JUNE 1971

AMERICAN Cinematographer

75 CENTS

International Journal of Motion Picture Photography and Production Techniques

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New Moviola Console Editors in Stock	PRICES ON REQUEST	

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CSC Scissor Support For 12/240 Lens	new	140.00
CSC Scissor Support For 9.5/95 Lens	new	140.00
CSC Zoom Motor w/control box and Lens Gears	new	475.00
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Bell & Howell Rack-Over (For Filmo)	used	59.50

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The Lowell Link System holds up everything except the shooting. And travels in one case!

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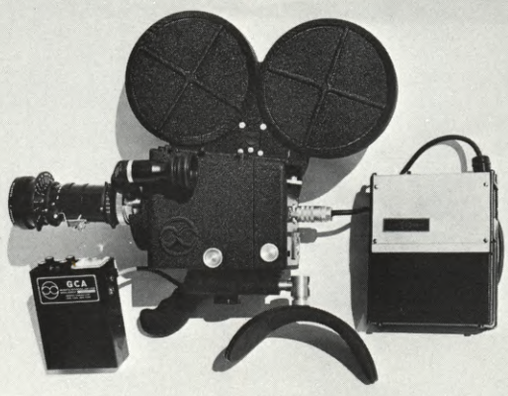
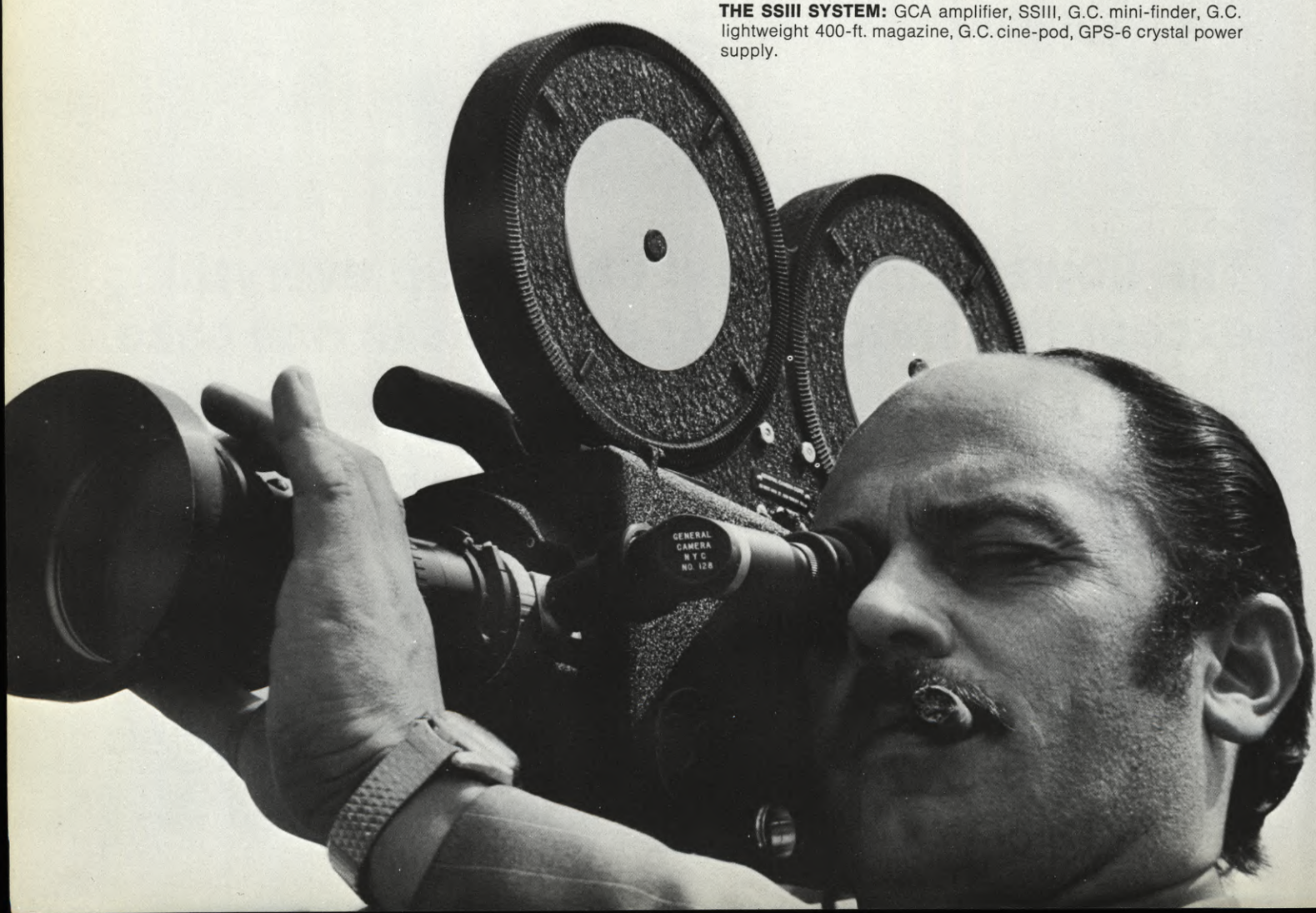
We think a cameraman should work with his head. Not his back.



THE SSIII SYSTEM: GCA amplifier, SSIII, G.C. mini-finder, G.C. lightweight 400-ft. magazine, G.C. cine-pod, GPS-6 crystal power supply.



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• FEATURE ARTICLES

• DEPARTMENTS

ON THE COVER: Producer-cinematographer Bert Van Bork, shown against a background of erupting volcano, Kilauea, on the island of Hawaii, during filming of the spectacular award-winning documentary, "FIRE MOUNTAIN".
motion picture production.

AMERICAN CINEMATOGRAPHER, established 1920, in 52nd year of publication, is published monthly in Hollywood by ASC Agency Inc., 1782 North Orange Drive, Hollywood, California 90028, U.S.A. **SUBSCRIPTIONS:** U.S. $7.00; Canada, foreign, including Pan-American Union, $8.00 a year (remit International Money Order or other exchange payable in U.S.) **ADVERTISING:** rate card on request to Hollywood or New York office. **CHANGE OF ADDRESS:** notify Hollywood office promptly.

Second-class postage paid at Los Angeles, California.

VICTOR DUNCAN supplies TODD-AO 35 for the Clyce Properties production of "The Pickle Goes In The Middle"

This is the kind of feed-back we like to get, which is as it should be, when you consider the combination of equipment Mr. Jessup selected: Our now famous SPR-reflexed BNC cameras and the superb TODD-AO 35 anamorphic lenses.

In addition to the unexcelled quality of the entire line of TODD-AO lenses (including zoom), their optics have the added advantage of maintaining a constant squeeze ratio (2:1) of the image at all focus distances without distortion.

As a very practical consideration, we supply our cameras with TODD-AO lenses in *convertible mounts,* which are interchangeable in the field and allow you to use any lens on three separate cameras: BNC, Arri or Mark II. Essentially, you get three lenses for the price of one! Lenses are available from 28mm through the 200mm Macro, and a 50-500mm motorized zoom.

For 35mm anamorphic photography, or for blow-up to 70mm, our highest recommendation goes with TODD-AO lenses on our conventional cameras. If you are considering "squeeze" on your forthcoming feature, won't you please give us a call? We would like to arrange for your own TODD-AO photo test.

*April 4 quote from Director of Photography Bob Jessup stating his preference for Victor Duncan package.

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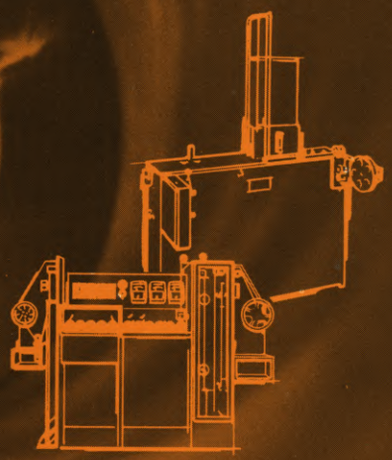
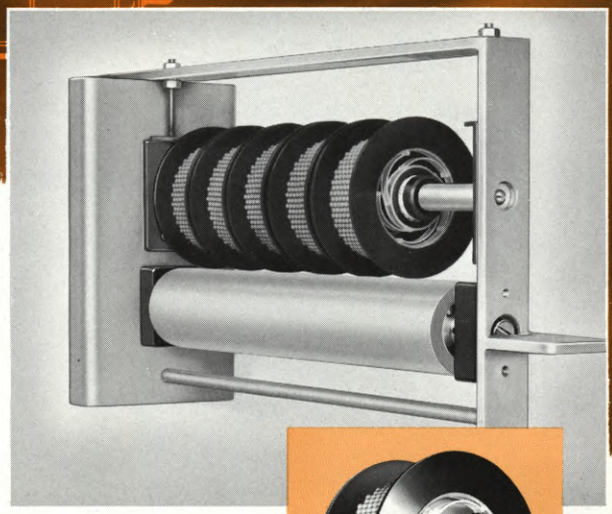
VICTOR DUNCAN, INC.

NEW TREISE PROCESSORS FEATURE

SBR™ drive!





Now you can change film sizes ...and still maintain uniform tension and constant speed!

Any laboratory that changes film sizes frequently or plans to process multi-perforated film will find the new Treise Processors a dream to operate. They feature a revolutionary new type of demand-drive that assures uniform controllable tension and constant film speed throughout the processor.

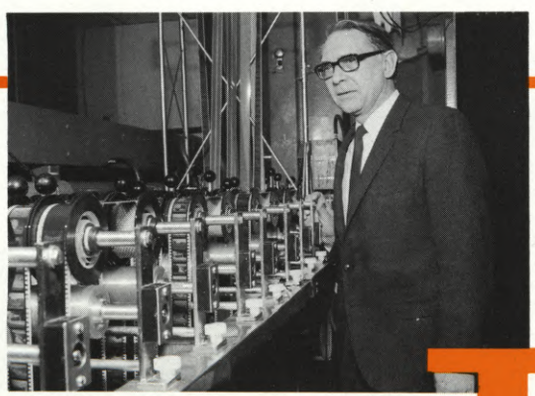
The heart of the Treise SBR-Drive is a unique new film roller with a flexible heavy-duty 5-leaf spring insert. The spring bearing rollers (SBR) are mounted on a stationary shaft at the top of each rack and are free to rotate. An overdrive shaft is mounted directly underneath. As film tension increases (or decreases), the SBR contact (or pull away from) the drive shaft. The result is individual strand control! Due to the unusual construction of the Treise spring insert, the distance between the rollers and the drive shaft is so small that the slightest change in film tension creates a response and thus maintains a remarkable degree of equilibrium.

All SBR are equipped with "soft touch tires" that firmly grip the film and smoothly move it along without the slightest scratch or abrasion. Treise processors operate smoother, too, because they feature heavy-duty gear box drive and torque motor take-ups.

When using SBR-Drive, the elevator is kept at a fixed position less than an inch from the bottom of the tank, thus permitting full utilization of chemical solutions. SBR-Drive comes either in individual lift-out racks or as part of a complete unit lifted out by hoist, for quick easy servicing.

SBR-Drive includes an automatic braking system to stop the processor, in the event a film breaks due to some error in handling.

The new Treise SBR-Drive Processors feature stainless steel tanks, with hastelloy or titanium components in ferri bleach areas. Models are available to accommodate any film size from 8mm to 105mm, to handle any kind of process, and to operate at speeds from 30 fpm to 250 fpm.



Bill Smith, Allied Film President, checks over his SBR-Drive.

ALLIED FILM LAB modified a 10-year-old processor with SBR-Drive . . . and now it runs like new!

Join the many leaders, like Allied Film Lab, Foto-Kem, News Film Laboratories, University Microfilm, etc., who are already benefiting from this revolutionary "step forward" in processor design. Write today for complete details about our modification program. Modernize *your* processor with Treise SBR-Drive!

Write for full information about SBR-Drive!

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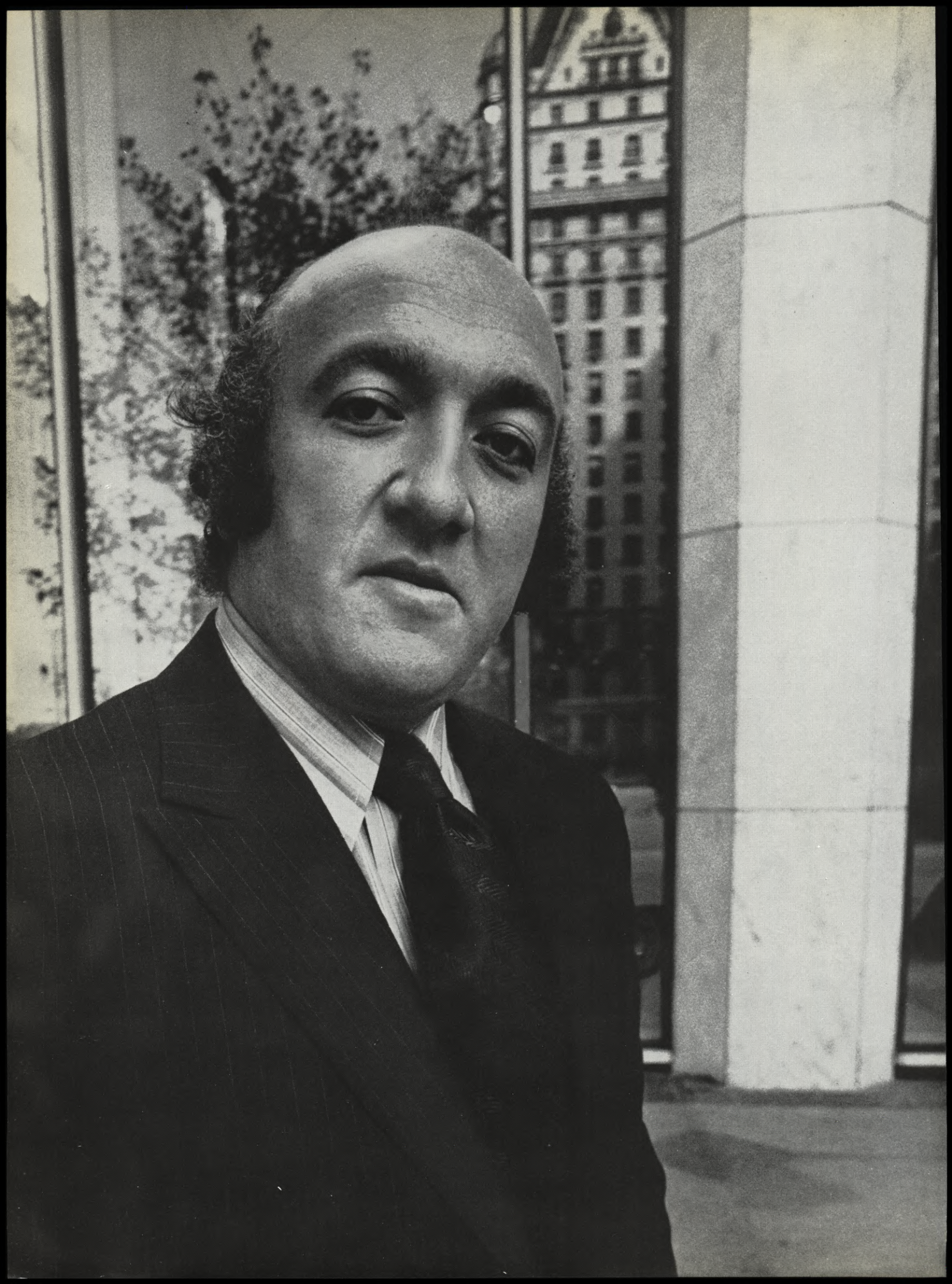
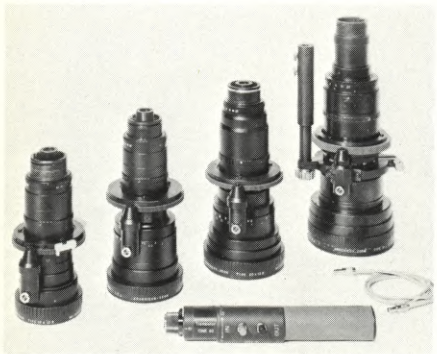


"Sure, there's always some risk involved

...but the important thing is that the industry is more flexible today than ever...some people are more willing to gamble on a percentage of the profits, and this kind of experimentation is a healthy sign...I think there'll always be a market for low-budget films and independent packages...of course, I'm looking at this as a distributor, but another major factor is the huge overseas market...and film quality is just as vital because of the competition from the foreign studios... fortunately, technology has kept pace with these changes...for example, Eastman came up with a great reversal intermediate film that prints a duplicate neg direct from the original picture release negative...now I can send negs overseas and they can print pictures with the same quality and sharpness... and that cuts down *my* risks..."

WHAT'S NEW

IN PRODUCTS, SERVICES AND LITERATURE



CINE 60 BRINGS POWER ZOOMING TO ANGENIEUX LENS OWNERS

Cine 60 Incorporated, well-known designer/manufacturer/dealer to the professional motion picture field, has announced the availability of a line of motorized zoom attachments designed specifically for the Angenieux family of quality zoom lenses. Featuring fingertip speed control, a rechargeable battery pack and a transistorized regulating circuit, these units provide professional results in an exceptionally compact, lightweight package.

The Cine 60 Angenieux Zoom Motors are available in four sizes to fit the 9-95mm, 12-120mm, 12-240mm and 25-250mm lenses. Their rugged design features a precision gear assembly which mounts on the lens barrels, which is rigidly coupled via a flexible shaft to the power-supply/motor unit. This design effectively removes any source of vibration from the lens barrel and provides the operator with smooth, variable speed control in a palm-sized unit. The control unit also has a built-in recharger.

Models are priced as follows: Model 6604, for the 9.5-95mm lens, $325.00; Model 6601, for the 12-120mm, $275.00; Model 6602, for the 12-240mm, $325.00 and Model 6603, for the 25-250mm, $435.00.

•

COLLEGE ESTABLISHES SCHAFFNER FILM LIBRARY

Franklin and Marshall College announces the establishment of the Franklin Schaffner Film Library in honor of the Academy Award-winning director of "Patton."

Negotiations with major film studios have resulted in naming the College as a depository of Mr. Schaffner's films on a permanent basis, President Keith Spalding said.

A graduate of Franklin and Marshall College in 1942, Mr. Schaffner's films include "Patton," "Planet of the Apes," and "The Stripper" for Twentieth Century Fox; "The Best Man" for United Artists; "The Double Man" for Warner Brothers, Inc.; and "The War Lord" for Universal. He is currently directing "Nicholas and Alexandra" in England.

In addition to prints of films directed by Mr. Schaffner, the library will include copies of scripts, stills, posters and other memorabilia connected with each motion picture.

Professor Sidney Wise, in charge of the academic supervision of the establishment of the library, said, "The collected films of Mr. Schaffner, along with shooting scripts, are to be used as resource material for students and faculty interested in the serious study of film in college courses and workshops.

"Having available the complete works of a director of the calibre of Frank Schaffner will provide students and faculty with a unique opportunity to review the development of the skills and talents of one of America's finest film makers," Wise said.

He continued, "Of course we couldn't have begun the project without the full cooperation of Mr. Schaffner. The response we have received from the studio executives with whom Frank Schaffner worked is a tribute to the respect with which he is held by his colleagues in the film industry."

Franklin Schaffner is a former resident of Lancaster, and a graduate of the City's McCaskey High School. His interest in films can be traced to his first job as an usher in the old Hamilton Theatre in Lancaster. He held that job through college and worked also as a radio writer and commentator for radio station WGAL in Lancaster.

After graduating from Franklin and Marshall in 1942, he finished a four-year tour of duty with the Navy, returning to New York to take a job with the Columbia Broadcasting Company. In a few short years he rose to become one of the leading television directors in the nation. Some of his credits include Studio One, Ford Theater, Edward R. Murrow's Person to Person, The Defenders, Jacqueline Kennedy's "Tour of the White House," and Playhouse 90.

One of his cherished awards is an "Emmy" from the Academy of Television Arts and Sciences as best director of the year for his staging of the "Caine Mutiny Court Martial". He won another "Emmy" in 1962 for the direction of "The Defenders".

In 1960 Mr. Schaffner received high acclaim as director of the Broadway hit, "Advise and Consent". Shortly after his success on Broadway, he signed a contract to direct films.

His "Oscar" awarded by the Academy of Motion Picture Arts & Sciences for "Patton" is his first.

•

NEW B & S EQUIPMENT LITERATURE AVAILABLE

Birns & Sawyer, Inc., pioneer Hollywood motion picture equipment supplier, has completed several new full-color brochures covering additions to the current product line.

Now available for both sale and rental, the new B & S SILENT GENERATOR, operating close to the production set, eliminates long cable runs and sets a new standard for quiet power. The noise emission level at six feet is only 55dB, about that of normal conversation.

"A complete mobile studio is ready on a moment's notice," said president Jack Birns. "Just hook the B & S FILMOVAN behind the Silent Generator for a whole new system of on-location production." The Birns & Sawyer Filmovan is a completely self-contained on-set unit with doors opening to 350 cubic feet of intelligently designed space "to hold everything you need": the most sophisticated lightweight equipment—cameras, sound, electrical and grip, dollies, tracks, tripods, lights, ladders and lenses. It also has a 10' x 7' topside shooting platform.

Another product addition is the new B & S STAR DOLLY which, according to Birns, is the first all-new dolly to be unveiled in a decade. These units are being imported by Birns & Sawyer from Italy and are basically two units in one: (1) A crabbing four-wheel (eight tire) Spyder-type with a pump-up hydraulic center column, and (2) a crabbing crane, a camera boom, with hydraulic column and vertical extension arm which brings the floor-to-lens height from a four-inch capability to 11 feet.

Brochures on each of these units are available by calling or writing BIRNS & SAWYER, INC., 1026 North Highland Avenue, Los Angeles, California 90038.

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PROFESSIONAL CINE PRODUCTS

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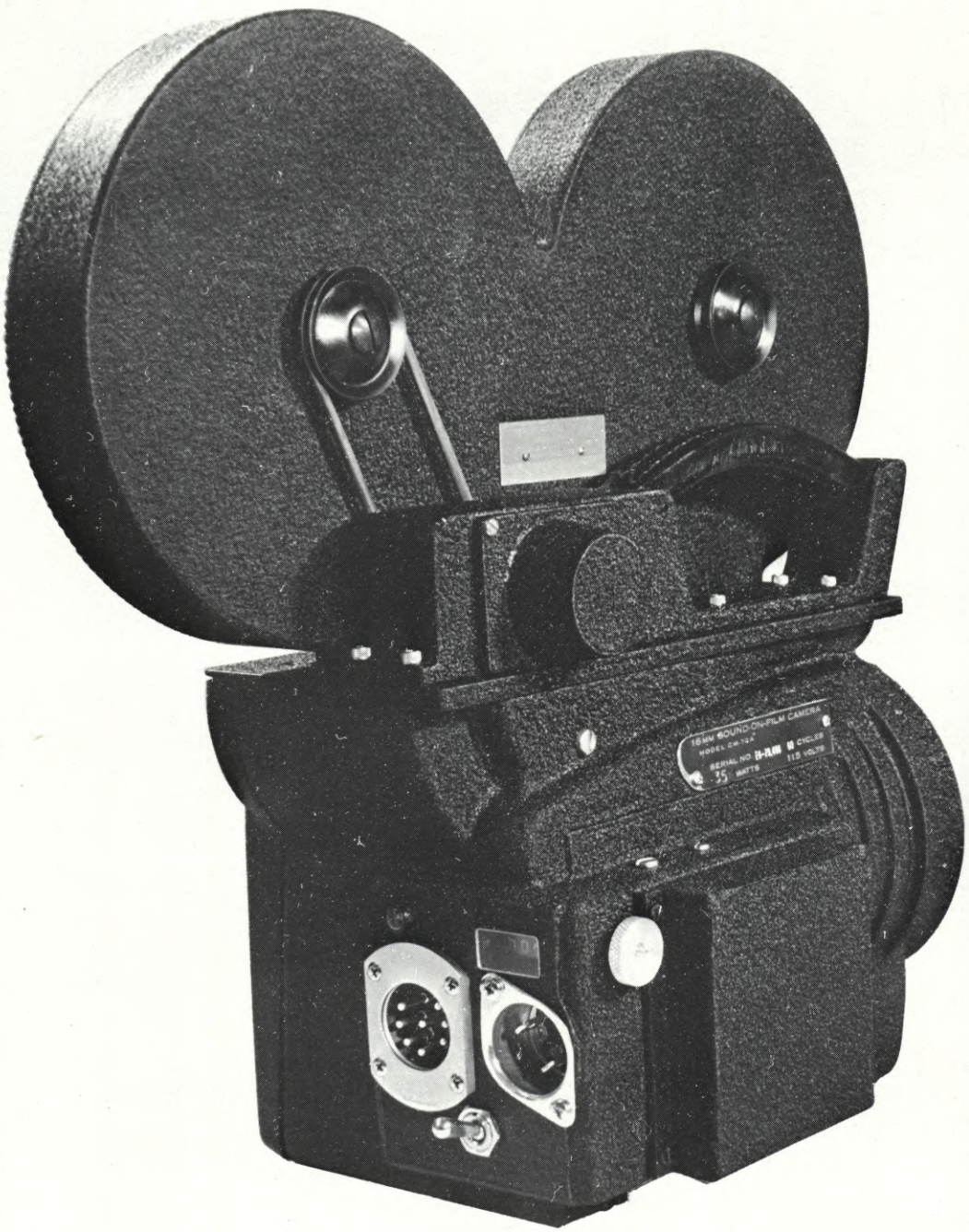
GORDON YODER/Over 32 Years in Motion Pictures



THE PRIDE OF OUR LINE . . . 400 & 1200 ft COMPACT CONVERSION OF THE CINE VOICE CAMERA. Meets all specifications of 2 major networks and in use by them NOW. Includes Filter slot; Super-Quiet Sync Motor; Silenced Veeder-Root counter; Rebushed tripod socket w/brass insert; complete refinishing of the camera when all machine work completed; FINEST WORKMANSHIP. Price (magazine not included). $795.00. Accessories available: Bloop lite & Sync pulse; Zoom finder support; handle w/switch on front of camera; hinged door; Zoom alignment blocks. Motor draws less than 30 watts.

A PRESCRIBED ABORTION. A recent conversation with a top notch motion picture engineer disclosed a problem that west coast laboratories are encountering when using the new reversal color internegative film for the production of 35mm color release prints. He stated that it was necessary to print the 35mm color reversal internegative "through the base" (base to emulsion), so that release prints made from such a negative would have the standard 35mm emulsion position, which incidentally is *away* from the projection lens. His concern was in regard to the loss of image quality encountered when printing the photographic image through the base of the original negative. His problem struck a very discordant note with me because one of my pet peeves is the so called "standard" emulsion position of 35mm prints.

Film has always been loaded into a camera with the emulsion *toward* the lens. Engineers in our industry would never consider turning the film over, causing the small bundle of light rays of the image to pass *through* the transparent base material onto the emulsion. It is obvious that a terrific deterioration of image quality would result. So, after the original 35mm negative was exposed with the emulsion *toward* the lens, it was processed and a positive print was made. The best possible print definition was achieved by good continuous contact printing, *emulsion* to *emulsion*. To maintain correct right and left orientation of our image it was necessary to project the print with its resulting "mirror" image so that the emulsion was *away* from the projector lens —in a "reversed" position.

As our industry grew and many prints were needed, it was necessary to protect the original negative from wear, so it became normal procedure to make a master positive print and from this master a duplicate negative was made. This dupe negative resembled the original negative in photographic characteristics and image emulsion position. Release prints made from the dupe negative had the same "reverse" emulsion position as a print from the original negative.

Are you aware what our industry has foolishly been doing for years in either procedure? We make 35mm release prints that have to be projected in such a manner that our beautiful photographic image must pass through the acetate base of the print on its way through the lens to the screen. Today, no engineer would recommend such a procedure but our industry not only sanctions it but makes it routine. Normal practice today in the optical industry is to avoid passing images through glass whenever possible, so front surfaced mirrors are commonplace. Many modern reflex cameras use front surfaced mirrors in an effort to obtain optimum image definition even for view finding.

For years I have wished for a process that would eliminate the master positive step. Such an innovation would not only eliminate one printing and one film step, but would produce release prints with an image emulsion position that is "forward"—*toward* the projector lens, thereby eliminating any loss of definition caused by passing the photographic image through the base of the film.

About fifteen years ago a producer brought to our laboratory a 16mm original black and white negative prepared in A & B rolls and ordered an answer print. The print was accepted by the client and an order was placed for a large number of release prints. We could not risk printing the large order from the original A and B negative rolls, so we made the usual composite picture master positive and the subsequent dupe negative. The loss introduced in these two film steps produced a print which showed appreciable loss of definition when compared to the print from the *original* negative. At that time, it so happened we had been making tests in an attempt to use Kodachrome camera stock as a reversal internegative. We had not been satisfied with the color that we obtained, but we thought that this method might prove satisfactory for a black and white image. A negative intermediate was made on Kodachrome and a print from it was enthusiastically approved by the customer. We had achieved several things—we protected the original negative, we reduced the price of the print by printing from a single roll instead of A and B, we improved the quality by eliminating the master positive film step, and we improved definition on the screen because the emulsion position was *toward* the projector lens.

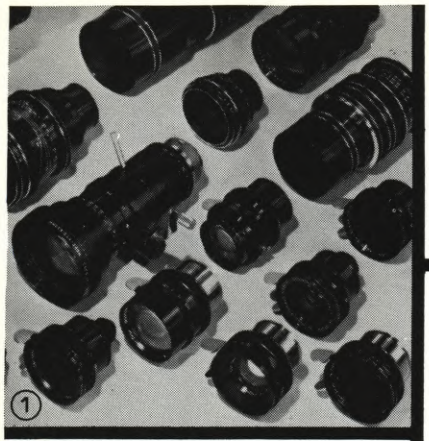
In the early days of television we were making 125 prints of a weekly half hour show. The subject matter was so timely that speed was imperative. It was photographed each Monday with multi camera technique onto 16mm black and white negative, and all release prints with an emulsion position *away* from the lens were shipped Tuesday. The release prints were developed, waxed, shipped and run on television projectors in a matter of hours. Because such prints were still "green" (unseasoned), we received many complaints from stations claiming that prints jumped and emulsion had a tendency to pile up in the gate of the projector. We experimented with many types of drying conditions and many types of waxes, but to no avail. In desperation, the show was photographed on reversal film from which a dupe negative was made, and release prints were made from the dupe. These release prints were made and shown under the same identical conditions as the release prints from the original negative, but because the emulsion position was now *toward* the lens—"forward," all the complaints disappeared. Additional tests convinced us that all projection prints regardless of format should have a "forward" emulsion position.

Recommended practice today (with which I disagree) states that 35mm projection prints should have an emulsion position *away* from the lens and this position is called "standard." In 16mm and 8mm however, the recommended standard emulsion position is "forward" or *toward* the projection lens. So 16mm and 8mm actually have better standards than 35mm!

So you can see why my friend's remarks disturbed me. A film manufacturer had taken the initiative to research, design, and manufacture a great new product—color reversal internegative—designed to improve color and definition. A side dividend was the fact that it put the image emulsion position of 35mm where it should be. Why then should we lose the benefits by compounding our errors and introducing more distortion by printing the negative through the base? My friend commented that if labs furnished prints with a forward emulsion position, problems might be experienced because of the failure of the theater projectionist to refocus. This is not a valid excuse for delivering an inferior product. Improved tools are great, but we must learn how to use them!

Byron

byron
MOTION PICTURES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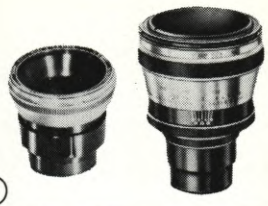
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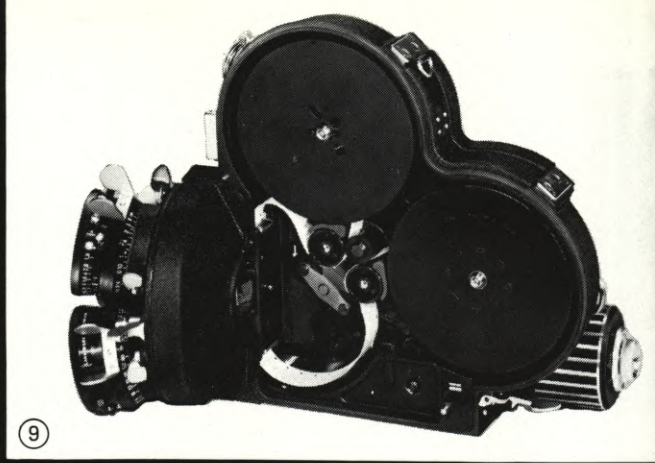
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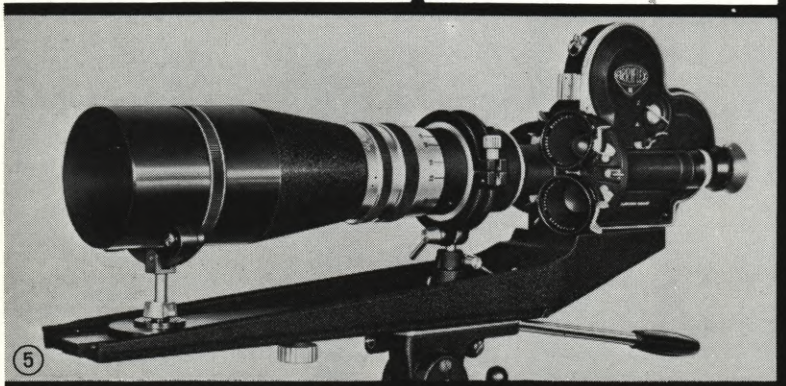
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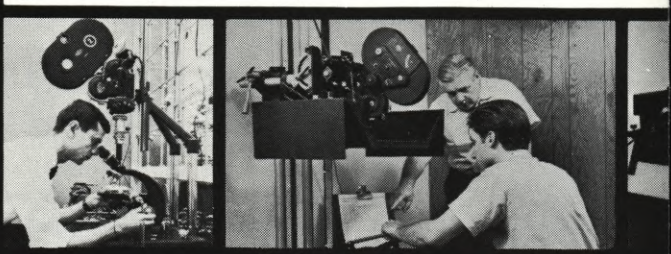

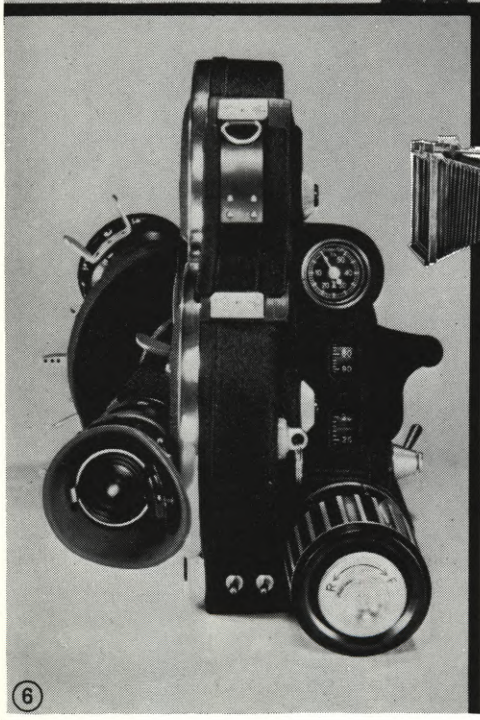
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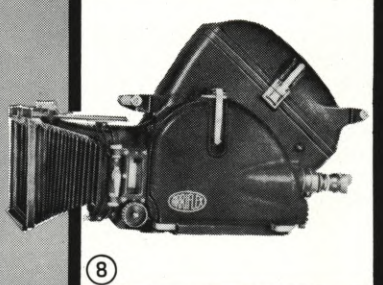
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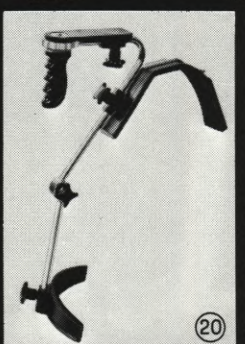
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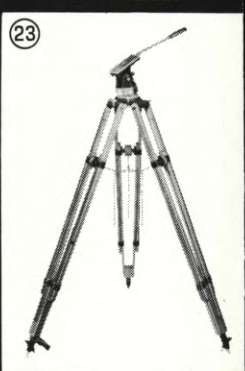
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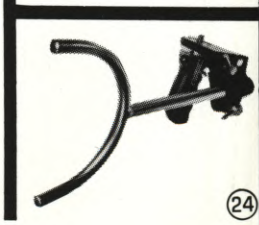
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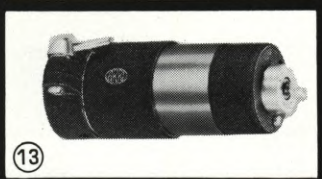
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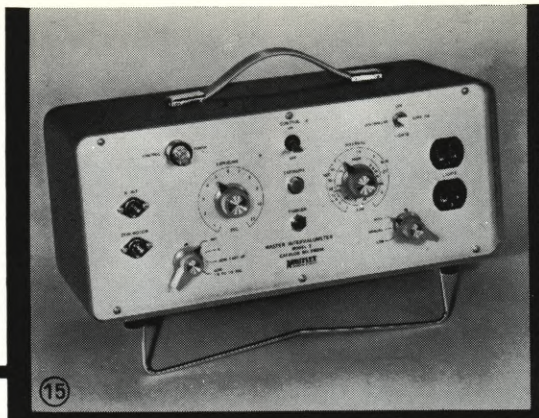
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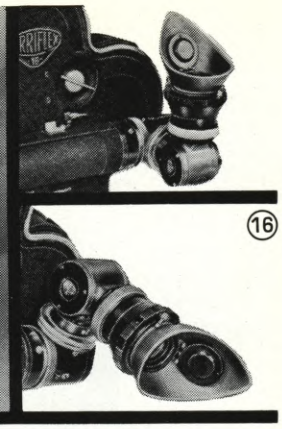

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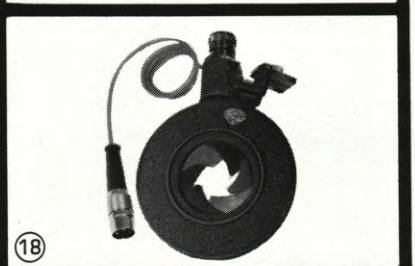
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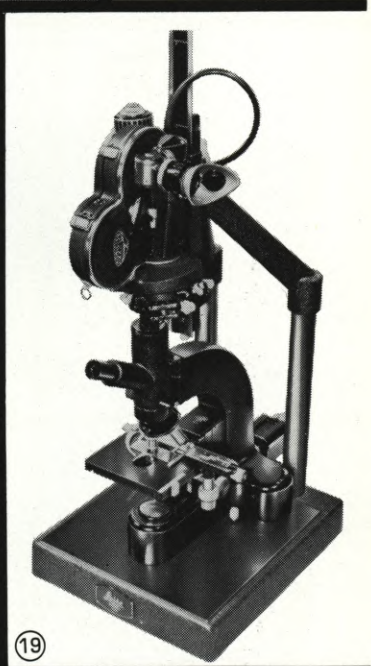
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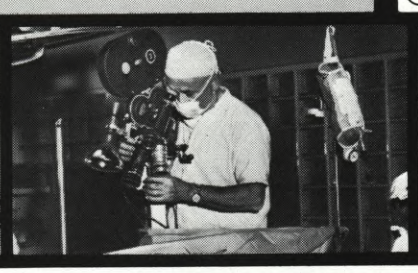

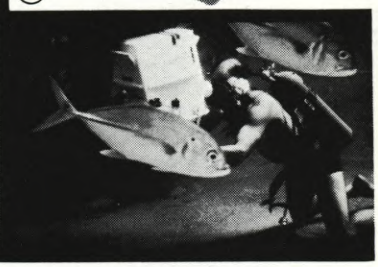

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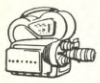

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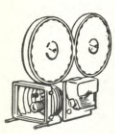

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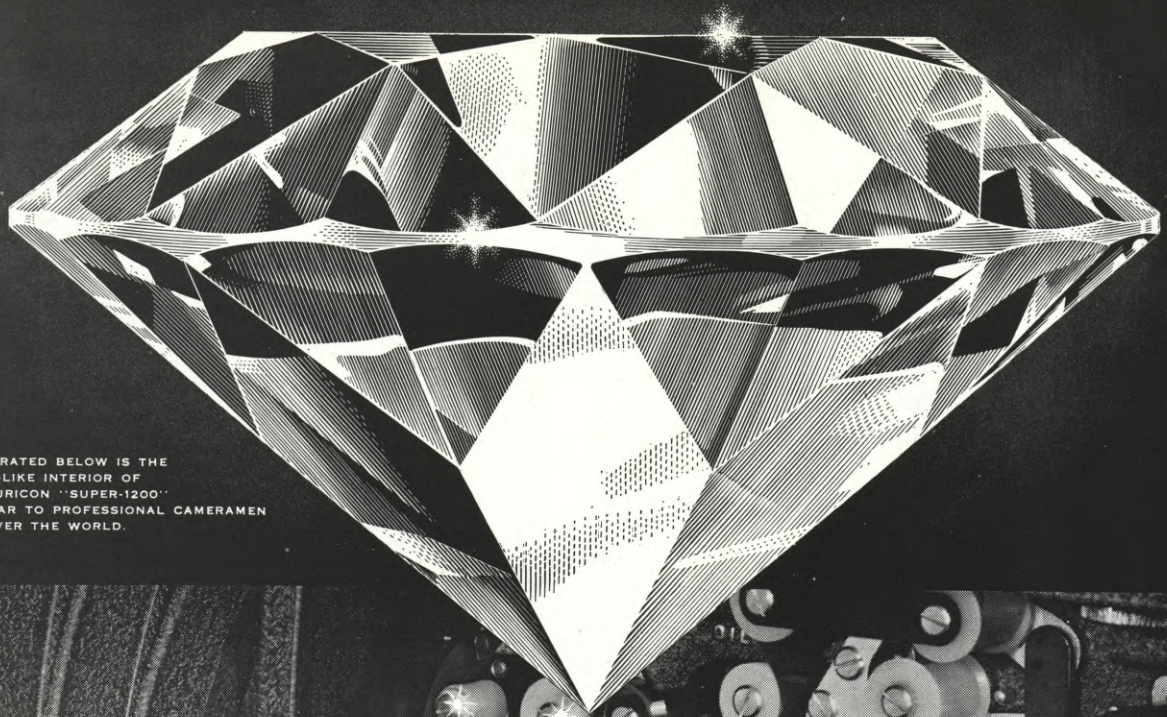
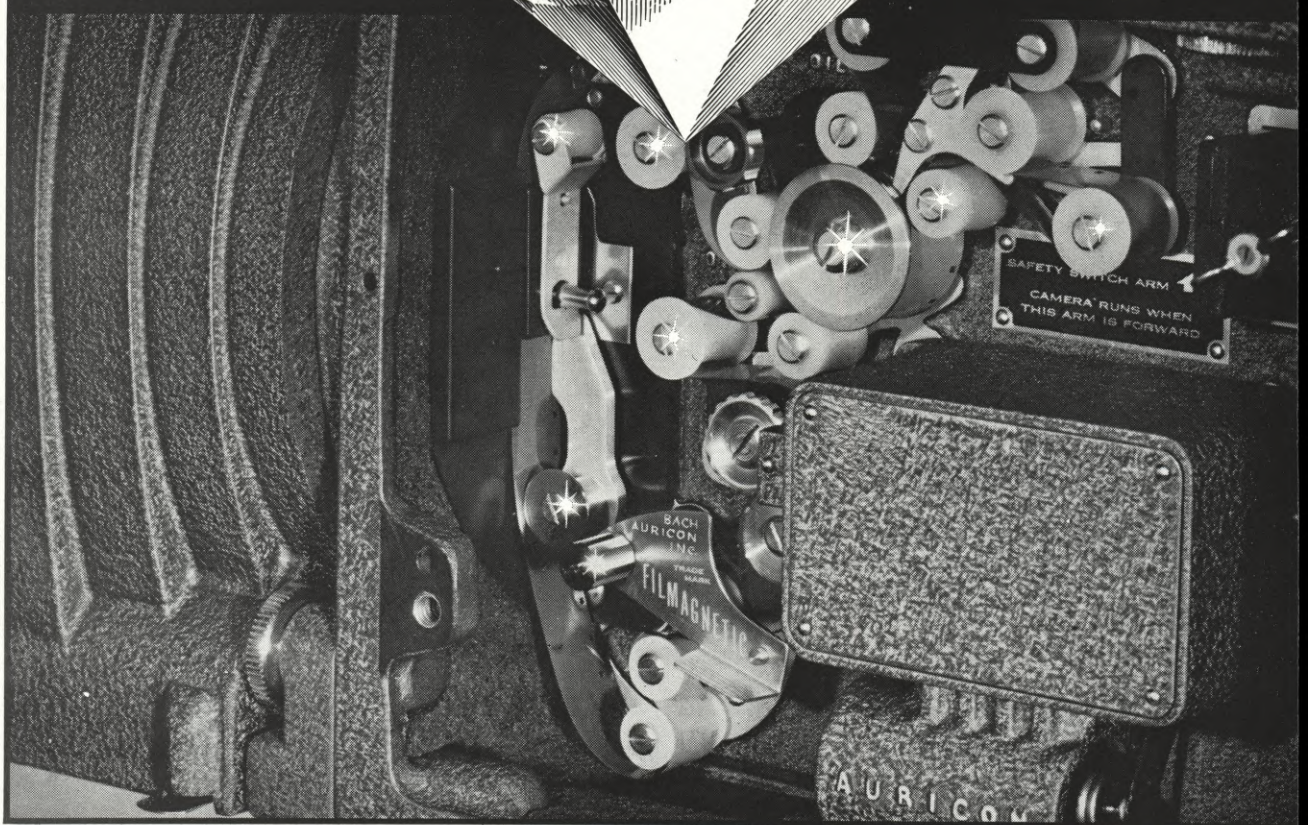


ILLUSTRATED BELOW IS THE JEWEL-LIKE INTERIOR OF THE AURICON "SUPER-1200" FAMILIAR TO PROFESSIONAL CAMERAMEN ALL OVER THE WORLD.



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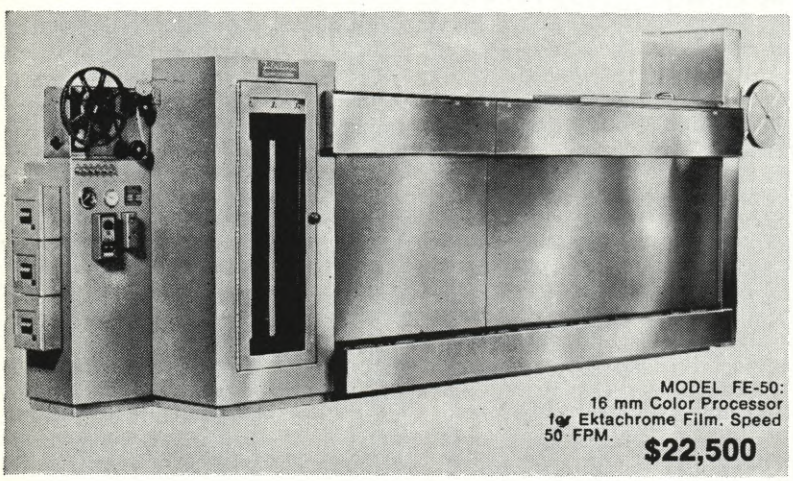

MODEL FE-50:
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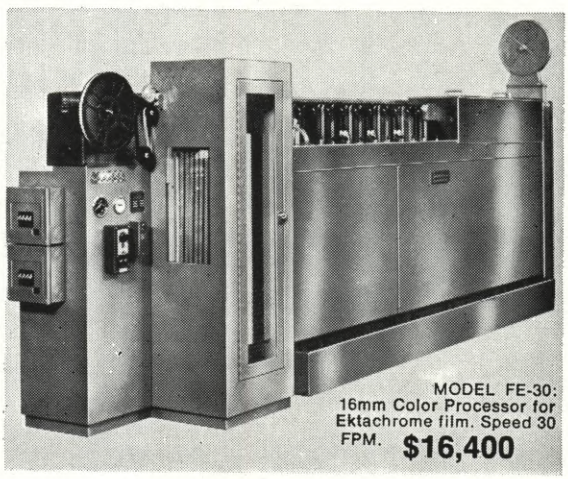

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Additional Features included in price of machine (Not as extras).

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TV Stations: WAPI-TV, WHP-TV, WMAL-TV, WXYZ-TV, WWL-TV, WMAR-TV, WJXT-TV, KETV-TV, WTOP-TV, WEAT-TV, WCKT-TV, WAVE-TV, WAVY-TV, KTVI-TV, WCPO-TV, KTAR-TV, WSYR-TV.

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The basic premise behind the pricing structure applied at THE EDITING PLACE is that "one of everything" will be provided to the customer, in keeping with current editing practices.

Should the customer require additional equipment to the basic package provided, THE EDITING PLACE will attempt to provide additions at the lowest possible cost. Some of the editing rooms are large enough to hold two editing benches, and if the customer needs another bench, and the room is large enough to hold it, the additional charge per week, with no discounts applicable, will be $15.00 for a bench with long arm rewinds, light box, and drop bags. CIR tape splicers, 16MM or 35MM will be $15.00 per week. Synchronizers (4 gang, 6 gang or 2 16MM gangs plus 2 35MM gangs) will be $15.00 per week plus $1.00 per week for each sound head added to the synchronizer. A four channel squawk box will be $10.00 per week. A moviscop 16MM bench viewer will be $10.00 per week. 16MM or 35MM hot splicers will be $15.00 per week.

Film racks and trim bins, if available, will be placed in the customer's editing rooms at no charge, in addition to the rack and bin in the basic rental.

Should THE EDITING PLACE have all additional equipment rented, and the need arises to bring in outside equipment, the customer will be charged at cost for such outside rentals.

RATES
TERMS
CONDITIONS —

EDITING ROOM RENTALS

STEENBECKS

MOVIOLAS

INTERLOCK SCREENING ROOM

FROM ONE DAY TO ONE YEAR

10 MINUTES AWAY FROM LABS, HOTELS, TERMINALS, NETWORKS, ETC.

LOCATED IN THE SAME BUILDING AS BELLEVUE-PATHE SOUND FACILITIES

THE EDITING PLACE

(division of Bruce Sabsay Productions Ltd., 290 Jarvis Street, Toronto)

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STEENBECK EQUIPPED EDITING ROOMS:

	DURATION:	RATE:
Each room is equipped with a Model ST6000 Steenbeck editing machine, in either 16MM or 35MM, or any combination of the two gauges. Also in each room there is a large editing bench with long arm rewinds, tight-winder, CIR tape splicer, 4 gang synchronizer, required mag heads for synchronizer, 4 channel low noise squawk box, split reels, spacers and clamps, punch, scissors, tape dispenser, film rack, trim bin, and for 16MM users a Moviscop.	one day (minimum rental) 1 week to 4 weeks 5 weeks to 12 weeks 13 weeks to 26 weeks 27 weeks to 52 weeks * * (maximum on one contract)	50.00 250.00 per week 245.00 per week 235.00 per week 215.00 per week

MOVIOLA EQUIPPED EDITING ROOMS:

Customer choice of either 16MM or 35MM standard Moviola editing machine with one picture head and one sound head, both heads being the same gauge. All other facilities as above in the section of this price list headed STEENBECK EQUIPPED EDITING ROOMS.	2 days (minimum rental) 1 week to 4 weeks 5 weeks to 12 weeks 13 weeks to 26 weeks 27 weeks to 52 weeks * * (maximum on one contract)	65.00 160.00 per week 145.00 per week 135.00 per week 130.00 per week

EDITING ROOMS WITH NEITHER STEENBECK OR MOVIOLA:

Equipped as above two items, except that no editing machine is provided.	1 week (minimum rental) 1 week to 4 weeks 5 weeks to 12 weeks 13 weeks to 26 weeks 27 weeks to 52 weeks * * (maximum on one contract)	100.00 100.00 per week 95.00 per week 90.00 per week 85.00 per week

EDITING SUPPLIES

The customer will be expected to supply his own leaders of any variety. A small supply of white leaders, track filler, SMPTE leaders, etc., will be kept on hand for emergencies and will be charged for at prevailing rates, or the customer can replace from his own stock.

Splicing tapes, white paper tapes (½"), grease pencils, and related materials will be supplied with each editing room up to reasonable useage. THE EDITING PLACE will charge for these materials if useage becomes very heavy in the opinion of the management.

A small supply of 16MM and 35MM plastic cores will be kept on hand, but large amounts will be supplied bythe customer.

TERMS AND CONDITIONS

Rentals of editing rooms are for 24 hour periods, that is, the customer will have access to his rented room along with the equipment in it for a full 24 hours. Rentals will commence at 9:00 A.M. on the day that the contract calls for it to start, and will run for the duration of the contract on that basis.

For customers with recognized credit, invoices will be for four week periods or less if the rental period is less, and will be thirty days net. 1% discount will be allowed for payments made within ten days of the date of the invoice. Customers who do not have recognized credit will be invoiced at the start of the contract for 50% of the time booked, and advance payment with 1% cash discount will be accepted. The remaining 50% will be accepted on the day that the rental ceases, also with 1% discount.

The rental contract contains the full terms and conditions and should be examined by the customer at the start of the rental.

All applicable sales taxes will be charged unless the customer has sales tax certificates for exemption purposes.

Rates and conditions quoted in this price list are subject to change at any time without notice; however, existing contracts will be honored at the contracted rates.

THE EDITING PLACE is a division of Bruce Sabsay Productions Ltd.,
290 Jarvis Street, Toronto, Canada.

05696

CINEMA WORKSHOP

By ANTON WILSON

VARIABLE SHUTTERS

The variable shutter has long been the most frequently misunderstood element of the motion picture camera. For many, the situations in which a variable shutter should or should not be used are not very well defined.

Most professional motion picture cameras employ a 180° shutter which will yield an exposure time of one half the length of a complete revolution or frame. Thus, the camera is essentially recording only half of the action and missing the other half. The closed half cycle allows the film to be advanced and registered for the next exposure or frame. Most camera manufacturers and designers feel that a full half-cycle is necessary, as registration accuracy could be jeopardized by a shorter and quicker advance stroke.

Even though the 180° shutter misses half the action, the remaining half provides sufficient information for the viewer's mind to perceive a relatively smooth flow of motion. This is accomplished by a phenomenon called blur (yes, BLUR!).

Our eyes have a tendency to sustain an image on the retina even after it no longer exists. This is known as *persistence of vision,* and is similar in effect to a characteristic of early vidicon tubes where an object would leave a momentary "after-image" subsequent to its removal from the scene. If the object is moving in a continuous path, the result of the after-images is effectively a blur; the combination of the actual image and the series of decaying after images. Our vision operates in the identical manner, and when we are confronted with a rapidly moving object, whether it be a waving arm or a pair of talking lips, it is perceived as a blur. Our minds have become so acclimated to this perceptual quirk that we cease to be consciously aware of it in most cases; yet, the fact remains.

Thus, when the motion picture camera operates with a 180° shutter or larger, it has effectively a persistence of vision similar to our eyes. Anything moving within that frame will be blurred. Upon projection, the eyes will perceive a very accurate sense of realism, as this blur is almost identical to the blur that would be perceived if one were actually viewing the scene live.

A variable shutter can reduce the amount of exposure time. However, it will also record a smaller portion of the action. For example, a 45° shutter will expose 12½% of the action and miss 87½% (see FIGURE 1). Thus, the smaller the opening, the less action is caught in the frame, and as a result the blur effect is minimized. Upon viewing a film shot with a small shutter opening, one sees a series of sharp distinct images which represent a very small sampling of the overall action. Contrary to popular belief, the effect is not a sharper picture, but rather an unnatural choppy or stroboscopic effect. Camera movements especially exaggerate this phenomenon.

FIGURE 1

SHUTTER OPENING	% OF ACTION RECORDED	EXPOSURE TIME @ 24-25 fps	EXPOSURE COMPENSATION
180	50	1/50	0
135	37½	1/65	1/3
90	25	1/100	1
45	12½	1/200	2
22½	6¼	1/400	3

It is for this reason that both the SMPTE and the ASC do not recommend the use of shutter openings much smaller than 180 degrees for almost all filming applications. The use of a small shutter opening to reduce excess light or to allow for the use of a larger aperture (to reduce depth of field) is not a recommended practice. In both of these situations, better results will be obtained by employing neutral density filters. In addition, the variable shutter in most professional cameras is not suitable for fades. It should be obvious now that the variable shutter is an extremely limited device on a production camera. There are however, several specialized situations where a variable shutter can be extremely helpful.

Those areas of cinematography requiring frame-by-frame analysis as opposed to smooth motion can benefit from a small shutter opening. Football training films are a good example of this category. Of prime importance is the ability to view every detail of a play, usually with the projector running at a very slow speed or even single-framed. In this case, one wants a sharp, distinct image on the film, and the aforementioned blur effect is unnecessary and undesirable. By employing a smaller shutter opening, the exposure time is decreased and a sharper image results. However, this also records a smaller portion of the action and it is feasible that an extremely quick and subtle move on a play may be missed by the camera.

Many cinematographers who specialize in sports analysis filming employ a higher camera speed, usually 30-36 fps. This provides a shorter exposure time (and thus sharper frames) without any loss of action. By combining these techniques, one can arrive at a camera speed and shutter opening relationship that will provide the necessary sharpness and yet capture sufficient action to maintain continuity for the specific analytical purpose.

While the variable shutter is almost superfluous on the production camera, it is an invaluable component of animation and optical printer cameras, which will be the topic of a future discussion.■

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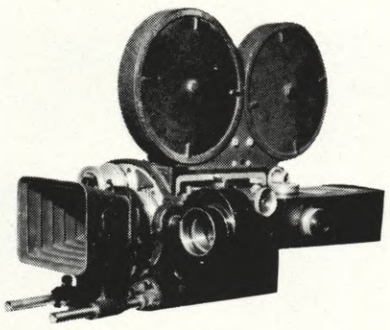

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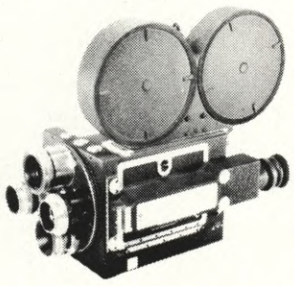

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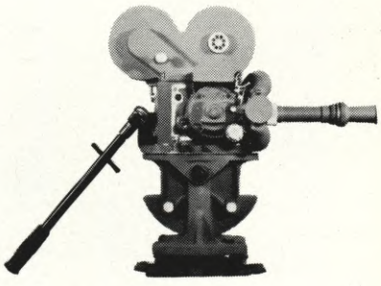

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A two-man documentary team risks life and camera to film a spectacular cinematic record of the second greatest volcanic eruption in the history of Hawaii

By BERT VAN BORK

Kilauea, one of the two volcanoes still active on the island of Hawaii, is known in native legends as the "House of Everlasting Fire" and as the home of Pele, the volcano goddess. In the more mundane records of the United States Geological Survey, it is classified as a "quiet" volcano—meaning that it erupts only occasionally (a dozen times since 1934). I was fortunate enough to be there when this smoldering giant blew its top in a spectacular way, making possible the filming of the short documentary called "FIRE MOUNTAIN".

How did I happen to be in the right place at the right time? It was sheer luck—or perhaps the volcano goddess decided it was high time she became a movie star. At any rate, I had been on assignment on the island of Hawaii, shooting a series of pictures for Encyclopedia Britannica Films. One of these, "HEARTBEAT OF A VOLCANO", was a documentary dealing with the ways in which scientists investigate a living volcano. The other was a film having to do with how life re-establishes itself following an eruption, the main fact being that it takes about 1,000 years for a forest to grow back fully after having been totally wiped out.

With me in Hawaii was Ulf Beckstrom, who doubles as assistant and editor. We always work together as a kind of team, usually just the two of us, because it's good to have a small crew—especially in hazardous situations like the filming of a volcano in full eruption. In such a case, if you have even one more person along that means you have one more worry. In the case of Ulf, the fact that he is also the editor makes it very important for him to go along on location. He actually sees what is happening. He knows from first-hand experience what is going on, and this gives him a better "feel" for the subject when it reaches the editing stage.

In our filming on Hawaii we had been lucky enough to photograph a small amount of volcanic activity, but

After he and his assistant had packed 150 pounds of filming gear through the jungle on foot, documentary producer-cinematographer Bert Van Bork sets up his Arriflex camera at a safe distance from Hawaii's erupting "quiet" volcano, Kilauea. (RIGHT) As they draw nearer to the vent, falling rain vaporizes to form a cloud of steam that blots out the fiery fury of the volcano and the danger that lies ahead.

we kept hoping that something more spectacular would happen. There was no real reason to believe that it would, since Kilauea had been quiet for a long time. Nevertheless, we "scouted the location", making full preparations for something that had only the slightest chance of occurring. We studied the topography of the area from a plane and I speculated that if and when there should be an eruption, the lava would flow in a certain way. Though it may have seemed foolish at the time, I decided that it was worth the gamble to cut a trail through the jungle and mark it with tape—just in case. As it happened, that gamble paid off handsomely.

In Hawaii, a volcanic eruption is regarded not as a destructive process, but as a land-building process. No population is allowed into the areas where eruptions are likely to occur. These areas are securely fenced off and, when there is the threat of an eruption, the highways leading into those regions are closed off. Working closely with government agencies on the island, we had arranged to get a key to the gate that seals off the area—just in case.

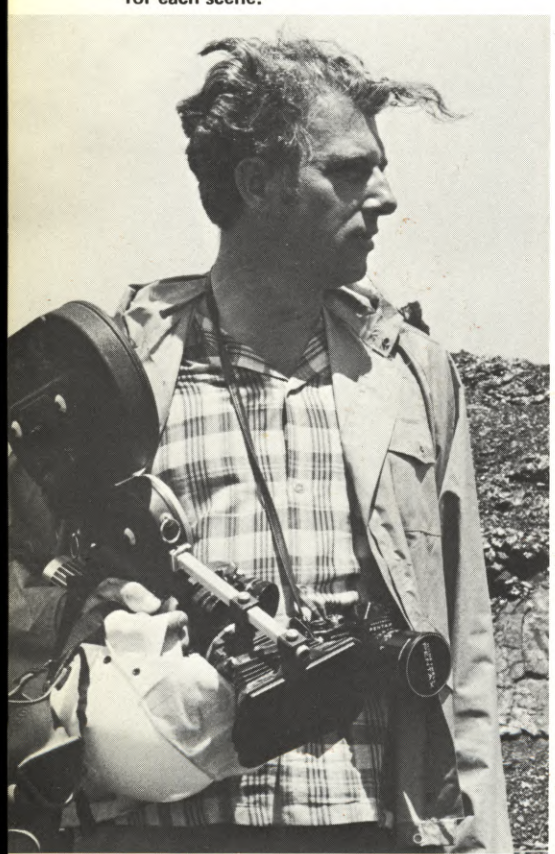
During lulls in our shooting, I viewed all the film locally available of eruptions that had been photographed during the years. This was because I'd had no experience in filming eruptions (how many people *do* have?), and I wanted to get a feel for the subject matter. I felt, also, that I might be able to detect certain problems peculiar to this type of filming, so that I might be better prepared—just in case.

From the footage I viewed, it ap-

From a distance the huge fiery fountain could be seen, but it was impossible to judge its height. From closer up it could be calculated that the column of molten lava shot 1800 feet into the air, almost twice the height of the Empire State Building and only 100 feet lower than the greatest recorded eruption in Hawaii's history, which occurred at this same site nine years before.

The daring film-makers moved to higher ground in order to get a panoramic view of the area. Seconds later, the ground below where they had just been standing was blown sky-high by a titanic explosion.

Having lost the head of his Spectra exposure meter, Van Bork was forced to use the spot metering system of his Pentax 35mm still camera in order to calculate a separate reading for each scene.



peared evident that all of the cameramen had made the same mistakes. There seemed to be a kind of sloppiness of exposure all the way through—as if they'd set the lens at, let's say, F/5.6, and left it there, photographing every scene at the same exposure. It seemed obvious to me that, because the brightness of the subject matter varied so widely, each shot would require its own special reading. I concluded that a good bit of the sloppiness apparent in the films I viewed was due to the fact that the cameramen had gotten excited by what was going on and had ended up fumbling around with the camera. This kind of excitement was certainly understandable—and I wasn't sure I would act much differently under the same circumstances—but I kept wishing for the opportunity to photograph this kind of subject matter carefully, with precise attention paid to such things as exposure.

Then I got my wish.

At midnight—after five weeks of waiting—Kilauea finally let go. I saw it first from the window of my hotel room. The sky was so fiery red that the whole city, the whole universe, seemed to be aflame. Then there was the roar—as if, in the distance, the world was breaking asunder, with mountains and continents crumbling into chaos.

We raced downstairs and jumped into the car, which had been kept ready, loaded with equipment. The eruption was seven miles away, but much of the road had been destroyed by previous lava flows. We drove for an hour. Then, in the darkness, we hiked through the jungle, following a trail of red reflecting tape installed by us three weeks before. We had carefully studied the area in daylight for all landmarks and high points, so that we would have a chance to escape sudden lava flows and move to more elevated areas, of which there were few. Hawaiian lava is known to be the hottest and fastest-flowing in the world. The lava is about 2000° Fahrenheit and flows at a speed of 20 to 40 miles an hour.

We had previously informed the U.S. Geological Survey of our plans and had given them detailed descriptions of the area where we planned to film so that in an emergency they could assist us. Just a few weeks before, during a lava flow, a National Park ranger had become trapped in his car when the lava flow cut off the highway, and he had to be airlifted out. His car was still standing there as a reminder.

In preparation for the possibility of shooting an actual eruption, Ulf Beckstrom and I had made practical plans and divided up our duties very carefully. He was to carry and take care of the film at all times, so that I would not have to worry about film or anything behind me. If we had to temporarily abandon anything as we moved forward, he would make sure to leave it in a place where we could see it. Lastly, and perhaps most important, he would help to keep me from doing anything too foolish, because it's very easy to get carried away in a situation like that.

There was one thing that I was determined to watch out for, and that is something that I am sure every cameraman has experienced. For example, you go to the Grand Canyon and you stand there in awe. You shoot film, but when you get home you are very disappointed in the footage. You don't have it. You haven't captured the scope of it—because the Grand Canyon defeats you. This can happen very easily, but I made up my mind in advance that the volcano was not going to defeat me.

It took an hour and ten minutes for us to reach the Aloi crater. A spatter cone had formed at the vent and, as we arrived at the area of activity, we had to cross a lava overflow from the night before. The crust was so hot that we could not stand in one place longer than a few seconds. Our shoes would start smoldering immediately, so we kept on moving steadily toward the vent.

Suddenly it started raining, a stream-

ing rain that soaked our clothing through. I was worried that we would be there for hours and catch pneumonia, but the heat was so intense that in a few minutes we were absolutely dry. As we pressed on and the temperature grew even hotter, much of the rain vaporized in the air. That which hit the hot lava turned into clouds of steam that enveloped us and within minutes it was impossible to see anything. The steam was so dense that I could not even see my assistant five feet away from me.

All we could hear was the gushing lava overflowing the vent. It was eerie knowing that the lava was creeping not far from us over the ground. We had, of course, no idea in what direction the lava was flowing. Again very suddenly the wind changed and started blowing the steam away from us and we could see a most spectacular sight: Out of the white steam we saw the red lava gushing about 20 feet into the air. To my dismay, I discovered at this moment that I had lost the head of my Spectra light meter. So, instead, I used the through-the-lens metering system of my Pentax camera as a light meter. The range of contrast from the white steam to the black lava was extreme. The meter of the Pentax worked perfectly and really got me out of a jam.

Luminous subjects, such as the fountain of a volcano at night, are extremely difficult to expose correctly with conventional light meters and practically impossible with incident light meters. Using the Pentax Spot Meter, I took readings of the brightest and darkest areas in which detail is important. The arithmetical average, or midway point, which will be used to determine the setting for exposure is found by adding the bright and dark area readings together and then dividing them by two. For my work with long lenses I used selective exposure or spot readings. The degree of validity of this method is also a function of the focal length of the lens.

Just as I had anticipated, it was necessary to take very, very careful exposure readings throughout the entire shooting. You simply couldn't set the lens at a single F-stop and shoot everything at the same aperture opening. Each scene called for its own separate setting. For example, I would shoot a scene at F/2.8 or even F/2, and on the very next shot (with the lens aimed at the hottest area of the fire mountain, for example) I would have to stop down to between F/8 and F/11.

Working to expose the glowing lava correctly was the most critical operation. It involved taking one reading for the lighter, yellow area and a separate reading for the deep red area of flame, and then averaging the two in order to arrive at a workable compromise. The important thing was not to wash out the color of the fire by over-exposing it. I always think of the internegative coming up later, so I tended to under-expose the fire just slightly in order to make sure that the rich warm tones would be preserved and not go white in the course of the requisite printing generations.

The picture was filmed on Eastman 7255 stock, the older and slower Ektachrome Commercial. I used just one Arriflex 16mm camera with 16mm, 25mm and 50mm Cooke lenses and 90mm and 300mm Kilfitt lenses. The camera was equipped with two 400-foot magazines, but the heat was so intense that I was afraid to leave that much film in a magazine for very long. It was for that reason that I used mostly 100-foot loads.

As we reached the vent area, the gases and toxic fumes made breathing almost impossible and we were forced to put on our gas masks. Lava was flowing around us like a giant amoeba and spatter was flying through the air. All around us there was steam and fire, and far above we could see the fountain of molten lava soaring high into the night.

I remember my first words: "This is the greatest show on earth!" It was a puny understatement. I was facing a spectacle that transcended human comprehension—a fire fountain shooting 1,800 feet into the air, almost twice the

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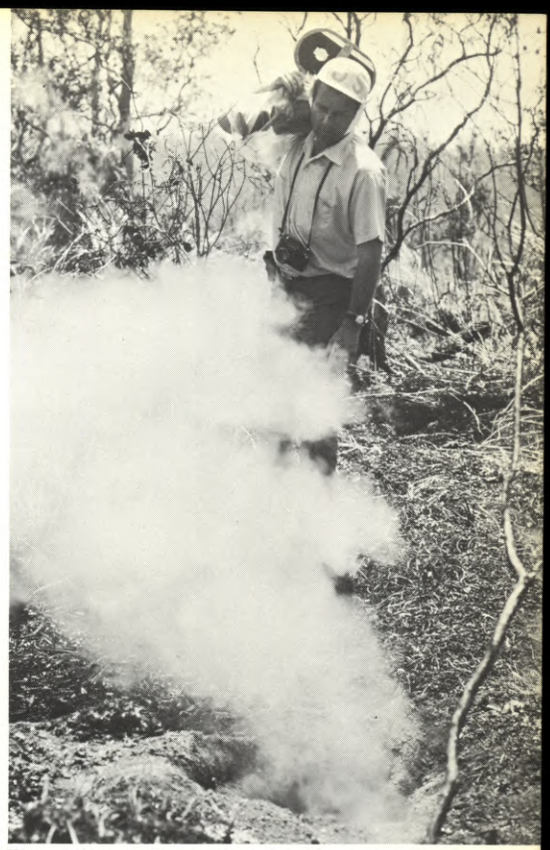


The author picks his way gingerly across the smoking terrain, aware that at any moment he might fall through the thin crust into a pit of boiling incandescent lava.

Back home in Evanston, Ill., following the "FIRE MOUNTAIN" experience, Van Bork takes it easy beside one of the several totem poles he has in his collection of primitive art.

(ABOUT THE AUTHOR: A producer-cinematographer with Encyclopaedia Britannica Educational Corporation, BERT VAN BORK is also a still photographer of international reputation. Before coming to America in 1955, he exhibited extensively throughout Germany and worked closely with the European motion-picture industry. A graduate of the Berlin Academy of Art, Mr. Van Bork was awarded, at the age of twenty-one, a National Art Award (1949) for a series of fifty woodcuts entitled "Night Over Germany," and in 1954 he received a National Award for Outstanding Photography, also in Germany. An exhibition of his photographs was held at the Grand Palais in Paris, sponsored by UNESCO, and he has received numerous national and international film awards, most recently at Naples for "Special Cinematography." As an art collector and a film producer, Mr. Van Bork has traveled extensively here and abroad, and his work has brought him into contact with many artists, among them Miró, Picasso, Chagall, Kokoschka, Dix, and Schmidt-Rottluff, as well as Lipchitz. He is now an American citizen, and lives with his wife, Maria, in Evanston, Illinois.)

THE WONDERS OF ARRI-LAND

A visit to the fabled factories where Arriflex cameras are born convinces the Editor that a single magic word, "precision", is what really makes the whole thing go

By HERB A. LIGHTMAN

The headquarters of Arnold & Richter KG at Turkenstrasse No. 89, located near the Schwabing district of Munich, includes company offices, factories, film processing laboratories, research facilities, motion picture studios, sound department, and a dubbing theatre that doubles as a public cinema at night. Totally destroyed by World War II bombings, the complex was painstakingly reconstructed in various stages which extended over more than 10 years. Company activity has now overflowed these facilities and is also housed in neighboring buildings.

Munich, West Germany

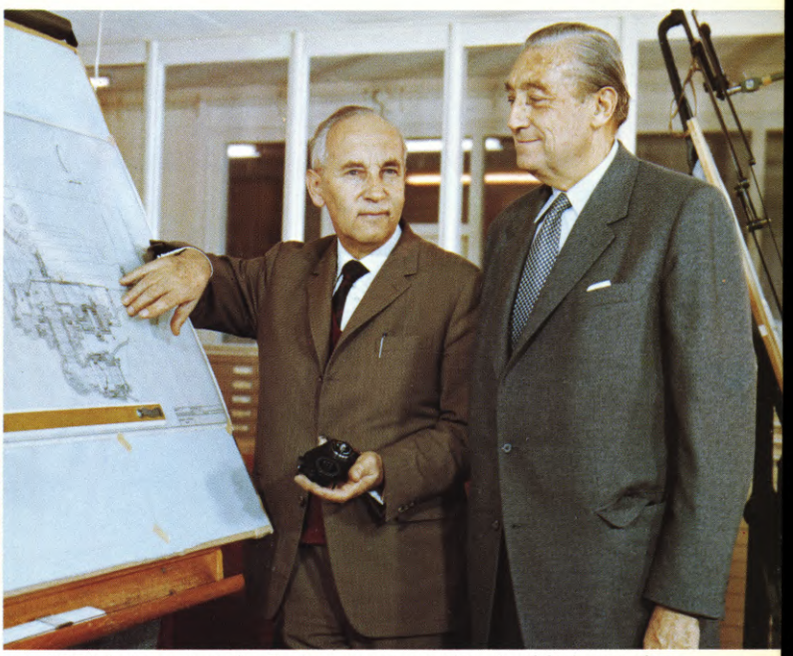
My journey to this beautiful and carefree Bavarian city is long overdue. I had been invited on several occasions to visit the headquarters of Arnold & Richter, KG, where the famous Arriflex cameras and many other items of motion picture equipment are produced. However, though my trips to Europe have been increasingly frequent during the past few years, the schedule has become more and more crowded with stops to be made within a limited space of time—so that, up until now, it would have been impossible to remain in Munich for more than a day or two.

Such a short stay can hardly begin to do justice to the vast ARRI technical empire, so I have been biding my time until, by some miracle, a full week might become available for that purpose.

The miracle has happened—and so it is that I find myself here, with nary a deadline commitment in another place for a full seven days.

It is good to renew acquaintances with Horst Bergmann, ARRI's affable, super-efficient Manager of Special Projects and Assistant to Dr. Robert Richter. He very kindly meets me at the airport and produces a precise schedule for the week to come, set down in

(LEFT) American Cinematographer Editor Herb Lightman visits with Dr. Arnold Richter in his beautiful country home at Stephanskirchen. (CENTER) A dinner party at the home of Dr. Robert Richter on Lake Ammersee includes ARRI Export Manager Reinhold Schutz, the author, Mrs. Ursula Richter, Dr. Richter and Special Projects Manager Horst Bergmann. (RIGHT) Pulvermuhle (the Powder Mill) at Stephanskirchen, country home of Dr. Arnold and site of an ARRI branch factory.



(LEFT) Motors for all of the Arriflex cameras are manufactured in a separate ARRI factory near the Turkenstrasse complex. A critical operation, shown here, is the dynamic balancing of Arriflex 16 BL armatures. (RIGHT) Camera Chief Engineer Erich Kastner, together with Dr. Richter, discussing details of one of ARRI's latest products, the 16 BL TTL exposure meter.

almost hour-to-hour detail. The following, presented in pseudo-diary form, is an account of my fascinating week in the ARRI wonderland:

Monday

My tour begins at Turkenstrasse No. 89, Arnold & Richter's main production facility in the heart of Munich. Located near the famous student/tourist area of Schwabing, the complex includes offices, factories, motion picture production studios, film processing laboratories and a large auditorium that doubles as a sound mixing studio by day and a conventional cinema theatre (open to the public) at night.

Totally devastated by bombings during World War II, the Turkenstrasse location was rebuilt as a thoroughly modern technical center. Its only drawback is that success has rendered it inadequate in terms of space, causing an overflow of activity into many smaller nearby buildings, where skilled craftsmen work in an almost "cottage labor" atmosphere to fabricate and test the multitude of components for ARRI products.

I am introduced to Plant Manager Ludwig Nebel, who graciously offers to give me a conducted tour through the main manufacturing facility, of which he is obviously very proud. We begin in a huge machine shop, where practically all of the component parts for Arriflex cameras are fabricated from raw materials. Up until recently, I am told, all of these parts were manufactured on conventional lathes, but rising labor costs and the need for ever-more-precise tolerances has made it necessary to install automated lathes for the fabrication of some of the parts.

This is the first time I have seen automated lathes in action and I find their performance quite fascinating. Once the lathe is programmed for the particular piece to be turned, everything else is automatic. The raw material, in the form of steel bars, is loaded into a tube and is supplied to the machine from the rear by means of continual feed. The quality of the resultant parts is higher than that which can be achieved with conventional machines.

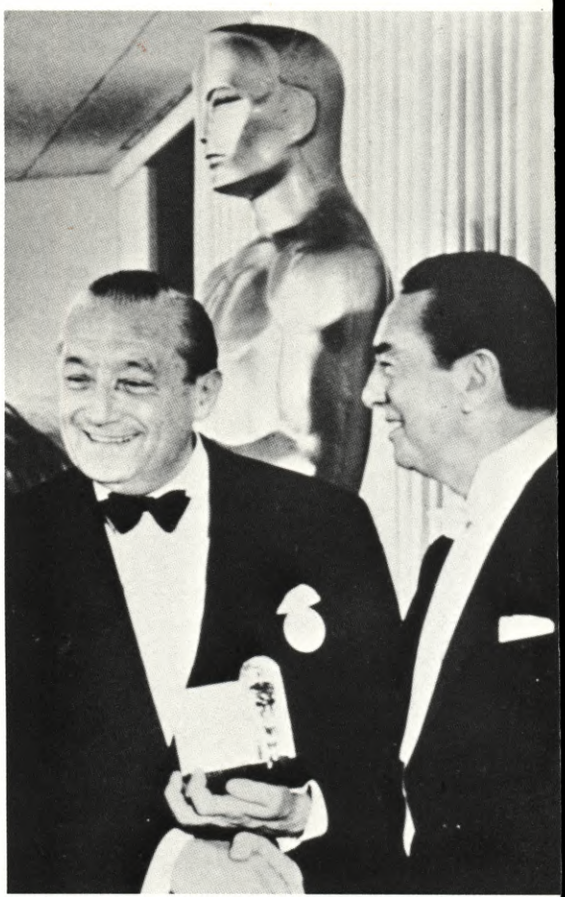
Partial view of the branch factory at Stephanskirchen near Rosenheim. In the background is the new foundry. Parts are fabricated here for Arriflex cameras, lighting equipment, and film processing machines. This complex also includes facilities for the manufacture of a range of optical items pertaining to film production.

(LEFT) Horizontal boring mill used for large component machine work. It is shown here at work on casting for a blimp 1000 (blimp housing for the Arriflex 35mm camera with 1000-foot magazine). (CENTER) The Arriflex 16mm camera assembly department, headed by Mr. Willi Zeintl. (RIGHT) The manufacture of Arriflex camera components is now extensively automated. Shown here is a program-controlled automatic lathe with tool turret for performing eight machine operations.

There are, however, several manually-operated lathes in the shop and these are most frequently used to fabricate parts of such a small run that it would be economically impractical to program and adjust an automatic lathe for their manufacture.

Certain parts that are formed on automatic machines must be finished manually. A high-gloss finish is achieved by using a diamond bit that cuts to a depth of only 1/1000th millimeter, leaving the part with a mirror finish. Many of the parts involved in camera manufacture are later given a black anodyzed coating with a silken finish.

(LEFT) Optical glass blanks for Arriflex mirror shutters awaiting polishing and silvering operations. These shutters must be polished to the most precise plane-parallel tolerances to assure optical veracity and noiseless operation. (RIGHT) An array of optical elements manufactured at the Stephanskirchen factory, including mirror shutters, viewfinder objectives and Ultrascope anamorphic lens elements.



On April 10, 1967, Arnold & Richter KG received a scientific/technical Academy Award for design and development of the Arriflex 35mm camera. Dr. Richter appeared personally to accept "Oscar" from Academy officer, MacDonald Carey.

(LEFT) A section of the ARRI Film Developing Machines Manufacturing Department. Shown here is the assembly of Arribloc Type 400 16mm reversal film processors. (RIGHT) The ARRI Film Laboratory. This is the daylight section of the color developing department, equipped with dual-channel ARRI Color Developing Machines for 35mm and 16mm films. One of the busiest in Europe, this lab utilizes the very latest ARRI equipment, plus several "workhorse" machines that are still performing perfectly after many years of service.

Taken to see the tool room, I am told that German high-precision workers do not provide their own tools for the job, the reason being that, because of the high cost of replacing such tools, a man might understandably be tempted to work with tools that are slightly worn-out. To guard against this, all of the tools used are not only requisitioned from the company tool room, but are checked constantly for accuracy and refurbished or replaced immediately, as needed.

I watch the manufacture of a master cam for the Arriflex 16mm standard camera. This is a part that must be equally thick on all sides. It is being fabricated on an automated milling machine that holds the maximum error tc a tolerance of ½ of 1000th of a millimeter. This extremely tight tolerance is critical to the noiseless operation of the movement, especially since the part revolves eccentrically. In the manufacture of older movements, with master cams milled on conventional machines, the allowable tolerance of error was unavoidably much higher. The switch to automated equipment has cut down the noise of the movement by 3 to 4 db.

The checking of tolerances on these automated machines is done by means of electronic monitors, which keep measuring the dimensions of the part and controlling the machine's operation until the desired tolerance is achieved.

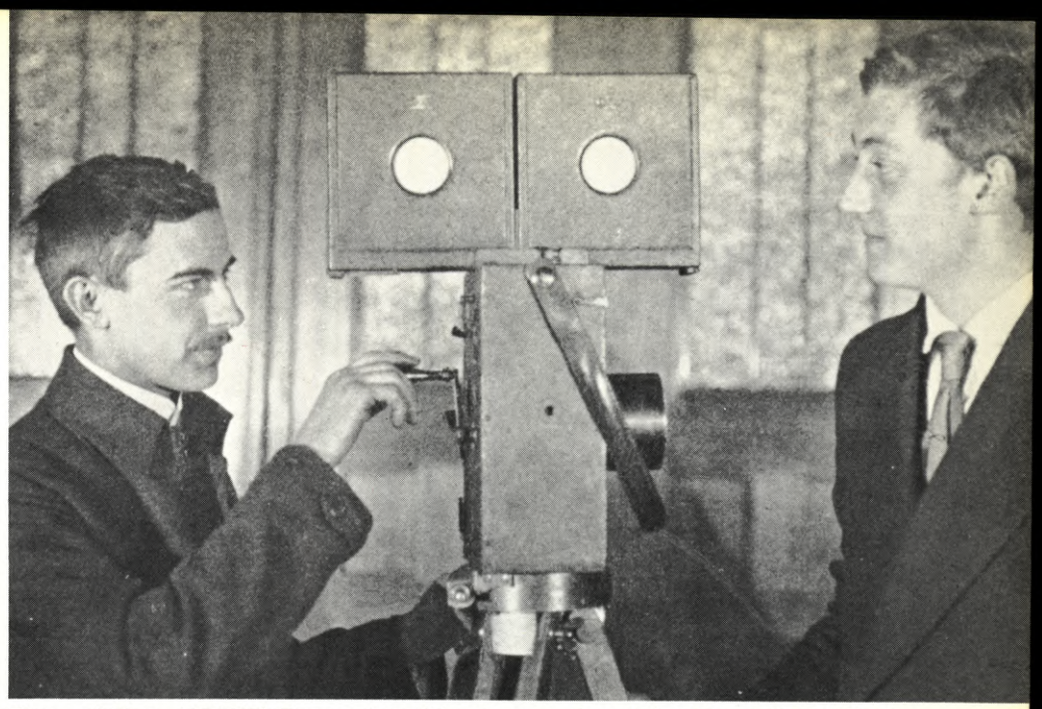
During the course of this phase of my tour, I observe the operation of milling machines that operate on the pantograph principle. Simply stated, the contours of a large pattern are traced, with the movements of the milling bit exactly reproduced in miniature to form the much smaller actual part. It is a very old principle, of course, but this is the first time I have seen it applied to machine tooling.

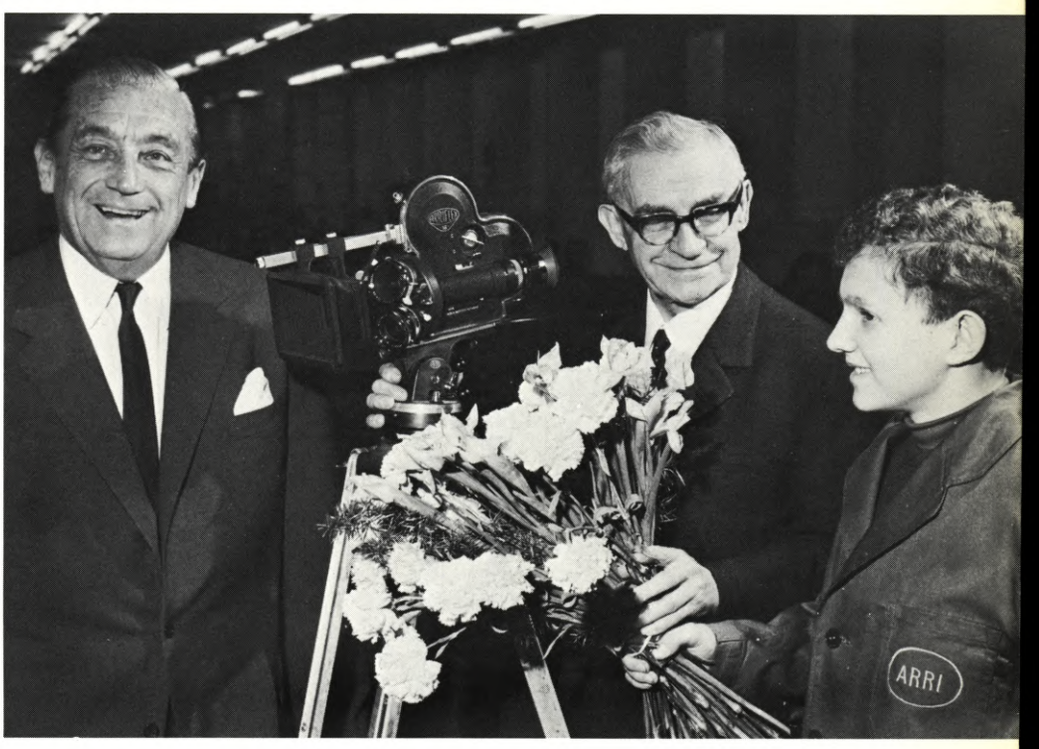
Some of the larger non-moving parts (such as elements of a camera housing) arrive from ARRI's own foundry in the form of rough castings, which are then ground to much more precise dimensions by machine.

On extremely critical parts, where precision must be maintained down to the proverbial "gnat's eyebrow", the incredibly fine tolerances are verified by a pressure tester. Simply stated, air is dispersed under pressure between a probe and the surface of a part to be tested. A highly sophisticated metering system interprets the pressure and, thus, provides a form of measurement more critical than can be achieved in any other way.

My first day at Arnold & Richter is devoted to the observation of dozens of high-precision machines, each of which is responsible for turning out a significant part of a very complex camera or other piece of cinematographic equipment. Through it all, the word *precision . . . precision . . . precision* . . . echoes like a heartbeat. It is the word that paces the 1400 skilled craftsmen at Arnold & Richter and the machines that do their bidding. If, to the layman, there might seem to be an undue obsession with the word—if there would appear to be an element of *overkill* to this preoccupation with perfection—there is a very good reason for it. A slight error in a single part may not be all that significant. But error in relation to the components of a complex bit of machinery like a modern motion picture camera tends to be cumulative. Several very small errors may, in the final analysis, add up to one very large one.

It's as simple as that!

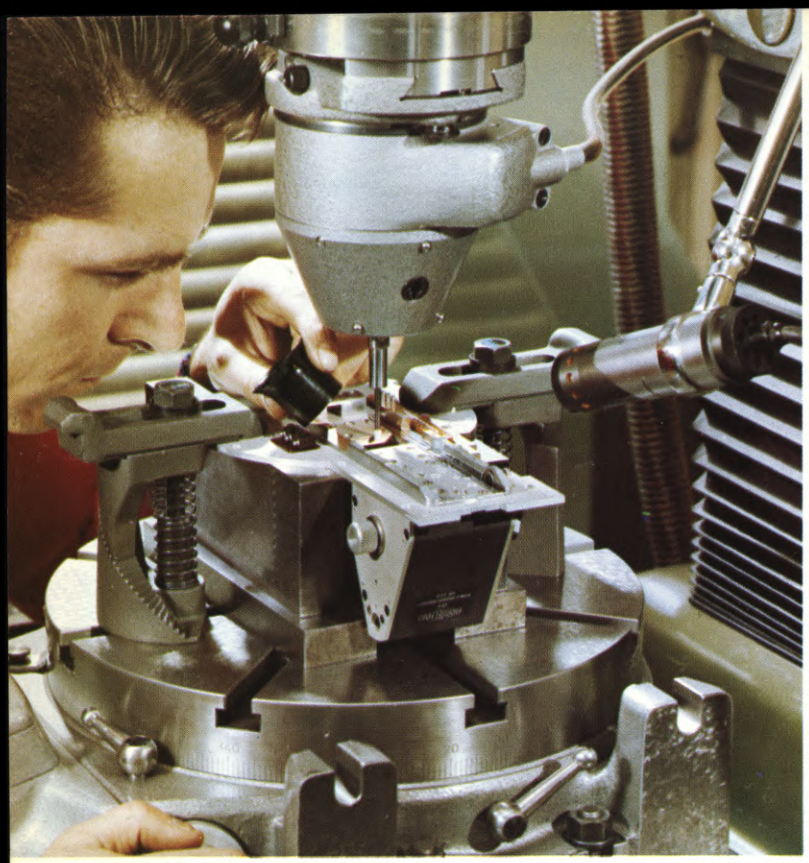


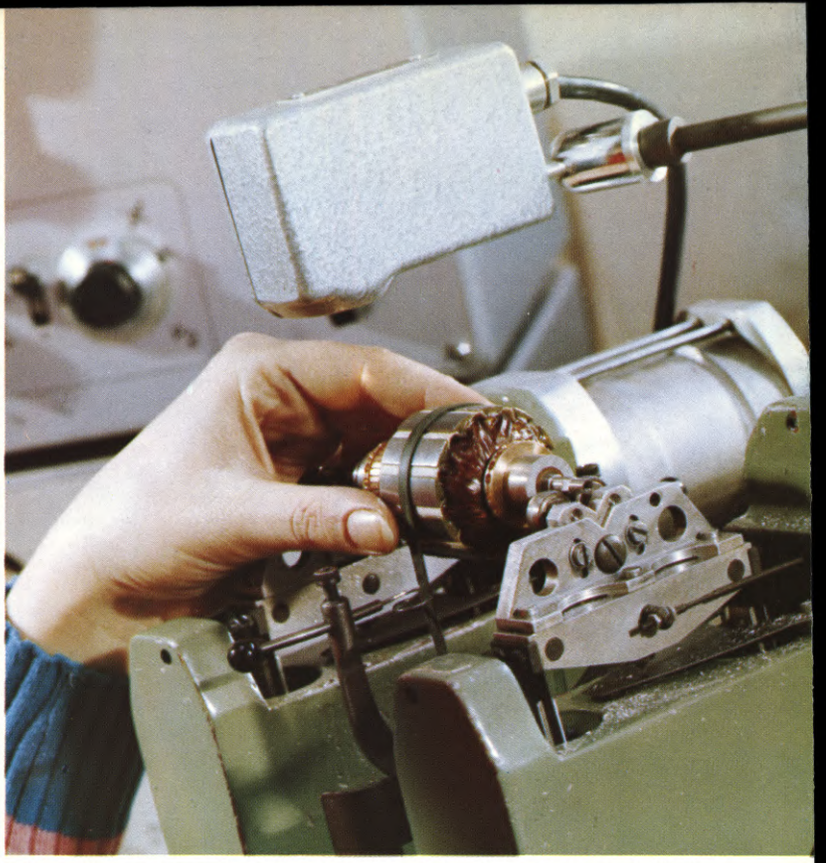


Then and Now. (ABOVE) Teenage intrepid cameramen August Arnold and Robert Richter, shown in 1916 with their pride and joy, a Pathe cine camera. (BELOW) Dr. Richter and Dr. Arnold, founders of Arnold & Richter KG, shown being congratulated by an ARRI apprentice on the occasion of the company's 50th anniversary in 1967. The long-enduring partnership of these two men is one of the truly inspiring stories of the film industry.

Tuesday

Today I have been invited by Dr. August Arnold to visit him at Stephanskirchen near Rosenheim where, on an estate called the *Pulvermuhle* (Powder Mill), is located Dr. Arnold's country





(LEFT) A jig boring machine with an adjusting accuracy of 1/1000th of a millimeter guarantees the precision of Arriflex cameras and allied accessories. (RIGHT) Closeup of 16 BL armature on dynamic balancing machine in ARRI branch factory. The company is proud of the fact that it makes motors, as well as all other parts and accessories, for Arriflex cameras, instead of sub-contracting to other vendors.

Dr. August Arnold, shown in the greenhouse of his estate at Stephanskirchen. Horticulture is only one of his many interests. He divides his time between this factory and the other ARRI manufacturing centers, constantly checking items currently in production, as well as designing and testing new pieces of equipment.

home, as well as an ARRI branch factory.

Leaving Munich, we drive the forty miles or so along the *autobahn,* which is strewn with fresh automobile wrecks, some of them quite horrendous spectacles involving semi-trailers and such. Horst Bergmann explains to me that there is no local speed limit and that, as a result, the carnage I am witnessing is quite the usual order of things.

The beautiful Bavarian countryside, as we near Stephanskirchen, is like something right off a Christmas card. The illusion is heightened when I catch my first glimpse of Dr. Arnold's home. It is a stately country house of classic rococo design and there is a brass plate at the entrance which proclaims in French that this is the Consulate of Togo. It is explained to me that serving as Consul for that African nation is one of Dr. Arnold's ancillary interests.

Our host greets us very cordially and invites us in for some refreshment prior to touring the factory. The refreshment turns out to be plum brandy distilled on the estate, a true firewater of such potency that Texans would be proud to call it "skullbuster". Dr. Arnold, on the other hand, drinks only Coca Cola.

The interior of the house is even more fabulous than the outside. The architecture might be described as "Bavarian baronial", but the "set dressing" teems with varied exotica (a huge inhabited cockatoo cage in the sitting room, a



(LEFT) Interior view of the new foundry at Stephanskirchen. (CENTER) Foundry technician pours molten metal into a mold for a camera part. Ten different alloys of aluminum, provided by a factory just one kilometer away, are used in the manufacture of various foundry items. (RIGHT) Dr. Arnold checks the operation of an injection mold casting machine. Sand casting is also a standard technique for the fabrication of larger pieces and those with a limited run.

full suit of samurai armor in the wine cellar, colorful native artifacts from Togo in the tower room, etc.). I am delighted with this collection of curios, which so keenly indicates the cosmopolitan tastes of the man who lives there, and my film director imagination is busily visualizing the whole place as the set for a Hitchcock movie.

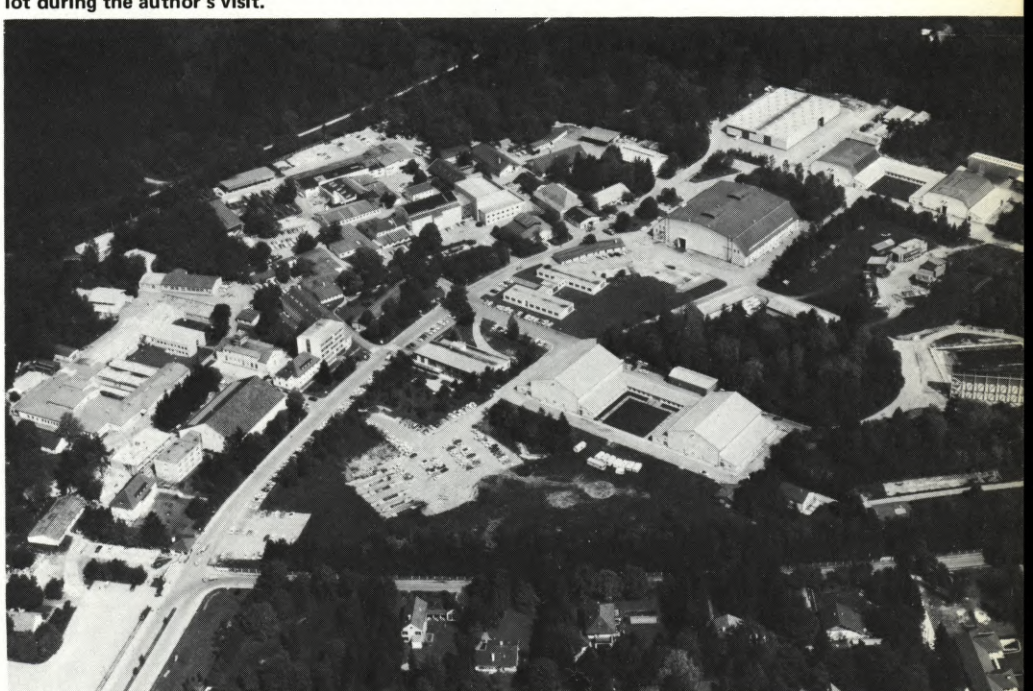
When we tour the factory afterward, Horst Bergmann very kindly serves as interpreter, since Dr. Arnold speaks little English and German is not one of my languages. We start with the new foundry, obviously our host's pride and joy. It is a large modern facility, fully equipped to turn out both sand castings and injection-mold castings.

It is explained to me that certain larger pieces (tripod heads, Arriflex 35mm gear covers, etc.) can only be produced by means of sand casting, whereas injection casting is best for producing smaller pieces and those which must be turned out in large quantities.

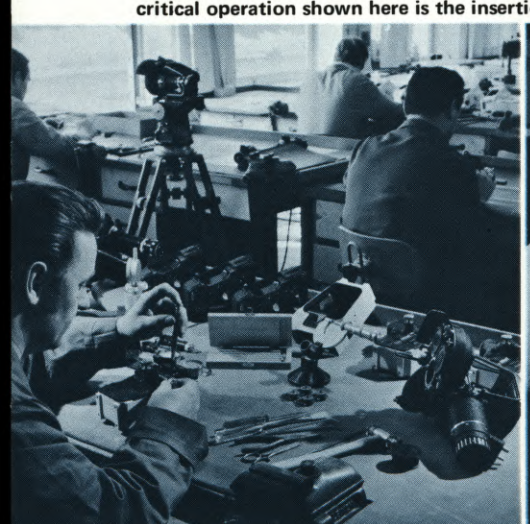
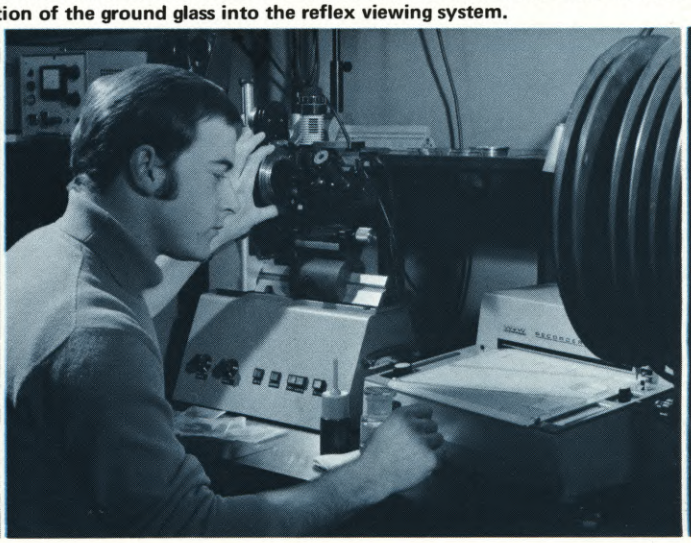
I find the sand casting procedure

Continued on Page 598

The motion picture studios of Bavaria Atelier Gesellschaft in Munich, were visited by the author during time off from ARRI. The studios are among the best-equipped production facilities in Europe. A separate new ultra-modern sound recording studio is now in operation in downtown Munich. Preparations for filming of the American musical, "CABARET" were in progress on this lot during the author's visit.



(LEFT) Mechanic adjusts parallel position of an Arriflex 35mm main drive shaft. (CENTER) Testing apparatus with graphic recorder for ND neutral density circular wedges used in manufacture of the Arriflex 16 BL TTL exposure meter. (RIGHT) Final assembly of an Arriflex 35 IIC camera. The critical operation shown here is the insertion of the ground glass into the reflex viewing system.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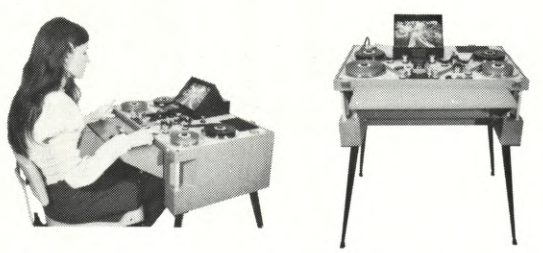

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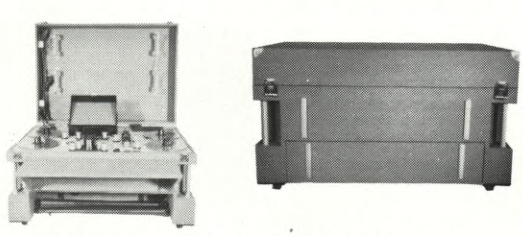

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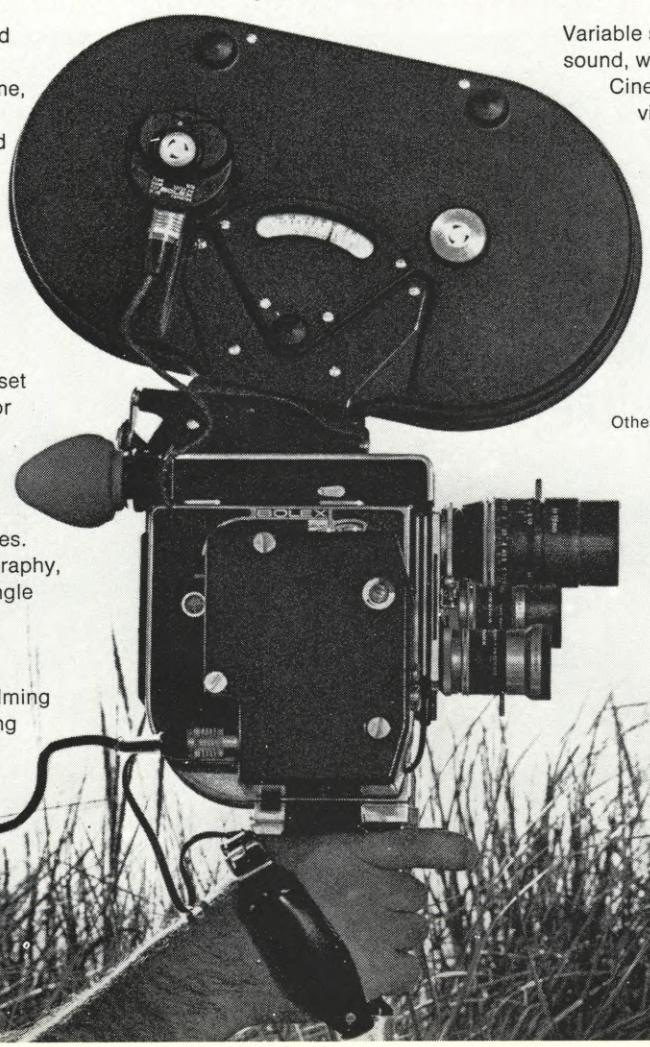

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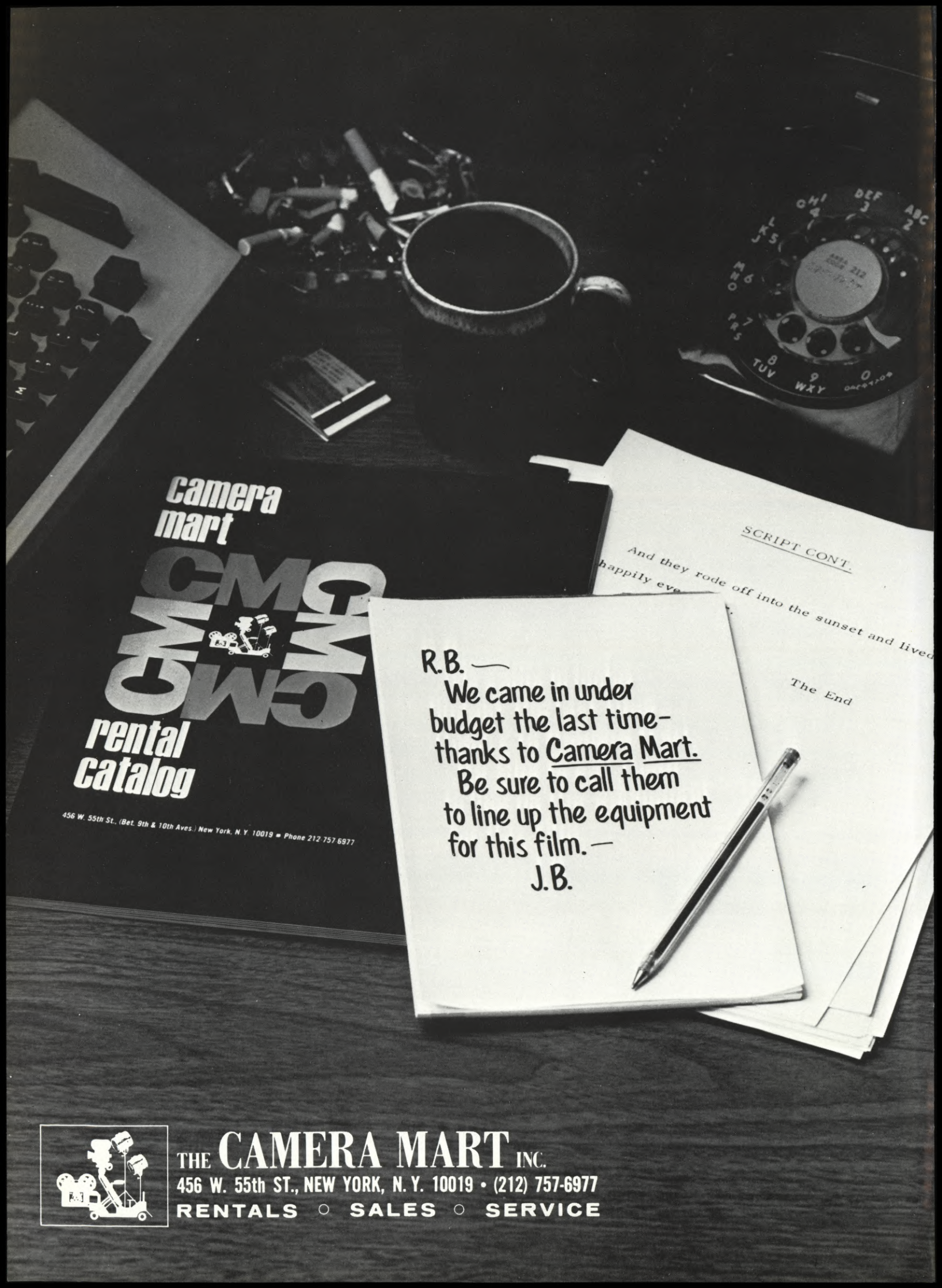

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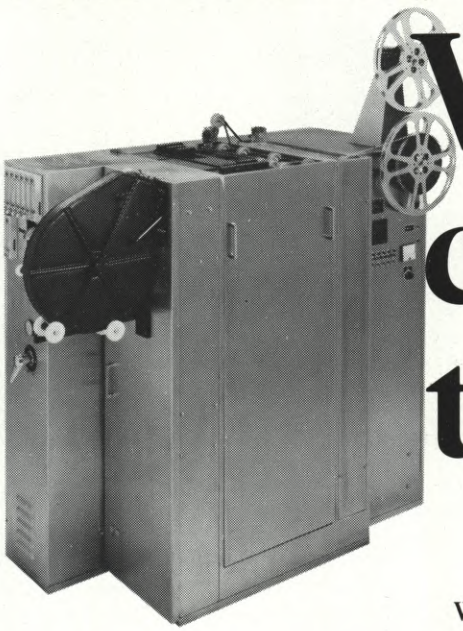

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"FIRE MOUNTAIN"

Continued from Page 541

height of the Empire State Building—a curtain of flame equal in magnitude to Niagara Falls and twice as high, cascading into the crater—a mighty river of lava pouring down the slopes at 30 miles an hour.

All around us the ground was shaking violently and cracking open. Puffs of steam belched from fissures amid ferns and rocks. These warned of tremendous subterranean pressures that could blow us off the face of the earth. This came close to happening. In one case I decided to move to a vantage point a bit higher up in order to get a better camera angle. Seconds later a gigantic explosion obliterated the spot where we had just been standing.

The cooling river of lava forms into mounds of rolling natural sculpture, leaving masses of gray, shiny rock such as this all around the base of the volcano. In Hawaii, such an eruption is regarded not as a destructive force, but as a land-building process.

Some of the scenes, especially the long shots, were filmed from a tripod, but a great majority of the footage was shot hand-held. In such cases, Ulf Beckstrom would stand behind me to lend support and steadiness and also to keep an eye out for imminent danger. When you are looking through the viewfinder you completely lose orientation regarding how close things are to you. Frequently the sea of red-hot lava would flow to within 15 feet of where I was standing. Beckstrom saved my life many times simply by dragging me away when the fiery lava got too close.

The volcano is a super polluter, and never in my life have I encountered such a problem of trying to keep the equipment clean and operable. The pumice fallout from the cone, mixed with rain, formed an abrasive sludge that splattered onto the lenses. The problem was to try to keep them clean without scratching them. I squirted Kodak liquid lens cleaner onto the glass elements to wash off the fallout and then I used lens paper very carefully. Every ten minutes I used up a pack of lens paper. The camera was kept wrapped in sheets of plastic to protect it from the water and the constant shower of abrasive particles. Changing of the film and magazines always had to be done under the cover of plastic bags and sheets. The "housekeeping" job was enormous, but it was one of the most important tasks of this assignment.

After five hours of this kind of "combat photography", the fire fountain died abruptly, a drama came to a sudden end. I had experienced the full spectrum of emotions, ranging from awe to exultation to extreme terror. But now I felt empty, profoundly regretful that it was over.

We descended the still-smoking mountain, with our film and camera, in a mood of desolation. Everything that had been lush and green before was gray now. Where the jungle had stood there remained only the grim specters of scorched tree trunks. It was depressing.

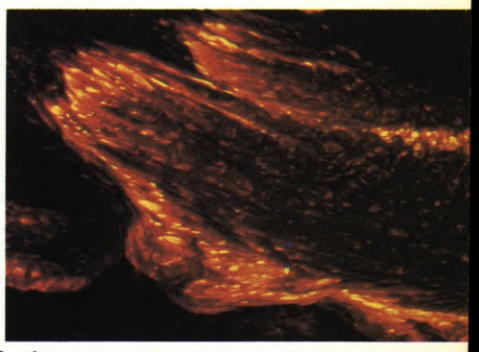
Yet, "in the can" there was a film record of that magnificent moment when the volcano goddess, Pele, soared in flaming splendor from her "House of Everlasting Fire".

That spectacular moment would live on in the form of "FIRE MOUNTAIN". ■

(ABOVE LEFT) The toxic fumes became so noxious as the film-makers approached the vent, that they were forced to don gas masks. (BELOW) In the wake of the volcano's fury—a ghostly gray landscape studded with the grim specters of scorched tree trunks, where a lush jungle had stood only hours before.





When Van Bork caught his first glimpse of this spectacular sight, he said: "This is the greatest show on earth!" But it was a puny understatement. He was facing a display that transcended the comprehension of mankind—a curtain of fire equal in magnitude to Niagara Falls, a mighty river of lava cascading down the slopes at 30 miles an hour.


(LEFT) All around them the ground was shaking violently and cracking open to expose new rivulets of red-hot lava. Puffs of steam came through fissures amid ferns and rocks. (RIGHT) Small eruptions of flame on the crusty surface warned of tremendous subterranean pressures that could have blown the film-makers off the earth.

(LEFT) The author stands silhouetted against the fountain of fire. Many times the river of fiery lava coursed within 15 feet of where he stood engrossed in his photography, and he was repeatedly dragged out of the path of certain death by his super-alert assistant and editor, Ulf Beckstrom. (RIGHT) After five hours of "combat photography", the eruption died down abruptly and Kilauea went back to sleep. The native Hawaiians call this mountain "The House of Everlasting Fire" and regard it as the home of Pele, the volcano goddess.


FREDDIE YOUNG GOES TO COLLEGE

Three-time Academy Award-winning cinematographer meets with a group of Canadian college students and ends up by helping them make a documentary film on his visit

By GEORGE WRIGHT
Media Co-ordinator, Sheridan College, Toronto

In the end, it was that we met Freddie Young.

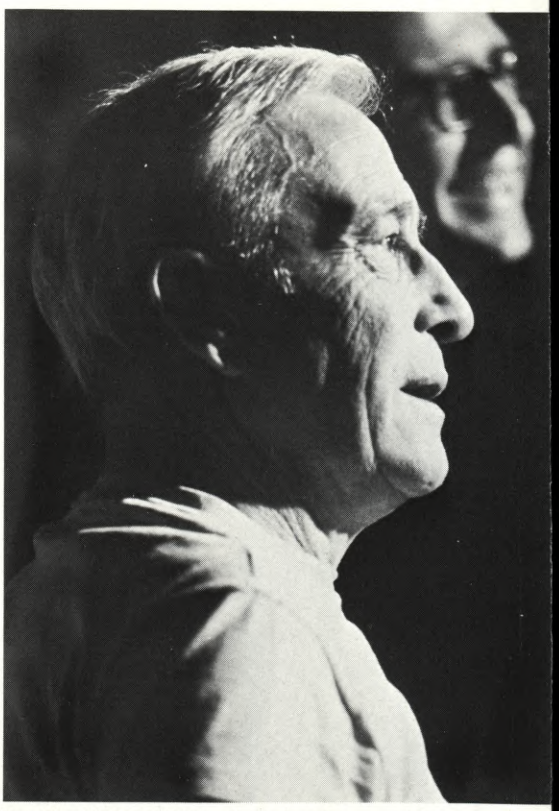
How else can we say it? He photographed "LAWRENCE OF ARABIA", "DOCTOR ZHIVAGO", and "RYAN'S DAUGHTER"—and everything back to the beginning of time, it seemed. He was out of our league entirely. A master of the large format cinema, professionally accomplished during most of the history of motion pictures, just finished with one big film and ready to start another. It was just too much. But . . . in the end . . . we met Freddie Young in Toronto in October, 1970.

There are three of us who teach film and one who works full time in the industry with Allan King Associates. We work free-lance and together as Central Medea Productions. Bruce Pittman, who works with Allan King, heard that Freddie Young, BSC, the famous cinematographer, was coming to Toronto as part of an MGM publicity tour for David Lean's film "RYAN'S DAUGHTER". He asked us if we wanted to have our students meet him. Sure. We talked about the date and arrangements to bring him to Sheridan College to talk to our film students. As we talked we thought further: "Why not shoot some film of this meeting?"

The idea grew. The facilities, the date, the procedure—these were all fairly straightforward things to work out. The students would be eager to meet a man who had worked on some of the biggest and most famous films of the day. But what about Freddie? His tour was physically exhausting, we knew. And Freddie is not a young man. He has worked in film since 1917, in fact. Further, he was going to be talking to a casual group of long-haired kids, and we were going to complicate it by intruding actual shooting into the whole process. How would he react to all this? It would be entirely reasonable to expect him to reject the whole affair. A publicity tour, 16mm film, freaky-looking kids, it would be just a little too much. To settle things, we had Bruce phone him in New York, his last stop before Toronto. He was extremely courteous. We were the first to phone him in advance, he said. So far so good. He went on to say that he was entirely agreeable; he was in our hands. That was far-out. Freddie Young in our hands!

In the meantime, planning went on. We found that we could use the Sheridan still photography studio. That meant that the lighting problem was solved, since the studio had a lighting grid and a wide range of floor lights all balanced for 3200K. We could shoot Ektachrome 7242, then. However, there were other problems: the studio was like a barn as far as sound went; the floor was bare concrete; there were print-drying blowers operating nearby; an air-conditioning murmur spread everywhere; the studio was overlooked by galleries where students worked. In short, it was no *sound* stage at all, in the true sense of the term, and there was no way we could make it one.

Then the inspiration struck: what about making a film about a simple little film being made? Why not use all the technical difficulties as integral features of the film? Let the soundtrack be busy and the location cluttered. The students could be their own crowd



Freddie Young, BSC, who recently won his third Academy "Oscar" for photography of David Lean's film, "RYAN'S DAUGHTER", shown during his recent visit to Sheridan College.

(LEFT) Freddie meets for a preliminary rap session with faculty members and students of the Sheridan College Department of Communications, during a tour of North America which he made in connection with the promotion of "RYAN'S DAUGHTER". (RIGHT) He answers questions and explains the techniques which he uses.

(LEFT) During informal question and answer session, students who expected Young to be out of touch with their world find that he is really "with it" and that they are able to learn much from him about film-making. (RIGHT) At a meeting in the college's still photography studio, the students approach Freddie on the subject of making a documentary on his visit and he surprises them by accepting the idea and pitching in to help.

control; they could be the lighting crew, the audience, and, of course, camera and sound teams as well. Further: let's get Freddie to set up the lighting and the camera for his own interview. Then, if we stood back and filmed the shooting being set up, we would have, on the one hand, an interesting record of a master at work in rather trying circumstances, and on the other, an extremely useful film for teaching film. And so we set up to do it—but of course, we had some problems.

Freddie Young was no problem. He was great and he *is* great. His visit is the basic reference point in the school year for many students who listened to him. It is for the four of us, as well. But when he arrived, confusion reigned. Lights were still being dragged out, students were milling about, orders were being shouted everywhere (with nobody listening, of course), and the cameras were still being loaded. What we had was a coffee table and a couple of chairs half surrounded by clusters of cube-like still photography props for the student audience to sit, stand and lean on. We had a track cleared for a dolly-mounted Eclair NPR trailing a power cable. We were getting a sync sound by driving the Eclair and a Nagra IV from the AC mains.

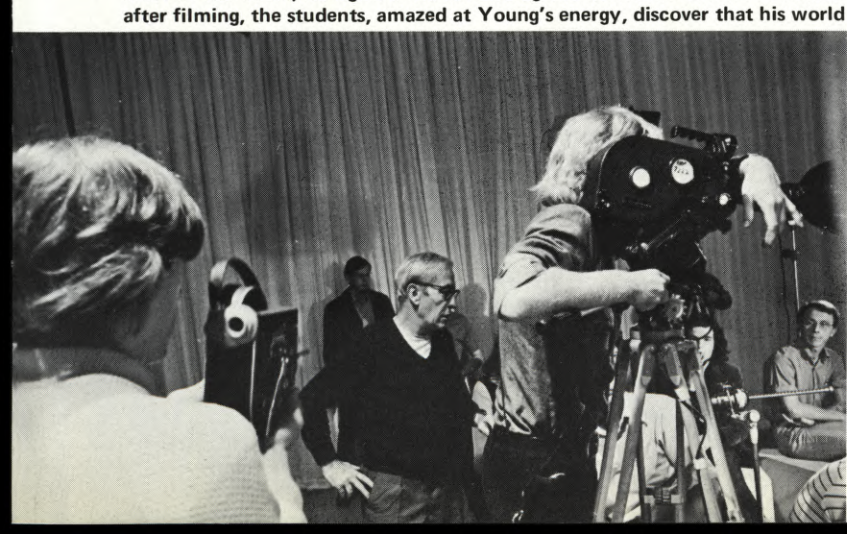
We wanted to have Freddie light the table and chairs, take his place at them and then give a few simple shot directions for the student Eclair crew while he was talking. Peter Mallett, one of our basic four, and Miroslav Ondracek, a Czech director currently teaching at Sheridan College, were to talk with Freddie and moderate a discussion. Gino Matteo, Bruce Pittman, and myself were to shoot non-sync footage of the proceedings. The buzz of our own Bolexes was to add to the already high general sound level. However, we had worked out a placement pattern of the sound of uni-directional and cardioid microphones to get the key sound of Freddie's talk to stand out over the background ambiance. We had also arranged for a break in which to screen the massacre scene from "DOCTOR ZHIVAGO" in 16mm in order to help the students ask specific questions of Freddie. This is how it all happened—more or less.

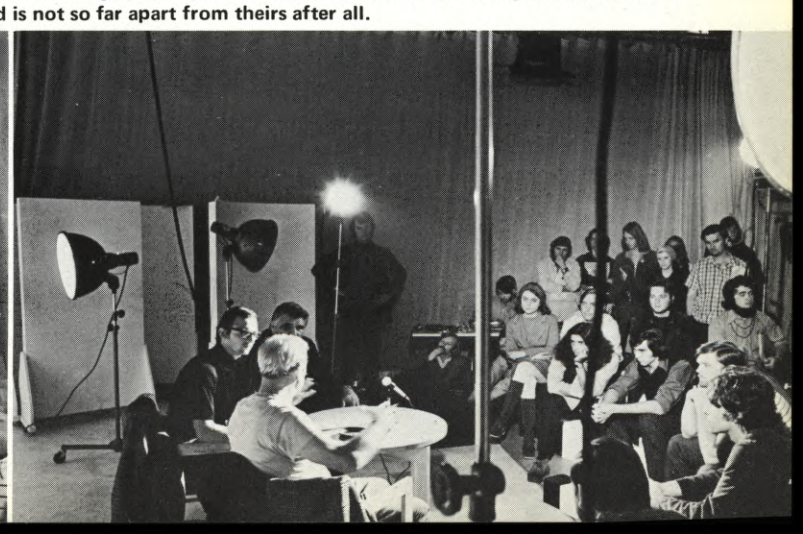
When Freddie arrived, he looked rather disgusted at the chaos. And it was obvious that 16mm was little more than home movies to him. But to a man who had mastered locations and crews all over the world, there was no great difficulty at Sheridan—once he had sized up what there was to do. Besides, the students were there to learn. In any case, he took over. Though he has worked with experienced men almost exclusively, he soon developed rapport with the students and his talk and his direction proceeded without a hitch. But there were hitches a-plenty on our side.

We had decided to shoot two film stocks, Tri-X Reversal and 7242. We wanted to get a rougher, more documentary feel to some of the footage so we felt that if we shot black and white on a set lit for color, we would have the

Continued on Page 593

(LEFT) The students were not quite ready for Freddie, but he soon whipped them into shape and brought order out of chaos. Though students did most of the work, he lighted the set and agreed to let his title of "Director of Photography" appear on the film. (RIGHT) During informal session after filming, the students, amazed at Young's energy, discover that his world is not so far apart from theirs after all.





A SURVEY OF MOTION PICTURE FILM STOCKS AND LABORATORY PROCEDURES

(PART 1)

An up-to-date state-of-the-art report on the various options available in basic raw materials and the alternative methods of processing them

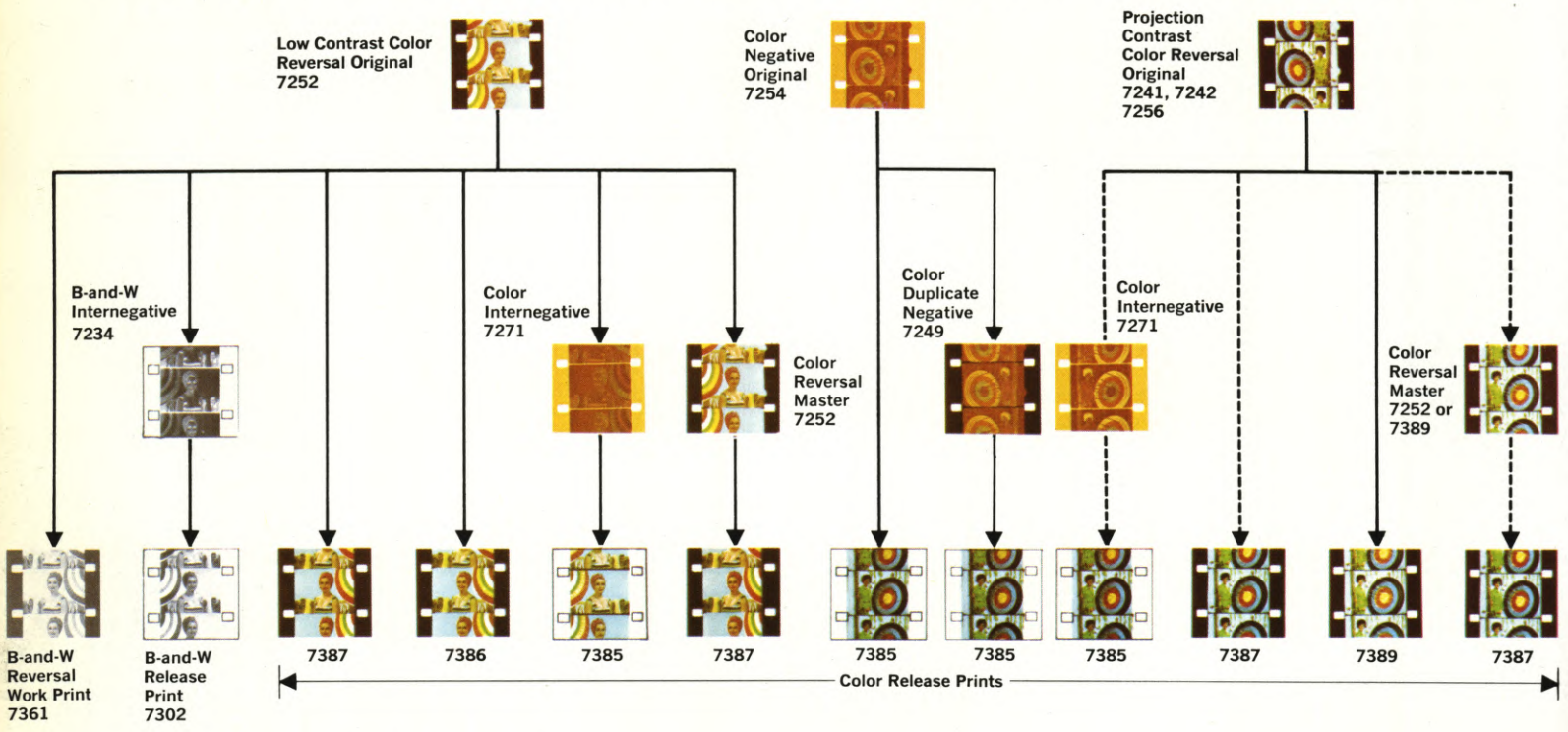
By RICHARD PATTERSON

Few things can be as mysterious to the neophyte producer as dealing with the lab. Perhaps he recalls his feelings as a kid when he took his snapshots to the drugstore for processing and continues to regard laboratory processes as a kind of magic which he is not meant to understand. In any event, he is often baffled by the variety of laboratory procedures and surprised to discover that he has choices to make which he had not anticipated at all. Even seasoned producers who are well acquainted with laboratory procedures do not always understand the reasons for those procedures, although they accept them as necessary.

What this article will attempt to do is survey the kinds of film in use today and the various laboratory procedures so that the film-maker can better understand the possibilities and limitations presented by any particular combination of films and procedures. The discussion will be restricted to Eastman Kodak films, but the principles should be relevant to other film systems as well.

Films stocks can be classified according to the kind of emulsion they employ

SCHEMES OF PRINTING 16mm COLOR PRINTS FROM 16mm CAMERA ORIGINALS



7234 Eastman Fine Grain Duplicating Panchromatic Negative Film
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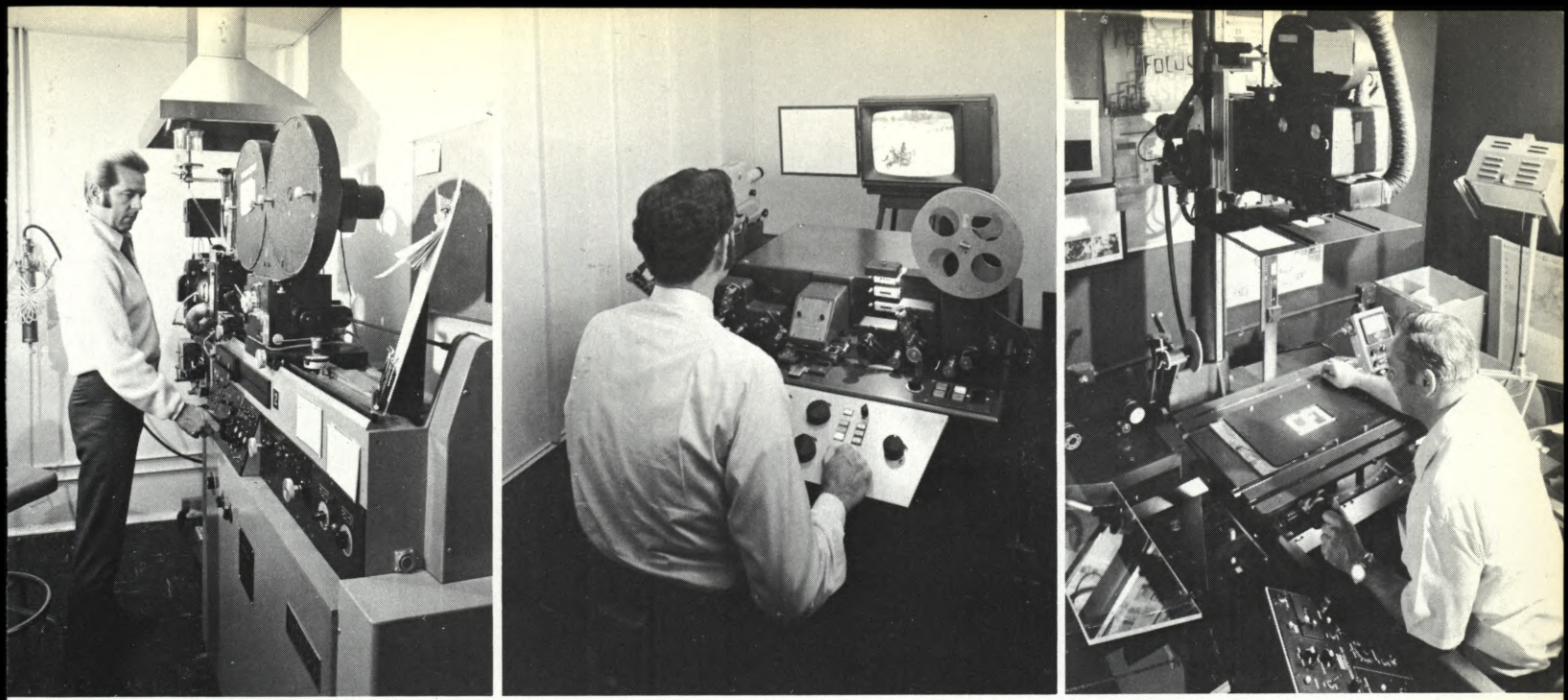
7302 Eastman Fine Grain Release Positive Film
7361 Eastman Reversal Duplicating Film
7385 Eastman Color Print Film
7386 Eastman Ektachrome Reversal Print Film
7387 Eastman Reversal Color Print Film
7389 Eastman Ektachrome R Print Film

NOTES

1. Where special effects are to be included, originals may be edited in "A" and "B" rolls. Where a color internegative or color reversal master is employed, the special effects can be introduced at this stage.

2. The choice of printing system depends on a number of factors, including the types of printing and processing equipment available, the physical and chemical processing requirements for each film, and certain economic considerations. As a result, certain compromises may have to be accepted.

3. The dotted lines indicate less preferable methods (from the standpoints of excessive contrast build-up or reduced definition).



Modern film laboratories use highly sophisticated equipment to offer a wide diversity of services. (LEFT) Optical printer used in making blow-up and reduction prints. (CENTER) Color video analyzer is used in most labs for "timing" originals to be printed. (RIGHT) Technician working at animation stand.

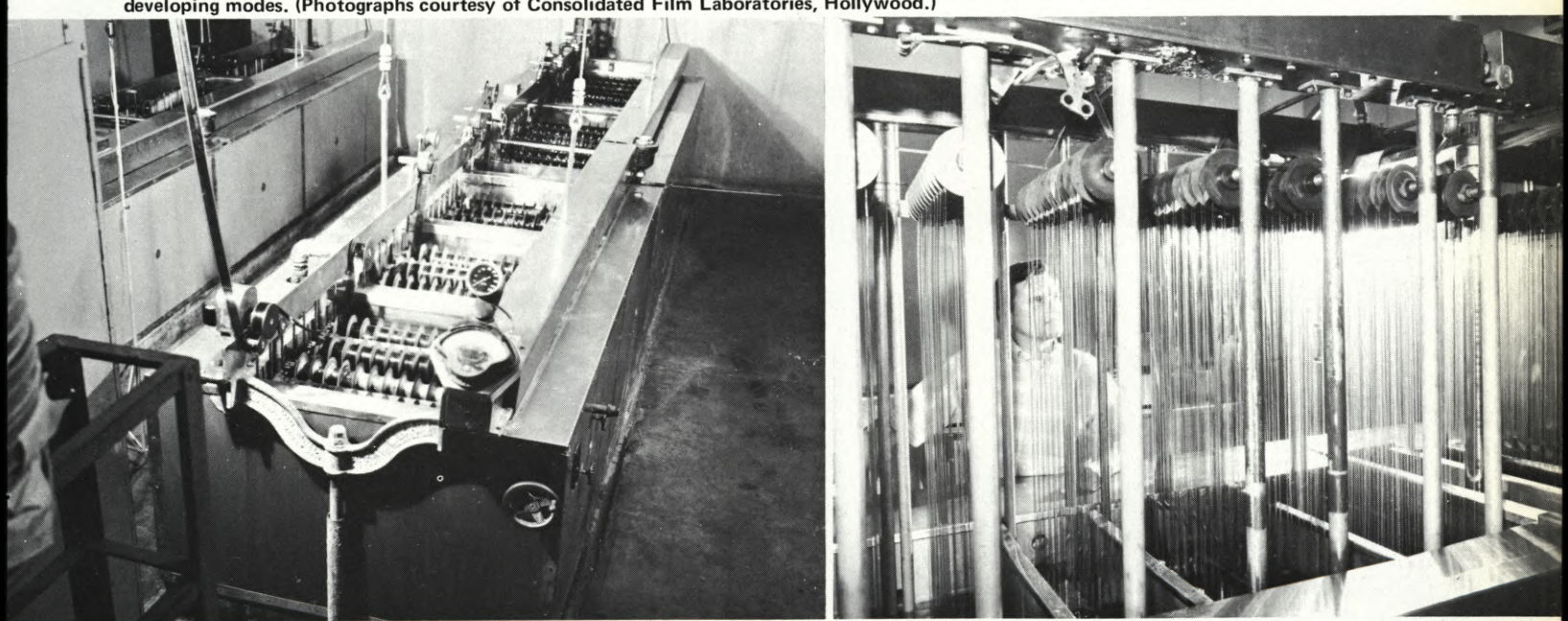
or according to the use for which the film is intended. In the first case, there are black and white or color films with negative-positive emulsions, reversal emulsions, or direct positive emulsions. In the second case there are camera films, duplicating films, release print films, and recording films.

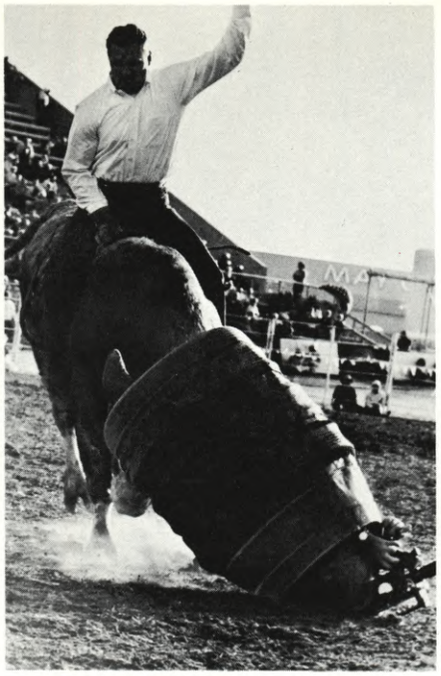
The traditional emulsion for motion picture work is the negative-positive emulsion. When this type of film is processed, the areas on the film which were exposed to the greatest amount of light retain the greatest amounts of silver and are therefore the most opaque. What this means is that original photography will yield a "negative" image, in the sense that the brightest areas in the scene will be reproduced as the darkest areas in the image. This negative image can then be used to produce a "positive" image by exposing a second piece of film through the negative so that dark or opaque areas in the negative will shield light from the second piece of film and produce corresponding light or transparent areas in the positive image when it is processed. This, of course, is what happens in "printing" a negative.

Theoretically, the same film stock could be used to produce either a negative or a positive image, but since, in practice, negatives and positives are produced by different means, separate film stocks are designed for each purpose. Since a great deal more light can be used to expose film in a printer than

Continued on Page 599

(LEFT) Laboratory Developing equipment. Due to the wide variety of film stocks now available, many of which require unique developing processes, a modern film lab must offer a flexible list of services. (RIGHT) Most new equipment is modular, making it adaptable to a range of developing modes. (Photographs courtesy of Consolidated Film Laboratories, Hollywood.)





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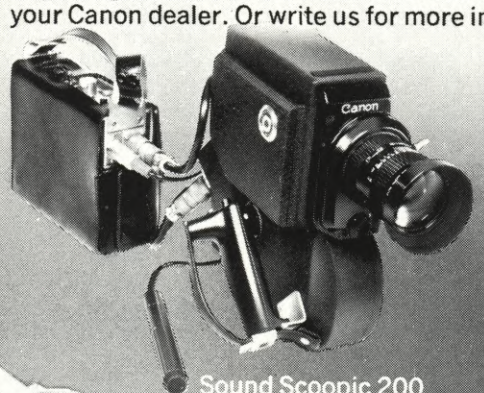

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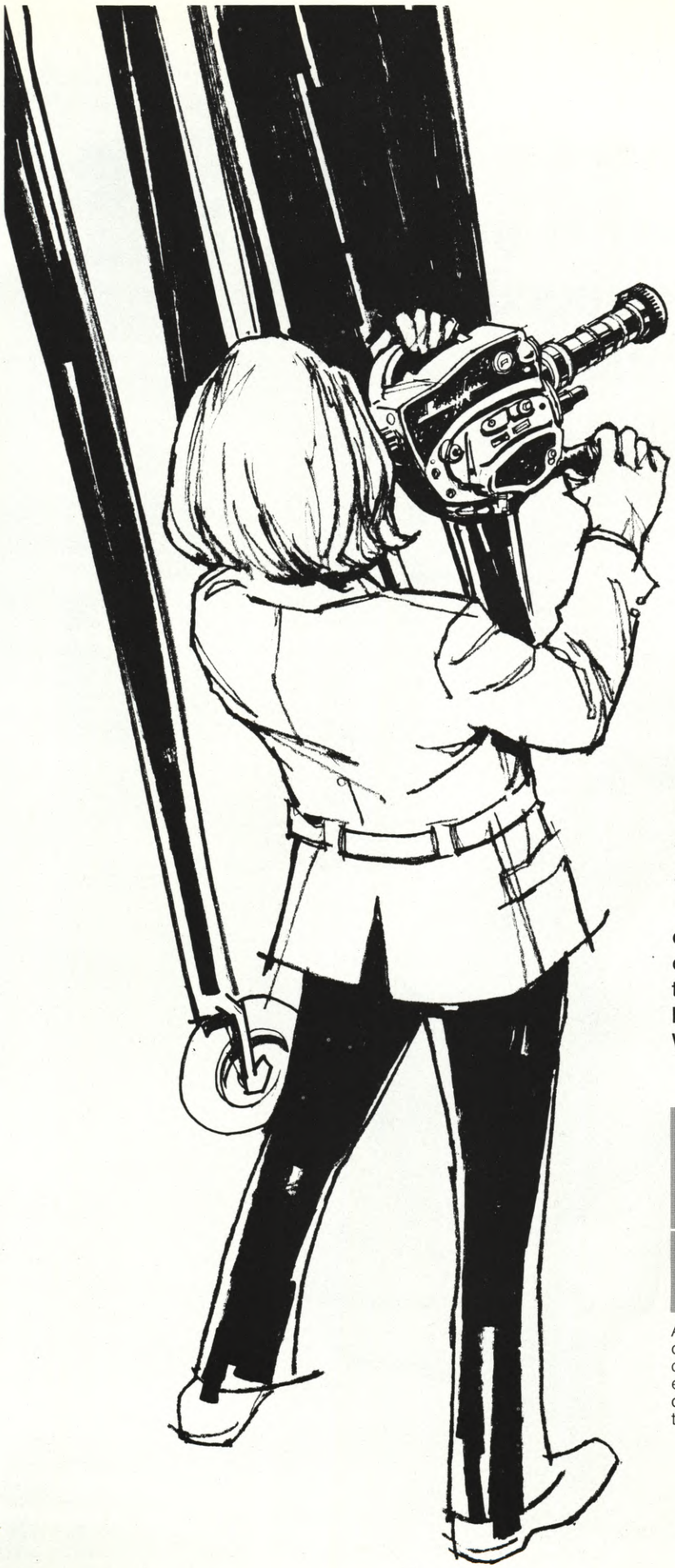

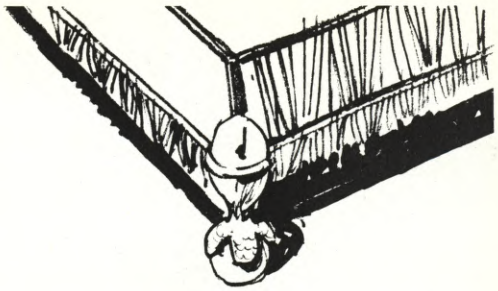

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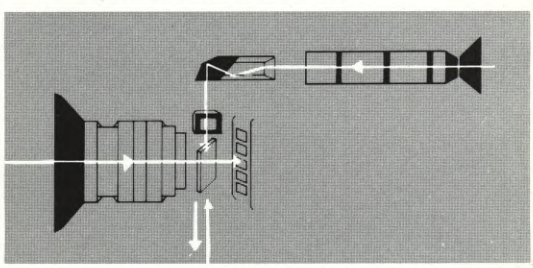

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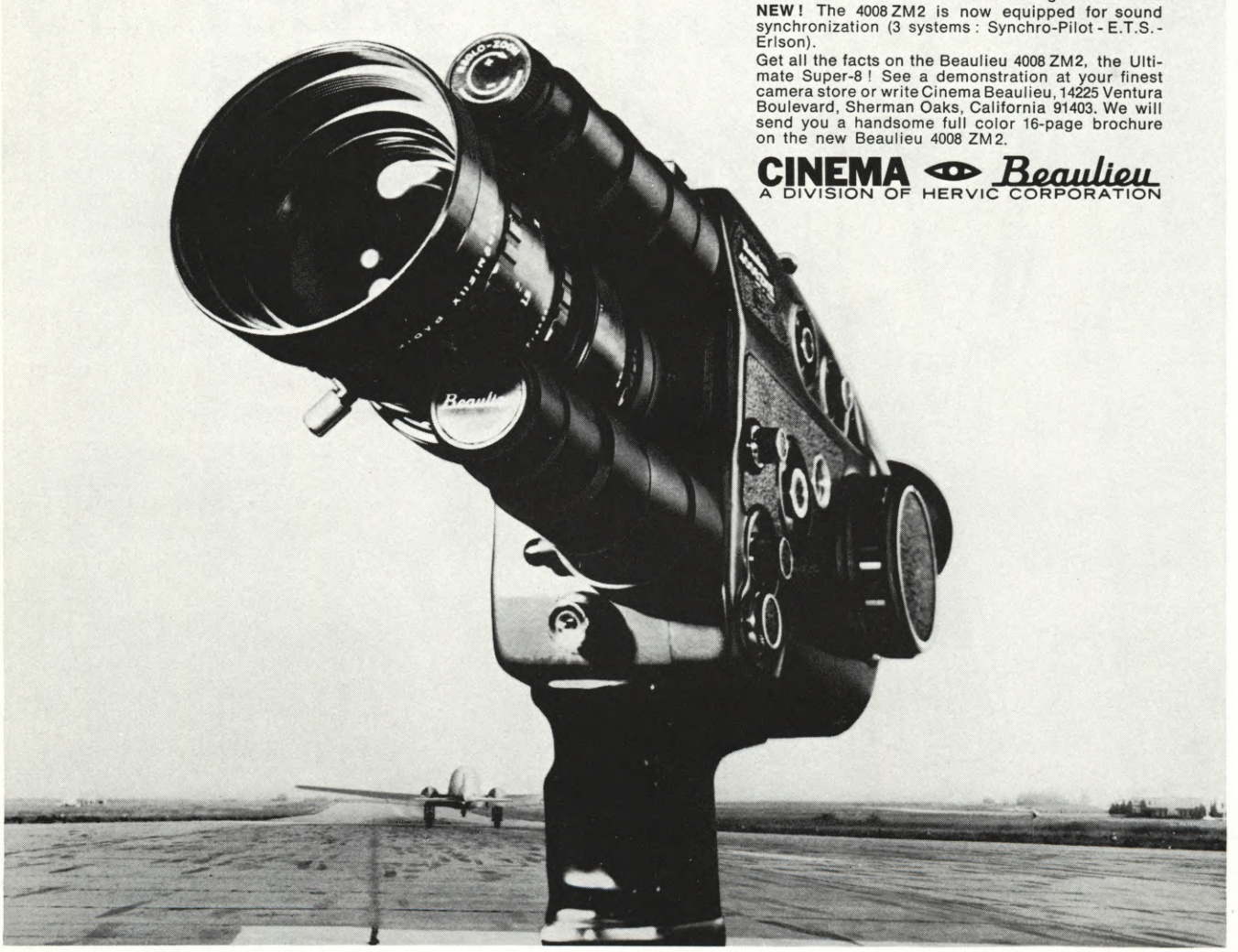

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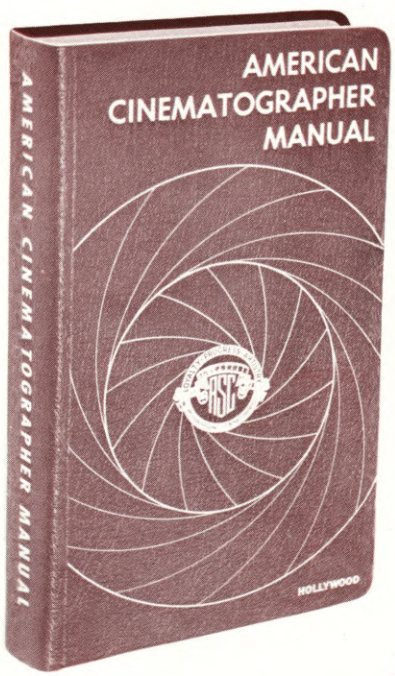

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WELCOME ABOARD THE FILM/TAPE BANDWAGON

Report on a happy "marriage" of tape and film when the video medium is used for the electronic editing and assembly of 16mm motion pictures

By GARY JONES
Director of Film Services,
WFAA Productions

Prophets of doom and pundits of every ilk point to the economic gloom settling over the television industry. Consequently, everyone—networks, local stations and advertising agencies included—is looking for means of lowering television production costs. Many producers have turned to video tape for producing less expensive commercials and programs. However, the real key to economical television production—without sacrificing quality or creativity—may be through electronic editing and assembly of 16mm film.

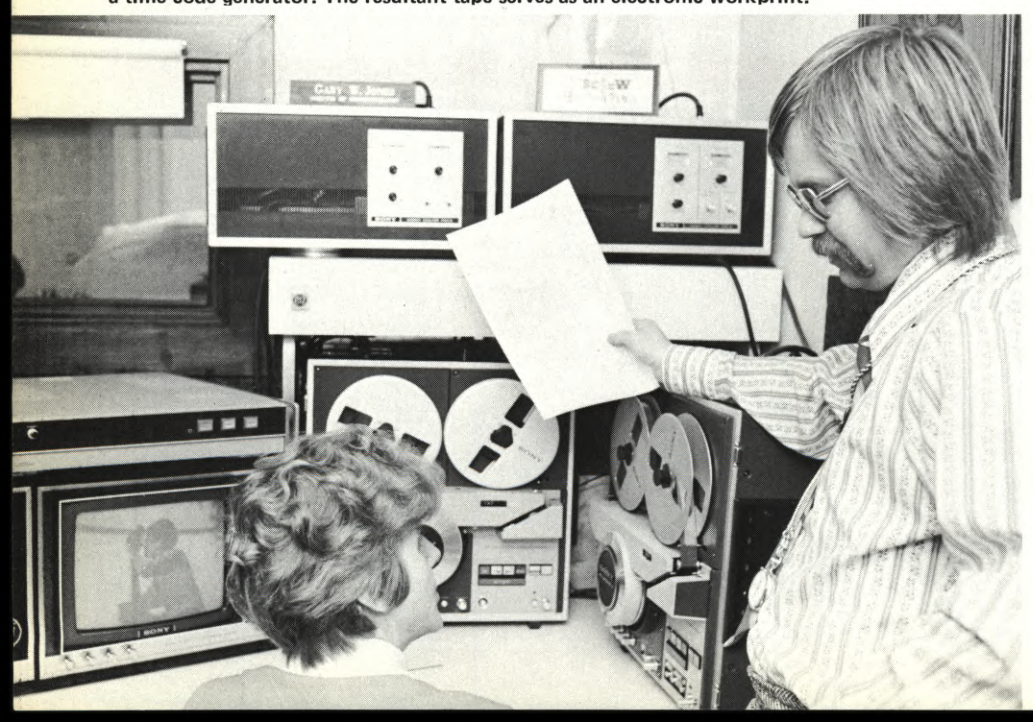
Video tape's superiority as a convenient, high-quality method of television distribution is well recognized. Sixteen-millimeter film's economy and flexibility have long been selling points. Now—thanks to videotape time-coding, electronic workprints with individual frame addresses, computer editing devices, disc recorders and the like—the best features of 16mm film and video tape may be combined into a television production method uniquely suited for an electronic medium.

As a 16mm film-maker and videotape director, I was initially encouraged by—though understandably skeptical of—the potential opportunities afforded by film/tape assembly. If it worked, I could see visions of 16mm film ousting 35mm from its place of preeminence in television program and commercial production. Lower production costs would assure 16mm's ascendency—but only if (and it's a big "if") electronic assembly would insure better quality 16mm television reproduction while maintaining the finesse and accuracy of proven film editing methods. And after weeks of working with the newest film/tape system, I am pleased to find that it works! Refinements in techniques and equipment are needed in some areas; but I am so enthusiastic over what I have seen to date that I want a good seat on the electronic film bandwagon.

At WFAA Productions our electronic film editing begins with the transfer of original 16mm footage to video tape. I prefer to work directly with ECO 7252, because the film's excellent definition, low contrast and rich color qualities come across beautifully on the television screen. If we have double-system sound, the 16mm mag film is rolled in simultaneously from a film recorder in selsyn/telecine interlock.

WFAA videotape operators, Mike Castaneda and Lonnie Shields, shown programming the Ampex HS-200 video disc recorder. Success of method depends upon top-notch technicians and equipment.

WFAA Productions film editor Ann Cooper and director Jim Rowley discuss the next cut on a 60-second film commercial being assembled electronically. The electronic editing process begins with the transfer of original 16mm footage to video tape, with each frame "tagged" by means of a time-code generator. The resultant tape serves as an electronic workprint.



While engineers record the film upon two-inch video tape using *two* Ampex 2000 high-band quadraplex video tape recorders (VTR's), a time-code generator tags each television frame (30 per second) with an electronic address which is stored on a cue track. (Two high-band copies of the wild footage are needed for A-B roll assembly.) At the same time we also record the film upon a one-inch tape with each frame-address number *appearing in the picture.* This is our electronic workprint.

The actual film/tape editing is done in a private work area—away from the noise, bustle (and expense!) of our broadcast-quality recorders. Editing one-inch video tape presents no problem to the film editor. Our editors have found electronic film editing desirable

because the speed and instant playback characteristics help keep themselves from "breaking stride" in the creative process. Later on in the assembly, it is easier to keep the ideas flowing and enthusiasm high because the editor can immediately see and evaluate a particular effect or dissolve.

If we are dealing with silent film/tape, then we usually edit to a mixed sound track recorded on the VTR from four-track audio tape or 16mm mag film. If we are editing double-system sound, we may either mix the other audio tracks after assembly of the video or may use the VTR's two-channel audio system.

It requires two VTR's to make a rough-cut workprint tape. One machine is used for viewing wild footage and the other is needed to assemble the edited scenes. We use Sony Model 320 VTR's, which allow us to view individual frames and to rock the frames back and forth in order to make precise editorial judgments. The Sony 320 has an editing system which permits clean "cuts" with the ability to do insert or "in-and-out" editing. Switches on the 320 allow cutting between machines to find the exact frame for a matched cut or dissolve. Lengths of dissolves must be noted, for one cannot put grease-pencil "X's" onto video tape. However, our editors do have instant, full-color, sync-sound playback of the material being edited. And this playback shows the editor more closely what his efforts will look like on television, because he or she is watching a Sony Trinitron 12" TV monitor instead of a film viewer.

Once the edited workprint meets with the editor's (and client's?) approval, he reads the start and stop frame-addresses for every scene on the workprint and enters them—along with dissolve lengths and desired optical effects—upon an easy-to-follow worksheet. At this point, the editor (if one of ours) or a WFAA Productions assistant (if the editor is a totally film-oriented individual unused to computer assembly) then translates the frame address into a simple computer program. The program takes but a few minutes to write and involves infinitely less time and trouble than searching out and conforming original film. Next, the information is entered into our Ampex RA-4000 random access programmer, which automatically finds the proper scenes on the wild footage rolls and records the master. Flashing time codes, luminescent television monitors and VTR's starting and stopping upon a computer's silent command provide a space-age aura to film/tape assembly.

Close-up of Sony monitor showing frame from "electronic workprint". At the same time 16mm film footage is recorded on two-inch videotape for the actual A & B roll editing, a separate transfer is made onto a one-inch reference tape, with each frame-address number appearing in the picture area.

However, all the electronic "pizzazz" does not detract from the business at hand. If necessary, an editor may make changes or additions immediately. The master tape may be erased and reused as many times as needed. Once the final assembly has been approved, the finished film/tape commercial or program is ready for prompt duplication and distribution.

There are many advantages gained by 16mm film/tape post-production. While avoiding the expense, cumbersome techniques and maintenance requirements of electronic photography, a producer also ends the waiting and costs for printing and additional chemical processing steps.

Special effects which would require hours or days to obtain through an optical film printer are integrated into the master footage at the touch of a button. And these electronic *16mm effects*—split screens, wipes, keys, freezes, reverses and the like—are *sharper* than the same effects optically printed onto 35mm film and then shown on a television screen.

Once film has been transferred to video tape, it will never discolor, streak, scratch or get dirty. Plus unlike 16mm or 35mm film, a large number of video-

Continued on Page 614

WFAA Productions Director of Film Services, Gary Jones (standing), looks on while WFAA Videotape Supervisor Bruce Harris enters electronic film assembly information into Ampex RA-4000 random access programmer.

ON LOCATION WITH "THE GODFATHER"

On the sidewalks of New York (and Hollywood and Sicily), rules are broken as off-beat photographic techniques are applied to filming of best-selling novel

By GREGG STEELE

En route to farther-off places, *American Cinematographer* Editor Herb Lightman stopped off in New York to observe filming on the Paramount production of "THE GODFATHER", adapted from Mario Puzo's best-selling novel and directed by Francis Ford Coppola.

To be photographed mainly on locations in New York, Sicily, Hollywood and Las Vegas, this production is the first to use the new Mark VI Cinemobile. Originally, at Paramount's request, this new model of a "studio on wheels" had "THE GODFATHER" painted on its sides in gigantic letters, but the identification attracted such huge crowds of onlookers, that the inscription had to be painted over.

Filming observed by Lightman included various locations on the streets of Manhattan (including the exterior of Bellevue Hospital), plus an important sequence on Staten Island, where several large houses had been enclosed by a stone wall to simulate "the Mall", stronghold of the gangster chieftains who are the main characters of the story.

In the following interview, Director of Photography Gordon Willis explains his visual approach to this particular assignment and details some of the unusual and rule-breaking techniques which he is utilizing:

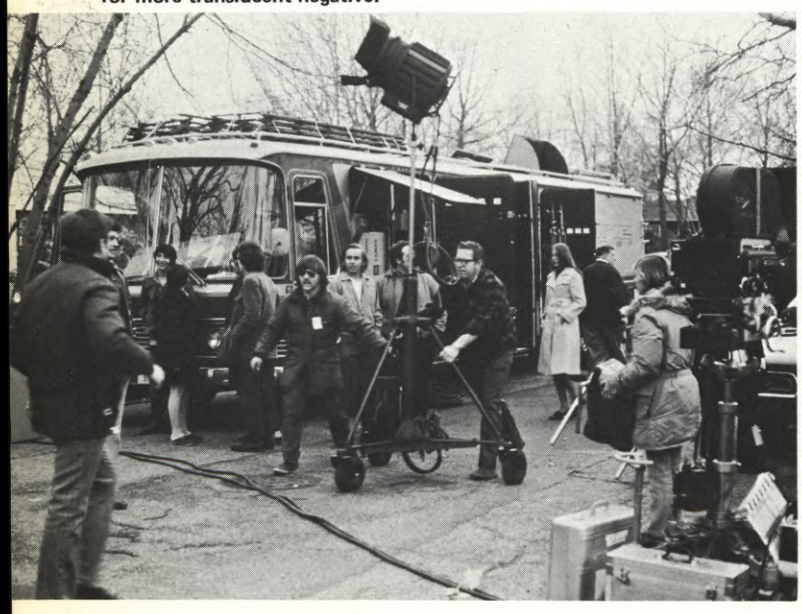
QUESTION: I understand that you are using a rather unusual photographic style in this film. Can you tell me a bit about the effects that you're after and the mechanical means you're using to achieve them?

WILLIS: Yes. When I first received this assignment I thought about all kinds of sophisticated ways to introduce this and that, but I finally came to the basic realization that this film, especially because it's a period film, should be kept mechanically simple—and Francis Coppola feels the same way about it. In all of the films I've shot I've tended to do the same thing philosophically—but none of them look the same, even though the attack is the same.

QUESTION: If I understand your meaning correctly, you are saying that you can arrive at a number of different results by using the same basic philosophy as a common denominator. If you were to sum up that philosphy in a sentence or two, how would you state it?

WILLIS: I think I would say: "See what you're looking at. Don't walk into a situation and re-manipulate it. Look at it!" There are too many people in this business who find a location that is exciting and then instantly proceed to rebuild it photographically. They forget why they chose that location in the first place. I don't mean that you shouldn't light anything. I simply mean that you should light it so that you still have what you came there to get. It may mean that you won't have to do any

(LEFT) On Staten Island, New York location for Paramount's production of "THE GODFATHER", crew unloads equipment from new Mark VI Cinemobile, in use for the first time on this picture. (RIGHT) Director of Photography Gordon Willis, behind Arriflex camera, studies the subject as he lines up for the next shot on the sidewalks of New York. Willis exposes Eastman 5254 negative at ASA 250, pushes it one stop in development for more translucent negative.



(LEFT) Inside bar location in Brooklyn, director Francis Ford Coppola (center) coaches actors for assassination sequence. The film will utilize as many actual location interiors as possible in New York, Hollywood and Sicily. (RIGHT) Cinematographer Willis takes a light reading inside dimly-lit Brooklyn bar. He calculates exposure critically, but resultant negative must be printed precisely right to preserve desired visual effect.

lighting at all. But then again, it may take you quite a while to work it all out so that it still looks the same. But see what you are looking at. Retain what's there.

QUESTION: In applying your philosophy to "THE GODFATHER", what kind of style have you arrived at and what are the mechanics involved?

WILLIS: In this particular case, I felt that the film should be brown and black in feeling, and that occasionally it should be hanging on the edge from the standpoint of what you see and what you don't see. A lot of cameramen work to increase the quality of an image, but in this specific case I'm working to decrease it. Most cameramen work to make the image as structurally sound and smooth as possible, but it's been my personal feeling that this isn't the best way to handle a contemporary story—and now that I've thought about it, I'm convinced that it's absolutely the wrong way to photograph a period story.

QUESTION: Translating that conviction into sheer mechanics in this case, what are you doing mechanically to follow it through?

WILLIS: I've photographed all of the material so far—and will continue to photograph it—so that the negative is not a super-heavy, thick type of negative. Theoretically, the negative is about one-half stop underexposed, but it's even more than that, according to the way that I rate the Eastman color negative. But getting back to the point, I feel that this film should have a brown look to it, with occasionally a bit of that 1945 blue-black in it. I think it should look like a newspaper photograph in bad color—a black and white print out of the New York Times, with a little color introduced.

QUESTION: Something like a bad rotogravure?

WILLIS: Right! That's exactly what I mean—but it should be well thought out, so that the effect means something on the screen. Before we started shooting, I sent Technicolor some material and told them to print it several different ways in terms of dye-transfer and duping, so that we could find the area in which it would print well according to what we've just discussed. They were very co-operative and came up with some nice things. When I got the material back I picked one dupe that I thought would do the job and, hopefully, when the shooting is finished, the entire film will be duped in that manner, using the dye-transfer process, and it will look right.

QUESTION: What is your feeling about visible grain in this particular picture?

WILLIS: I feel that the grain structure should be more prominent that usual. Now, this is nothing new. A lot of people have said: "I want everything to look messy."—but there is a very thin line between "different" and "lousy". I mean, you can get so abstract that you have no point of view, and everything you do is really meaningless. It's just sloppy work and nothing more. I'm not a believer in using grain structure and things like that to cover up something that is essentially not good to begin with. I believe that if you start at the bottom and make everything very good —and then use such things as grain properly—it'll work.

QUESTION: This unusual "bad rotogravure" visual style we've been discussing—do you intend to use that consistently throughout the entire picture?

WILLIS: No—it wouldn't be right to do that, because the action of the story moves from New York to Hollywood to Sicily. This brown, sort of broken-down quality I've described relates to the New York sequences, but not to those that take place in Hollywood. I plan to emphasize the contrast between the two locales by giving the Hollywood sequences a cleaner, crisper, sort of West Coasty, California quality—which should be a bright, hard image. In juxtaposing the two—in cutting from New York to California—there should be a very definitive difference in relation to the atmosphere and the people.

QUESTION: How, then, do you intend to handle the Sicily sequences?

(LEFT) Willis and Coppola discuss set-up for an upcoming scene. They are in complete accord on photographic treatment of "THE GODFATHER", agreeing that it should be kept simple, but that each major shift in locale should be given a distinct photographic style to suit it. (RIGHT) New Cinemobile Mark VI, parked outside St. George Hotel in New York. Director of Photography calls this van "contemporary, well thought-out, a meaningful piece of equipment for any cameraman or producer."

WILLIS: In terms of the dramatics of the story, the feeling of New York carries over to Sicily—but not exactly. It will be brown, but smoother. The color quality will be the only thing I'll carry over to Sicily. In other words, when we deal with the family in New York, it's like a broken-down, melted-down Sicily —but the essence of it is there. Sicily will be olive and nice and warm and sunny.

QUESTION: What mechanical method do you intend to use in order to achieve that effect?

WILLIS: Well, I've never been to Sicily, but after doing some research I've arrived at the conclusion that the Sicilian sequences should be very rich and very brown—with a very creamy kind of feeling. It seems to me that the way to attack a thing like that is to over-state it. So, I plan to photograph Sicily through rather heavy chocolate brownish filters. Brown is a nebulous color, but there are times when it can be very beautiful on the screen because it tends to make everything very rich, in a monotone sort of way. It desaturates the primary colors. I plan to photograph all of the Sicilian exteriors that way.

QUESTION: What about the interiors?

WILLIS: I'll use chocolate filters, but they won't be nearly as heavy as the ones I use outdoors. I've had a series of gelatin filters made up in varying densities of the chocolate tone, and I'll use the lighter ones inside. This should give me a good relativity between the interiors and the exteriors in Sicily.

QUESTION: You mentioned earlier something about the way you rate the Eastman color negative—implying that this is different from the normal rating. Can you explain that?

WILLIS: Well, for example, if you take a roll of Eastman color and expose it under the conditions that Eastman recommends—which is ASA 100 for interiors and ASA 64 for exteriors— you'll get very nice photography and it will certainly print well. But Eastman has built a margin for error into the film. It allows for my error, for the laboratory's error, for everybody's error. It's right for Eastman to build the material like that, because if they cut it too close a lot of people would make mistakes in using the film. So I can understand and appreciate why they rate their film the way they do. However, I started out by shooting the film at the established rating several years ago. Then I began to experiment with lowering the ratings. First I dropped it one stop and rated it at ASA 200. I had the lab push it an extra stop and everything looked fine. Then I exposed it at ASA 200 and had them process it normally, without any pushing. When I saw it on the screen I thought it looked terrific. I mean, it was a lovely image and I liked it. So, I shot all of the interiors for "THE LANDLORD" and for "LOVING" with the film rated at ASA 200 and no pushing in the lab. The result has a very specific quality.

QUESTION: But what did you mean before when you said that you would be one-half stop under-exposed, according to your method of rating the film?

WILLIS: What I meant was that right now I am using a variation of the formula. I'm exposing at ASA 250, and having the film pushed one stop in the lab, which means that, theoretically, I'm under-exposing one-half stop. The truth of the matter is that I like the look of that result. It appeals to me because the film becomes more translucent. You can see through the colors, rather than having them just sticking on the screen. Because the fog level is raised slightly in the pushing, the material tends to have a kind of foggy, not-quite-there look which, at times, is quite nice.

QUESTION: Doesn't this method leave very little latitude in printing?

WILLIS: Exactly. It means that once I've got the basic quality I want on the negative, the lab can do very little to jerk it around. I can expose it for the way I want it to end up on the screen. Some people complain that the way I expose it they can't do this and they can't do that with it. They can't print it up, for example—and that's exactly why I expose it that way. Film material is designed to be printed in one range and one range only. I don't like giving a lab the flexibility to print it up and down, because sooner or later someone, somewhere, in some little room will decide that it should be a little more this way or that. He'll straighten it out for you. Everything will be just perfect—and it will be a disaster. So, I don't like to give the lab a full negative for two reasons. The first is an aesthetic reason; I don't like the way it looks on the screen. Secondly, it gives me the security of knowing that they won't be able to do

anything to it because they can't print it up. If they try to print up what I've shot, it will fall apart.

QUESTION: On the other hand, that means that you have to be very exact in your exposure. Isn't that so?

WILLIS: Yes, I certainly have to be—but I'm very proud of the fact that I'm very meticulous in the way I expose film. That doesn't mean that I take hours. I'm actually very quick, but quite consistent in the way I expose material. I'm very sure of relativity. In other words, I know what something is going to look like a stop over the key or a stop and a half under the key. I never make general exposures. I always expose for something specific in the scene—always—and everything else in the scene relates to what I expose for. I know how the material is going to print, and it prints on one light throughout the movie. I tell the lab the pack to use and the light to use, and if they'll do it that same way from day to day they'll be pleasantly surprised. The relationship of under-exposure to over-exposure to normal exposure will all fall in properly. It's when they try to level everything off that they get into trouble. It won't work.

QUESTION: I notice that you're using the new Mark VI Cinemobile on this picture, which is the first time it's been used by anyone. How is it working out?

WILLIS: I've never used a Cinemobile before on any movie. I wish I had. When I sat down and thought things out prior to starting this film, I realized that, of all the films I've worked on, if I didn't keep my end of this movie relatively tight and simple, it would look like the Normandy invasion. There would be trucks and bodies strewn all over the place. It's not that I'm using more equipment than I usually use. I'm using the same amount. It's just that there's a tendency for things to grow out of proportion on a "big" movie, or one that's had a lot of publicity. I wanted to keep my part simple.

QUESTION: How did you happen to decide upon using the Cinemobile?

WILLIS: I went out to California to talk to Fouad Said because I thought he might have something to offer that would help me keep things fast and simple. After talking and thinking and working with him for a week I was very impressed and decided that what he had to offer was terrific. We've been using it for some time now and have found it to be excellent. The people he sends along with the truck are excellent, too.

QUESTION: Do you find that you can carry everything you need for a big picture like this?

WILLIS: We've packed more firepower, so to speak, into that Mark VI than most people have got strewn over eight or ten trucks on the average movie. What I'm saying is, of course, based on my philosophy of making a movie. There are a lot of people in this business who still haven't given up using arcs. I gave them up long ago. So, even though the Cinemobile provides much room for arcs, if you choose to use them, I don't. I use that space for other types of lamps and things which I feel are of more value in shooting a picture. I've found the unit to be excellent. It's contemporary. It's well thought-out. It's a very meaningful piece of equipment for any cameraman, any producer. You can load and unload from both sides of the vehicle. The way it's designed, you can pull things off as you need them, without having to unload the whole truck to get at one thing.

Cinematographer checks scene through viewing glass, as camera is set on high parallel for shooting of sequence at "the Mall" location, Staten Island.

QUESTION: Is there anything it doesn't have that it should have?

WILLIS: Not really, even though there is one thing that we hadn't planned on. I happen to use hundreds of feet of Elemack dolly track, because I believe that if you're going to make dolly shots, you'd better be able to make them fast. Anyway, we hadn't planned on taking along 200 feet of Elemack track. However, we've got it stacked on top of the van and it fits fine, because he provided for that with a railing area. I'm very delighted with the way Said has extended himself. He listens well and he'll incorporate your suggestions into his equipment. He'll keep making design changes, too, which I'm very happy about. I don't presume to speak for other people, but in my department I feel that he's made a major step forward in helping to modernize the business. He's made it easier and less costly for people to shoot, and that's very important. Movies cost enough money. There's no point in spending your entire day working as a parking lot attendant so that you can make a shot. I'm delighted with these trucks and I'll use them whenever I can—forever, if I can get ahold of them. ■

About location shooting, Willis advises: "See what you're looking at. Don't walk into a situation and re-manipulate it. Look at it!"

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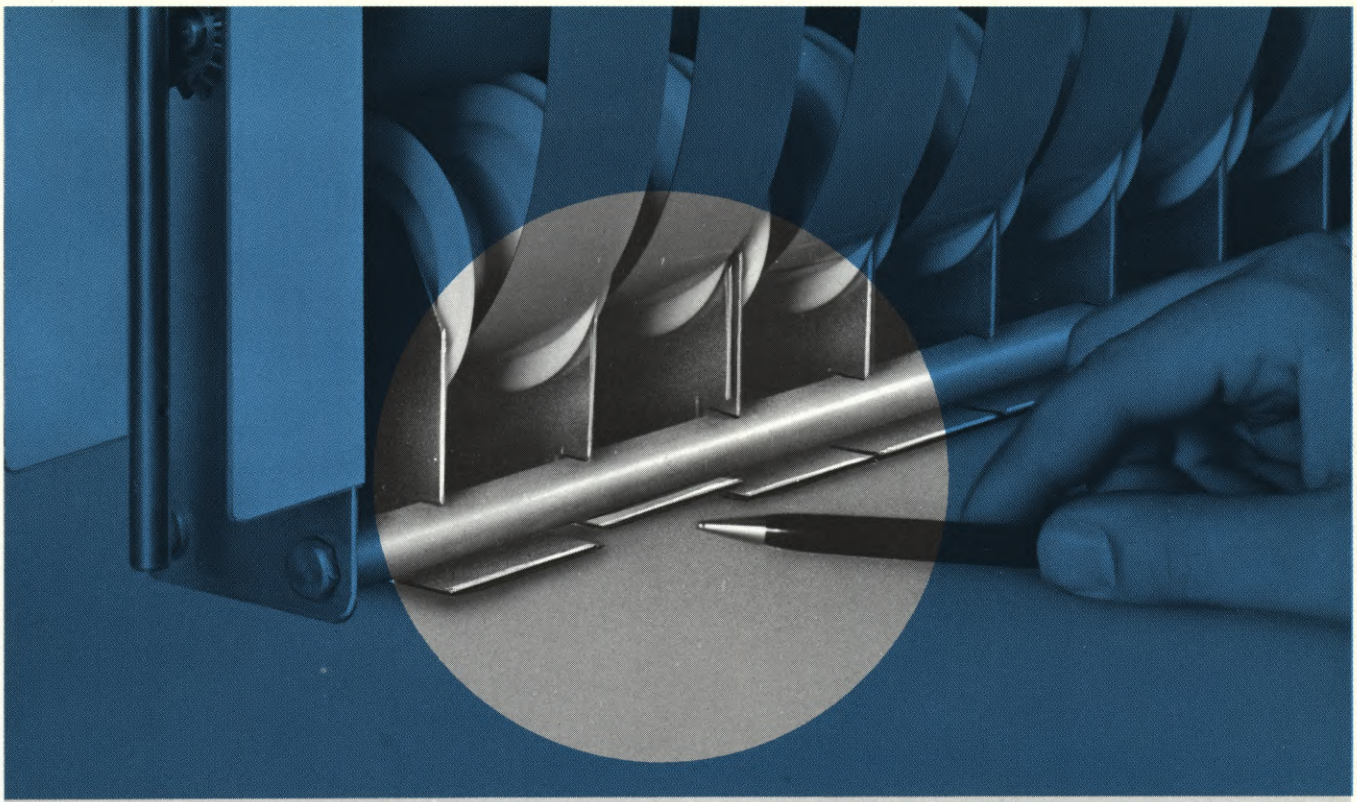

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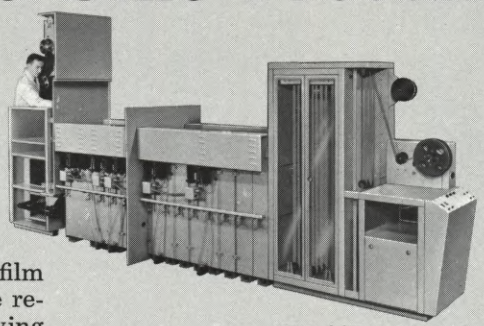

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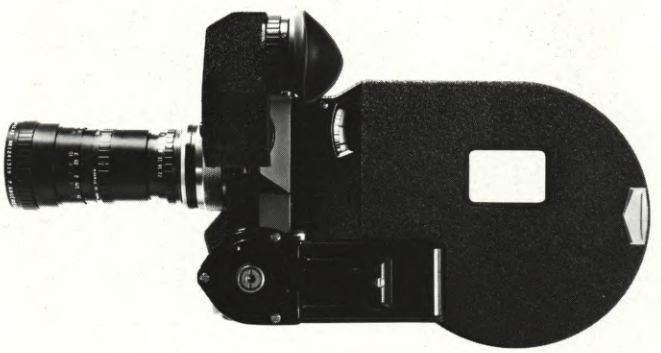

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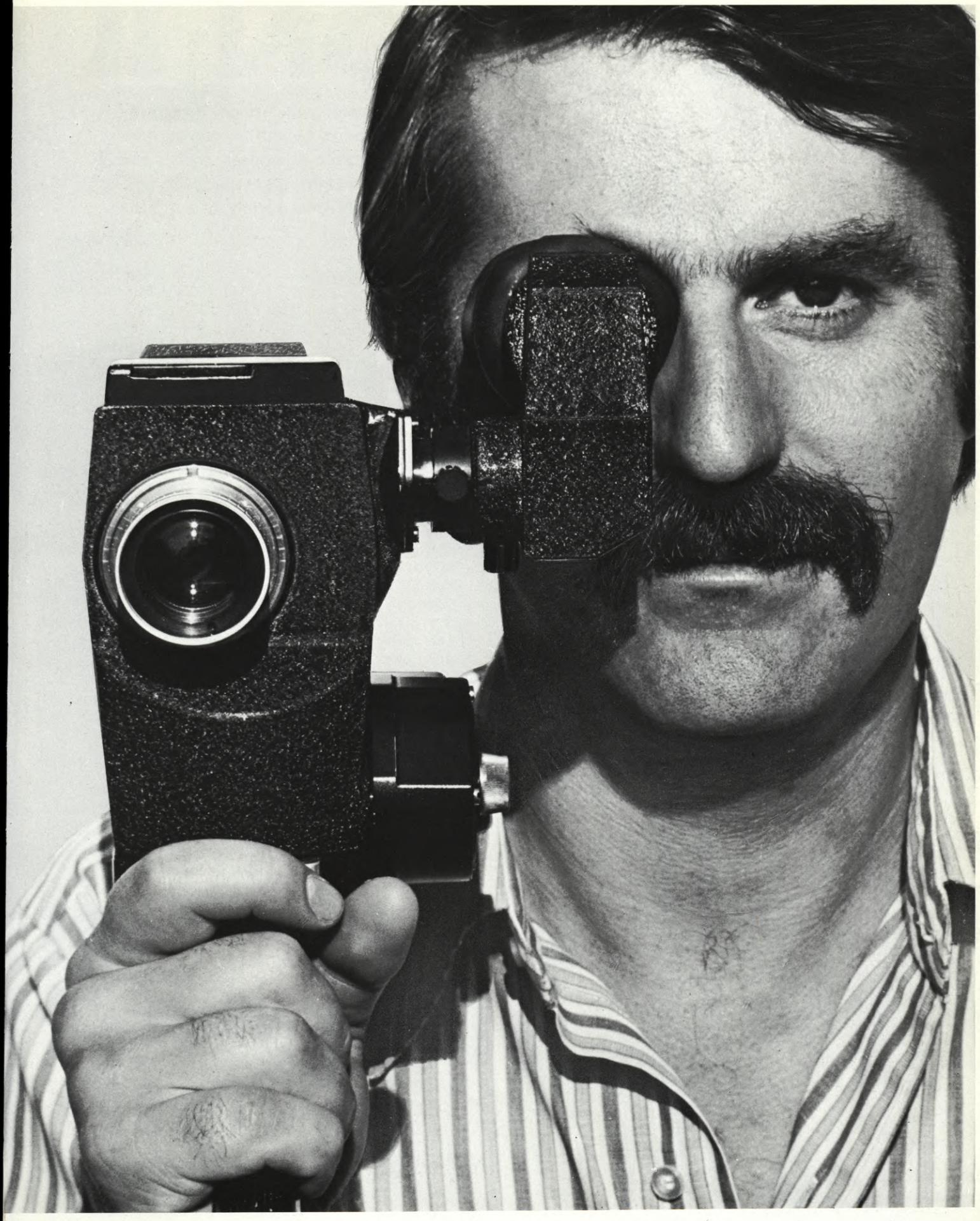
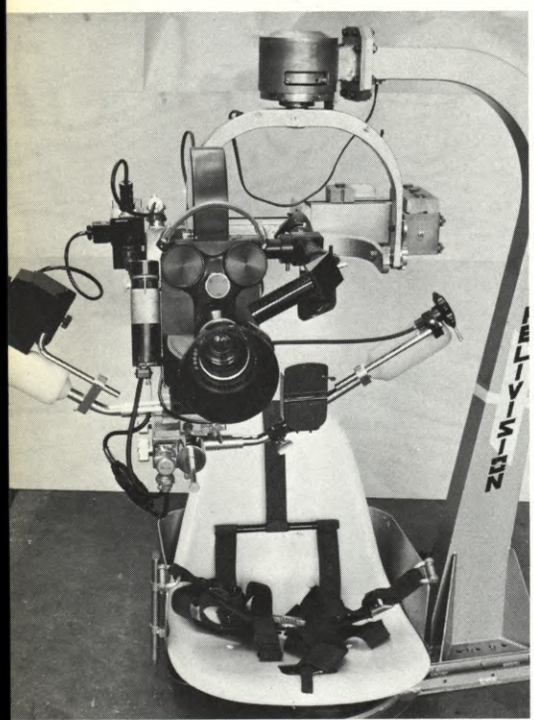


HELIVISION II

After a dozen years of evolutionary development, a French anti-vibration system for professional cinematography from a helicopter reaches a stage where it is light in weight, more compact, and adaptable to a much wider variety of aircraft



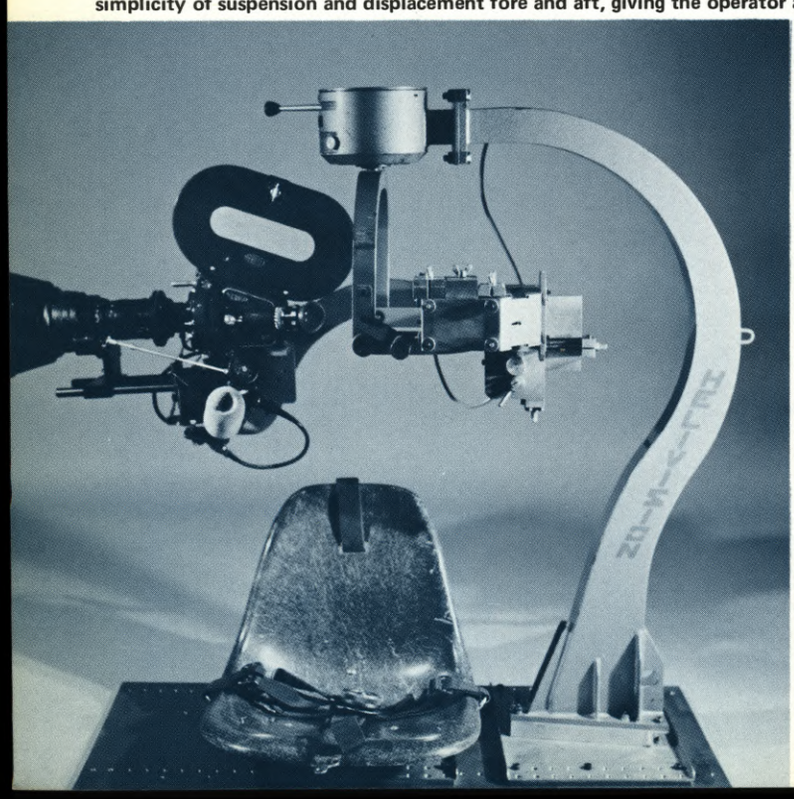
Back in 1958 a man named Albert Lamorisse saw the possibility of creating a new dimension in motion pictures and set about making the first patented, practical, anti-vibratory system to be used in professional cinematography from a helicopter. His development of *HELIVISION* earned him an international reputation and the films he made brought many prizes home to Paris—including an "Oscar" from Hollywood.

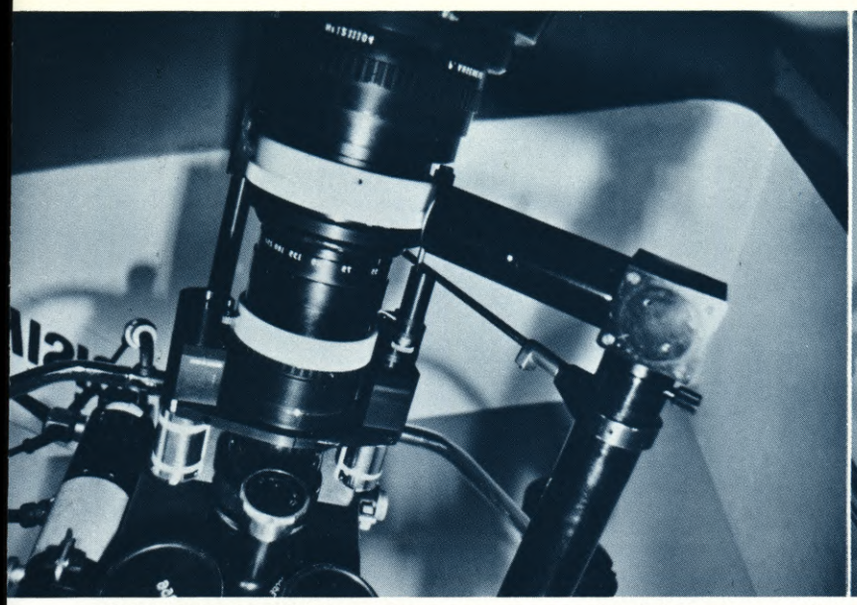
Lamorisse was not content to sit by. He was a fidgety man who always wanted to find out how things could be done in a better way and he participated in the making of his films up to the very last one, "LE VENT DES AMOUREUX", ("The Lovers' Wind"), started in 1967 for a special showing in October, 1971, at the 2,500th anniversary of the dynasty of the family of the Shah of Iran. While concluding the shooting of the film in 1970 he was killed in an unfortunate helicopter accident.

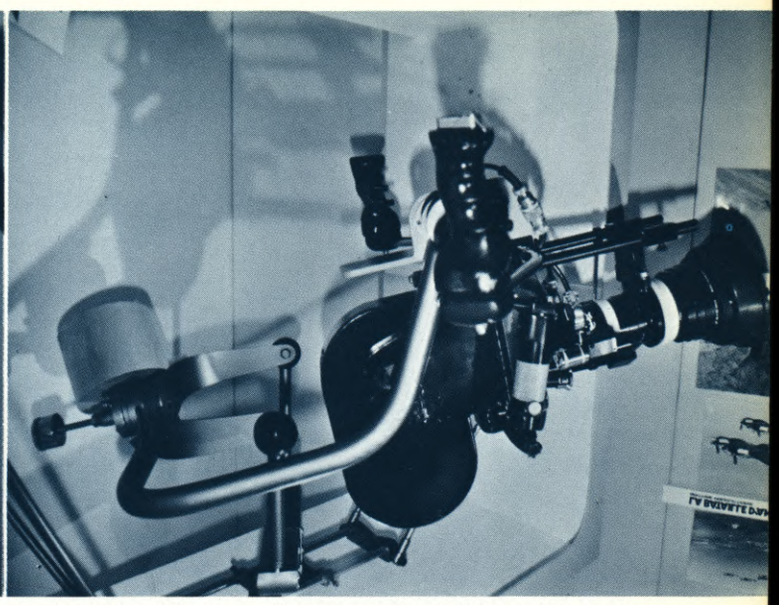
Albert Lamorisse inspired those of his associates who continued the operation of his FILMS MONTSOURIS—HELIVISION COMPANY, so that now *HELIVISION II* has been born. Under the aegis of Mme. Claude Lamorisse, his widow, and Mme. Geneviève Buisette, Associate Director of the company, work has been completed on an anti-vibratory camera mount which, more than ever before, gives the flexibility of helicopter photography a new impetus—and at a greatly reduced cost.

Up to now the Bell Jet Ranger, which is a highly desirable helicopter for filming because of its lightness, speed and power, has presented many difficulties as a practical anti-vibratory camera platform installation due to space limitations. This factor, combined with the heavy weight and bulk of previous camera systems, has frequently forced the producer into using either a slower and less powerful helicopter or hiring a much larger and more expensive ma-

(ABOVE LEFT) A third stage in the development of Helivision, shown with an Eclair Cameflex and 25mm-to-250mm Angenieux zoom lens mounted. (BELOW LEFT) The Arriflex configuration of Helevision I. This rig weighed 237 kilos (almost 500 pounds) and was so cumbersome that its use was limited to mounting only in larger aircraft. (RIGHT) Helevision II, which, by comparison, weighs less than 70 pounds and features simplicity of suspension and displacement fore and aft, giving the operator a greater front or rear shooting angle, as desired.







(LEFT) Closeup of Heden control motors on zoom lens. The periscope addition to the finder picks up the distance scale for superimposition on the finder field. (RIGHT) View of Helevision II, showing handle controls for zoom and focus. Counter-balance unit permits rotation about four axes for precise adjustment.

chine. In the former case, he was forced to sacrifice quality and to inhibit his director because the machine was incapable of doing what was wanted; in the latter case, other sacrifices had to be made because of budget limitations.

Shipping weight was also a factor for the producer to consider, since filming is done all over the world and the only practical camera supports come from France or the United States. The thought of having to pay enormous sums of money just to ship a lot of iron and heavy batteries often forced this type of shooting to be eliminated from the script.

HELIVISION II continues the basic concepts of what has been used successfully in professional filming since 1958. However, the need was recognized for a lighter and more compact unit, one which would be even easier for the camera operator to manage in order to get high-quality results. So the experience of Bernard Dresner, who has specialized in this field since 1948, was brought into the operation. He is an American Director of Photography now resident in Paris. Working with M. A. Baucheron, the engineering genius associated with *HELIVISION,* this new model was developed after much thought and planning. The years of study and development that went into its development have now paid off.

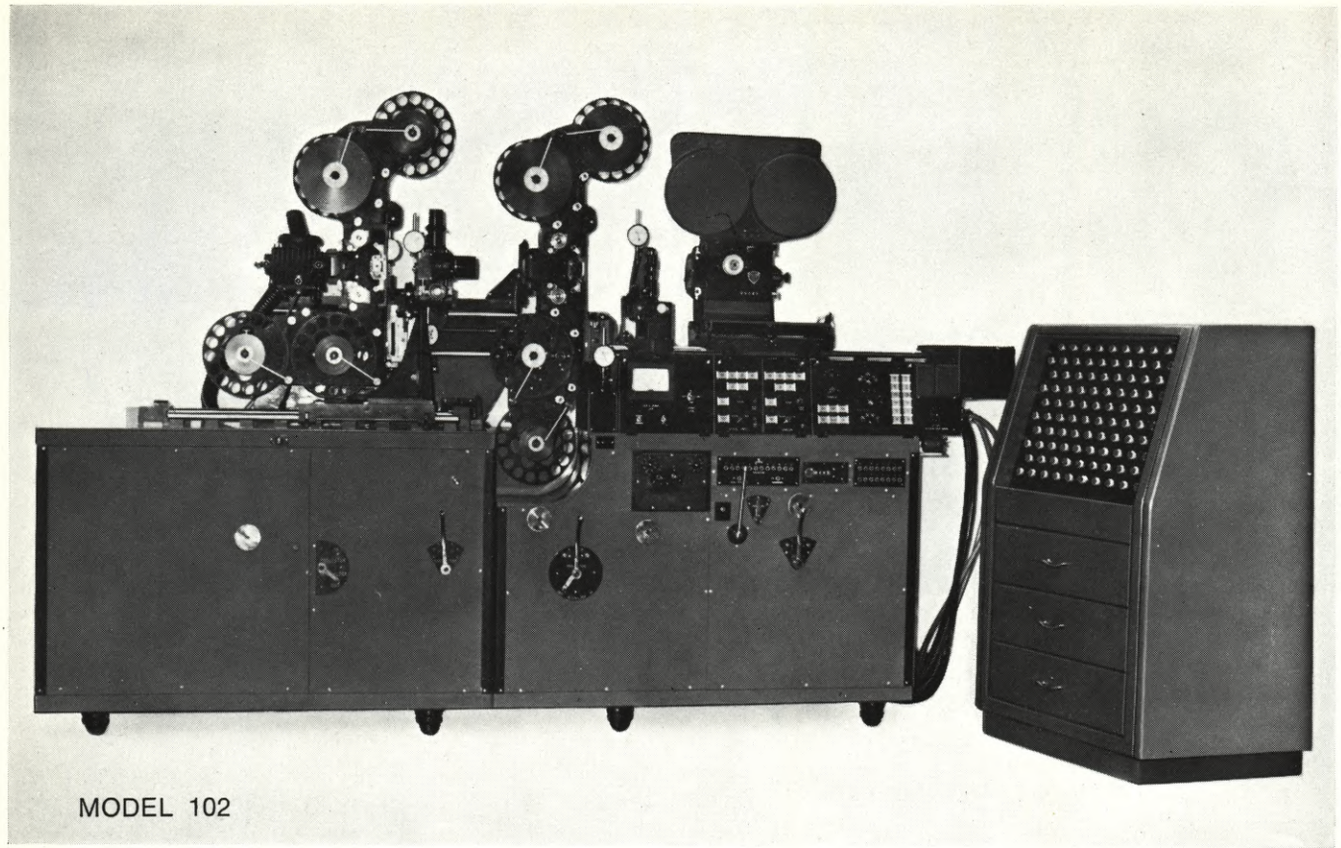
Dresner says, "It was necessary for us to ask ourselves many questions, one by one, and to come up with the answers, one by one. What would improve existing mounts? How could we benefit by their shortcomings through our experiences and those of others in this field?

"First we asked ourselves, 'Does it have to weigh so much?' Analysis proved that it was possible to reduce the weight of materials used in fabrication. After all, an aircraft isn't built of cast iron! Why all the dead weight which only increases shipping costs and reduces the maneuverability of the helicopter? Certainly it doesn't add to the result on the screen. So, we used aircraft metals and we reduced the all-up weight of a complete system, including 35mm camera, 25-250mm zoom lens with electronic controls, remote focus control and all counterweights, to *under 35 kilos!*

"We knew we had the only system which could fit into a small space with ease and comfort, since this is a *suspended* system. There is no encumbrance on the deck of the helicopter—if you can find a point from which to

Continued on Page 610

Albert Lamorisse, designer of the Helivision anti-vibration mount, and creator of many notable films, including "THE RED BALLOON", "STOWAWAY IN THE SKY", "WHITE MANE", VERSAILLES", etc. Shown here with an early model of Helivision, he was killed last year in an unfortunate helicopter accident while filming "LE VENT DES AMOUREUX".



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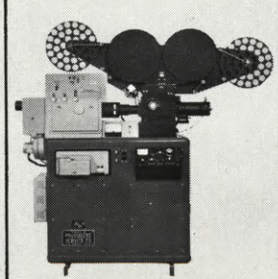

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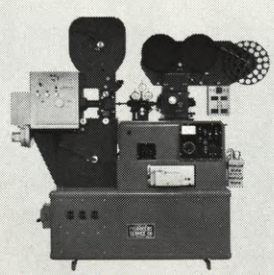

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THE EVOLUTION OF A NEW MACRO-ZOOM LENS SYSTEM

Working to specifications set by the Motion Picture and Television Research Center, Canon engineers design a range of 35mm varifocal lenses with unique calcium fluoride optics and macro characteristics

When the zoom lens was introduced to cinematographers some years ago, the concept gave rise to several intriguing possibilities: 1) It would eliminate the necessity of hauling around a large number of fixed-focal-length lenses, 2) Shooting would go faster because it would no longer be necessary to waste time in changing lenses, and 3) The "zooming" characteristic itself would open up a new area of creative effects.

The very nature of this new instrument, however, placed certain restrictions upon its capabilities. For example, zoom lenses were, generally speaking, slower than fixed-focal-length lenses—with poorer resolving power and a greater degree of distortion. Also, they were large and heavy, a fact that was bound to mitigate against their use in the growing trend toward location filming.

The Motion Picture and Television Research Center, sponsored by the Association of Motion Picture and Television Producers, rapidly realized that if the standards of performance of zoom lenses could be raised to a level of fulfilling the quality requirements of the most discriminating film-makers, the best interests of the industry—both economic and creative—would be served. The Research Center, therefore, vigorously encouraged all lens designers and manufacturers to produce high-quality lenses of this type.

As a further form of encouragement, the Center helped generate specifications for such lenses through its Camera Committee, which is composed of the most highly qualified representatives of the motion picture studios. Basically, two types of lenses were required: spherical and anamorphic.

Since the high-precision specifications set down by the Center would require a massive effort and very sizable investment on the part of the lens manufacturers, most of these were loath to take on such a project. The first manufacturer (having the requisite technical competence) which agreed to embark on so ambitious a program was the Canon Company of Japan. As a result, the Research Center developed a close liaison with Canon and a program was mapped out for the design and production of a full line of high-quality varifocal lenses—both spherical and anamorphic.

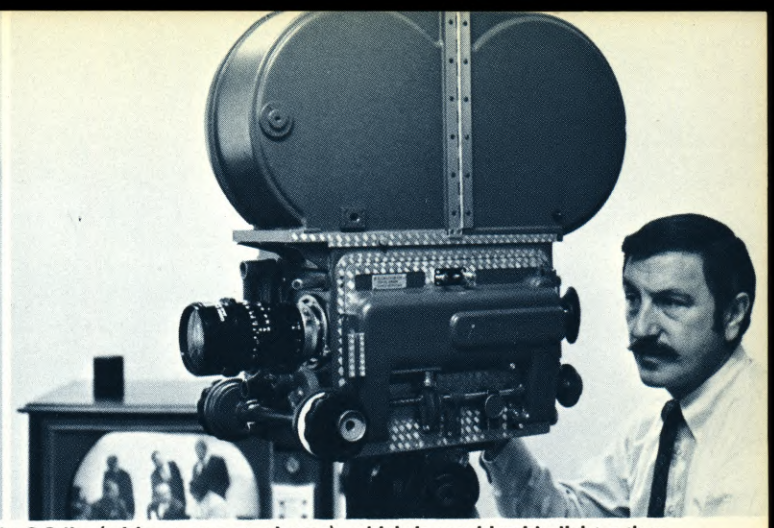
The following statement by Wilton R. Holm, Executive Director of the Research Center, details the step-by-step implementing of that program:

In October, 1968, the Motion Picture and Television Research Center began an intensive study of the possibility of obtaining high-quality, anamorphotic zoom-varifocal lenses for professional 35mm cinematography. The Research Center's goal was to make available anamorphotic lenses which would offer the advantages of varifocal *lenses, yet provide image quality essentially as good as the best* fixed-focus, non-anamorphotic *lenses used for photographing professional 35mm motion pictures.*

By August 1, 1969, I had surveyed the state-of-the-art in aerospace optics, and decided that such lenses were not only needed by the motion picture industry, but were within the technological capabilities of modern, computerized lens-design techniques. I then contacted many of the world's leading optical companies—in Asia and Europe, as well as in the United States. Only Canon, Inc. of Japan, was willing to try their hand at designing and marketing a high-quality, anamorphotic zoom-varifocal lens.

In January, 1970, a program was initiated at Canon in Tokyo. Working with the Research Center, Canon developed design and performance specifications for the desired high-quality anamorphotic zoom-varifocal lens. But when it became apparent that the Canon design offered two new and unique features not available even on non-anamorphotic lenses, the Research Center asked Canon to include a non-anamorphotic (spherical) 35mm zoom-varifocal lens in the program. The two new and unique features in the Canon design were: (1) the use of calcium fluoride lens elements, and (2) a macro focusing capability which permitted the lens to focus sharply on very close objects, and so function as an insert lens

(LEFT) Technical experts representing various major studios and production companies assemble at a luncheon meeting in conference room of the Motion Picture and Television Research Center to see the first industry demonstration of the new Canon 35mm macro-zoom lens system. (RIGHT) Keiichiro Ryu (President of Ryu-Den-Sha, Tokyo, and exporter of the new lenses) and Milton Forman (who will import and distribute them) are available to ask questions, as the Center's Executive Director, Wilton R. Holm, explains features of the new lens system.



(LEFT) The Canon K-35 Anamorphic Macro Zoom K3x40A lens weighs only 6.2 lbs (without mount adapter), which is considerably lighter than other lenses of similar characteristics. Its anamorphic ratio is 2:1, according to the specification set by the Research Center. (RIGHT) Edmund Di Giulio, President of Cinema Product Development Corp. tries out the lens on one of his company's reflex-converted BNC's. CPD will provide maintenance and servicing for the new lenses.

as well as a general-purpose lens.

As a result of the cooperative efforts of Canon and the Research Center, three new 35mm zoom-varifocal lenses will become commercially available to the professional cinematographer by mid-1971. Two of these three lenses will be anamorphotic, *with focal-length ranges of 40mm to 133mm and 60mm to 200mm on the short axis; the third lens will be* non-anamorphotic, *with a focal-length range of 25mm to 120mm. Each of these lenses will provide excellent image quality at any focal length within the focal-length range.*

These lenses can save production time in a number of ways:

(1) Fewer lens changes will be required.

(2) Many camera set-ups can be made with minimal or no movement of camera and lights.

(3) Many dolly shots can be avoided by using these lenses as zoom lenses, thus saving time and labor required for laying dolly track, practice dolly runs, etc.

(4) The varifocal feature permits "fine tuning" on new set-ups. A camera position that is almost, but not quite, right can be compensated by changing the focal length of the lens slightly, instead of moving the camera to a slightly different position.

(5) All zoom lenses can accomplish (3) and (4) above, but with a loss in image quality if the lens is not a true varifocal as well as a zoom lens.

(6) An almost infinite number of focal lengths is available within the focal-length range of these new lenses, with superior image quality available at any focal-length setting.

(7) By proper use of the macro-focusing adjustment, in conjunction with the normal focal-length settings, a new degree of creative freedom in perspective control becomes possible.

(8) Availability of the Canon Anamorphotic zoom-varifocal lenses will make it possible to own, as well as to lease, modern, high-quality, professional 35mm anamorphotic lenses.

By the time the Research Center's program was implemented, certain technical advances had been made by Canon which greatly influenced the characteristics of the resultant lenses. The first of these was the development of an optical system which permitted a Macro feature to be incorporated into a zoom lens, *without the loss of light transmission.*

This Macro feature permitted the minimum lens-to-subject distance to be reduced to five centimeters (two inches), while maintaining a total absence of distortion. An additional characteristic was the fact that the background was not "lost" when photographing under these conditions.

The second very important development was Canon's new capability for growing calcium fluoride crystals of very high quality to the large sizes required for the manufacture of photographic lenses. Up to this point, calcium fluoride had been restricted in use to the small objective lenses of microscopes.

Calcium fluoride has some characteristics which could render it useless for the rugged service demanded in motion picture production. For one thing, it has a tendency to absorb moisture under conditions of high humidity. Also, its coefficient of expansion is about four times that of glass, although in the opposite direction. Both of these factors could result in lenses which might not be stable when zooming or when used under conditions involving severe changes in temperature.

However, the positive features of calcium fluoride were important enough to justify an all-out effort on the part of

Canon K-35 Macro Zoom spherical lens, shown with adapter and 2X extender. The extender, matched to its individual lens, extends the zoom range to 50mm-240mm, while cutting the effective lens speed to T/5.6. Adaptors are available for both Mitchell and Arriflex 35mm cameras.

Canon K-35 Anamorphic Macro Zoom Lens K3x40A

SPECIFICATION:

Focal length	: Horizontal 20–67.5mm Vertical 40–135mm
T–stop	: T/4.5 for exposure
Zoom ratio	: 3.3
Anamorphic ratio	: 2:1
Lens construction	: 25 Components 30 Elements
Image format covered	: 18.669mm x 20.093mm diagonal 28.9mmϕ
Maximum image format covered	: 28.9mmϕ
Minimum object distance from focal plane	: 1.4m for image format 28.9mmϕ
Angular field of view	: Horizontal 18.8°–57.7° Vertical 8°–26.2°
Object Dimension at 1.4m object distance	Wide 72.6cm x 172cm Tele 21.8cm x 51.6cm
Clear aperture of front glass	: 94mmϕ
Overall length (from front vertex to focal plane)	: 293.96mm
Back focal distance	: 42.54mm
Macro	: 17cm (from front glass)
Zoom type	: Canon Mechanical Compensation Type
Weight	: 6.2 lbs (without mount adapter)
Size	: 108mmϕ (Maximum diameter) x 254.5mm (with Mitchell mount adapter)

Canon to solve the abovementioned problems. These positive features included the fact that calcium fluoride permitted the design of lenses that were smaller in size, higher in resolution and with a major reduction in chromatic aberration.

Canon's efforts to solve the problems peculiar to calcium fluoride were eminently successful. The lenses are now specially treated to render them impervious to moisture under all operating conditions. Canon also developed a self-compensating mechanism to correct focus shift caused by extreme changes in temperature. Tests show that there is no change in resolving power between -4° F. (-20° C.) and +104° F. (+40° C.).

Two prototype lenses were delivered to the Research Center for testing. These were units of the Canon KSx25 lens, having a speed of T/2.8 and a focal range of 25mm to 120mm. Included was the Macro optical mechanism and a 2X extender which doubled the focal range (50mm to 240mm) while modifying the speed to T/5.6.

Arrangements were made for practical color film tests of these prototypes to be made by Paramount Studios, Universal Studios, Howard A. Anderson Co., F & B/Ceco (Hollywood) and EMI-MGM Elstree Studios (London).

Some of these tests consisted of direct comparisons with fixed-focal-length and existing commercial varifocal (zoom) lenses. Other tests involved footage shot to indicate performance of the lenses under actual production conditions.

Information sought through these tests pertained to such elements as: the quality of resolution, the amount of distortion, ability of the lenses to remain in controlled sharp focus throughout the range of zooming, amount of chromatic aberration, size of image format, contrast, image quality, depth of field, etc.

The tests showed that the resolving power of the new Canon lenses was generally able to approach closely that of the Super Baltar fixed-focal-length lenses and, at focal lengths of 50mm and longer, it was *equal* to that of the Super Baltars.

From the point of view of distortion, pin-cushioning, etc., the Research Center's specification was a maximum of 3% distortion—a target that was met. This meant that the distortion of the Canon lenses was only about 50% that of other existing varifocal lenses.

The color rendition was excellent and there was no evidence of chromatic aberration.

Canon K-35 Anamorphic Macro Zoom Lens K3x60A

SPECIFICATION:

Focal length	: Horizontal 30–100mm Vertical 60–200mm
T-stop	: T/4.5 for exposure
Zoom ratio	: 3.3
Anamorphic ratio	: 2:1
Lens construction	: 22 Components 27 Elements
Image format covered	: 18.669mm x 22.093mm diagonal 28.9mmϕ
Maximum image format covered	: 31mmϕ
Minimum object distance from focal plane	: 1.4m for image format 31mmϕ
Angular field of view	: Horizontal 14.2°–45.0° Vertical 5.3°–17.7°
Object dimension at 1.4m object distance	:Wide 28.4cm x 75.8cm Tele 8.5cm x 22.7cm
Clear aperture of front glass	: 76.5mmϕ
Overall length (from front vertex to focal plane	: 223.05mm
Back focal distance	: 42.25mm
Macro	: 17cm (from front glass)
Zoom type	: Canon Mechanical Compensation Type
Weight	: 4.4 lbs (without mount adapter)
Size	: 100mmϕ (maximum diameter) x 186.5mm with Mitchell mount adapter

Mr. Ryu demonstrates unique macro characteristic of the new lenses by holding his wristwatch at the point of closest focus, just a few centimeters in front of the forward lens element. In addition to permitting large insert closeups, the macro capability can be used to radically alter the perspective of a scene, thereby providing the cinematographer with a most important creative tool.

A M P T P RESEARCH CENTER BULLETIN

OPTICAL PARAMETERS OF ANAMORPHIC LENSES

Now that a variety of anamorphic lenses is becoming available for 35mm motion picture photography, the question of specifying optical parameters—especially true T-stops—will become increasingly important. Today our industry has the Todd A-O/Dimension 150 lenses available, in addition to the Panavision lenses. In a few months Canon and possibly Cooke lenses will become available. Specifications for all of these lenses will be supplied by the manufacturers; but they may be computed in different ways and, therefore, be misleading if users try to relate performance of the various lenses on the basis of specifications alone.

Let us assume an anamorphic zoom-varifocal lens which, on the horizontal axis, has a focal length range of 20 to 100mm, and on the vertical axis a range of 40 to 200mm. Let us assume this lens to have a clear front-element aperture such that the calculated speed for the horizontal axis is f/2.8, then the calculated aperture stop for the vertical axis would be f/5.6. And the T-stop, assuming no reflection or absorption losses, would be T/4. Practically, such a lens would have a true T-stop of perhaps T/4.5.

This hypothetical lens could be fabricated from a prime lens of 40-200mm by anamorphosing at the front, or from a 20-100mm lens by anamorphosing at the rear. Diagrammatically it would look as follows:

Horizontal Axis (H):	*H = 20mm-100mm (f/2.8)*
Vertical Axis (V):	*V = 40mm-200mm (f/5.6)*
Theoretical T-stop:	*100% T = T/4*
Actual T-stop:	*T = T/4.5*

It can be seen from the above that our hypothetical lens could be rated as f/2.8 and T/3 to T/3.3, with reference to the horizontal axis; it could be rated as f/5.6 and T/6 to T/6.3 with reference to the vertical axis. Or it could be rated with reference to the true light-transmitting ability of the lens, which would be the theoretical T-stop corresponding to f/4 (the aperture stop midway between f/2.8 and f/5.6) and which would be about T/4.5 because of transmission losses in the lens.

Quite clearly, if the T-stop is established on the basis of the f-stop corresponding to the short axis, we get a speed rating which is one stop faster than the true transmission stop of the lens. If the T-stop is established on the basis of the long-axis f-stop, the speed rating is one stop slower than the true transmission stop of the lens. In the first case the lens speed rating makes it look faster than it actually is; in the second—slower. Certainly no one would want to give their lens a less-than-optimum T-stop rating; therefore, we might expect to find some ratings based upon the short-axis f-stop, but none based upon the long-axis f-stop. Obviously, the proper rating would be based upon the measured T-stop of a lens.

The Research Center plans to initiate a standard procedure for specifying speed and other performance factors relative to anamorphic lenses. It is our belief that much confusion can be avoided by facing this problem now, and thus avoid a future maze of unrelated specifications which would make it impossible to compare lenses except by physical test.

We recognize that already the speed ratings of some anamorphic lenses are based upon short-axis data. We, therefore, welcome points of view from recipients of this Bulletin and from other interested parties.

Wilton R. Holm

A major aspect of the testing related to depth of field, and the resultant footage revealed that this was excellent throughout the entire range of focal lengths. In addition, the self-compensating mechanism built into the optical system by Canon resulted in the ability of the lens to remain in focus (and *not shift its focal plane*) throughout the full range of zooming.

The tests proved that the optical requirements and specifications established by the Motion Picture and Television Research Center had been met and, in several respects, exceeded.

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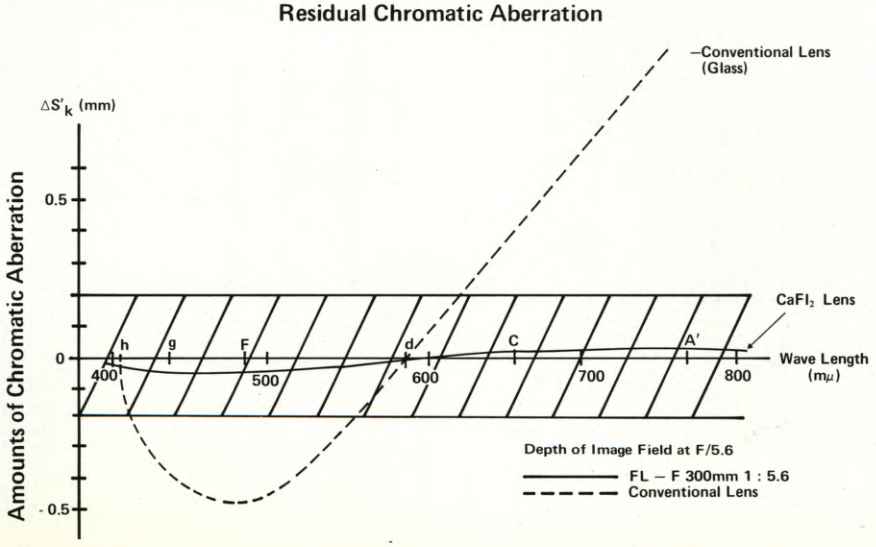
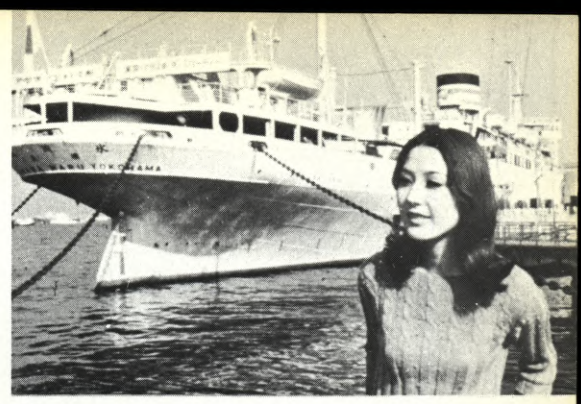
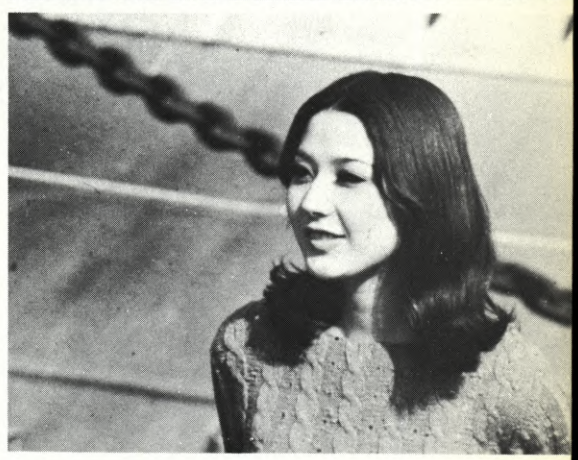
Chromatic Aberration Comparisons Between Conventional Glass and Calcium Fluoride Optics







How macro feature alters perspective: (TOP) Subject five feet away, photographed with lens at wide-angle extreme. (CENTER) Same subject distance; lens at telephoto extreme. (BOTTOM) Subject distance: 1.6 feet, photographed using macro zoom ring.

Canon K-35 Anamorphic Lens K35-30A

SPECIFICATION:

(Front Anamo)	
Image format	**: 31mmϕ (0.735" x 0.98")**
Focal length	**: Horizontal 15mm Vertical 30mm**
Anamorphic ratio	**: 2:1**
T-stop	**: T/3 for exposure**
Minimum object distance	**: 0.5m**
Clear aperture of front lens	**: 90mmϕ**
Clear aperture of rear lens	**: 20mmϕ**
Overall length (front lens to focal plane)	**: 180mm**
Back focal length	**: 29mm**
Distortion (Barrel)	**: not exceed 3% (minus)**

A man, his work, and his camera

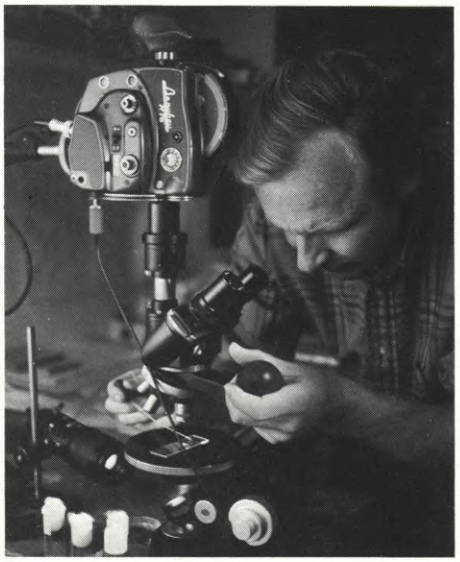
Bruce J. Russell—Biologist/Cinematographer
☐ Producer of the Thorne Biology Film Loop Library
☐ Winner (1969) American Film Festival/Science Film Loop Division ☐ President, Educational Films Lab (Newcastle, California)

"Film loop production is a demanding form of the motion picture arts. Loops are silent—the story must be carried visually without the help of a sound track. Getting meaningful ecological sequences of organisms in their natural environment requires motion picture camera equipment which is both compact and reliable. The Beaulieu R16B has some unique advantages for this kind of work, and I have exposed some eleven miles of 16mm film through mine during the creation of 150 single topic films.

Capturing the life styles of the little known animals of the tide pools, mudflats, streams and ponds, I have tried to give the student a biologist's *eye view*. Precision reflex viewing and behind the lens metering are prerequisites for this kind of quick, unobtrusive field work. My camera is frequently attached to the end of some device—a periscope, an underwater viewing tube, the microscope—often improvised equipment which permits the interesting, visually involving shots which characterize our ecology films.

The Beaulieu's mirrored shutter, which sends full light to the large ground glass viewing screen, provides a bright picture of what is going on before the lens. I am able to focus and set the aperture without removing my eye from the view finder, and this is a terrific advantage when filming living organisms in their natural surroundings.

After three years of this challenging work, the Beaulieu 16mm camera has become an automatic recorder of what my eye sees at the levels of observation common to biologists—normal, macro (as with a stereo microscope) and micro. Its unusual flexibility has allowed me to explore, both scientifically and aesthetically, the fascinating world of living organisms."



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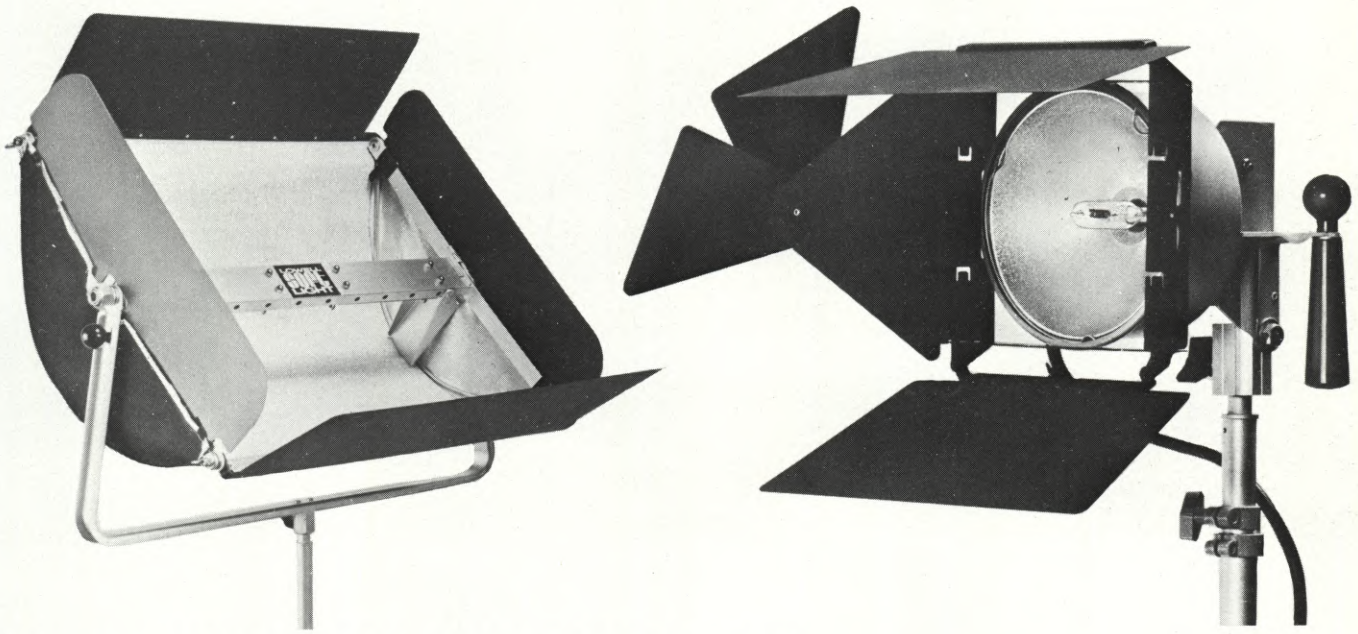

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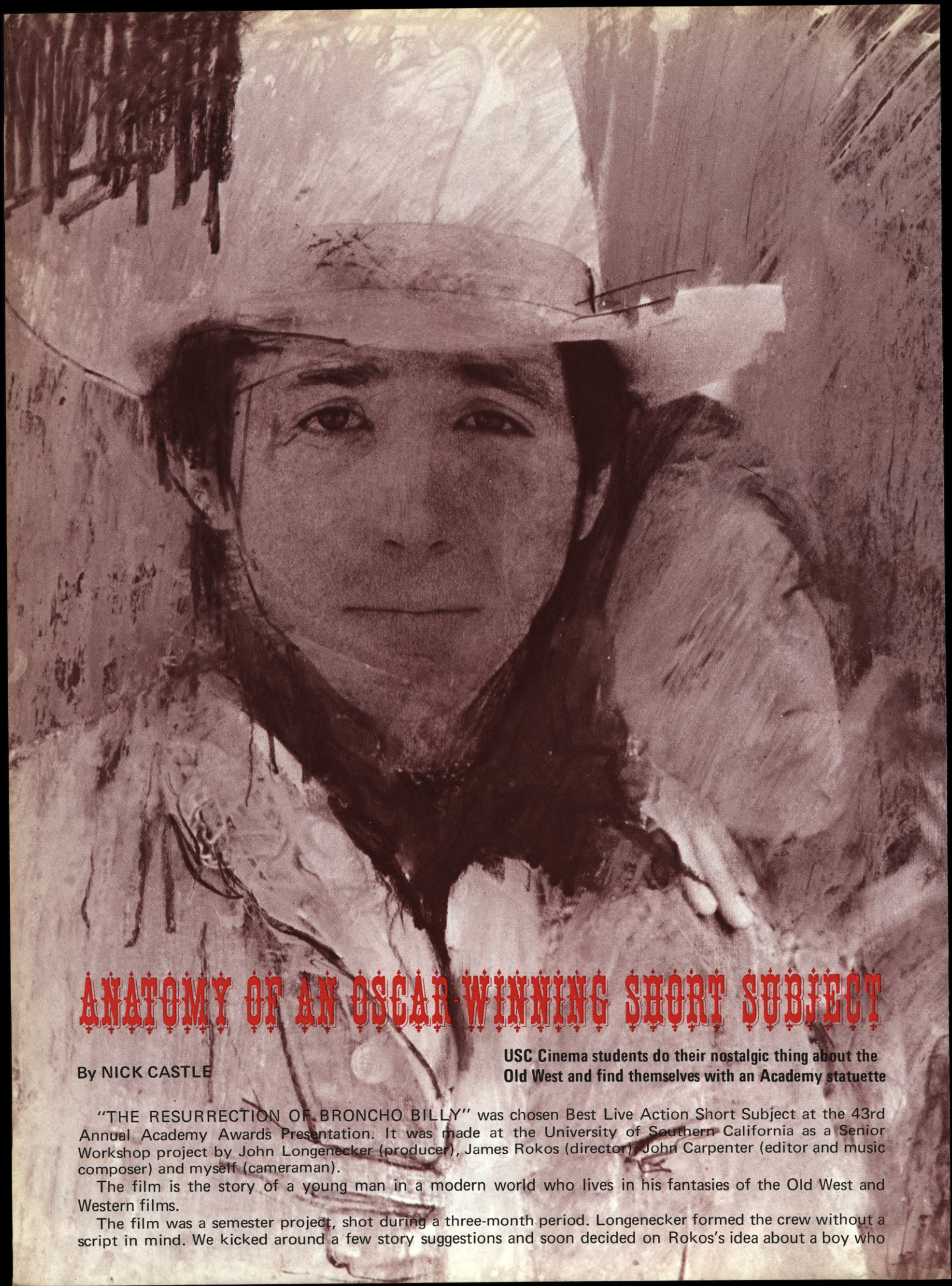


ANATOMY OF AN OSCAR-WINNING SHORT SUBJECT

USC Cinema students do their nostalgic thing about the Old West and find themselves with an Academy statuette

By NICK CASTLE

"THE RESURRECTION OF BRONCHO BILLY" was chosen Best Live Action Short Subject at the 43rd Annual Academy Awards Presentation. It was made at the University of Southern California as a Senior Workshop project by John Longenecker (producer), James Rokos (director), John Carpenter (editor and music composer) and myself (cameraman).

The film is the story of a young man in a modern world who lives in his fantasies of the Old West and Western films.

The film was a semester project, shot during a three-month period. Longenecker formed the crew without a script in mind. We kicked around a few story suggestions and soon decided on Rokos's idea about a boy who

(LEFT) Johnny Crawford, playing role of "BRONCHO BILLY" cinches saddle of his trusty steed, "Two Bits", while leading lady Kristin Nelson waits to ride off into the sunset with him. (RIGHT) Director James Rokos leads Johnny, Kristin and Two Bits up a trail for final scene of the film. Students made film as a classroom exercise, had no aspirations toward awards.

dreams of movie heroes. From this premise the four of us and another student, Trace Johnson, wrote the script, constructing scenes and re-defining the character. Within a week, we presented the final draft to our instructors for approval.

Longenecker cast the film, working through his father's firm (the Robert Longenecker Agency). Probably his best move as producer was to ask his longtime friend Johnny Crawford (star of the "RIFLEMAN" series) to head the cast. His next door neighbor, Kristin Nelson, a talented artist and actress, was recruited to play the female lead.

The next step was to choose locations and establish a visual style for the film. The pictorial challenge was a fun one to tackle: the idea of giving the locations and situations the look of a Western film. The drama of Western film camera-work was implemented: the stark high and low angles, the supertight close-up, and the suspenseful dolly shot. So, a crosswalk on Wilshire Blvd. became the scene for the face-off of a showdown; Barney's Beanery, an old-time saloon; and crossing the street in Westwood, a ride through a cattle drive. It was decided very early in the planning not to use any zoom shots, in keeping with the classic Western style of the photography. (The "crane" shot in the showdown scene was accomplished within our budget with the use of an "Angenieux 12-120 crane.")

Sound was also affected by the Western style. Broncho's boots magically have spurs jingling and his imagination is filled with clicks of guns and the threatening sounds of crackling twigs prior to the ambush.

The actual shooting of the film was chaotic, what with our relative inexperience and non-compromising egos. Although we were individually accountable for our specific responsibilities, the concepts and ideas for the film were equally shared among all crew members, including the actor, Johnny Crawford. In practice, this policy led to many heated arguments, but because of our agreement on the original concepts of the film, these disagreements, in many cases, led to a better motion picture.

Because there were only four crew members all responsibilities overlapped: the director loaded magazines, the producer did sound, the editor took light

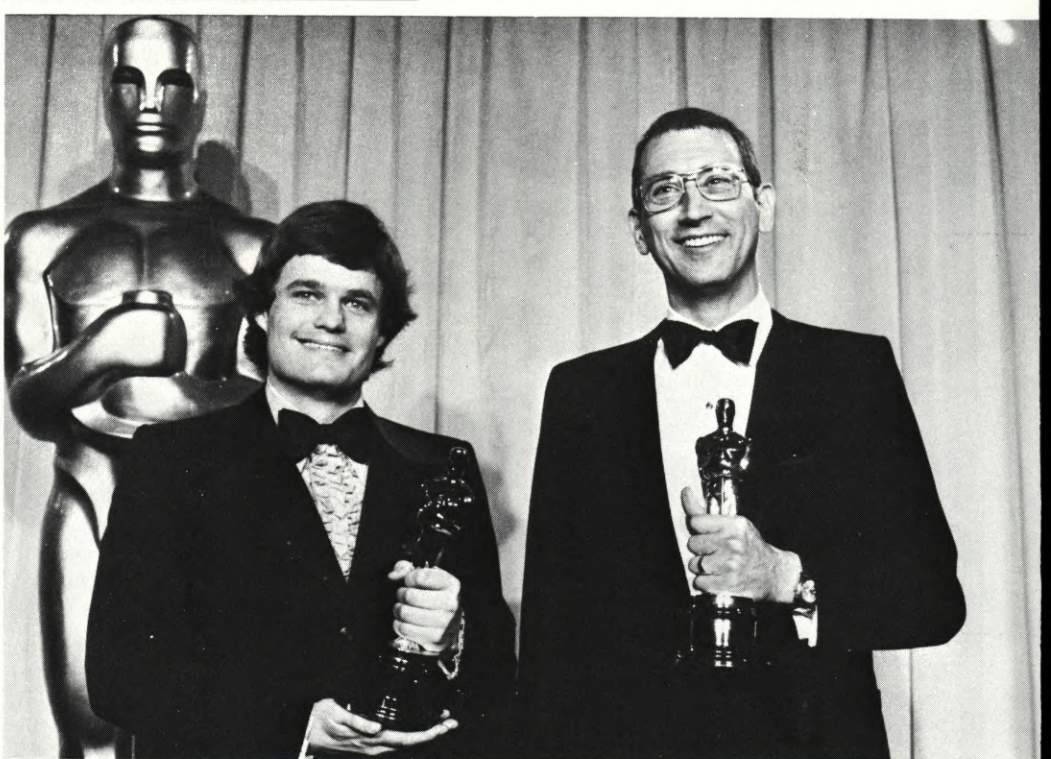
Cameraman Nick Castle checks depth of field in the American Cinematographer Manual. Sync-sound scenes were shot with Arriflex BL and Eclair NPR cameras.

(LEFT) Director Rokos runs his actors through their paces while staging a scene in the park. (RIGHT) Crawford, Castle, Nelson and Longenecker have a short rap session between camera set-ups. They have all been close friends since they were in grade school. (OPPOSITE PAGE) Don Nelson's painting of Johnny and Kristin in costume served as the main graphics motif for advertising and brochures.

Rokos and Castle photograph inserts of nostalgic Western movie posters on the sound stage. This was the only non-location footage shot for the picture.

readings, and I did high harmony on the theme song. We had one-hundred percent location shooting, from an attic in a Bel-Air mansion to an alley in the downtown district. Although many of our locations called for filming in heavily populated parts of the city, the words: "we're making a student film" had the uncanny power to disperse seemingly fascinated groups of onlookers very quickly. So we went practically unnoticed through the streets of Los Angeles.

The farthest point of our location scouting took us to the western prairies of Thousand Oaks, a San Fernando



On the night of the 43rd Annual Academy Awards Presentation, Longenecker and Dr. Bernard Kanter, head of the USC Cinema Dept., proudly accept Oscars for Best Live Action Short Subject.

Producer Longenecker doubles as soundman. Because there were only four crew members, their technical responsibilities overlapped and they all willingly performed several functions.

Valley suburb. We had planned to shoot the final scene on the streets of an old Western town, but the International Motorcycle Racing Club had plans of their own. It was the one day out of the year that the Western town was used as the finish line for the annual races. Longenecker tried one last-ditch effort to salvage the day by using the throng that had gathered on the roofs of the buildings to cheer as our hero rode into town. The effort failed because time ran out and the five thousand screaming fans wouldn't take direction.

As cameraman on a very low-budget film, I found myself riding in shopping

Continued on Page 596

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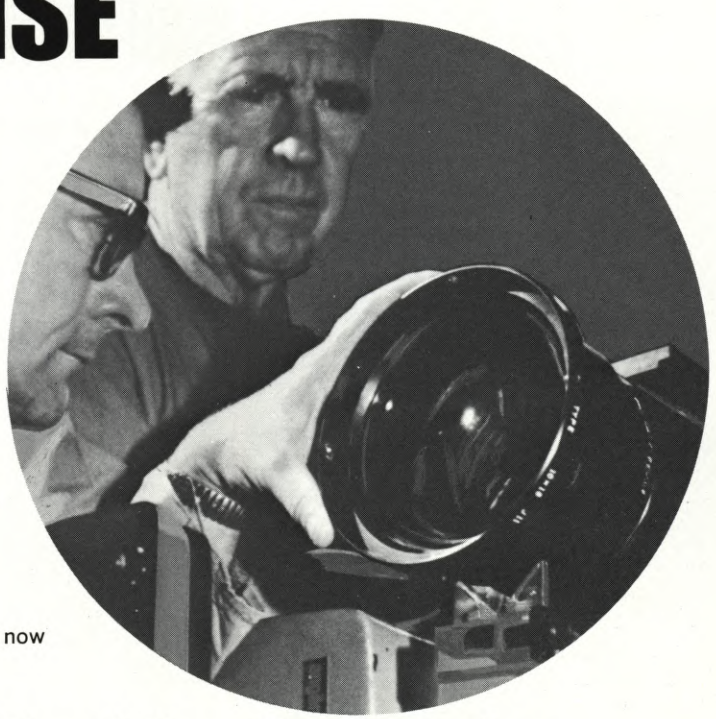

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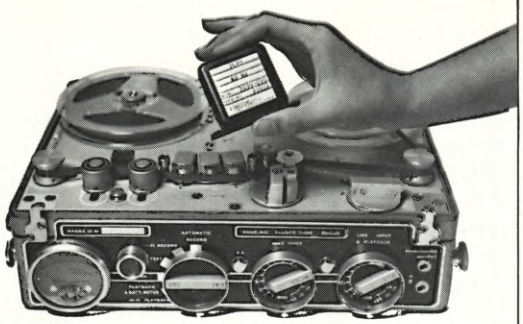

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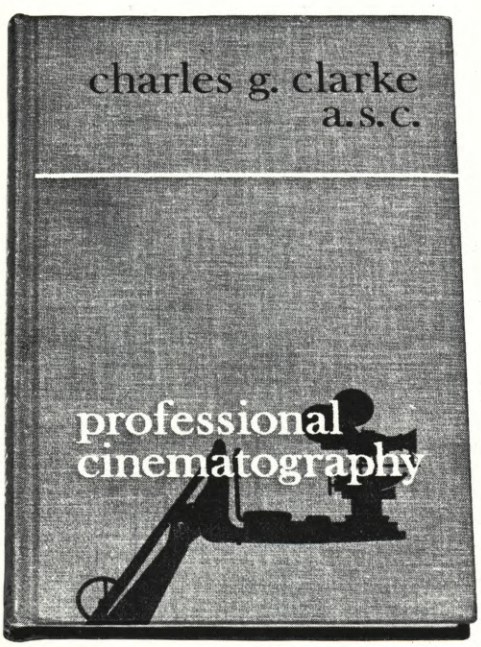
By CHARLES G. CLARKE, ASC

Professional Guidance For Aspiring Cinematographers



SUBJECTS INCLUDE: Camera, camera mounts . . . Lenses, wide-screen lenses . . . Filters and Filter effects . . . Day-for-night photography . . . Exposure for color and black and white films . . . Light meters and their use . . . Color temperature meters . . . Equipment for set lighting and its control . . . Camera angles and techniques . . . Special lighting problems . . . Color psychology . . . Composition . . . Special photographic effects . . . Set operation on the sound stage . . . New film emulsions . . . Forced development data.

ABOUT THE AUTHOR: Charles G. Clarke, ASC, a top Director of Photography at 20th Century-Fox for many years, and an ASC member, taught Advanced Cinematography at the University of California at Los Angeles, where he recognized a need for practical professional guidance for students striving to be the industry's future Directors of Photography. It is this need which has given rise to his publication of a book on the subject and subsequently the latest revised edition of Professional Cinematography. The first edition of this valuable book has become required reading at many universities and schools offering courses in cinematography.

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FREDDIE YOUNG AT COLLEGE

Continued from Page 557

kind of image we wanted. In addition, we also wanted cutting possibilities between black and white and color if Freddie talked extensively of lighting. But our plans got shifted when one of our Eclair magazines, loaded with 7242, jammed, and they really went out the window when the power source failed on a load of 7242 in the only Bolex with a 400' magazine. We were reduced to shooting 100' loads on hand-wound Bolexes for much of the very important non-sync footage and we ended up getting much less color than we wanted. But when Freddie had finished we had close to 2000' of footage and so we went to editing.

What emerged is a film we called "FREDDIE YOUNG, THE MAKER AND THE PROCESS". It was completed with Allan King's financial help and the use of his facilities. Cut through and over Freddie's talk with the students are clips from "RYAN'S DAUGHTER", "BATTLE OF BRITAIN", "DOCTOR ZHIVAGO", and stills from "LAWRENCE OF ARABIA". We found that we had to put a narrator's voice over to bridge Freddie's comments and the films inserts that we made. We had fun matching certain shots and sequences to the actual critical points that Freddie was explaining in his talk. We even decided to leave in certain rough spots such as sound track noise, or our own clapboard difficulties, or the loss of image at the beginning or ending of a camera run. We felt that if what we made was actually a kind of unfinished film, the questions and criticism that it would generate would constitute a valuable learning experience. And so we did. It is, after all, the maker and the process.

Through it all, Freddie Young was the constant. The film is about him and about his craft. He even consented to letting us use his name as Director of Photography on the film. It is probably the only "unfinished" film he was ever associated with. His energy is indefatigable. He lived up to his reputation as the "iron man". At dinner afterwards, though obviously tired, he still had humor and courtesy enough to treat us to anecdotes of the production of "RYAN'S DAUGHTER" and earlier films. And shortly after he left Toronto, he was to work in Spain with Franklin Schaffner on "NICHOLAS AND ALEXANDRA". He is, all in all, an impressive man, the professional's professional. As we said in the film, "There are not many like him left." ■

QUESTIONS & ANSWERS

Conducted by CHARLES G. CLARKE, ASC. and WALTER STRENGE, ASC.

(Inquiries are invited relating to cinematographic problems. Address: Q. & A., AMERICAN CINEMATOGRAPHER, P.O. Box 2230, Hollywood, Calif. 90028.)

Q In the March, 1971 issue of *American Cinematographer* you ran an article titled "THE 'WHAT' AND 'WHY' OF DOUBLE SUPER-8" which stated that "certain of the Bauer Super-8 cameras permit rewinding of up to 90 frames into the 'air space' of the cartridge." I'm sure I'm not the only one whose curiosity is hopelessly aroused. Can you explain the process in more detail?

A The cameras to which reference was made are the Bauer C Royal models. (See *American Cinematographer,* December, 1969). Design of the Kodak Super-8 cartridge does not permit *true* rewinding of the film, but Bauer engineers discovered that the square configuration of the cartridge allows for a small amount of empty space surrounding the circular film roll. It is into this "air space" that the camera mechanism "backs up" as many as 90 frames in order to permit the making of automatic dissolves as short as four frames or as long as the full 90 frames. How it works: A scene is faded out with the aid of the camera's variable shutter which, when closed, stops the camera automatically. During the fade, a built-in *computer* registers the number of frames used for the fade-out. When a button is pressed, the film is transported backwards (into the "air space" of the cartridge) the same number of frames used in the fade-out. When the camera start button is pressed to expose the next scene, the variable shutter is gradually opened to expose a perfect lap dissolve.

Q Is Eastman Kodak coming out with a new color negative camera stock?

A We have heard this rumor for the past two years but, to date, it is still a rumor.

Q Why is 16mm EK color negative type 7254 used only in a very limited way?

A This is a very fine film with good color response and a fast ASA rating, but it has basic economic and mechanical limitations.

Q What is "m-format film"?

A This was a film format introduced by Maurer about the same time Kodak introduced Super 8mm. Look on pages 506 to 566 of the August, 1962 SMPTE JOURNAL for all the information.

Q When shooting color film out of doors, should you use a CC filter in addition to the Wratten No. 85 filter to balance color when shooting early in the morning or late afternoon? Can one be of gelatin and the other glass?

A Purpose of the No. 85 filter is to convert daylight to the proper color temperature. When shooting from morning to late afternoon, color temperature of daylight changes progressively. Therefore, to obtain optimum color rendition in your photography at all times, it is necessary to take color-temperature readings of the daylight at intervals, as well as exposure readings; then, with the proper filters, make the necessary corrections of the light to effect consistent results, This can also be corrected by your laboratory.

As regards the filters, both glass and gelatin filters give good results, and the two types can be used together with success. Glass filters should be optically ground to insure definition of image.

Q For a theatrical film shooting a night scene, would you do day-for-night or shoot at night?

A Each scene is different for getting the best results. We prefer to shoot at night, using lights. Even shooting day-for-night we would stop down three stops and use lights.

Q I am shooting a scene that requires a dusk effect. Would you use a matte or graduated filters?

A You do not say what the scene is or if you would be using fill light. We would not cut a matte or use graduate filters. We would use a light sky and go down three stops and get some lights in windows or on cars.

Q In your January issue you mentioned the use of heat filters to cut down on the heat transmission for filming in operating rooms.

A Write: Berkey ColorTran, Inc., 1015 Chestnut Street, Burbank, Ca. 91502, for information about the ColorTran High Absorption Heat Filter.

Q Would you please give me the names of some books on film editing?

A The only one we have heard of is *"The Technique of the Cutting Room"* by Ernest Walter. It is available at most book stores. We offer this information without recommendation.

Q Why can't color films be processed in developing units recommended for B&W processing? I understand all are of stainless steel and all of the film guides are of teflon, plastic or some other non-corrosive material.

A Color cannot be developed in units recommended for B&W processing. Color processing has to go through a first color developer and then a second. Several more solutions are required. Through the years film processors have found that Teflon rollers are the best, as they resist corrosion and all the chemical reactions that happen to stainless steel.

Q What is the purpose of the load elevator section on professional film processors? Why can't the film go directly into the processing chemicals, rather than take several turns in the elevator section, around several reels?

A Basically this procedure gives the operator of the machine more time to make a change and splice. If a break should occur during developing, he can save the film that is on the elevators.

OSCAR-WINNING SHORT

Continued from Page 590

carts and trunks of cars, lying in contorted positions on doorway dollys, up on horses and down in dirty gutters. The sync sound scenes were shot with Arriflex BL's and Eclair NPR's. On days when the equipment was all booked up by other crews, we re-scheduled and did MOS scenes with the Arri S, when available, or Johnny Crawford's Bolex.

The film was made for $700. Thousands of dollars were saved by the fact that we were at a film school. All of the equipment was free from rental, as were the editing facilities, mixing and viewing rooms.

Early in the planning stages it was decided to tint the black and white portions of the movie in sepia to add to the Western flavor. Also, a match-dissolve was needed to effect the switch in the ending scene from sepia to color. For these post-production operations we decided to go to Technicolor. The match-dissolve was a simple matter of taking the shot and dividing it into both a sepia and color master positive, and then dissolving the two. The effect was an emergence of color within the shot. With the help of John Donlin at Technicolor, we printed the film on 35mm stock, double rank, (two 16mm prints on one piece of film) for better release print quality.

We shot the film using Plus-X negative for the sepia scenes, and ECO for the color section. On the Saturday that we shot the park scene, we could only get our hands on one 400' roll of Plus-X reversal. This later posed a problem in the printing. We couldn't combine reversal and negative originals to make a print.

John Donlin, at Technicolor, figured it out for us and made a timed master positive from the original negative. Since the master positive was first generation, the emulsion was no longer in original position. In order to make a sharp-resolution print emulsion positions should be the same. So we decided to flip the original black and white reversal and the original ECO to correspond with the black and white master positive. We printed the whole mess on color print stock, filtering the black and white sections in a sepia tone. We picked a sepia tone that we liked and used the same filter ratio throughout the sepia section, compensating slightly for density variations.

Universal's 16mm division, headed by Christopher Wood, has a contract with USC for distribution rights to all

films owned by the school. These films are packaged and distributed to universities across the nation. Chris was shown our film and decided to put it in his "Take One" series. This proved to be an important step, for out of these screenings came favorable audience reaction, good newspaper reviews and the awareness that the film had a general appeal. During this time the film was entered in several festivals, winning recognition at the Atlanta, Edinburgh, and San Francisco Film Festivals.

In order for a film to be a contender for an Academy Award it must be in 35mm and have played in a commercial theatre in Los Angeles. After some discussion, the USC Cinema Dept. agreed to pay for the blow-up, and the original was sent to the Consolidated Film Industries lab for that purpose. Meanwhile, Longenecker and Crawford decided to re-mix the sound track, which had some rough edges.

The music theme for "BRONCHO", written by John Carpenter, is one of the important elements contributing to the mood of the film. The 16mm optical track didn't do the sound justice (or was it that the 16mm sound track didn't do the film justice?). At any rate, we re-transferred the music from the original ¼-inch tape to 35mm mag stripe and also did a transfer of the dialogue from 16mm to 35mm mag stripe.

The re-recording was finally done at Cinesound, from two 35mm tracks, four 16mm tracks, and several McKenzie loops onto 35mm, full-coat three-stripe. The quality of the sound track this time, was very professional.

The film was then brought to the attention of Gary Burkhart, booker for National General theatres. Gary enjoyed the film and made the decision to book it at National General's new theatre in Westwood Village. "BRONCHO" played at the National Theatre for seven weeks and, thanks to Gary, had marquee billing.

The film was entered for Academy consideration. It made the first and second cuts. Then it was nominated for an Academy Award.

Don Nelson painted a portrait of Johnny Crawford and Kristin that visually represented "BRONCHO BILLY". This was just what we needed to use on our flyers, and the couple of ads we took to get people to go and see the film.

We started out with great hopes for making a good student film and never really dreamed of an Academy Award.

Next month "THE RESURRECTION OF BRONCHO BILLY" will go into world-wide distribution. ■

WONDERS OF ARRI-LAND

Continued from Page 547

very interesting to watch. A special type of sand is delivered by conveyor belt to various sand dispensary stations. It is measured from a hopper into a frame and then has a wooden form corresponding to the finished piece forced into it under tremendous pressure. Molten metal is then poured into the resultant negative sand impression. When the metal cools, the piece is removed from the sand mold and sent out for machining down to precise specifications.

It is a basically primitive method, handed down from antiquity, which is used in foundries everywhere and it has several advantages. First of all, the wooden forms used are relatively inexpensive to make and are easily modified. Moreover, the process is economically feasible for producing only a few units of a particular piece. The main drawback of the method is that the resultant castings are quite crude and require considerable machining to turn them into finished parts.

We move on to a part of the foundry where injection castings are being stamped out by powerful machines. One part being manufactured by this means is a section of the throat assembly for an Arriflex 16mm Standard camera magazine. The machine that produces these castings is an awesome contraption that belches flame and hot metal, but the pieces that emerge are much closer to their finished form than those made by sand casting and require far less machining. The main disadvantage of this method is that the molds used are made of steel and must be created by a toolmaker. They are, therefore, quite expensive and the process is not economically practical unless there is a run of 2,000 or more pieces to be made.

I notice piles of aluminum ingots stacked about the foundry and I am told that ten different kinds of alloys are used, depending upon the requirements of the various parts to be manufactured. These alloys are compounded and shipped in from an aluminum plant that is conveniently located only one kilometer away.

On the way from the foundry to another of the factory buildings we pass a creek which runs through the estate and which has been intricately dammed and harnessed so that it provides not only fish, but hydroelectric power to operate some of the factory machinery. Nothing is wasted at Stephanskirchen.

We move through areas where technicians are at work at lathes and milling

Continued on Page 612

SURVEY OF LAB PROCESSES AND FILM STOCKS

Continued from Page 559

is available when exposing film in a camera, a negative film designed for use in a camera needs to be faster than the film onto which it will be printed. Also, in the case of black and white, the camera film should ideally be sensitive to all colors of light, whereas film for the printer need only be sensitive to one color. Therefore a positive film stock is something quite distinct from a negative film stock but a positive stock should not be confused with a reversal stock or an "auto-positive" or "direct positive" stock. A positive film stock yields a positive image only when it is exposed through a negative.

A reversal film yields a "positive" image on the same piece of film exposed in the camera by means of special processing which essentially incorporates the printing process into the development. Reversal emulsions were designed originally to make amateur movies possible by eliminating the need for printing, in order to get an image suitable for projection. A black and white reversal film employs essentially the same emulsion as a negative film. It can be processed in the normal manner to yield a negative image, but its design also enables it to be processed to yield a positive image.

In reversal processing a negative image is developed; but then, instead of removing the undeveloped emulsion and leaving the silver image on the film as is done in normal negative processing, the silver image is bleached off and the undeveloped emulsion is left on. This remaining emulsion is then completely exposed by means of a light in the processing machine and developed to yield a positive image.

Since the areas on the film which received the least exposure in the camera yielded the least amount of silver in the first development, they will contain the most emulsion left to be exposed in the processing machine and will, therefore, retain the greatest amounts of silver in the final image. By the same token, the areas receiving the greatest exposure in the camera will yield the greatest amount of silver in the first development leaving the least amount of emulsion to be exposed and developed in the final steps after the first image is bleached off.

Once reversal films began to be used professionally, methods were devised for duplicating reversal images. A reversal film can be printed onto a reversal film to yield a positive image or it can

be printed first onto a negative film to get a negative image which is then printed onto a positive film to produce an image suitable for projection. As we shall see, both of these approaches are widely used; and reversal films have also been developed for use in making duplicates of camera negatives. If a negative is printed onto a reversal film, it will yield a negative image.

Finally a "direct positive" or "auto-positive" film stock employs an altogether different kind of emulsion from either a negative or a reversal film. The emulsion of a direct positive film is designed in such a way that the areas exposed to light do not accumulate silver in the course of development while the areas not exposed to light do. This means that the film produces a positive image without requiring reversal processing. The direct positive emulsion was designed originally for microfilm, and, as a result, it is capable of extremely high resolution. Eastman Direct MP film is capable of resolving 1000 lines per millimeter while all other motion picture films can resolve something less than 200 lines per millimeter. On the other hand, since the direct positive film was designed for a situation in which one frame was viewed at a time, the need for uniformity was not so great as within an emulsion designed for motion picture work. The direct positive emulsion does not have sufficient speed to be used as a camera stock, but it has found wide use as a printing stock, especially in the printing of black and white duplicate workprints.

Thus far the discussion has been limited to black and white films, but the same basic principles apply to color films. Color films are constructed in such a way as to have three emulsion layers, each of which is sensitive to only one of the three primary colors, (red, blue, and green). The first step in the processing of color film is the development of a silver image in each layer which constitutes a record of one of the primary colors. Then this silver image is replaced by an image of the appropriately colored dye. The way in which this is achieved distinguishes two of the basic color processes. In one system the dyes are incorporated into the film itself; in another they are introduced during the processing. In either case, the silver image is removed completely, leaving only the three dye images, which when combined in viewing create the effect of a full colored image.

With color negative film the colors of the negative image are the complements of the colors in the scene (yellow, cyan, and magenta rather than blue, red and

green) just as the density, or opacity, is inversely proportional to the brightness of the scene. What is blue in the scene will appear yellow in the negative image and blue in the final positive image since the positive film will be reacting to the presence of the yellow in the negative image. With a reversal color film, of course, the colors in the image correspond directly to the colors in the scene to which the film is exposed. Both negative and reversal images are composed of cyan, magenta, and yellow layers which combine to create a full-color image by a subtractive process. The difference between the two is a matter of how the colors created by the three layers correspond to the colors in the original scene.

As was indicated above, film stocks are also differentiated according to their intended use. Since, in general, greater speed or sensitivity is achieved only by increasing the granularity, there can be no one all-purpose film stock. Moreover, each time an image is duplicated there is usually an increase in contrast, so it is better to have the contrast of the original image considerably lower than the contrast desired in the final image. Camera stocks are, then, designed to be as sensitive as possible without being excessively grainy, and to be sensitive to all colors of light. With color films, of course, the "color balance" of the film is designed according to the color of the light illuminating the subject to be photographed (daylight or tungsten).

In addition to camera stocks, there are release print films and duplicating film. Occasionally, as we shall see, release prints are made directly from the camera stock. In this case the release print stock must be designed to respond to the camera original in such a way as to yield the best possible image for viewing. In many cases, however, release prints are not made directly from the camera stock, but by means of various intermediate steps involving films classified as duplicating films. Duplicating films are designed specifically as intermediate steps in a printing system and their characteristics are such as to yield not an image which is suitable for viewing, but an image which is best suited for printing onto a release print stock, or onto another duplicating stock in some cases.

Finally there are film stocks classed as "recording films" which are designed for making sound tracks or for making kinescopes of television images.

One of the first choices a producer must make is the choice of a camera stock to use in shooting his picture. If he is shooting a film designed for

theatrical release and there are no unusual budgetary restrictions or exceptional circumstances dictating the use of 16mm equipment, he will probably use a 35mm stock. If he plans to shoot in color his choice is very simple. Eastman Color Negative #5254 is the obvious choice; in fact it is virtually the *only* choice. Ektachrome MS and Ektachrome EF color reversal films are available in 35mm, but there would be no advantage to using them since they were designed to yield an image for projection rather than printing. In some instances, where sequences in a 35mm television or theatrical picture have required available light photography with extremely low light levels, 35mm Ektachrome E7 has been used and forced developed as much as three stops, but there is only one lab in Hollywood equipped to process 35mm Ektachrome E7. Since both the raw stock and processing costs for 35mm Ektachrome E7 are about twice that of Eastman Color Negative, the use of 35mm Ektachrome E7 for television or theatrical productions is rare. By far the biggest users of 35mm Ektachrome E7 are the cameramen working with the aero-space industry. Filming missiles in flight with extreme telephoto lenses requiring an aperture setting of F/64 demands the extra speed obtainable with Ektachrome E7, and the higher contrast is often helpful in shooting a white missile against a white sky.

If the producer of a 35mm picture wants to shoot in black and white, his choice of a camera stock is still relatively simple. Eastman offers three different black and white 35mm camera stocks: Plus-X Negative #4231, Double-X Negative #5222, and 4-X Negative #5224. The choice is simply a matter of knowing how fast a film is required.

For a producer working in 16mm, however, choosing a camera stock can be a much more complicated matter. First of all, he has the option of using a reversal film rather than a negative film. In general, a reversal original is better than a negative because the dirt or scratches inevitably picked up in the course of editing and handling of the film register on the print as dark spots or lines rather than white spots or lines and are therefore much less distracting on the screen. There are other factors to be considered, however.

For black and white 16mm photography there are three negative films (Plus-X, Double-X, and 4-X) and three reversal films (Plus-X, Tri-X, and 4-X) with speeds which more or less correspond. The reversal films do not have as great a latitude as the negative films,

which means that, in some instances, the exposure of a reversal film may be more critical or that there may be a loss of detail in highlight or shadow areas with a reversal film. The contrast of these black and white reversal films is also designed for projection so that a print from a reversal original will seem contrasty in comparison to a print from a negative, but the choice here may be a matter of taste and, in any case, it is possible to get a flatter print from a reversal original by means of a dupe negative. Reversal films have a finer grain structure for a given speed, but the cost of negative raw stock, processing and print, is considerably cheaper.

The long term costs for a production will depend on the number of release prints required, and if a large number of prints are needed, a reversal original may prove cheaper in the long run. The choice between negative or reversal for a 16mm black and white production is something that should be discussed with the lab. It is interesting to note that the use of 16mm black and white negative is much more common on the East coast than it is in Hollywood.

If a picture is being shot in 16mm color, the best results can be obtained by using Eastman Ektachrome Commercial 7252. This is a low-contrast reversal film which was designed specifically to be used as an original from which prints are to be made, rather than being projected itself. The only problem with it is its relatively slow speed. Ektachrome Commercial #7252 was designed to have an exposure index of ASA 25/16 (Tungsten/Daylight), though it can be forced developed to an effective exposure index of ASA 50 with a sacrifice in latitude. This means that Ektachrome Commercial #7252 is a full two stops slower than Eastman Color Negative, and one might ask why 16mm Eastman Color Negative #7254 is not used instead of Ektachrome Commercial #7252.

The main drawback to 16mm Eastman Color Negative is the fact that the emulsion was designed for the 35mm format, with the result that its grain structure is not really suitable for 16mm. For the same picture information on 16mm and 35mm Eastman Color Negative the relative size of the grain in the 16mm image will be almost twice that in the 35mm image. This fact combined with the problems of negative dirt and scratches and the difficulty of making 16mm dupe negatives for protection or printing prevents 16mm Eastman Color Negative from being as good a camera stock as 35mm Eastman Color Negative.

The other 16mm reversal color films (Ektachrome MS #7256 and Ektachrome EF 7241 & 7242) have greater speeds than Ektachrome Commercial, but they are designed to have projection contrast. Ektachrome MS has the highest contrast of all the Ektachrome films and is not really considered to be a professional film stock. It is possible, however, by means of "flashing", to reduce the contrast to that of Ektachrome Commercial, and this seems at present, to provide the best answer to the need for a higher-speed 16mm color film. It should be noted, however, that Eastman Kodak does not recommend flashing Ektachrome E7 because of the loss of latitude which results. It is also possible to increase the speed of Ektachrome EF one or more stops above its rated exposure index of ASA 125 by means of forced processing.

With a black and white film the contrast can be controlled in the processing. The same film stock exposed in the same manner can be processed in different solutions or for different lengths of time in order to get different degrees of contrast. The contrast cannot be controlled, however, in processing a color film. The reason for this is that the processing of a color film must be such as to yield the proper color balance. Except for the fact that forced development can increase the effective speed of some color films in certain highly specialized instances, there is only one proper way to process a color film, and any variation in processing will produce deviations in the color rendition which can not be corrected in subsequent printing. One very interesting unconventional practice in color processing is a technique developed by a Japanese television station in which Ektachrome E7 is processed as a negative and the image is reversed electronically to a positive in broadcasting. The point of this technique, of course, is simply to reduce the time and expense involved in processing color news footage.

The simplest, although not always the most economical or best, way to get a number of release prints of a picture is to print directly from the edited camera original onto a release print stock. If the original has been matched-cut in the form of "A" and "B" rolls, it is possible to incorporate fades, dissolves, and superimposed titles into each print during the printing process. The procedure, which is virtually standard in 16mm, is also possible in 35mm where only a few prints are required. If the original is black and white negative, the release prints would be made on Eastman Fine

Grain Release Positive #5302 (35mm) or #7302 (16mm). If the original is 16mm black and white reversal, the print will be made on Eastman Reversal Duplicating Film #7361. If the original is color negative, the prints will be made on Eastman Color Print Film #5385 (35mm) or #7385 (16 mm). These same print film stocks are used in making the "dailies" which are edited to make the work-print of the picture.

If the original is a 16mm color reversal film, the print stock used will depend on the kind of reversal original that was used. The combination which produces the best results is an Ektachrome Commercial original printed onto Eastman Reversal Color Print Film #7387. This stock can also be used to make prints from Ektachrome MS or EF films, but there will be an increase in contrast beyond the desired projection contrast unless the original was flashed before processing, or unless the print stock itself is flashed. If the original is unflashed Ektachrome MS or EF, it can be printed on Ektachrome R Print Film #7389, a print stock designed specifically for making prints from projection-contrast reversal color originals. The new improved version of Ektachrome R Print film (#7389 replacing the old #7388) offers the advantage of having been designed like Reversal Color Print Film #7387, so that it yields a non-reversal silver sound track rather than a reversal dye-sulfide track. What this means, in brief, is that it is now possible to obtain projection-contrast prints with a high quality sound track from an unflashed Ektachrome EF or MS original. Prior to the introduction of 7389, the only way to get a sound track on Ektachrome R prints was by printing from a positive track (rather than a negative) and applying a sulfiding solution to the track area during processing. The resulting dye-sulfide track was acceptable for some purposes, but not as good as the track obtainable on Reversal Color Print Film #7387. This meant that a producer with an unflashed Ektachrome EF original was faced with the choice of compromising picture quality in order to get track quality or vice versa.

Although making reversal prints from an Ektachrome EF original is not a common professional procedure, some work has been done in flashing the Color Reversal Print stock in order to reduce the contrast of the print, and it is perhaps worth experimenting with this technique in order to compare the results with a 7389 print since 7387 has a greater resolving power than 7389.

Dailies from an Ektachrome Com-

mercial original can be made on Reversal Color Print film #7387, but this film requires very complicated processing similar to that used for Kodachrome film and, quite often, the film must be sent to Kodak for development. The delay which this usually entails can be avoided by making the daily prints on Ektachrome Reversal Print Film #7386 (not to be confused with Ektachrome R Print Film #7389). Ektachrome Reversal Print Film #7386 is designed for making prints from low-contrast reversal originals (Ektachrome Commercial or flashed Ektachrome EF). The processing for this film is the same ME-4 process used for Ektachrome MS and EF, so that any color lab can easily develop the print, and dailies from Ektachrome Commercial originals can be made very quickly. This print stock yields only a dye-sulfide reversal sound track, however, and is not an adequate replacement for Eastman Reversal Color Print film #7387 in making composite release prints.

The producer with a limited budget may want to consider using black and white dailies from a color original. Before the practice of making one-light color dailies became standard, it was quite common to make black and white dailies from color negative on normal black and white positive print stock. The problem with this procedure, however, is that black and white positive print stock is sensitive only to blue light and does not reproduce a color image well. Reds and greens will both appear as black, while a deep blue may appear white. There also may be some loss of detail in the image, since separation in color photography often depends on differences in color rather than modelling with light and shadow. If the photography was done with color reversal original instead of negative, though, better results can be obtained in printing black and white dailies, since the print stocks available are orthochromatic; i.e., sensitive to both blue and green light.

There are two print stocks which may be used in making black and white dailies from color reversal originals: Eastman Reversal Duplicating film #7361 and Eastman Direct MP film #7360. The latter is a "direct positive" or "auto-positive" film and is substantially less expensive than the reversal stock. Direct positive film is most commonly used for making duplicate workprints for post-production work (often referred to as "dirty dupes"), but it is also suitable for making black and white dailies.

To be continued.

CANON MACRO-ZOOM LENSES

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Following completion of formal tests at the EMI-MGM Elstree Studios in England, Mr. A.W. Lumkin, Manager of Technical Services and Equipment, wrote: *"The lens is going great guns. Have put it on a movie and they won't let go. Everyone is highly delighted. Looking forward to getting the final version in due course as you promised . . . The zoom lens has now been in constant use on one of our productions and the operational boys are delighted with it."*

Zoom lenses require a mechanical system of high complexity, as compared to that of fixed-focal-length lenses. In many cases, this complex mechanism can be successfully designed and produced. However, in the past, the mechanical ruggedness of zoom lenses has left something to be desired, and it has become evident that even though the mechanical system may function efficiently when the lens is new, the rugged usage encountered in film production often results in a lack of mechanical tolerance reliability later on. Because of this, the Research Center placed great emphasis upon the need for excellent mechanical design and workmanship.

Two major deficiencies which had previously been exhibited in zoom lenses were: an excessive amount of play between the assemblies, which later resulted in a loss of optical performance; and a lack of sturdiness in the zooming structure, which resulted in a binding action when zoom motors were attached.

The prototypes of the spherical lens indicated certain deficiencies in these areas. The contour of the lens did not permit easy installation on the Mitchell BNC camera, because it interfered with the follow-focus mechanism. However, the lens did fit nicely onto the Arriflex 35mm camera. The Canon company has agreed to modify its design to provide proper clearance on the BNC.

In addition, the prototypes of the Canon 25mm-to-120mm lens exhibited some of the same deficiencies which seem to be common to all other zoom lenses. There was play between the mechanical elements. There was also a tendency of the zooming and focus functions to bind up when a clamp for a zoom motor was attached, and there was a typical lack of the much-to-be-desired smoothness in the movement of the zoom action. The Canon company has since modified its mechanical tolerances and bearing surfaces to meet the

Canon K-35 Macro Zoom Lens K5x25

SPECIFICATION:

Focal length	: 25—120mm
T-stop	: T/2.8
Zoom ratio	: 5x
Lens construction	: 15 Components 19 Elements
Wavelength range for color correction	: 400—700mμ
Image format covered	: 18.669mm x 22.093mm diagonal 28.9mmϕ
Maximum image format covered	: 31mmϕ
Minimum object distance from focal plane	: 3½ ft for image format 28.9mmϕ
Angular field of view	: Wide 39.9° x 46.5° Tele 8.9° x 10.7°
Object dimension at 1.2m object distance	: Wide 63.4cm x 75.0cm Tele 13.8cm x 16.3cm
Clear aperture of front glass	: 111.0mmϕ
Clear aperture of rear glass	: 36.0mmϕ
Overall length (from front vertex to focal plane)	: 257.9mm
Back focal distance	: 56.18mm
Macro	: 5cm (from front glass) (2")
Zoom type	: Canon Mechanical Compensation Type
Weight	: 8.8. lbs. without mount adapter)
Size:	: 135mmϕ (maximum diameter) x 209.5mm (with Mitchell mount adapter)

Canon K-35 Lens K35-18 (Wide Angle)

SPECIFICATION:

Image format	: 31mmϕ (0.735" x 0.98")
Focal length	: 18mm
T-stop	: T/2.8
Minimum object distance	: 0.3m
Clear aperture of front lens	: 40mmϕ
Clear aperture of rear lens	: 20mmϕ
Overall length (front lens to focal plane)	: 100mm
Back focal length	: 29mm
Distortion (barrel)	: Not exceed 2.5% (minus)

rigid mechanical specifications set down by the Research Center, and these new and improved lenses are scheduled for early delivery.

Although the program of the Research Center originally emphasized the anamorphic lenses, it is the spherical lenses with the macro feature that have become available first. Two separate models have been designed in order to cover the full range of industry requirements. The first of these is the 25mm-120mm varifocal lens with a speed of T/2.8. Used with a matched 2X extender that assures consistently high optical performance, the range of the lens becomes 50mm-to-240mm, with a speed of T/5.6. All of these lenses are being provided with Mitchell BNC and 35mm Arriflex adapters. It is recommended that these lenses be mounted with supports, and this is particularly true for use with the Arriflex 35mm camera.

A wide-angle (18mm) spherical lens with a speed of T/2.8 will also be available. Utilizing the advantages of calcium fluoride and having a minimum lens-to-subject distance of one foot, the lens will have a distortion factor not to exceed 2.5%—which is equal to that of the best lenses ever produced. (See specification tables on opposite page.)

The Canon anamorphic lenses, having an aspect ratio of 2:1, as per specifications set down by the Research Center, have been designed so that three lenses will cover the entire range of requirements for this format.

These will consist of (1) Wide-angle anamorphic lens, (2) Basic 40mm-135mm varifocal lens, and (3) Auxiliary long focal-length varifocal lens (60mm-200mm).

With the 2X extender, these three lenses will cover the range from 30mm to 400mm, with maximum exposure stop of T/4.5, and minimum stop of T/9, using the extender.

These anamorphic lenses are of entirely new design, not adaptations of existent lenses for the 2:1 anamorphic format. As a result, they are faster and more efficient than modified existent "zoom" lenses.

Canon's macro development applies equally to the spherical and anamorphic lenses of the new system. Combined with the zoom effect, it offers the cinematographer a new creative instrument to fulfill the basic intent of the script and the director.

For further information about the new Canon macro-zoom lens system, contact the importer/distributor: FORMTEK, Inc., 708 No. Alpine Drive, Beverly Hills, California 90210. ■

HELIVISION

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hang the unit. So we set about to devise such an installation which could be mounted rapidly by one man and with no change in the helicopter itself. We accomplished this, and in so doing, found that we could install the means of shooting out of either side, with the ability to change shooting direction (because of light, wind change, terrain problems or screen direction) inside of *five minutes!*

"To be sure, *HELIVISION II* can be mounted in helicopters other than the Jet Ranger. It is ideally suited to the Hughes 500 and, in its classic conformation on a floor-mounted suspension, it will fit into a Bell J-2, Alouette II, III or 315. It can be fitted into a Bell G, small Hughes or Brantly with the use of other suspensions, thus opening another new area of economic operations where speed or power requirements are not critical. After all, you don't need a drop-forge to kill a fly. Why pay for one?

"Then we wanted the capability of efficient and simple changeover to accommodate differing weights of camera and lens combinations. *HELIVISION II* can mount anything from an 8mm to a 65mm Panavision camera with 50-500mm zoom. Its capacity is changed by the replacement of only one module, and that is done in less than thirty seconds. In effect, our system can now take a weight of from 4 pounds (1¾ kilos) to 150 pounds (70 kilos), the changeover being made in increments of 10 kilos with a smooth adjustment for all weights in between, in accordance with the user's requirements.

"Next we needed to simplify the controls for zoom and focus so that an inexperienced operator would find greater freedom to concentrate on his subject material and his composition. To this end, we called on Hedén Engineering Company in Göteborg, Sweden, to develop our control systems. We wanted a morphology closer to that of the human being than was heretofore available; that is to say, we wanted the controls to fall into the hands with comfort and with simple control of all the electronic systems.

"Mr. Hedén is the engineer who developed the Hasselblad 500 C camera, prototype of the camera used on NASA's Gemini and Apollo projects. He came up with a system which is exclusively made for *HELIVISION* and which makes all controls available at the fingertips, so that, literally without lifting a finger, the right thumb can start and

stop the camera motor and two fingers control the speed and direction of the 10:1 zoom (16mm or 35mm). The movement of the zoom can be slowed down to a barely perceptible crawl (to add to or detract from the movement in or out of the helicopter) or speeded up to a total zoom time of 1½ seconds. This is accomplished by a simple increase or decrease of pressure on one of two buttons located at the tips of the index and second fingers of the right hand.

"The left hand controls the focus, thus enabling the operator to constantly maintain the subject focus within his depth-of-field. His focus calibrations are visibly superimposed on the lower right-hand corner of the ground-glass image so that he has a continual reference without removing his eye from the finder.

"Further," Dresner says, "in the event there is an extremely critical follow-focus problem starting, say, from a full screen closeup of a silver dollar and pulling back to the whole world, we can offer our *HEDEN-HELIVISION II* remote-focus control for the assistant cameraman. There is room for him in the helicopter, and to spare, since we do not have a huge counterweight swinging behind the camera.

"The assistant has a small box which is connected electronically to the focus motor and, by flipping a switch, he can take over control of the focus and operate it by cranking a small wheel which has a ratio of ten to one. If he needs a fast focus change he has that, too, and can preset his focus calibrations as he would on a dolly. There is even a split-second focus change which is entirely electronic. And, believe it or not, the calibrations on the remote focus become more accurate than those of the lens itself!

"Added to all this, and very important too, is the perfect stability of the horizon which remains level through the means of a new, articulated head, introducing a standard which has not, until now, been a reality. The horizon is not affected by mass inertia or momentum due to acceleration or deceleration."

HELIVISION II was shown publicly for the first time at the VIDCA (1st International Video Cassette Festival) in Cannes from the 17th to the 24th April and at the International Film Festival from the 12th to the 27th of May . . . also at Cannes. The response of those who saw it was even greater than had been anticipated, with several long-term agreements being signed on the spot. Not a bad start for the newest member of the *HELIVISION* family! ■

WONDERS OF ARRI-LAND

Continued from Page 598

machines, finishing parts and creating tools. We watch workers turning out telescopic segments for the ARRI extendable monopole-type lights which are widely used in European television stations. We pass through another section where magnesium blimp components are being finished.

We next move into a fascinating department where various optical components are manufactured. These include viewfinder objectives, ARRI's anamorphic Ultrascope lenses (for which special machinery had to be designed), and mirror shutters for the full line of Arriflex cameras. The front surfaces of these mirror shutters are ground to an accuracy of within 8/1000ths of a millimeter.

A visit to departments where editing machines and components for ARRI film processing machines are made completes the technical part of the tour, after which Dr. Arnold turns his attention to showing me about the estate itself. This is, I am told, a working farm that grows various crops to feed the livestock that are resident here.

I am taken into the barn for personal introductions (by name) to these creatures. There is a herd of contented cows, a colony of pigs and a magnificent ram right off a Bock beer label. He seems friendly enough, but when I foolishly reach out to pet him he charges fiercely and crashes his horns into the stall gate that (fortunately) stands between us. So much for being an animal-lover!

Our next stop is a greenhouse where Dr. Arnold pursues his hobby of cultivating exotic plants. After that we enter a crypt-like catacomb where a little ol' brandymaker is busily distilling the firewater which I had previously sampled up at the house. ARRI has to be the only manufacturer of motion picture equipment in the world that brews its own plum brandy.

Just before we leave, Dr. Arnold shows me a new ARRI light which he is testing. It is a very compact luminaire that burns cool and is equipped with a unique shutter arrangement that provides a smooth form of dimming. The lamp being used in the tests of this unit is an experimental halogen vapor bulb that is not yet commercially available. Rated at 400 watts, it is said to have the same light output as that of a standard 1000-watt tungsten-halogen lamp. It burns at 6000° Kelvin and has a lifespan of 3,000 hours. I am very much impressed with this compact, high-

powered lighting unit and hope to be hearing more about it soon.

Wednesday

We are back at the Turkenstrasse headquarters of Arnold & Richter to continue the tour of facilities begun on Monday and, once more, Mr. Nebel has kindly offered to show us around.

ARRI is proud of the fact that everything to do with Arriflex cameras is manufactured "under the home roof", so to speak, instead of being sub-contracted out to other vendors. This applies to a wide range of accessories—such things as matte boxes, single-system sound modules, filter-retaining rings, tripod components, shoulder braces and a multitude of other items.

The company even has its own plastics department, equipped with plastics-injection machines of its own design, wherein are produced such seemingly minor items as lens caps, cores, etc. Larger components, such as the Arriflex 16mm BL molded hand-grip (with fiberglass reinforcement) are also made here.

There is a special "gluing department", where everything that has to be cemented is handled. This is a very delicate operation and one which must be reliably executed, because it obviously wouldn't do to have cemented parts coming unstuck. Parts to be glued are first thoroughly cleaned by means of an ultrasonic unit. Then a very special kind of epoxy is used that will cement practically anything to anything else. An impressive example is that a stainless steel bushing is glued into the aluminum casting of the Arriflex 16mm turret, with tests proving that the result is equal in strength to that of the best mechanical fit.

We come to the department where the 16mm single-system sound modules are assembled and tested for wow and flutter characteristics, which are very critical elements in the consideration of motion picture sound. The basic nature of a camera, considered in terms of its fundamental design, is at odds with the achievement of optimum single-system sound. This is because, on the one hand, the camera movement advances the film *intermittently* but, on the other hand, one would like to achieve a smooth *continuous* flow of the film over the sound head. This is the inherent problem that plagues every manufacturer of single-system sound modules, but ARRI is proud of the fact that its wow and flutter figure is held in the neighborhood of .3%. When one considers that wow and flutter variations are not audi-

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FILM/TAPE BANDWAGON

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tape generations may be made without impairing picture quality.

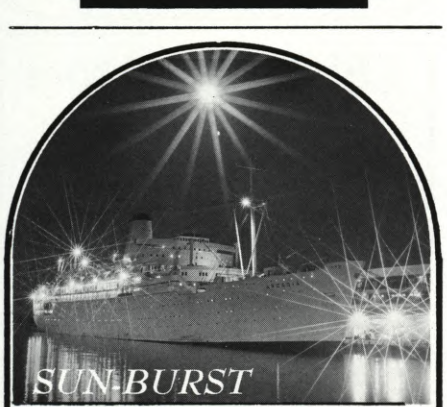
Direct film projection to video tape also allows the use of a greater range of 16mm film stocks. Soft-emulsion Ektachrome films and high-speed films like EFB 7242 (ASA 125-500) increase the scope and versatility of professional 16mm production.

All these advantages add up to phenomenal savings in time—significant savings in money—and increased efficiency for the producer of television spot commercial and program film production. Of course, the distribution must be to television systems via video tape. Film-to-tape-back-to-film transfer is not yet advisable. As yet, electronic film editing cannot be used successfully for theatrical films. If super high-resolution telecine cameras are ever developed, however, then this limitation may be overcome.

Presently, only major production houses like WFAA Productions in Dallas, Teletronics in New York, and Technicolor's Vidtronics in Los Angeles offer electronic film assembly. This is because of the initial cost of the sophisticated videotape equipment required. For example, at WFAA we have over a million dollars invested in video tape recorders and computerized editing devices.

On the other hand, the actual workprint editing is done on considerably less expensive gear, which would be within the budget of film production houses and advertising agencies. A one-inch helical tape editing room—complete with two VTR's and a color monitor—can be outfitted in first-class style for less than $9,000.00. In addition, half-inch color VTR's are available in the neighborhood of $1,200.00—thus making it feasible for editors and directors to view footage at home on regular television sets and to pre-select scenes prior to actual editing.

We at WFAA feel that the increased flexibility and professionalism of electronic 16mm film editing—coupled with the television industry's overall concern for production economy—will accelerate the acceptance of film/tape assembly as the most popular means of producing filmed television programs and commercials. And as more film directors, cinematographers, editors, and producers get involved with 16mm film/tape, their new ideas and talents will enable electronic post-production to make even greater contributions to creative filmmaking. ■



WONDERS OF ARRI-LAND

Continued from Page 613

ble below 1%, this is very good indeed. Final audio tests of the sound module, in combination with the amplifier, take place in the company's electronics department.

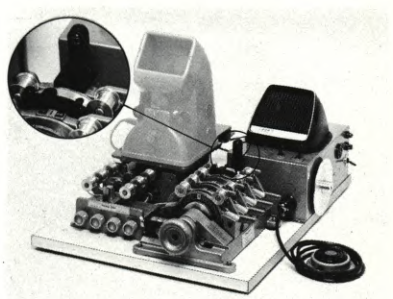
A visit to the Arriflex Repair Section is ample evidence of the fact that ARRI is not interested simply in selling cameras, but also in servicing and maintaining them at top-level performance for cinematographers around the world.

To date there have been approximately 13,000 Arriflex 35mm and 16mm cameras produced and it is inevitable that many of them will be sent to this department for the various repairs to which all hard-used mechanical equipment is heir. In the United States, of course, this meticulous service is very capably provided by the Arriflex Company of America in its extensive repair facility at Woodside, N.Y. But I am very heartened to see how here in Munich the cameras that were born here are treated with tender loving care when they "come home" for repairs.

A short while later I have a chance to examine a demonstration model of the movement that is the heart of various Arriflex cameras, including the Standard 16mm Arriflex, the Model S and the 16 BL. It is a gem of engineering, with everything about it designed to result in a rock-steady picture with precise registration. The various parts of this movement are so accurately matched that only when they are all in place can the camera be precisely adjusted and tested.

The adjustment of the mirror shutter to the movement is an especially critical operation. The degree of permissible error in relation to the true-running characteristics of the shutter must be kept below 1/1000th of a millimeter, not only to assure its optical accuracy, but its silent running characteristic, as well. If this degree of error is exceeded in any reflex camera, the image as seen through the viewfinder will move visibly. Also, there is likely to be an increase in the amount of noise radiation, a condition that would be unacceptable in a camera like the Arriflex 16 BL.

To minimize the possibility of error in the mirror shutter's relationship to the movement itself, the first consideration is to make sure that the glass itself is perfectly plane-parallel, a condition which is thoroughly checked at the Stephanskirchen optical department. The mounting of the glass shutter onto a steel plate base is done with the highest degree of precision and the ball



bearings used are individually tested to make sure they will run true.

The final critical evaluation of the mirror shutter and its relationship to the camera movement has to do with the flange bearing tolerance. The shutter is mounted on the flange and the precise adjustment is made by placing ultra-thin leaves of gold foil between the shutter and its bearings.

I am impressed by the fact that the 16mm movement is a single compact unit embodying the pulldown claw and registration pin, the shutter, the film gate assembly and the viewfinder component (mainly the deflecting prism). Bergmann informs me that it was a pioneering development to incorporate all of the various drive functions of such a movement onto a single shaft. The main shaft drives, not only the pull-down and registration mechanisms, but the shutter and the tachometer, as well. In effect, it represents two movements combined in a single cam.

We pay a quick visit to the Apprentice Training Department, where a group of young "eager beavers" are engrossed in learning the skills they will need to become top ARRI technicians. Among my prized possessions is a miniature "working model" of an Arriflex camera which these apprentices have made as part of their training.

I am told that apprentice candidates are selected according to the grades they have earned in elementary and high school. They receive six months of "basic training" in this department and then are allocated to various production departments throughout the factory. They are then returned to the apprentice training center for more advanced instruction, which includes both theoretical and practical tutelage.

Some of the boys enter the training program at the age of fourteen under a kind of "work-study" plan. They attend regular school one day a week and spend the rest of their time at the ARRI plant. The entire training program takes three and a half years to complete, after which they go directly onto the company's assembly lines.

On display are samples of their work —beautifully articulated technical drawings and intricate assemblies made up of precisely fitted working parts—all of which represent training problems to be solved. I am most impressed, not only by the industriousness of the apprentices themselves, but by the depth and breadth of their training.

Thursday

This day begins with a continuation of the Turkenstrasse headquarters

"tour", and the first place I am taken is the department where the new ARRI 35mm x-ray camera is being assembled. This is a highly specialized and quite exotic piece of equipment, without viewfinder, but with all of the attachments necessary for x-ray cinematography. It has a maximum frame-rate of 150 frames per second, which permits the camera to be synchronized with the pulse of an x-ray tube. Its filming speed can be varied by remote control.

The camera features a quick-loading external magazine which includes a pressure plate and snaps onto the camera body. The present magazine has a 200-foot capacity, but a 400-foot model is in preparation. The movement incorporates an ingenious compensating device which counteracts the force generated by the pulldown claw and registration pins, in order to minimize vibration, particularly at the higher filming speeds.

We now move into a department which is of particular interest to me—that in which the sensational new Arriflex 35 BL camera is undergoing its final pre-production refinements.

The working models of this camera which were shown at *Photokina 1970* (See *American Cinematographer,* December 1970), had a noise level without lens blimp (measured at three feet in front of the camera) of 39 dB, but the ARRI personnel on duty there emphatically stated that this noise level would be considerably reduced in the production models.

Now I have a chance to see what progress has been made in that direction, and it is very impressive so far. The model shown at *Photokina* utilized a master drive belt for transmitting the drive power from the motor to a secondary shaft which then, by means of a gear, drove the magazine and another secondary shaft which, by the employment of a cross-shaft, drove the shutter of the camera. Now, I am told, the engineers have done away with the gear-train transmission of the drive power to the magazine. They have also eliminated the electro-mechanical pilotone generator in favor of a method of generating the sync-pulse signal electronically. As a result, and also by virtue of using a tooth-belt drive to replace all but one set of gears, the drive power from the motor is now transmitted directly to the drive mechanism of the magazine. This makes the Arriflex 35 BL the only professional 35mm camera to utilize only one set of gears in the entire drive train.

In order to reduce the noise factor still further, the new configuration em-

ploys a solid rubber mount to completely isolate the motor acoustically from the skeleton of the camera. This means that mechanical noise from the motor is no longer transmitted to the skeleton, or from there to the taking lens.

I find this information most encouraging and ask to what degree the noise level has been reduced thus far.

"We estimate 5 dB to date," I am told, "but the final measurements have not been made. We are aiming toward a further reduction—in the neighborhood of an additional 5 dB."

I ask what more is being done toward the achievement of this goal and am told: "We have made careful measurements of various movement configurations in respect to noise level and, from the resultant graphs, we have been able to determine which configuration will give us the optimum result. Having effectively reduced the camera body sound level, we are now making modifications on the movement, with the aim of reducing the noise radiation of the movement itself—and this looks very promising."

When I first arrived in Munich several days ago, I was given a cordial message of welcome from Dr. Robert Richter, along with the explanation that he was recuperating from a cold and would not be coming in to his Turkenstrasse office during the entire week. However, he did invite me to dine with him and his wife this evening at their home, very kindly asking, at the same time, whether I would enjoy having venison for dinner. I certainly would!

Invited, also, are Horst Bergmann, ARRI Export Manager Reinhold Schutz and Dr. Walter Stahl, son-in-law of Dr. Richter. We drive a distance of about 25 miles out of Munich to Dr. Richter's magnificent country house on the shores of picturesque Lake Ammersee.

It is a great pleasure to renew acquaintances with our host and to meet his gracious wife. I have known Dr. Richter for a number of years, having met him several times in Hollywood, at the *Photokinas* in Cologne and at international conferences of the film industry. He is a jovial and urbane man with a most pleasant personality and a vital interest in everything pertaining to motion pictures.

I present Dr. Richter with a color photograph which I took of him with Hal Mohr, ASC, during a recent visit to the ASC clubhouse in Hollywood.

After dinner, we adjourn to the "screening room" where we are shown one of our host's early efforts as a teenage cameraman. Made *circa* 1918, it is a wild and woolly saga of the Ameri-

can West, complete with *ersatz* cowboys and Indians tearing up the Bavarian countryside. It is a most amusing film—and the technical quality is incredibly good.

After a thoroughly enjoyable evening, we bid our host and hostess farewell and head back toward Munich. It occurs to me, on the way, that the story of Arnold & Richter, boyhood friends in 1913 and still working together after all these years, would made a very interesting movie.

Friday

It is the last day of a busy week, and there is still a lot left for me to see of the ARRI operation.

As mentioned previously, this operation has burst the bounds of its main building in Turkenstrasse and has bubbled over into a number of other structures on plots of land covering a sizable area of the Schwabing district.

We head first toward a converted automotive garage which now houses a plant where the ARRI developing machines are assembled from components largely manufactured at Stephanskirchen.

Following that, we visit a converted three-story residence which has become a workshop for the fabrication of the various motors that drive Arriflex cameras. A skilled group of technicians, many of them women, are at work here, winding armatures, assembling miniaturized parts into components and conducting unbelievably delicate quality-control tests.

We next explore the complex of buildings that surround the main headquarters in Turkenstrasse. There is the ARRI film production studio, with two large sound stages and complete ancillary facilities. One of the stages is utilized mainly for rental to producers of commercials, documentaries and low-budget features. The other stage is currently being used to test a new experimental 2000-watt halogen-discharge lamp which, I am told, puts out as much light as a conventional 10,000-watt incandescent lamp. Seen in action, it is most impressive.

We next tour the company's fully-equipped sound recording studios, after which it is time to visit the ARRI laboratories. This installation was made viable when the production of Fox newsreels in Germany was resumed following World War II, and it was awarded the contract to do the processing and printing. It has remained one of Europe's busiest laboratories ever since.

Our last stop in the Turkenstrasse complex is the large ARRI theatre

which serves as a sound mixing studio by day and a public cinema, showing theatrical features, at night.

After lunch, we drive out to the suburbs of Munich to visit Bavaria Atelier Gesellschaft, more commonly known as "Bavaria Studios". This is a large motion picture studio complex, very similar in character to those in Hollywood and London.

At the studio, I am very kindly greeted by Mr. Benno Nowotny (Head of the Technical Department), Mr. Walter Pindter (Head of Sales and Disposition) and Mrs. Helga Sandberg (Head of Public Relations). I am given a tour of the facilities, which are excellent, and am most impressed by the modular construction of sets (which is standard here) and the way in which standing sets (without wild walls) are illuminated for television filming by means of light poured through frosted plastic sheeting which serves as "ceilings" for the sets.

Just now there is no actual shooting going on in the studio, although several companies are filming on location. The main activity on the stages is the building of large sets for production of the upcoming American musical, "CABARET".

Adjacent to the Bavaria Studios is an installation known as IRT (Institut fur Rundfunktechnik). I am told that it is a government facility devoted to television research. During an all-too-brief visit, I talk with Research Engineers Adolf Brosch and Franz Pilz, and am then given a tour of the facilities.

Being a film type, I find most interesting the extensive testing that has been going on here relative to the use of Super-8 as a TV newsfilming format. Also noteworthy are tests being made of two small but powerful halogen-discharge lighting units, one made by Phillips, the other by Siemens.

It is now late in the day and, since there is nothing constructive left that we can do for the cause, Horst Bergmann and I take off for a weekend of skiing at St. Anton in the Austrian Alps.

It has been an extremely busy and informative week for me. My in-depth visit to Arnold & Richter KG has left me with a very favorable impression of 1,400 skilled technicians working in an atmosphere that happily blends "Old World craftsmanship" with the very latest in automated technology.

And it has given me a new respect for that term that seems to pulsate through the organization like a heartbeat *. . . precision . . . precision . . . precision . . .* ■

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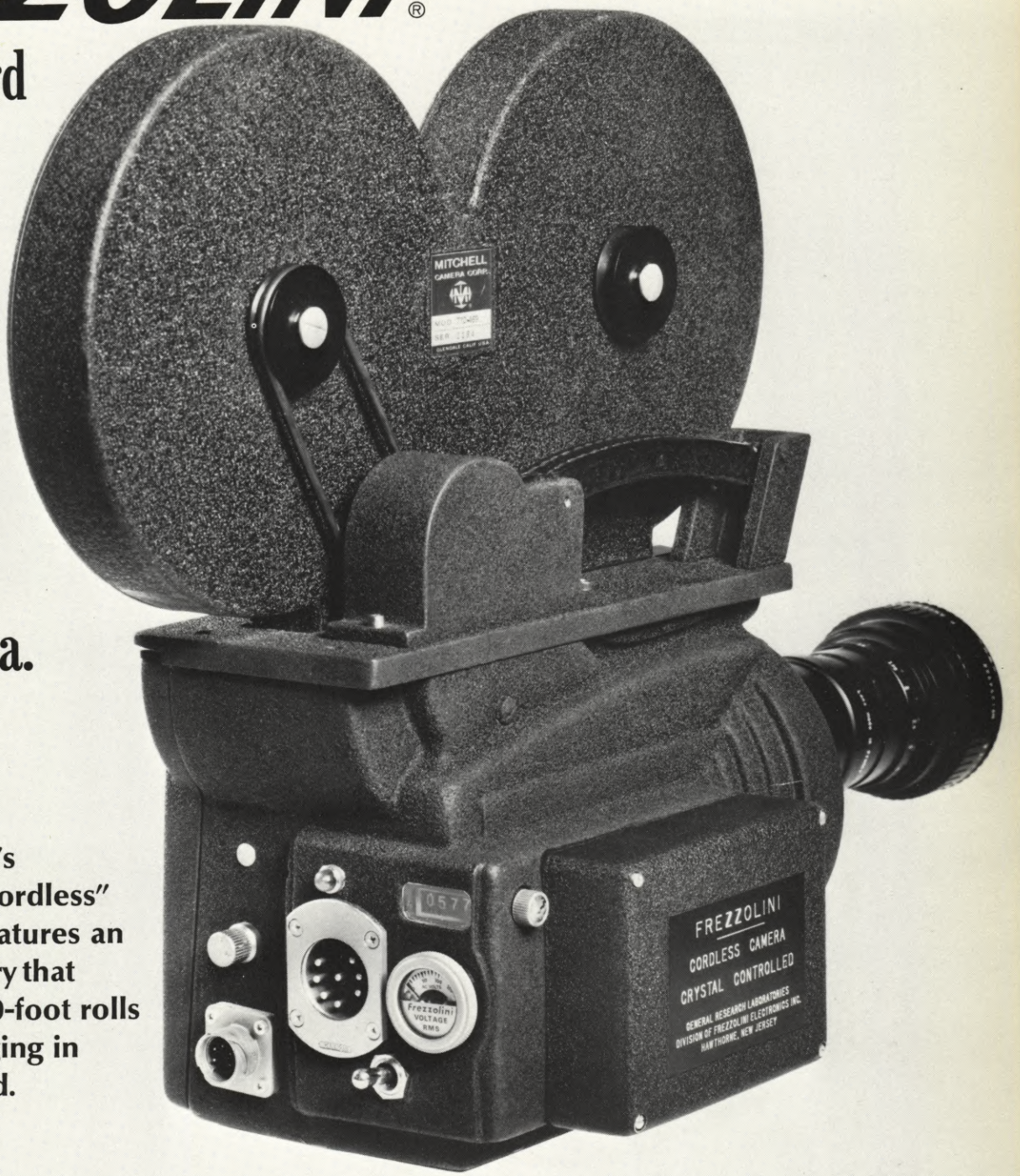

Jim Frezzolini's new "Frezzi-Cordless" conversion features an internal battery that runs Eight 400-foot rolls without plugging in its power cord.

FEATURES: Quick-change internal battery. Complete power source operating compatibility. Also can run on AC 110 volt, 60 hz. or any Frezzolini AC Portable Power Inverter, *OR* from the DC battery portion of the Frezzolini 1000-DX (with an adapter). *PROVEN RELIABILITY:* Camera mechanism field and lab-tested. Total camera weight including internal battery, magnetic sound head, Angénieux 12-120mm zoom lens (specify finder): 17 pounds, ready-to-roll. Supplied with crystal-controlled module for double-system sound or, at a reduced price, with standard transistor-controlled module where specified by purchaser.

For information about the **"Frezzi-Cordless" Camera** see your professional motion picture supply dealer or write or phone James J. Crawford, Vice-President Engineering.

(Your present conversion can be made "Frezzi-Cordless" by FREZZOLINI too. For details, write or phone Mr. Crawford)

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