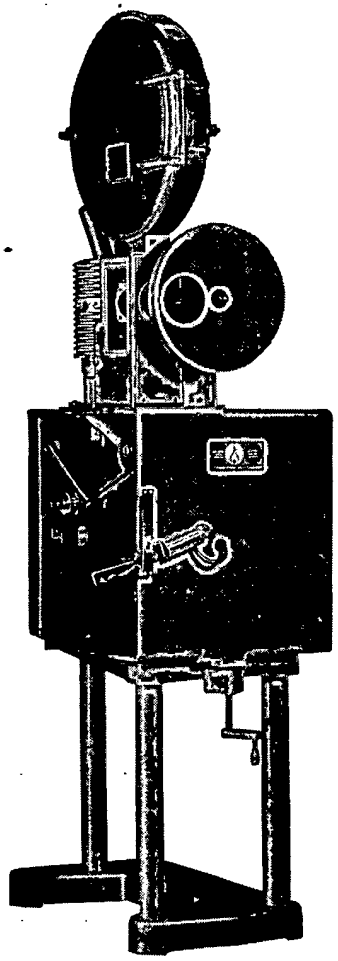
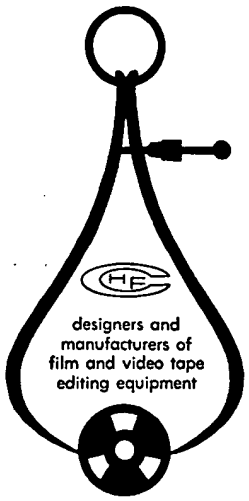
4. A start-stop lever controls the power to the lamp and motor.
5. The magazine and take up core takes up to 3,000 ft. of film.
6. Upper guide rollers are made to handle the film from either direction of the feed reel.
7. A free wheeling take off flange is provided in the magazine.
8. A lamp near the takeup reel permits hand inspection of the film prior to takeup.

NOUVEAU

Le projecteur contient un obturateur Simplex anterieur transformé avec deux clavettes intermittent. Les films de 16mm ou 35/32 tournent avec une vitesse de 144 pieds à la minute, tandis que les films de 35mm tournent avec une vitesse de 165 pieds á la minute.

1. Le regulateur de voltage d'intensité d'eclairage.
2. La lampe de 500 watt est nécessaire pour les films de 16mm, et de 1000 watt, pour les films de 35mm (un ventilateur est mise pour rafraichir la chambre de la lampe).
3. L'objectif de 2½ est instalé.
4. La manette de mise en marche et d'arret controle en meme temps la lampe et le moteur.
5. La boite de films avec noyau peut contenir 3000 pieds du films.
6. La roue supérieure est construite de manière de recevoir le film dans les deux directions, nourrie par la bobine centrale.
7. Une roue est instalée pour libérer rapidement le film de la boite.
8. La lampe se trouve pres de la bobine recepteuse, et donne toute facilité pour inspecter le film a main dans le projecteur.





NUOVO

Questi proiettori sono Simplex transformati, otturatore al fronte, meccanismo di scatto di due punte. La velocitá di proiezione in 16 o 35/32mm e di 144 piedi per minuto, e in 35mm, di 165 piedi per minuto.

1. Controllo manuale della luminositá della lampada.
2. Lampada di 500 watt per 16mm e di 1000 watt per 35mm.
3. Obbiettivo di proiezione di 2½".
4. Maniglia per controllo di motore e lampada di proiezione.
5. La cassetta porta pellicola puo contenere 3000 piedi.
6. I rulli superiori di guida sono construiti per operare con film provenente di ambi lati della bobina svolgitrice.
7. Disco con montatura sporgente nel magazzino.
8. Una lampadina illumina la bobina avvolgitrice, permettendo l'ispezione manuale del film prima che si avvolga nel proiettore.

NUEVO

Esta máquina es un proyector simplex convertido, obturador al frente y movimiento intermitente a doble grifa. Para 16mm o 35/32mm, la velocidad fija de proyección es de 144 pies por minuto, para 35mm es de 165 pies por minuto.

1. Un reostato controla la intensidad de la lampara de proyección.
2. Para 16mm se usa una lampara de 500 watt, y una de 1000 watt para 35mm (un chorro de aire ventila las lámparas en ambos casos).
3. Cada unidad está provista de un lente de proyección de 2 pulgadas y media.
4. Una palanca de control opera el motor y la lampara simultáneamente.
5. Capacidad de proyección: rollos de hasta 3000'.
6. Los rodillos de guía superiores operan con la película en ambas direcciones.
7. La tapa de la bobina de carga es desenroscable.
8. Una lámpara ubicada junto a la bobina de toma permite la inspección manual de la película antes que se rebobine en la bobina superior del proyector.

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TESTS AND MEASUREMENTS

Apparatus for Measurement of Non-Linear Distortion as a Continuous Function of Frequency, H. D. Harwood, *BBC Engineering Div. Monograph,* No. 49, July 1963.

Measurements of the non-linear distortion products generated by a system, such as a loudspeaker, which has more than one degree of freedom must be made as a continuous function of frequency if a true assessment of the distortion is to be obtained. Various methods of performing such measurements are reviewed and the limitations are indicated. A description is then given of a new system by which the individual harmonic and intermodulation distortion products can be measured as a continuous function of frequency. In addition the working principles are described of a new type of stroboscope which is capable of operating at constant illumination up to unusually high repetition rates; this device is suitable for examining vibrating systems for resonance modes which may give rise to distortion through excessive amplitude.

Details are given of the circuits employed and the performance obtained from an equipment constructed on these principles, and the results of some measurements are shown.

current literature

The Editors present for convenient reference a list of articles dealing with subjects cognate to motion-picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

Bild und Ton vol. 16, no. 9, Sept. 1963

Über die Herstellung duplikationsfähiger Original-Bild-Negative (The Manufacture of Master Negatives for Duplicating) (p. 274) *Hilmar Mehnert*

British Kinematography vol. 43, no. 1, Jan. 1963

The Production of Television Test Charts (p. 4) *L. J. van Rooyen* and *G. D. Shevel*

Film Technikum vol. 14, no. 8, Aug. 1963

Vorbereitungen für ein europäisches Farbfernsehsystem (Preparations for a European Color TV System) (p. 260) *H. F. K.*

Rückprojektionsanlage für Film und Fernsehen der Kamera- und Kinowerke Dresden (Back Projection Unit for Film and Television of the Camera and Kino Factory, Dresden) (p. 262) *Gerhard Pierschel*

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Switching Time in Diodes and Transistors (p. 89) *S. Tanaka* and *K. Katori*

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Compensation of Beam Landing Errors for the Shadow-Mask Type Color Picture Tube (p. 74) *Takemaro Sakurai, Koro Shushido, Jihei Nakagawa, Kihachiro Koizumi* and *Eiichi Yamazaki*

Tech. Jour. Japan Broadcasting Corp. vol. 15, no. 11

A Miniature Television Camera for Interview Use (p. 1) *Y. Fujimura, K. Suzuki* and *T. Hirashima*

Temperature Rise Tests of UHF Transmission Lines (p. 41) *K. Endo* and *K. Takewaki*

International Projectionist vol. 38, no. 8, Aug. 1963

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Jour. Brit. IRE vol. 26, no. 2, Aug. 1963

A Frequency Meter With Continuous Digital Presentation (p. 109) *P. Wood*

On the Measurement and Interpretation of Nonlinearity in a Television System (p. 141) *J. B. Potter*

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Direct Wide-Band Phase Shifters (p. 227) *P. V. Indiresan*

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Anode Aperture Effects on the Performance o Electron Gun (p. 23) *Jun Nishida, Hiroshi Hamada* and *Masazumi Terada*

An Analysis of Signal-to-Noise Characteristics of an FM System by Means of a Discontinuous Model of the Modulating Signal (p. 38) *Akima*

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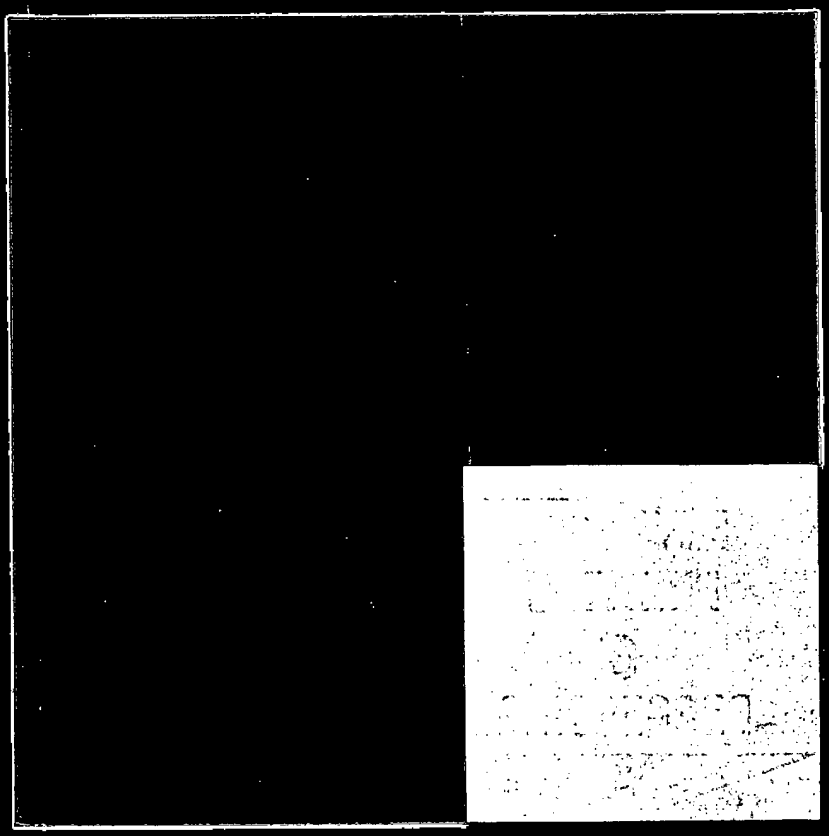

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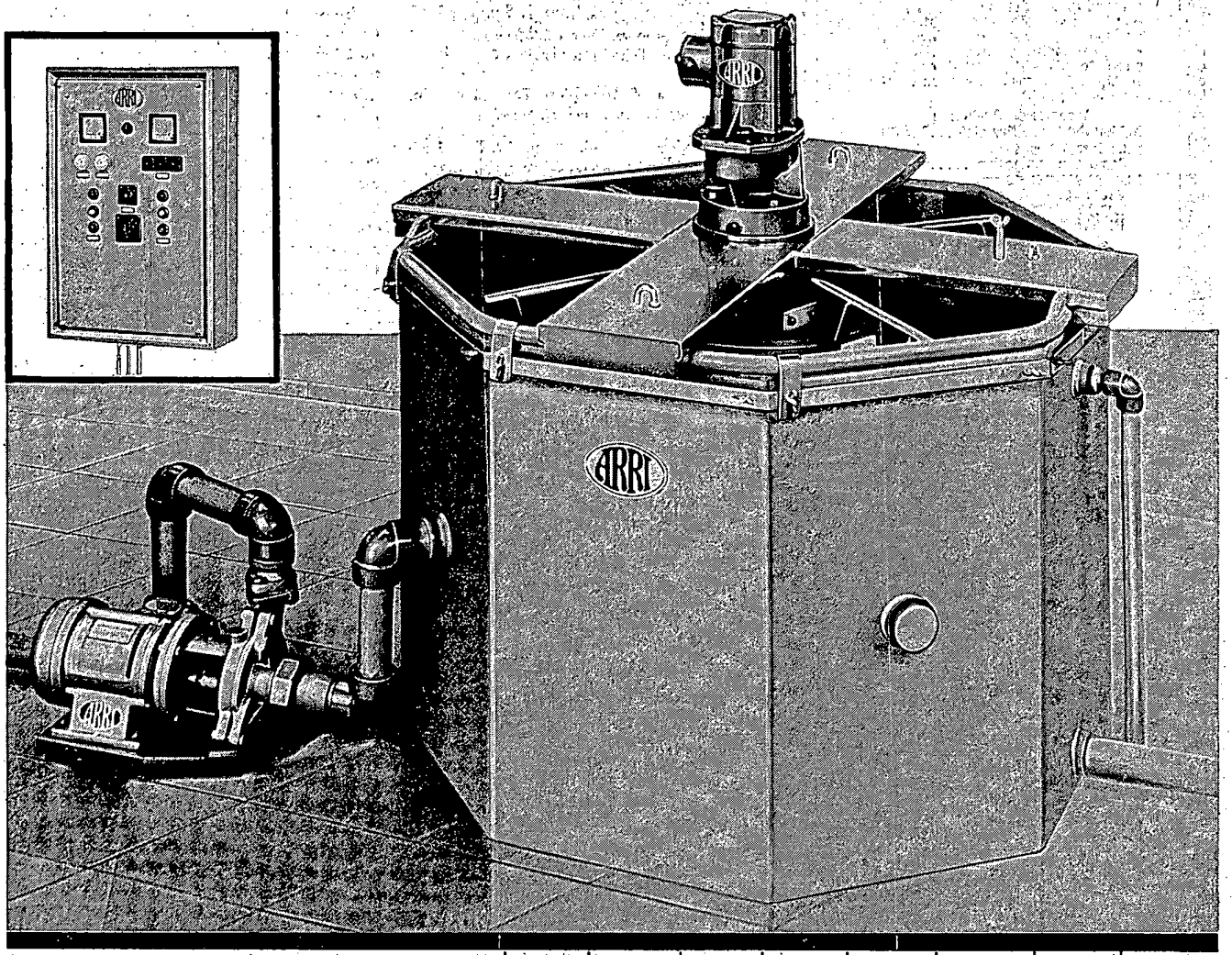

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50	50	2	21¾" 21¾"	27½" 15¾"	2943 sq. in.	13 sq. ft.	500 liters
100	100	2	25½" 25½"	35⅜" 21⅝"	4586 sq. in.	22 sq. ft.	1,000 liters

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Toshiba Direct Viewing Storage Tube (p. 1431)

Books, Booklets, Brochures

The BBC Handbook 1964 is an extremely attractive paperbound book containing a great deal of information on television in general, as well as BBC in particular. It is profusely and imaginatively illustrated, mostly with photographs from BBC programs. As an example of the diversity of material in musical programs alone, a photograph of Leopold Stokowski rehearsing the BBC Symphony Orchestra is backed by a photograph of the Beatles at the time they were presented at the BBC Light Programme at the Royal Albert Hall. In addition to updating historical and statistical material contained in previous Handbooks, the 256-page 1964 Handbook contains considerable new material conveniently arranged and indexed. The book is divided into six sections: Television, Radio, Programme Services and the Public, The External Services, Engineering, and Reference (130 pp. — Constitution, Council, Committees, Contracts, . . . Index). Following the Foreword, by Sir Arthur fforde, BBC Chairman, are brief, informative discussions by BBC officials including "Strait-Jackets Are No Longer Being Worn," by Kenneth Adam, Director of Television; "Engineering of the New Network," by F. C. McLean, Director of Engineering; "Radio's Role in 1964," by Frank Gillard, Director of Sound Broadcasting; and "The Changing World of Politics and Broadcasting," by Sir Beresford Clark. BBC representative in New York is J. Aistrop, British Broadcasting Corp., 630 Fifth Ave., New York 20. The handbook is priced at 6 shillings ($1.00 in the United States).

The 1963 Statistical Abstract of the United States (84th annual ed.) is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at a price of $3.75. The 1,036-page volume summarizes statistics on the social, political and economic organization of the United States. A publication of the Department of Commerce, Bureau of the Census, it was prepared under the direction of Edwin D. Goldfield, Chief, Statistical Reports Division. The book is designed to serve as a convenient volume for statistical reference and as a guide to other statistical publications and sources. It contains 1,262 tables. Table 1,178 (p. 844) gives statistics for motion-picture theaters on establishments, receipts, payrolls, and employees of regular theaters, by States, for 1954 and 1958.

Sources of Information on Educational Media is a 30-page booklet prepared by John A. Moldstad of Indiana University for the Educational Media Council in cooperation with the Office of Education of the U.S. Department of Health, Education and Welfare. It is available from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, at a price of 20 cents.

The booklet contains published lists of new educational material, bibliographies and information about equipment, organizations (key professional organizations concerned with new educational media), graduate programs, and locations to visit. Under the heading of "Locations to Visit" are included selected listings of new media programs by geographical area.

A 4-page illustrated folder prepared by Geo. W. Colburn Laboratory, Inc., 164 N. Wacker Dr., Chicago 6, shows in graphic detail how to mark 16mm work prints and originals and how to prepare leaders and set up original 16mm A & B rolls. The illustrations and accompanying text are presented in clear and understandable fashion useful for reference as well as a guide to procedure.

The Educational Media Index is scheduled for publication in April, according to an announcement from the Educational Media Council, 250 W. 57 St., New York, N.Y. 10019, and McGraw-Hill Book Company, 330 W. 42 St., New York 36. A multi-volume directory of materials (other than standard printed matter) currently available for educational use in the United States, the Index will list such items as films and kinescopes; filmstrips, slides, and transparencies; programed instruction materials; videotapes; phonodiscs and phonotapes and other materials.

McGraw-Hill is now completing compilation of the *Index* for the Educational Media Council under a contract with the U.S. Office of Education. Present planning includes regular revision and supplementation of the Index. A specially designed electromechanical system is used to provide for flexible publication and special research and information services based on the bibliographic data used in publishing the directory.

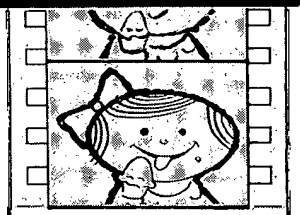
Developing Human Resources for Educational Television: Report of a Survey of Educational Television Personnel has been prepared by the National Association of Educational Broadcasters, Du Pont Circle Bldg., Washington 65, D.C., in co-

ANDRÉ DEBRIE TIPRO RA OPTICAL PRINTER

CONTACT 16

DOES ALL 4

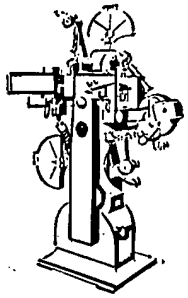
CONTACT 35



Of the many ingenious Andre Debrie motion picture printers made, perhaps the most versatile is the TIPRO RA (*Reduction* and *Aggrandissement* or blowup) Optical Printer.

Four modes of operation are available in a single machine—REDUCTION from 35mm original to 16mm print . . . BLOWUP from 16mm original to 35mm print . . . CONTACT 16 . . . and CONTACT 35.

Designed for the finest quality black and white printing, the TIPRO RA may be equipped with light changes by resistance actuated by notches in the original film or by pilot band. Register pins on both channels guarantee the ultimate in picture steadiness which is especially important for making quality dupe negatives.



Fine print quality—the result of careful engineering and precision manufacturing—is a traditional hallmark of André Debrie film printing equipment. Such quality has its ultimate payoff in your customer's satisfaction with your production.

Truly the most versatile line of cine printing equipment, André Debrie printers are made to fit your specific needs. Black and white or color, 35, 16 or 8 mm output on single or multiple strands, contact or optical—these are some of the many options available. Others include wet gate printing, automatic fading device and several methods of light changes. Regardless of the options you select, quality is assured by Debrie's "stop and shoot" or "step" method of printing.

Designing and making motion picture film equipment is our only business and has been for many years. We can build it better and more economically than your own laboratory or engineering department. Whatever your particular equipment requirement, you owe it to yourself to check André Debrie film printing equipment first. We will be glad to supply full information upon request.

ad

ANDRÉ DEBRIE OF NEW YORK

College Point 56, New York · Hickory 5-4200

A DIVISION OF BELOCK INSTRUMENT CORP.

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operation with the U.S. Office of Education. Findings of the survey are presented in a 46-page report. Project Director was Vernon Bronson and Associate Director was James Fellows. Mr. Bronson is Director and Mr. Fellows is Assistant Director of the Office of Research and Development, NAEB. The report concludes that, "The need to develop a professionally effective curriculum for television specialists and television users is intimately related to the urgent need for revision of teacher education curricula and communication media curricula."

Instructional Television at the University of Akron, published in the June 1963 issue of *Broadcast News*, has been reprinted as a 12-page illustrated brochure and is available from L. V. Hollweck, Editor, RCA Educational TV News, Broadcast Marketing Dept., RCA Educational Electronics, Camden 2, N.J. Authors K. F. Sibla and W. Mavrides present a detailed description of the University's television system and how it works as an educational medium. Mr. Sibla is Head of the Department of Electrical Engineering and Mr. Mavrides is Director of Television of the University of Akron.

Readings in Public Communications: A Bibliography for Candidates for the Master of Science Degree in Television and Radio has been compiled and edited by A. W. Bluem. It is available upon request from Syracuse University, TV-Radio Center, Syracuse, N.Y. The bibliography is intended to "draw upon the literature, arising out of many disciplines, which bears upon the nature of man in a society of which public communications are an important aspect."

Instructional Television Materials: A Guide to Films, Kinescopes and Videotapes Available for Televised Use, 3rd Ed., has been announced by Northeastern Regional Instructional Television Library, Eastern Educational Network, 238 Main St., Cambridge 42, Mass. The guide lists 324 courses available from distributors. Although some are appropriate for more than one educational level, 157 are intended for elementary use, 62 for secondary, 52 for college, 43 for adult education, and 10 for in-service education. Four courses are distributed by Instructional Television Libraries: *Accent on Music, Exploring Nature, Patterns in Mathematics*, and *Primary Concepts in Science.*

The British National Film Catalog, published by British National Film Catalog Ltd., 55a Welbeck St., London, W.1, England, is issued six times a year. British film productions, including educational, scientific, cultural, industrial, and entertainment films, are listed together with brief synopses and credits. The subscription price of $17.64 includes, in addition to the six bi-monthly issues, an annual cumulative volume.

The Educational Film Library Association, 250 W. 57 St., New York, N.Y. 10019, has announced the availability of the five booklets listing all productions nominated

for screening at its American Film Festival in the years 1959–63 bound together in a special binder for convenience as a reference unit. The unit is priced at $5.00. Included in each listing is basic information about the film or filmstrip, a brief description of its content, and the name and address of the source from which it may be purchased, rented, or borrowed.

More than 2,000 government films are listed and described in catalogs available from Norwood Films, 926 New Jersey Ave., N.W., Washington 1, D.C. Currently available are the 1962–63 General Catalog, together with supplements issued April, 1963, and September, 1963. Also available is a 1962–63 catalog of films on medicine and allied sciences for professional use. All of the films are for sale, although some of them can be sold only to authorized groups. The firm also maintains a list of films available for rental.

The 1964 Educational Filmstrip Catalog published by the Society for Visual Education, Inc., 1345 Diversey Parkway, Chicago, Ill. 60614, is available to teachers and administrators without charge. The catalog lists more than 1,600 filmstrips, including about 100 new titles, and also lists other instructional material and audio-visual aids. Subject material covers all grade levels, from primary through high-school. Most of the filmstrips are in color and many have narrations on accompanying records. SVE is a subsidiary of General Precision Equipment Corp.

A 22-page illustrated booklet describing the company's organization and activities is available from Cinerama Camera Corp., 11930 W. Olympic Blvd., Los Angeles 64. Among other activities, the firm, a subsidiary of Cinerama, Inc., is engaged in research and development in the field of advanced photoinstrumentation for industry and space exploration.

The Videotape Minicruiser, a mobile television studio contained in a Studebaker station wagon, is illustrated and described in a four-page brochure available from Ampex Corp., Mail Stop 6-1, 401 Broadway, Redwood City, Calif. Features of the Minicruiser are described along with its key component, the VR-660 broadcast Videotape television recorder.

Quartz iodine lamps for professional use, operating directly from 120-v, a-c or d-c are illustrated and described in a catalog available from ColorTran Industries, 630 S. Flower St., Burbank, Calif. In addition to a full listing of the firm's quartz iodine lamps, the catalog also contains information on MiniDyne and ColorDyne electronic lighting control systems.

The Winston Automatic Gain Control Amplifier is illustrated and described in a four-page brochure available from Fairchild Winston Research Corp., 6711 South Sepulveda Blvd., Los Angeles 45. The unit, which is designed to work with TV, facsimile, audio, sinusoidal, or pulse type data, is thoroughly explained with block diagrams, frequency response curve

charts, and charts covering its compression characteristics.

The use of linear ball bearings to overcome frictional and other problems, thus increasing the accuracy of manual and numerically controlled machine tools, is described in detail in a 6-page technical report available from Thomson Industries, Inc., Manhasset, L.I., N.Y. The report, by H. R. Havemeyer, is reprinted from the May, 1963, issue of the *Tool and Manufacturing Engineer*.

The EMT 140 Reverberation Unit is illustrated and described in an 8-page brochure available from Gotham Audio Corp., 2 W. 46 St., New York, N.Y. 10036. The unit is a device for creating artificial reverberation. Besides reproducing acoustically rooms of various sizes it is said to have the ability to increase the apparent distance between sound source and microphone.

The B&K Sound Level Meter, Model 2203, and Octave Band Filter Set, Model 1613, are described in a 12-page illustrated brochure available from B&K Instruments, Inc., 3044 W. 106 St., Cleveland 11, Ohio. In combination, the instruments are used for sound, noise or vibration measurements and analysis, such as traffic and industrial noise, noise in buildings, sound distribution in theaters, product noise investigations, and noise law enforcement.

Processing and printing units are described in leaflets available from Uhler Cine Machine Co., 15762 Wyoming Ave., Detroit 38. Illustrated and described are various equipments including a combination continuous printer for 16mm film, a printer (professional combination 16mm and 8mm contact); a 35 – 16mm optical reduction and enlarging printer; optical printer (16 to 8mm and 8 to 16mm); cine printer (color or black-and-white); and processing units, 16 and 8mm, for sound or silent films.

The General Radio Experimenter, published by the General Radio Co., West Concord, Mass, in the September/October 1963 issue describes a new sound and vibration analyzer (Type 1564-A) designed primarily for the frequency analysis of acoustic spectra having components in the frequency range between 2.5 cps and 25 kc. Copies are available upon request from the film.

Computers in Control is an 8-page brochure available from Manager, Marketing Services, TRW Computer Division, Industrial Computers, 8433 Fallbrook Ave., Canoga Park, Calif. Applications of TRW industrial control computers are described. The computers are used in various areas of industry, including chemical, electric power, television, missiles and others.

The Hycam 16mm high-speed camera, Model K1001, is illustrated and described in a four-page folder available from Red Lake Laboratories, 2971 Corvin Dr., Santa Clara 2, Calif. The camera is said to be capable of a speed of 10 to 8,500 pictures/sec. An earlier Hycam is illustrated and described in the November, 1962, issue of the *Journal* (p. 896).

A 148-page illustrated catalogue (No. 663-A) available from Burke & James, Inc., 321 S. Wabash Ave., Chicago, Ill. 60604, lists more than 10,000 items of photographic and instrumentation equipment. Illustrated and described are such equipments as professional cameras, enlargers, laboratory equipment, lenses, laboratory cameras, thin-film optics, process cameras, apochromatic lenses, vacuum printing equipment, and a wide variety of related equipment.

Camera drives and projection equipments are among the items described in a bulletin available from Lafayette Instrument Co., P.O. Box 57, Lafayette, Ind. Also described are time, memo and animation equipments.

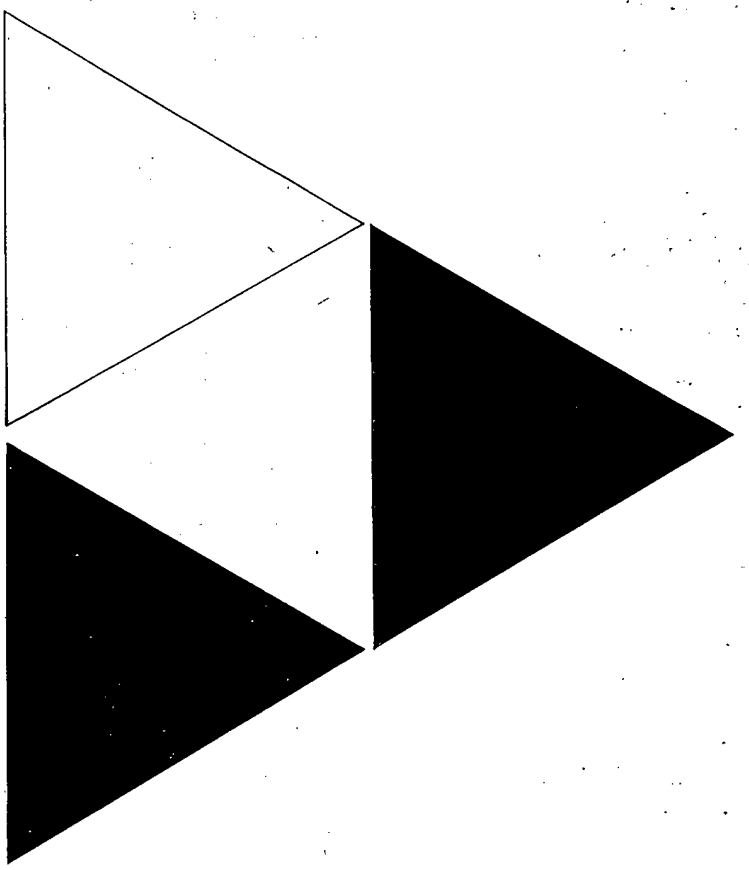
A 10-page selected bibliography on instructional television is available upon request from Ampex Corp., Video/Instrumentation Div., 401 Broadway, Redwood City, Calif. 94063. More than 70 books, reports and other publications are included in the bibliography, which was compiled for Ampex by Richard H. Dewey of the Instructional Television Center, San Jose State College, San Jose, Calif.

Analyzing instruments are illustrated and described in a short form catalog (#863) available from Allison Laboratories, Inc., 11301 E. Ocean Ave., P.O. Box 515, La Habra, Calif. The catalog lists prices and gives general information on the various items. Instruments include continuously variable passive filters, equalizers, analyzers, random noise sources, multiple oscillators and other instruments for making tests and measurements.

Recording storage tubes, their operation and application, are described in a 20-page illustrated booklet, "The Image Instruments Electrostore: A System for Image Storage and Processing With the Recording Storage Tube," available from Image Instruments, Inc., 2300 Washington St., Newton Lower Falls, Mass. The booklet describes in detail new ideas for scan conversion techniques in military, industrial, and aerospace applications.

A pocket guide, used to determine the size of the area telecast with any image-orthicon camera lens, operating at any distance from 3 ft to 1,000 ft, is available from Television Zoomar Co., 500 Fifth Ave., Suite 5520, New York 36. The Hyper-Universal Zoomar Lens and the Angenieux-Zoomar, Model 10-2-1 B are illustrated and described on the back of the pocket guide.

A Note on Basic Statistical Concepts, Application Bulletin Number 101, is a leaflet available from Elgenco, Inc., 1231 Colorado Ave., Santa Monica, Calif. The purpose of the bulletin is to disseminate information on the application of low-



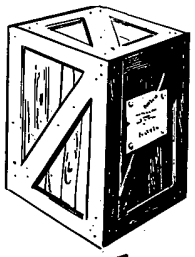
frequency and audio-frequency noise in the solution of engineering problems. Areas covered include definition and interpretation of probability density, probability distribution, ensemble average, time average, ergodic process, variance, standard deviation, normal or Gaussian function, autocorrelation function, spectral density and the concept of white noise.

Special lenses for use in such fields as aerospace, aerial mapping, aerial reconnaissance and photominiaturization are described in seven technical data sheets available from C. P. Goerz American Optical Co., 461 Doughty Blvd., Inwood 96, L.I., N.Y. The information includes suggested applications, resolution values, distortion, mechanical configurations and cutaway design drawings.

A detailed description of the new FCC-approved economical 2,500 mc closed-circuit service for instructional TV is available upon request from Industrial Products Div., Adler Electronics, Inc., 1 LeFevre Lane, New Rochelle, N.Y.

Futura projection arc lamps are illustrated and described in a leaflet available upon request from Strong Electric Corp., 79 City Park Ave., Toledo, Ohio 43601. The lamps are designed to meet requirements of 35mm and 70mm projectors and can be changed from one film width to another by turning a knob.

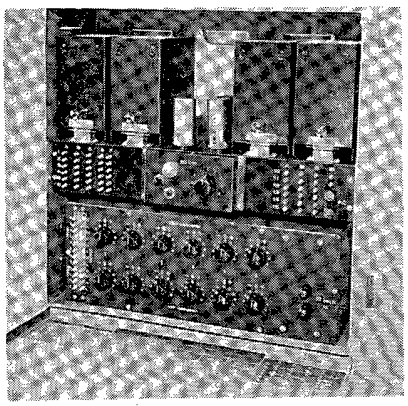
Oscilloscopes and cameras are described in a short-form catalog available from Scientific Instrument Dept., Du Mont Laboratories, Divisions of Fairchild Camera and Instrument Corp., Clifton, N.J. Oscilloscopes, oscilloscope record cameras, pulse generators, probes and accessories are illustrated and described. Specifications are included on current instruments including the new transistorized high-frequency 765 series together with plug-ins.



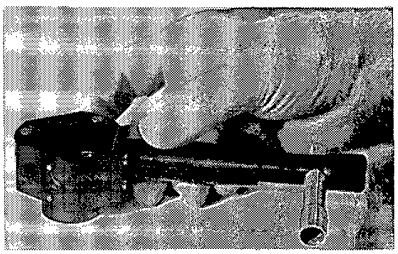
new products (and developments)

Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products or services.

Erratum: The producer of the Woodruff/Albert 35AV1 All-Format Automatic Camera (p. 73, January, 1964, *Journal*) is Woodruff/Albert Camera & Instrument Corp., 141 West 42 St., New York, N.Y. 10036. This information was inadvertently omitted.



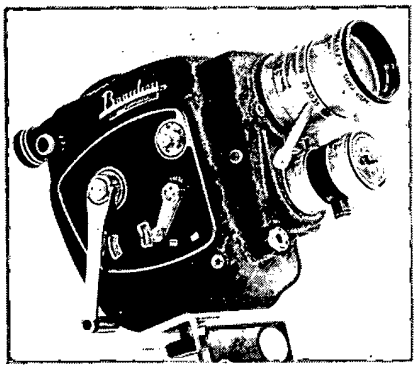
The Century Theatre Acoustic Compensator has been designed by Century Projector Corp., a Division of United Industrial Syndicate, Inc., 729 Seventh Ave., New York, N.Y. 10019, to provide a fast and accurate means of adjusting the frequency characteristics of multiple-channel theater sound systems for controlled sound reproduction. It is designed as a compact unit said to have no insertion loss and not to require changes in system gain or amplification. It can be added to almost any multichannel sound system. The input is a bridging type having an impedance of about 100,000 ohms. The output is high impedance and will connect to the input of power amplifiers having input impedances of 1,000 ohms or higher. It can be used at a remote distance (in the auditorium) by using shielded cables for the connections.



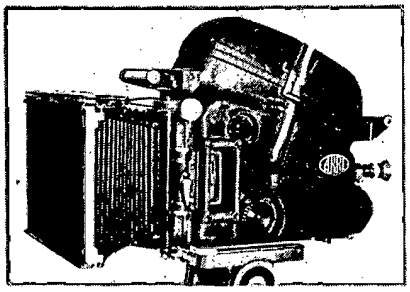
A compact equal-path interferometer, a precision testing tool for industrial and laboratory optics, has been announced by Perkin-Elmer Corp., Main Ave., Norwalk, Conn. It is used to measure deviations of optical path in lens systems, mirrors, prisms and raw glass. The unit consists of the basic interferometer, mercury-arc light source and power supply, positioning adjustments and mounting stand. The complete instrument weighs 14 lb and measures 12 × 17 in. (maximum dimensions). The basic instrument measures only 2 × 2 × 6 in., but is said to be capable of testing optics up to the largest size. The unit is priced at $1,995.

An instrument designed for precise testing of large complex optics has been developed by the Electro-Optical Division,

Perkin-Elmer Corp., Norwalk, Conn. The instrument consists of Perkin-Elmer's Modee 5200 gas laser combined with its Modified Twyman-Green Interferometer. Studies conducted by the company have been directed toward demonstrating the usefulness of the laser interferometry technique in the inspection of the synthetic crystal rod materials used in solid state lasers. Using this technique, extremely high fringe contrasts have been observed in large synthetic ruby and other crystal rods. It was reported that the gas laser is an ideal source for interferometer illumination due to its monochromaticity and long coherence length. Even at an output power of 1 mw, the gas laser's continuous beam is capable of producing some 3,000 times more useful light energy than a conventional arc light source. It is commercially available as a fully equipped unit at a price of about $10,000.



The Beaulieu MCR8 8mm camera has been announced by Cinema Beaulieu, 921 Westwood Blvd., Los Angeles 24, Calif. Features include the Beaulieu 45° mirror-shutter which intermittently transmits light to the film, with no prisms or partial reflecting mirrors interposed, and to the variable focusing 20× eyepiece. Combined with a special ultraluminous ground glass, the shutter is designed to ensure exact "no parallax" reflex viewing with constant depth of field control. A variable shutter device permits fade-in or fade-out with a complete film stop. Other features include a frame counter, total film rewind and a precise front seating arrangement to ensure microscopic precision alignment and seating of all "D" mount lenses. The camera is available with the Angenieux Super Zoom (6.5 mm to 52 mm) at a price of $399.50, or with the Angenieux K2 Zoom (7.5 mm to 35 mm) at a price of $359.00. It will be on display at the 95th SMPTE Conference, Los Angeles.



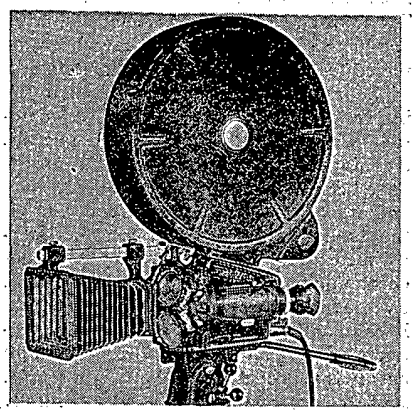
A new model 120S special blimp for the Arriflex-35 has been announced by the Arriflex Corp. of America, 257 Park Ave. South, New York, N.Y. 10010. Features

include a rectangular front port large enough to clear the fields of wide-angle lenses to 18mm, externally controlled diaphragm settings, a follow-focus mechanism which can be operated from three different positions, and interchangeable filter holders to suit every lens requirement. The blimp is said to be extremely quiet and suitable for the strictest sound stage requirement. It has the Arriflex "floating" camera base on which are integrated the Arriflex-35 camera, motor and a newly designed focus and diaphragm mechanism. An integrated electrical system provides for either a-c line operation or d-c battery operation. Overload switches and fuses protect the motor against accidental overloads. Other features include a connection for a remote-control stop-start switch, interior lights for scales and controls, a special film-threading light which is automatically cut off when the motor is started, and an electrical chassis on which all major controls and components are combined. The blimp, together with camera, motor and 400-ft magazine, weighs about 88 lb. Dimensions are 24 × 16 × 18 in. It is priced at $3,360.

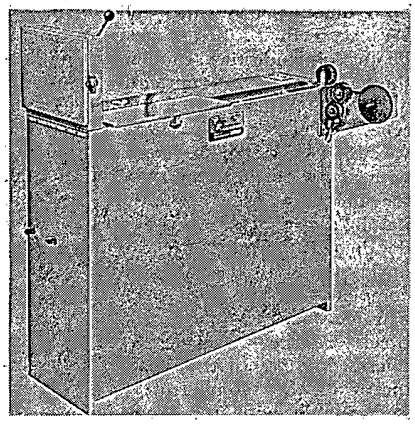
A Conversion Kit which adapts the Arriflex Universal Fibre Glass Blimp for use with the Model 120 Angenieux, mounted on either Arriflex-16S or Arriflex-16M, has been announced by Arriflex Corp. of America, 257 Park Ave. South, New York 10. The new kit includes a long, extended front port, to accommodate the length of the lens, and mechanical parts to modify the blimp's regular focus/diaphragm controls so that the model 120 Angenieux may be focused and zoomed from outside. Installation requires no machining and no special tools. The kit is priced at $375.

A special adaptation stand to accommodate 1000-ft magazines on Arriflex-35 cameras has been announced by Arriflex Corp. of America, 257 Park Ave. South, New York, N.Y. 10010. The new stand supplements the Model 1000 Blimp, the announcement stated. The adaptation stand is designed so that the Arri-35 camera may be driven by either the standard Arri-35 synchronous motor on geared base or by the Arri 24-v d-c governor-controlled motor on geared base. The stand is equipped for Rangertone, Pilotone, or similar synchronous sound recording systems. A special universal motor (24-v, a-c or d-c) is built into the Arri stand and drives the magazine take-up. A take-up belt switch and interlock is incorporated into the stand. Total weight of the stand plus sync motor, camera and 1000-ft magazine is about 50 lb. Price of the stand alone is $1,850.

A 1200-ft magazine for the Nova 16mm High Speed Camera has been announced by Photo-Kinetics, Inc., 1624 Stillwell Ave., Bronx 61, N.Y. The camera is designed to take from 200 to 3,000 pictures/sec, continuously variable. The control is a servo-loop design operating on 115 v, 60 cycles. It is designed to control the speed of the camera to within 1% at all speeds. The camera weighs 60 lb without film and the control weighs 20 lb.



A new M 1,200-ft gear-driven magazine for the Arriflex-16M has been announced by Arriflex Corp. of America, 259 Park Ave. South, New York, N.Y. 10010. The new magazine is a double-compartment type, all gear-driven. The two compartments are arranged coaxially. After the magazine is loaded, mounting on the camera is said to have the same speed and convenience as the M 200-ft and M 400-ft magazines. The magazine may be threaded in daylight except for placing the film on the spindle in the feed compartment and drawing the leader down through the feed sprocket channel, operations that are done in the darkroom. Overall dimensions of the magazine are 15 × 14 × 3½ in. It is priced at $640.



A compact black-and-white processor called Model MT-10 has been announced by Treise Engineering, Inc., 1949 First St., San Fernando, Calif. The processor, which occupies 3 × 5 ft of floor space, processes negative or positive, 16mm, 35mm, or 16/35mm combination. It can be supplied to process 35mm up to 10 ft/min or 16mm up to 20 ft/min. The unit is self-contained, has daylight operation, and requires only simple plumbing and electric plug-in. Models are available especially for microfilm, radiology and television station operations. Prices start at $3,150.

An Angenieux 10:1 Viewfinder lens for use with vidicon cameras has been announced by Zoomar International Inc., Glen Cove, N.Y. The lens is an adaptation of the 15mm-150mm f/2.8 lens. The viewfinder model can be mounted to any portable TV camera which operates without an electric viewfinder.

An Angenieux 10:1 zoom lens for the Kodak Reflex Special Camera has been announced by Zoomar International Inc., Glen Cove, N.Y. The lens has a range of 12mm to 120mm, $f/2.2$ and is delivered with a special Kodak Type R mount of hardened steel to ensure proper alignment over extended periods of use. A 4:1 reduction crank for slow smooth zooming and a lever for rapid zooming are supplied.

The new model 250 Angenieux lens will be supplied in factory mounts for all models of Arriflex-35 cameras according to an announcement by Arriflex Corp. of America, 257 Park Ave. South, New York, N.Y. 10010. The lens, which zooms through 10 focal lengths from 25 to 250, is priced at $2,290. The special Arriflex cradle is available at an additional cost.

Edicomp, an editor computer developed by Videotape Productions of New York, Inc., 101 W. 67 St., New York, N.Y. 10023, and the Editec developed by Ampex Corp. have been incorporated into an electronic editing system called Edimation.

Edimation is designed to eliminate entirely any cutting and splicing of tape and also is designed to bypass any intermediate time-consuming film editing process. In this system, the magnetic tape, which is the central element of computer systems and automation systems as well as audio and video recording systems, is used to carry, remember and implement complex and precise editing instructions as well as to remember and reconstruct pictures and sound.

The Edicomp is designed to carry and put into effect many and complex instructions involving relatively long periods of production time and numerous changes and scene sequences by retaining a reference point in time from which all changes are computed. During and after a long production, for example, instructions as to good and bad takes, or changes, are recorded on the video tape so that the process of "save" or "reject" later becomes virtually automatic.

The Editec, used mainly for television commercials, is a device for "pushbutton editing" for the electronic splicing of two successive scenes to an exactness measurable in thirtieths of a second. In combining the two devices into the Edimation system, both the Editec and the Edicomp have been improved and adapted to more extensive use.

An improved version of the SeAQUArtz underwater light, called the Mark II, has been announced by Birns & Sawyer Cine Equipment Co., 6424 Santa Monica Blvd., Los Angeles, Calif. 99038. Tested at a depth of 1000 ft underwater, a new model incorporates such improvements as aluminum housings chemically plated with Kanigen, a 92% nickel alloy; a pyrex glass disc placed directly in front of the quartz iodide lamp to absorb the initial thermal shock; and a specially tempered glass for the front lens to withstand pressure at 1000 ft. Other models are available for use at depths of 350 ft or less. The underwater light is 7½ in. square and weighs

Professional Services

$7\frac{1}{2}$ lb. It is reported to deliver 5,000 w of exposure. The aluminum housing includes a 65,000 candlepower quartz iodide Sylvania Professional Sun Gun lamp and reflector. The Mark II 1000 is priced at $450; and the Mark II 300, at $295.

A double system sound package for the H-16 and H-8 Bolex cameras has been announced by the Sonex Engineering Co., Box 1189, Glendale, Calif. The package includes a sound blimp, a sync motor and a pulse signal kit said to make most $\frac{1}{4}$-in. tape recorders usable for soundtrack recording. Two series of sound blimps and motors are available, the professional type priced at $299.50, and a semi-pro version priced at $149.50. Pulse signal kits are priced at $29.95 for stereo machines and $99.50 for monaural machines.

The Tymeter is a digital readout clock movement announced by Tymeter Electronics, Pennwood Numechron Co., 7249 Frankstown Ave., Pittsburgh 8, Pa. The device shows $\frac{5}{8}$-in. digits with front panel time reset facility; the digits can be reset individually. It is 3 in. high, $5\frac{1}{2}$ in. wide, $3\frac{1}{4}$ in. deep and weighs 2 lb. It is priced at $16.00.

employment service

These notices are published for the service of the membership and the field. They are inserted three months, at no charge to the member. The Society's address cannot be used for replies.

Positions Wanted

Motion Picture Equipment Sales/Manufacture. 17 yrs diversified experience with two top companies. Knowledge of manufacturing and sales procedures of theatre and sound recording equipment for export and related administrative procedures. Wishes position with company located in New York metropolitan area. Resume upon request. Reply to R. Valle, 1480 Hancock St., Elmont, L.I., N.Y.

Writer-Director. Staff experience with two of Chicago's largest industrial film studios and the world's largest producer of educational films. Free-lance experience with top New York film studios and TV producers. Have independently produced shorts. Seek temporary or full-time assignment anywhere. Write to D.K., c/o Harris, 326 West 55 St., New York, N.Y. 10019.

Producer-Writer-Director. Presently employed as writer-director for aerospace firm. Experienced in all phases film production including planning, cinematography, editing and film processing. Extensive Multicam and educational film background; interested in educational and industrial film production or supervision. B.A. and graduate work at USC Dept. of Cinema. For resume write: Stan Follis, 15111 Graystone Ave., Norwalk, Calif. 90651. Tel: (213) 863-3475.

TV/Motion-Picture Production. 3 yrs experience free-lance 16 & 35mm cinematography, film editing. Graduate TV Production RCA Institutes. Assoc. Member IATSE. Seeking opportunity for advancement with TV or film production company. Willing to relocate. Allan Rosenstein, 1350 East 5th St., Brooklyn 30, N.Y.

Audio Visual Aids Director. 18 yrs experience with Studebaker Corp. in all phases A-V work specializing in motion-picture production. Extensive experience in management of photographic and art studio. Thoroughly experienced in planning, organizing and budgeting. Background in both 35mm and 16mm films for public relations, sales, manufacturing and advertising fields. Age 43, married with family; will relocate. Edw. A. "Jack" Price, 2417 Crest Ave., South Bend, Ind. (219) AT 9-6839.

Motion-Picture Engineer. 14 yrs experience in all phases of laboratory work; repair, design and construction of motion-picture equipment; testing and evaluation of new equipment and products. Some production experience. Experienced in all phases still photography except aerial work. Speak, read and write German fluently. Desire more challenging position. Prefer Washington, D.C., area. Presently employed. Married. 909 North Greenbrier St., Arlington 5, Va.

Writer-Director. 7 yrs experience writing and directing dramatic feature films. Former Director of Cinema and Theatre Affairs in Iraq and member of the Iraqi Committee for Studying Movie Scenarios for Local Production. B.A. degree from Univ. of Baghdad, with special program in cinema at UCLA. Write: M. M. Al-Yasin, 10616 Wellworth Ave., Los Angeles 24, Calif.

TV Production. Wish to relocate in Los Angeles area. Young man, married, M.A. degree in TV production from major Midwest university. Experienced in TV direction, radio and TV announcing. Hold FCC Second Class Radiotelephone License—qualified in operation of color and monochrome cameras and terminal equipment, color and monochrome video tape recorders, film sound recording and mixing, and kinescope recording. Resume and references on request. Box 7373, Detroit, Mich. 48202.

Director-Cameraman-Editor. Young creative, productive woman seeks position preferably in the Los Angeles area (until June '64) or New York, with motion picture or television company, providing opportunity for intensive training and increased responsibilities. For full resume write: Scylla R. Trad, c/o Manager of 625 Landfair, Los Angeles 24, Calif., or phone GR 9-5404.

Positions Available

Technical Sales Assistant. Assistant in Sales Department, preferably with motion-picture equipment sales experience. Duties will include work in order department and customer contacts in person, by phone and mail. Excellent career opportunity for ambitious young man. Good starting salary. Many employee benefits. Send resume to: Victor James, Vice-President, Arriflex Corporation of America, 257 Park Avenue South, New York, N.Y. 10010.

Equipment Maintenance. Assistant to Chief Engineer of motion-picture laboratory. "Take charge" type desired to supervise maintenance of developing and printing machines, etc. Excellent opportunity for qualified man. Salary open. Submit resume to: General Manager, M.G.M. Laboratories, Inc., 10202 W. Washington Blvd., Culver City, Calif. 90232.

Laboratory Manager. For rapidly growing midwest laboratory. Well experienced in laboratory procedure, understand SMPTE standards, able to supervise production of top quality work, handle producer services and meet with clients. Excellent opportunity for progressive individual. Send resume and salary requirements to Edward C. Powles, General Film Laboratory, Inc., 66 Sibley St., Detroit 1, Mich. (313) 961-7818.

Cameraman. Opportunity for cinematographer seriously interested in pursuing creative career in industrial-educational-training film production to join staff of well established studio. Must have had experience with 16 and 35mm cameras, interior lighting techniques, negative and reversal color films. Position requires man not opposed to hard work on the job and with a personal interest in client-producer relations. Salary commensurate with experience. Send detailed work history and film samples to F.J.H., 438 Washington Bldg., Washington, D.C.

Film Editors and Negative Cutters. Send resume Box 433, Gracie Station, New York, N. Y.

Motion-Picture Laboratory Personnel. Printing, processing, timing. Send resume Box 433, Gracie Station, New York, N. Y.

Journals Available/Wanted

These notices are published as a service to expedite disposal and acquisition of out-of-print Journals. Please write direct to the persons and addresses listed.

Complete set of Journals from January 1934 through December 1963. Excellent condition. For sale only as complete 30-year set. Write: Don Norwood, 1470 San Pasqual St., Pasadena, Calif.

Complete set of Journals from January 1951 through December 1952. Perfect condition. Write: K. Tsien, 14 Esplanade, Mount Vernon, N.Y.

Complete set of Journals from March 1956 through December 1962, including indexes and directories, in excellent condition. Write: J. B. Pesek, 369 Huntington Lane, Elmhurst, Ill.

July 1937 through July 1963. Complete less June 1942 and Nov. 1955. Condition excellent. Make offer to: Carl S. Williams, 237 Colgate Ave., Berkeley 8, Calif.

Jan., Mar. Pt. II (High-Speed Photography Vol. I), July Aug., Sept., Nov. (High-Speed Photography Vol. II) 1949; Jan., Feb., June 1950; July 1951. Available for trade only for the following: Trans. No. 1; Journals: Apr., May 1936; Apr., May 1937; Jan., Mar., July 1938; Feb. 1939; Mar., June 1940; Feb.-May, July 1944; Jan., Apr., Aug. 1945; High-Speed Photography Vol. III. Gian. Maria Rimoldi, Via Plinio 39, Milano, Italy.

Transactions and Journals 1917 through 1963 (partly bound). Excellent condition. Very reasonable. J. J. Kuehn Sound Film Laboratory, 59 East Illinois St., Chicago 11, Ill.

Complete 1944 (except Aug.); complete 1945; Mar., Apr., May, June, July, Aug., Nov., Dec. 1949; complete 1950; Jan., Feb., Mar. (Pts. I & II), Apr. 1951. Complete years' issues available only as unbroken lots. R. H. Cricks, Technical & Export Publicity Ltd., 101 Wardour St., London W.1, England.

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News Columns

Advertisers

Meeting Calendar

IEEE International Convention, Mar. 23–26, New York Hilton, New York Coliseum, New York.

Optical Society of America, Apr. 1–3, Sheraton-Park Hotel, Washington, D.C.

NAB, Annual Convention, Apr. 5–8, Conrad Hilton Hotel, Chicago.

95th Semiannual Technical Conference of the SMPTE and Equipment Exhibit, Apr. 12–17, Ambassador Hotel, Los Angeles.

Institute of Environmental Sciences, Technical Meeting and Equipment Exposition, Apr. 13–15, Sheraton Hotel, Philadelphia, Pa.

DAVI, Annual Convention, Apr. 20–25, War Memorial Auditorium, Rochester, N.Y.

SPSE, International Conference, Apr. 23–May 2, Americana Hotel, New York

National Microfilm Association, Apr. 28–30, Benjamin Franklin Hotel, Philadelphia.

Educational Film Library Association, Apr. 29–May 2, Biltmore Hotel, New York.

AICE, National Meeting, May 3–6, Penn-Sheraton Hotel, Pittsburgh, Pa.

Inter-Society Color Council, 33rd Annual Meeting, May 4, 5, Statler Hilton Hotel, New York.

ASTM 67th Annual Meeting and 16th Materials Testing Exhibit, June 21–26, Conrad Hilton Hotel, Chicago

AICE, ASME, ISA, IEEE, Fifth Joint Automatic Control Conference, June 26–28, Stanford University, Palo Alto, Calif.

NAVA, National Convention, July 20–23, Sherman House, Chicago.

Techniques of High-Speed Photography, Dr. H. E. Edgerton, July 27–31, MIT, Cambridge, Mass.

PSA, International Convention, Aug. 16–20, Queen Elizabeth, Montreal, Canada.

UFPA, National Convention, Aug. 17–22, Oklahoma Center for Continuing Education, Univ. of Oklahoma, Norman, Okla.

SPIE, 9th Annual Technical Symposium, Aug. 24–28, Deauville Hotel, Miami Beach, Fla.

96th Semiannual Technical Conference of the SMPTE and Equipment Exhibit, Sept. 27–Oct. 2, Commodore Hotel, New York.

IEEE, International Congress on Instrumentation in Aerospace Simulation Facilities, Sept. 28, 29, Paris, France.

Optical Society of America, Annual Meeting, Oct. 7–9, Statler Hilton New York.

NAB, Annual Convention, Mar. 21–25, 1965, Shoreham and Sheraton Park Hotels, Washington, D.C.

97th Semiannual Technical Conference of the SMPTE and Equipment Exhibit, Mar. 28–Apr. 2, 1965, Ambassador Hotel, Los Angeles.

98th Semiannual Technical Conference of the SMPTE and Equipment Exhibit, Oct. 31–Nov. 5, 1965, Queen Elizabeth Hotel, Montreal. Exhibit, May 1–6, 1966, Sheraton Park Hotel, Washington, D.C.

100th Semiannual Technical Conference of the SMPTE and Equipment Exhibit, Oct. 2–7, 1966, Ambassador Hotel, Los Angeles.

101st Semiannual Technical Conference of the SMPTE and Equipment Exhibit, May 8–12, 1967, Statler-Hilton Hotel, New York.

103rd Semiannual Technical Conference of the SMPTE and Equipment Exhibit, Apr. 22–27, 1968, Ambassador Hotel, Los Angeles.

105th Semiannual Technical Conference of the SMPTE and Equipment Exhibit, Apr. 20–25, 1969, Fontainebleau Hotel, Miami Beach Fla.

SMPTE Officers and Committees: The rosters of the Officers of the Society, its Sections, Subsections and Chapters and of the Committee Chairmen and Members were published in the April 1963 Journal.

sustaining members

of the Society of Motion Picture and Television Engineers

For the addresses and descriptions of activities of these members, see the Society's Journal for April, 1962, Part II. New members and supplementary descriptions were published in July, 1962, and April, 1963.

Progress toward the attainment of the objectives of the Society is greatly aided by the financial support provided by the member companies listed below.

Acme Film Laboratories, Inc.
Alex Laboratorios Cinematograficos S.A.
Alexander Film Co.
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Kollmorgen Optical Corporation
Labcraft International Corporation
Laboratoires Cinématographiques CTM France
LAB-TV
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Lipsner-Smith Corporation
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M.G.M. Laboratories, Inc.
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Universal Pictures Company, Inc.
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Motion Picture Laboratories, Inc.
Motion Picture Printing Equipment Co.
Movielab, Inc.
Moviola Manufacturing Co.
National Carbon Company, Division of Union Carbide Corporation
National Screen Service Corporation
National Theatre Supply Company
Newman & Guardia Ltd.
Nichion Company, Ltd., Japan
North American Philips Company, Inc.
Novatech Corporation
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W. A. Palmer Films, Inc.
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Pathé Laboratories, Inc.
Peelcraft Limited, Canada
Photo Methods for Industry—P.M.I.
Photo-Sonics, Inc.
Pittsburgh Motion Picture Lab
Precision Laboratories (Division of Precision Cine Equipment Corporation)
Prestoseal Mfg. Corp.
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Video Film Laboratories
Westinghouse Electric Corporation
Westrex Company
International Division
Recording Equipment Division
Wilding Inc.
WRS Motion Picture Laboratory
Zoomar, Inc.

The Society invites applications for Sustaining Membership from other interested companies. Information may be obtained from the Chairman of the Sustaining Membership Committee, Joseph T. Dougherty, E. I. du Pont de Nemours & Co., Inc., 45 Rockefeller Pl., Rm. 550, New York 20, N. Y.