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International Federation of Television Archives Newsletter

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INTRODUCTION

Sam Kula
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In March 1981 the International Federation of Film Archives (FIAF) and the International Federation of Television Archives (FIAT) decided to join forces, for the first time, and organize a joint technical symposium. There were two objectives. To review established practises in the conservation of all moving images (optical and magnetic), and to investigate new technologies and their practical application in moving image archives.

The FIAF and FIAT members in Sweden (Cinemateket/Svenska Filminstitutet and Sveriges Television AB) undertook to host the symposium in Stockholm, and with the assistance of an organizing committee made up of members from both organizations, and with financial support from the Swedish Government, the Symposium took place 1-4 June, 1983. The sessions were held at the Filmhuset of the Svenska Filminstitutet and in its laboratories and film storage vaults, and in the studios of Sveriges Television.

One of the problems the organizers faced during the two years of planning was the level at which the sessions should be set, and the papers presented here indicate the range that was finally determined as necessary to meet the needs of both established and emerging archives. While established archives were anxious to explore the possible impact of laser discs and digital recordings on their activities, the emerging archives were equally anxious to learn the most effective and tested procedures in the current technology of moving image conservation. Through the efforts of Anna-Lena Wibom, Director of Internation Relations for Svenska Filminstitutet, and Chairperson of the Organizing Committee, delegates from twelve countries in Africa, Asia and Latin America, in which moving image archives were still in the process of development, were invited to atend the Symposium as guests of the Swedish Government.

Several of the papers were audio-visual presentations and it has been impossible to reproduce the slides or the moving image examples that were used to illustrate the lectures. Those that were incomprehensible without reference to the visual displays have been omitted.

The Organizing Committee is grateful to all those who gave so freely of their time and energy to make this Symposium possible. In particular Anna-Lena Wibom and the staff of the Cinemateket, Svenska Filminstitutet, and Stellan Norrlander and the staff of Sveriges Television are to be commended for contributing so generously to ensure the success of the Symposium.

Further information on the activities of the International Federation of Film Archives can be obtained by writing the Secretariat, Coudenberg 70, 1000 Brussels, Belgium.

Further information on the activities of the International Federation of Television Archives can be obtained by writing the Secretariat, Centro de Documentacion de RTVE, Edificio Somosaguas, Madrid, Spain.

1.
PSYCHO-PHYSIOLOGY OF FILM AND VIDEO*

Dimitri Balachoff
Meuter-Titra Laboratories

DRUNKENNESS FROM THE BOTTLE AND PLATO'S CAVE

"Qu'importe le flacon, pourvu qu'on ait l'ivresse" wrote the French poet Alfred de Musset, which in dull terms means "No matter the shape of the bottle, as long as one get drunk". In the same way, millions of people, watching television, seem to believe "No matter the screen, as long as we can see the films". Yet, what exactly do they see? If the taste of the wine is not changed by the shape of the bottle, are we sure that the *same* film is actually seen on screen and on video?

The last VIDCOM in Cannes set a new focus on this subject. Lectures in the Grand Palais were illustrated by projections on very large video screens. It was indeed very impressive and gave the responsible technicians a well deserved pride... but the main question remains open as before: is it really the same effect on the spectator? And if not, why?

For me, the question is now clearly resolved. Electronic image, despite its present perfection and even its improvements in the future, shall NEVER be the SAME as the optical image. My opinion may look controversial or provocative but it is sound: film and television are not alike, they are no "brothers" or "relatives", even no "family enemies", they are two deeply different media, confused by superficial approaches and dissembled appearences. Cinema and television are alien to each other, as painting and sculpture, of music and literature, or water and fire. At a time of many speeches of reconciliation between cinema and television, this may seem outrageous. My purpose is not to make war or peace on a stage of illusions and mutual lies, but to search the truth, at least a part of it. Millions of people watching films on television do NOT see what they believe to see, they only see shadows of films, just as the prisoner in Plato's Cave who thought he was seeing the world but only perceived its gloomy reflections.

THE PERILS OF TELECINE

Everywhere in the world, television is a big eater of cinematographic films. In any country of Europe, audience is proposed several movies every day. Yearly they reach more than one thousand in Great Britain, in France and in Germany, more than two thousand in Belgium, Luxembourg and Italy. The number is increasing every year. Statistics in France show that there are 20 or 30 more film viewers on TV sets than before theatre screens.

*This paper is adapted from a presentation to the British Cinematograph Sound and Television Society and was presented to the Symposium in a slighthg altered form.

Nevertheless, this enormous success of films on TV remains paradoxical, if we recall that each film, when broadcast, suffers some degree of degradation, sometimes very small, sometimes disturbing, never meaningless.

For the large audience, this degradation is balanced by the fun of the show, the suspense of the action, the comfort to stay at home, its cheapness in regard to the cost cinema tickets and transportation costs. It's the triumph of easyness, but the "connaisseur", the "cinephile" feels frustrated, and technicians or critical observers fail to explain "what" is missing in the message.

A few years ago, at the time of black and white television, integrity of image itself was at stake. Picture was not sharp, small details were lost, latitude of exposure between darkness and highlights was extremely restricted, counterlights and shots against the sun were appalling. Today, with color television and serious improvements in the technology of receiving sets, most of these failures have disappeared. Image is generally excellent, sharp and finely defined, and color balance usually good. However the film on television is not the same. Why?

THREE CLASSICAL EXPLANATIONS

Three different kinds of explanations have generally been suggested about this phenomenon. All three, even if not wrong, are inadequate and insufficient.

The first kind of explanation is purely technical and indicates a "perfectionist" trend of mind. It assumes the difference as being purely quantitative, relying upon factors that can be improved, as the size of the screen, its brilliance, its contrast, its definition, etc. This kind of explanation was accepted in the past but seems now rather naive. Even when technology will provide giant video screens, reaching the same definition, brilliance and contrast as present theatre screens, the difference shall remain. A very simple experience is convincing for that purpose: seeing a film on a perfect video screen, in a dark room, at a short distance giving the same magnification as a theatre seat IS NOT the same as seeing the same film projected in the worst conditions of lights and optics, or even on the small screen of the cheapest editing table. My conclusion is that the origin of the difference is not quantitative but qualitative. It's not a matter of degree, it's a matter of nature.

The second kind of explanation is sociological, and it displaces the source of the difference from the image to its observer. It is true indeed that the psychological and environment conditions are completely different. Going to a movie is going out, it's a feast, a party, one feels among other people, one shares a collective mood, one laughs, one cries, one feels happy or sad, one sits in the dark, prisoner of one's seat, the eyes are attracted by the screen, the audience is captive. At home, the mood is more familiar and sometimes domestic, the room is not necessarily dark and it is often noisy, attention is intermittent, frequently disrupted by conversations with children or relatives, by telephone, or even music and talks from the radio playing simultaneously, or sometimes the reading of a book or a newspaper.

These factors are indeed very important in the actual life but they are not sufficient to explain what we are searching; they could be applied for instance to any field of culture, as music, painting or anything else, they are irrelevant to our subject.

It is easy to reverse these two types of environments, to look at a film on video in a dark and quiet room, in opposition to a screening of the same film with a bad projector, with a noisy surrounding, like in a dancing club or a discotheque. The fundamental difference remains.

The third kind or explanation is *semiologic*, it is much more complex and subtle than its predecessors. The source of the difference is displaced once again; after leaving the image for its observer, it is now transferred from this observer to a system consisting of a collection of signs in relation with each other. The difference is not explained but accepted and justified by its semantic function. This means that the difference between film and video is of the same nature as the difference between a novel and its translation in another language, or between one painting and its reproduction. Each language, each art, each form of

expression is autonomous and specific, it forms its own system of signs. This kind of explanation, although not wrong in the philosophic point of view, presents two important failures:

a) it is a tautology, evading simple questions by a system of definitions referring to each other and dismissing any problem not stated to its own term;
b) it sets more new questions, such as "is television a specific language?", "what is the difference between an original and its reproduction?" or "what are the relations between reality and its representation?". I suppose brainstorming upon these questions will continue to take place during the next ten or twenty centuries.

In conclusion, I believe the three kind of explanations which I briefly summarized are inadequate and insufficient, and the source of the phenomenon must be searched in another direction.

ANALYSIS OF FILM DEGRADATION IN TV

I would like now to try an analysis of the specific aspects of the phenomenon in observing the elements of the film language which seem to be the most affected or disturbed by video transmission. This analysis may look very subjective and personal but it is in fact based on a long experience and on repeated observations which most people naturally try to avoid. It so happened that my professional occupation allowed me to cross different views on the same subjects.

As a laboratory technician, often engaged as sound dubber or editor, I had the opportunity to observe my short sequences repeated hundred of times. After a few runs, the content of the sequence vanishes progressively and at the same time you begin to discover the formal elements which sustain the sequence. The main visual elements are the length of each shot, the invisible but sensitive rhythm formed by their relative length, the space perspective given by the focal characteristic of each shot and the illusion of movements produced by the succession of diverse focals, the successive relations of axes and angles of the camera, the contrast or the continuity of lights from one shot to the next one, and of course the movements of the camera. All these elements are the bones of a film, its structure which bears the action and the story. A film cannot exist without them but they must remain invisible to the common spectator. The quality of a film depends in many cases on the strength of its structure and on its balance and harmony with the style of the subject. Film critics are unfortunately not aware of these elements of the film structure — I mean many of them — except in obvious cases of mistakes, misuses or "overdo". I believe this routine of the lab technician should be taught and practiced in the film schools, it is one of the most accurate methods to analyze a movie, and its use prevents a lot of naive misunderstandings.

As an introducer and lecturer in "cine-clubs" I also had the opportunity during more than fifteen years to see many times a same film in different locations, to observe reactions of the audience and sometimes predict them with an accuracy of one tenth of a second, and sometimes to be puzzled by unexpected responses. This was a practical and concrete way to measure impact of this invisible film structure.

Finally, as a "presentator" of films in Belgian Television, since twenty years or more, I screened several times more than two hundreds movies, observed repeatedly over the optical screen and on the video.

What are the conclusions of this long and mixed experience? They are very simple and clear, but they leave me in some perplexity.

At first, it seems that television decreases the structural weaknesses of any given film. An "average" movie often looks better on television than in cinema, if subject, dialogues and acting are good. Failures in direction, shooting, editing, lack of rhythm are almost unnoticed. Television erases wrong cuts, too long shots and even misleading camera movements.

The same reason may explain why some television plays or serials, which are nice to look at home are absolutely unbearable on a cinema screen: action, dialogues and acting are the same, but everything seems too long and too slow, deprived of rhythm and credibility and

the dramatic sense is absent. These weaknesses appear because the film structure is missing. This rule knows some brilliant exceptions. Such as Ingmar Bergman's "Scenes of a Marriage" and "Magic Flute" where he succeeded in combining the clear and somewhat redundant narration usual in television with a strong film structure.

If the television decreases the weaknesses of a film, it also reduces the effects of its qualities, and by the same process diminishes the specific effects of its language. For instance, editing is considered in the cinema — or it should be remembered by those who forgot or ignore it — as a second direction. It is an essential stage in the creation of a film. In television, editing is just an ancillary routine of assembling, without sublety or eloquence. The rhythm of a sequence vanishes or becomes excessive. Rhythmic cuts and allegoric flashes or inserts, like in Sam Peckinpah's movies for instance, loose their effect and look absurd. In Orson Welles' "Falstaff", the admirable sequence of the battle, which is a masterpiece of editing, is deprived of its lyrical sense and becomes a sad confuse flow of disordered frames. The films of Eisenstein, seen on television, are a disaster It looks like Michelangelo brewed in a kitchen mixer and re-adjusted like a kid puzzle.

By changing the effects of the film structure, television sometimes gives a perverted image of some classic of the cinema. A few more examples: take the westerns of John Ford: the well-constructed scripts and the excellent acting remains, but something more important is missing: the sense of space, this very special sense of "spatial epiphany", because John Ford was a genius of cinematographic topography, and also the absolutely perfect "rhythm" in the editing of each scene.

Take the comedies and thrillers directed by Howard Hawkes: television transmits their brilliant dialogues and his clever way to shake up situations and vicissitudes, but television is completely blind to the essence of his films: his sceptical and unconstrained attitude, his philosophy of "male friendship", his sense of humor, expressed in very subtle but effective camera angles and movements in the rare balance between the perfect timing of the shots and sparkles of the dialogue. Take finally the musicals of Busby Berkeley: television shows indeed what his camera saw but it fails to restitute the way in which he saw what the shows — but this is in fact one of the extreme limits of the film language, the "point blank" in the misunderstanding between television and cinema.

Why then the perplexity? Because the three kinds of explanations which I mentioned do not resist to my observations. I am convinced that another explanation exists, more simple and more effective. I think I found it in an hypothesis based on the "GESTALT THEORIE", the theory of forms.

"GESTALT THEORIE" AND SYNERGISTIC PERCEPTIONS

The theory of forms was elaborated in Germany, in the late 1800's by Ehrenfels, Helmholtz, Mering and other scientists, after meticulous research on sensitive perceptions of animals and men. This theory explains how any part or piece changes when it is placed in one system or another. The theory also states that a system or "ensemble" is perceived before any of its parts, and that the notion or concept of "form" finds its source in the internal relations of the elements of a system.

A few years ago, in a short experimental film named "RESEARCHES ON RETINA AND TYMPANUM" I almost by chance put together some synergetic effects of stimulations between eye and ear. It seemed to open a new range of explorations and I expected to find in this field a better understanding for the film degradation in televison. I did indeed find something, but not between eye and ear, but in some synergetic aspects in visual perception itself.

OPTICAL AND ELECTRONIC STIMULATION OF THE RETINA

Let's look again at a comparison between an image seen on a screen or on a video tube, and let's examine the stimulation of the retina, excluding lighting conditions, environment and shape or content of the image which is observed. What are the differences?

In optical viewing, at each 24th of a second (or to be more accurate, at each even fraction of a 48th of a second), the whole surface of the retina is stimulated by receiving a complete image. The persistence of the stimulation on the surface of the retina is supposed to join together those successive and fugitive stimulations and to create the impression of a moving image. When a film is screened, at each cut, the whole retina is stimulated by one complete image, completely different from the complete image just seen a fraction of a second before.

A synergetic effect is produced by the simultaneous stimulation of millions of cells, cones and rods, forming the surface of the retina. An harmonic effect (like a musical chord) is produced by the difference of levels between separate cells of the retina.
A rhythmic effect is produced by the regular passes of the shutter, coming as a metronome every 24th of a second. The general level of stimulation is high, more than 400,000 times the level from a video tube. Contrast between dark and light areas is received on the whole of the retina surface. Sensitivity is increased by surrounding darkness.

In electronic viewing, retina is never stimulated on its whole surface. The flying spot excites a minimal point each 400,000th of a second. The persistence of the stimulations received by the retina is supposed not only to create impression of a moving image but even of still image, which is never perceived in its integrity by the eye. Viewing is analytical and sequential. There is no synergic or harmonic or rhythmic effect. In fact, image is not seen by the eye but by the brain. General level of stimulation is low, 400,000 times weaker than the optical image.

As you can understand, stimulation of the retina is completely different in the two systems, but what happens next.?

THE TWO BRAINS OF MR. SPECTATOR

The human brain consists of two hemispheres, each one assuming specific functions. It is generally known that the left hemisphere controls the right part of the body, while the right hemisphere does the same for the left part. Many more subtle and complex tasks are split between the two parts of the brain, but a lot of research has still to be achieved in this field. What is presently accepted must be checked by experimental tests, and it is not yet sure that all human brains react in the same way. I just read a few months ago that Japanese people might be different from Europeans — but I could not find further information on the subject.

We think the left hemisphere controls the visual sense and the intellectual, analytical, logical and sequential operations. The right hemisphere is concerned with hearing, and the harmonic, rhythmic and spatial perceptions, and also the symbolic or imaginative sense, and the emotional drives.

The limits or borderlines between these functions of the two parts of the brain are certainly not as defined and accurate as may be understood from my superficial remarks. Sensations and perceptions are mixed, blended, influenced by each others. Memory, sensitivity, imagination of each human being are fabrics made of entangled messages and responses from both hemispheres. Nevertheless, some trends prevail and here is the point where the *form* of stimulation of our senses plays an essential part, and with that form we return to shape of the bottle and its importance in getting drunk in a way or another.

I believe optical viewing, as we know in the cinema, is synergetic, harmonic, rhythmic, it stimulates spatial imagination, emotive reactions, symbolic feelings, dreams and phantasms, drives, passions, subconscious moves.

Electronic viewing, on the contrary, is analytical, sequential, punctual, abstract, more intellectual than emotive. It is more concerned with verbal and logical concepts than with feelings. To paraphrase Marshall MacLuhan, I believe cinema is a hot medium, like music and dance; television is cool like books, radio and verbal statements.

Now, let's go back to film language. During its short history, cinema achieved the elaboration of cinematographic structures sometimes discovered by chance or unconsciously but forming a system which is consistent in all its elements and in accordance with the kind of perception I have described.

These structures are efficient in optical viewing, and the system works and functions with spectators, who perfectly receive the message and understand the language. These structures are not adapted to electronic viewing, language runs off the rails, signs are not understood, and the viewer does not really SEE the film, he sees something else THROUGH the film.

That's why you can't get drunk with the wrong shape of bottle, and why movies are lost between the dead lines of a cool code, and that's why millions of people, linked by invisible chains to their electronic gadgets, each in his own individual Plato's cave, dream that they are seeing the world, the life, the art, among fallacious and abusing reflections of faked films.

2.
L'ARCHIVAGE DU FILM

Frantz Schmitt
Service des Archives du Film
Centre National de la Cinématographie

Après le remarquable exposé de Monsieur le Professeur Dimitri Balachoff sur la psychophysiologie du film et de la vidéo, qui a intéressé à la fois les spécialistes des techniques Anna-Lena Wibom et les organisateurs de ce symposium ont souhaité que j'introduise, en quelque sorte, cette première journée toute consacrée au film, par un exposé liminaire sur l'*"Archivage du Film"*. Vaste sujet, en vérité, qui nous concerne tous au premier chef et, qu'à l'évidence, je ne pourrai avoir la prétention de traiter sous tous ses aspects en une intervention d'une heure. Aussi m'a t-il semblé, à la fois pour rester concret, et pour ne pas seulement paraphraser les orientations et directives générales très bien développées dans les diverses publications spécialisées de la Fédération, mais aussi pour sensibiliser (du moins je l'espère) les plus jeunes archives du film ici présents aux questions techniques auxquelles nous sommes tous confrontés em permanence, qu'il valait mieux présenter um exemple précis de fonctionnement, d'organisation d'une archive-type. Si j'ai choisi le casde figure des Archives Françaises du Film ce n'est pas du tout, et je tiens à le dire, parce que je considère que les solutions qui ont été choisies et appliquées sont parfaitement exemplaires et satisfaisantes. C'est simplement d'abord parce que, bien sûr, je connais bien la situation de cette archive, d'autre part parce que celle-ci, qui n'a que 13 ans d'existence, est une archive relativement jeune, et a donc pu, dans une certaine mesure, bénéficier des enseignements de ses aînées; d'autre part aussi parce que la préservation qu'elle doit assurer dans le long terme concerne des volumes importants — actuellement 640.000 bobines de film, soit 72.000 titres environ, soit 190.000.000 de mètres de film environ, dont à peu près 25 — 30% encore sur nitrate, enfin et surtout, parce que cette archive a l'ambition, une fois que ses bâtiments et installations seront terminées — c'est-à-dire sous 2 ou 3 ans, sauf en ce qui concerne bien entendu le stockage, pour lequel on continuera de construire — d'être d'une totale autonomie technique pour le traitement de tous les films, de la réception des dépôts au tirage des copies destinées à la diffusion extérieure: c'est-à-dire que l'archive ne devra pas faire appel à aucune entreprise, à aucun prestataire extérieur pour ses travaux.

C'est pourquoi le titre réel de mon intervention sera *"Schéma général d'organisation et de fonctionnement d'un Service d'archive du film techniquement autonome.*

PROBLÈMES POSÉS, SOLUTIONS POSSIBLES. MÉTHODOLOGIE GÉNÉRALE.

Encore une fois je ne peux, dans les limites de cette intervention, qui se voudrait une vue d'ensemble et une introduction technique au symposium qu'effleurer certains aspects des problèmes, mais la nomenclature même des exposés prévus par se symposium

laisse entendre que beaucoup de points seront développés plus précisément par mes collègues spécialistes. Enfin j'ai bien conscience que certaines options prises par mon Service ne peuvent intéresser indifféremment tous mes collègues, qui n'ont pas les mêmes problèmes ou qui, pour des raisons économiques, techniques ou simplement pratiques, ont opté pour des solutions différentes.

Cela dit, je traiterai mon sujet par diapositives interposées.

DIAPO 1 *Citation Bergman* (Le premier film que j'eus entre les mains. . . jusqu'à ce qu'il se déchira. . .).

L'attitude de Bergman enfant est sans doute celle du créateur en puissance, mais elle peut-être aussi de celles qui contribuent à la disparition des films.

- Ne pas confondre cinéphilie, amour des films, et préservation à long terme.
- S'assurer, pour tout film projeté, qu'on dispose bien d'une matrice de tirage.

DIAPO 2 *Brochure Matuszewski*

Au plan des principes, de la théorie, et même des méthodes, tout a pourtant été proposé, prévu, par MATUSEWSKI dès 1898 dans son ouvrage *"Une nouvelle source de l'histoire"*. Citons le simplement sur un point: . . . *"les rouleaux négatifs, acceptés par un comité compétent, seront scellés dans des étuis, étiquettes, catalogués: ce seront les "types" auxquels on ne touchera pas. Le même comité décidera des conditions dans lesquelles les positifs seront communiqués. . .*

A lire et à relire. . .

DIAPO 3 *Dépôt légal (insert).*

Seule l'instauration d'un système de dépôt légal, ou obligatoire, peut aujourd'hui véritablement permettre, complémentairement d'ailleurs à l'organisation de dépôts volontaires, d'assurer une collecte aussi systématique que possible de toute la production nationale. Plus tardivement seront pris les textes d'application du dépôt légal, plus élevé sera fatalement le pourcentage des films irrémédiablement perdus.

DIAPO 4 *Dépôt légal (loi 1943 + Décret).*

En France, le dépôt légal était prévu aussi pour les films par une loi de 1943, mais il a fallu attendre le décret du 23 Mai 1977 pour que son application commence à devenir effective.

Des milliers de titres ont ainsi disparu. Des millions d'heures de travail sont investies par les archives dans des travaux de restauration longs et coûteux, à partir de copies uniques et détériorées, simplement parce que les législateurs n'ont pas cru, en temps utile, que les images en mouvement relevaient de la culture et des patrimoines nationaux.

DIAPO 5 *Film nitrate en décomposition*

Au commencement était le film *"flamme"*, ou film en nitrate de cellulose. Peut-être n'est-il pas inutile de rappeler, pour les plus jeunes archives et les spécialites de la vidéo, et aussi pour donner une première dimension du problème, que l'usage de ce support, voué, de par la nature même de ses constituants chimiques, à une autodestruction irréversible, a éte quasi exclusif, dans tous les pays, jusque dans les années 50. En France, il a été utilisé jusqu'en 1954 et la distribution et l'exploitation des films nitrate n'ont été définitivement interdites que par un décret de 1961.

Au cours de sa décomposition, et en contact avec l'humidité incluse dans la gélatine, ce support forme de l'acide nitreux (HNO_2) ou de l'acide nitrique

(HNO_3) qui fait "pâlir" l'image de l'emulsion et augmenter la décomposition jusqu'à totale dégradation, en plusieurs phases successives, dont les ultimes sont beaucoup plus rapides que les premières.

En outre, un film nitrate frais accuse une température d'inflammation de l'ordre de 130°C. Au fur et à mesure de la décomposition du film, cette température décroît et certains experts soutiennent que l'inflammation peut alors devenir spontanée à des températures assez basses, de l'ordre de 45°C.

La rapidité de cette altération du nitrate est très variable, et ne semble pas exclusivement, ni même principalement, liée à l'âge du document.

Elle parait plutôt liée à 3 facteurs principaux:

1.°) la nature même des constituants chimiques du support, qui sont différents selon les types et marques de pellicules

2°) les conditions de traitement des films en laboratoire: développement, lavage en particulier

3°) les conditions de stockage des films après traitement. Ainsi un stockage à température élevée, ou dans une atmosphère trop humide, accélère le processus.

DIAPO 6 *Combustion dans l'eau d'un film nitrate.*

DIAPO 7 Une bobine de film "flamme" plongée dans l'eau continue de se consumer; elle flambe encore si on la ressort du récipient avant totale consomption. Il n'existe aucun moyen connu pour éteindre un feu de film nitrate.

DIAPO 8 *Incendie du Bazar de la Charité* (Kodak 2/41).

Depuis le célebre incendie du Bazar de la Charité, à Paris, le 04 de Mai 1897, de nombreux incendies survenus dans des laboratoires ou des archives ont démontré que le risque d'incendie n'avait rien d'illusoire. Il importe donc, d'une part que les films nitrate soient conservés dans des locaux séparés, spécialement équipés, d'autre part que la manipulation et le transport de ces films soient effectués exclusivement par des personnels formés par l'archive, au courant des risques réels, et prenant les précautions indispensables.

DIAPO 9 *Organigramme.*

Cet organigramme exprime sommairement les activités principales du Service des Archives du Film:

— Prise en charge des films chez le déposant
— Inspection et vérification
— Identification et inventaire: un exemplaire des fiches d'inventaire est transmis au déposant, dans un "dossier de de dépôt".

Suite:
DIAPO 9

— Fichiers documentaires et Catalogage
— Traitements en laboratoire et contretypage éventuel
— Stockage films de sécurité et stockage "nitrate" séparés
— Consultation et recherches, pour les films dont l'état le permet.

Nous suivrons maintenant plus en détail ces différentes activités.

DIAPO 10 *Stockage et Conservation en l'état.*

DIAPO 11 *Arrivée de films en salle de transit.*

La section "stocks et mouvements" a en charge la conservation des films en l'état, de leur prise en charge chez le déposant à l'organisation de tous les mouvements internes et externes des films. Elle organise et contrôle tous les

mouvements de films, aussi bien entre les diverses sections du Service que pour les sorties à l'extérieur.

A leur arrivée, les films sont entreposés dans une salle de transit, où un examen sommaire permettra de les orienter rapidement vers le point de stockage approprié, nitrate ou acétate.

DIAPO 12 *Pile de Boîtes.*

L'utilisation par l'industrie cinématographique de boîtes métalliques, souvent entreposées dans de mauvaises conditions, et vite rouillées, pose souvent un premier problème, dès l'arrivée, celui de l'identification sommaire du contenu, au moins au niveau du titre, les étiquettes et informations sur la tranche étant parfois illisibles.

Evidemment, aucune des informations encore disponibles ne doit être perdue par le stockiste, qui les prend en compte sur la fiche de préstockage. S'il y a doute sur le titre, celui-ci est indiqué entre crochets carrés.

DIAPO 13 *Boîte roillée*

A un stade de décomposition avancée du film nitrate, la boîte elle-même est perforée par l'attaque de l'acide. Il n'est cependant pas certain qu'aucune image de ce film ne puisse être récupérée.

DIAPO 14 *Effet de rouille avant traitement.*

Au minimum, la rouille qui se dépose sur le film va attaquer celui-ci.

DIAPO 15 *Effet de la rouille, après traitement.*

Dans certains cas, un traitement reste possible, mas il ne permet pas toujours de récupérer l'intégralité des images atteintes.

AV → AR

DIAPO 16 *Boîtes plastiques.*

C'est pourquoi le Service a adopté exclusivement des conteneurs en matière plastique. Ceux-ci, étudiés en liaison avec des laboratoires spécialisés, sont chimiquement neutres, en particulier ne contiennent aucune trace de chlore. Il s'agit de boîtes en polyéthylène ou en polypropilène.

DIAPO 17 *Boîtes plastiques.*

Fabriquées par une société sous contrat, ces boîtes existent en capacités de 60m, 120m, 300m et 600m, tant en 35mm qu'en 16mm.

Elles comportent un code de couleur simple, qui évite toute confusion:

— Fonds rouges: nitrate (un orifice d'aération, permettant le dégagement des vapeurs nitreuses, est percé dans ces fonds)

— Fonds verts: acétate.

Couvercles

- Noir: négatif ou contretype,
- blanc: positif,
- bleu: interpositif (fine grain).

Un axe central permet de positionner exactement le noyau, tenu fixe.

DIAPO 18 *P.E. Cellules nitrate.*

Les films sont immédiatement stockés dans les locaux appropriés, selon la nature du support.

Voici une vue d'ensemble des cellules pour films "nitrate".

DIAPO 19 *Plan cellule nitrate*

Vue en coupe d'une cellule d'une capacité de 1.400 boîtes environ. Il n'existe aucune communication d'une cellule à la suivante de sorte que si un

incendie affectait une cellule, cela n'aurait aucune incidence sur les cellules voisines. Le renouvellement de l'air est prévu à raison de 5 fois le volume de la cellule par heure.

DIAPO 20 *Vue intérieure cellule nitrate* (Kodak 1/43).

Chaque cellule, équipée d'étagères métalliques, comporte 2 portes "panique" et un éclairage de type antidéflagrant.

DIAPO 21 *P.R. Hygromètre — thermomètre extérieurs.*

Une régulation constante en température et humidité est assurée aux normes suivantes:

— Température: 12°C ± 2°C.

— H.R.: 50% ± 10%.

En fait, il n'y aurait évidemment aucun inconvénient à stocker un film à plus basse température, et hygrométrie plus faible, mais, outre des frais d'exploitation encore plus onéreux, se pose alors le problème d'une mise en équilibre progressive, au moment de la sortie des films du stock, ce qui ralentit les opérations et n'est pas compatible avec les obligations de certaines archives.

Les films nitrate sont regroupés dans différentes cellules, selon leur degré de décomposition plus ou moins avancé, mesuré par des tests d'état chimique.

DIAPO 22 *P.E. Bâtiment Acétate.*

Ne présentant pas le même danger, les films de sécurité sont stockés dans des silos de plus grande capacité et conditionnés aux mêmes normes.

DIAPO 23 *Plan en coupe Bâtiment B.*

Chaque bâtiment, aveugle, comporte 5 niveaux. Une bonne isothermie est assurée par des murs en ciment, brique, isolant, et un revêtement extérieur en tôle d'aluminium.

DIAPO 24 *Vue intérieure Bâtiment B.*

Le stockage des boîtes est horizontal, et non sur la tranche, pour éviter tout risque d'ovalisation et de tassement des bobines. Les piles sont de 9 boîtes au maximum. Les matrices de tirage sont stockées séparément des dépôts.

DIAPO 25 *Vue intérieure — Système Compactus.*

Les derniers locaux construits sont équipés d'étagères type "Compactus", mobiles sur rails. D'une seule main, par un dispositif exclusivement mécanique, il est ainsi possible de manoeuvrer plus de 10.000 boîtes. Ce système, onéreux à la construction car nécessitant des planches porteurs importants, est beaucoup plus économique en exploitation, puisque dans un même volume, on peut loger ainsi près du double de films.

Ces locaux comportent en outre des détecteurs de fumée.

DIAPO 26 *Thermo humidimètre.*

Des contrôles des conditions de température et d'humidité sont effectués constamment. Le report de l'affichage permanent des données à un tableau central de contrôle est prévu prochainement.

DIAPO 27 *P.E. Cave avec boîtes couvertes de champignons.*

La constance des données, tant en température qu'en hygrométrie, est très importante. Alors qu'un excès de sécheresse rendrait le film cassant et provoquerait un phénomène de retrait qui le rendrait inapte à l'utilisation ultérieure dans les appareils de projection ou de tirage, une humidité trop élevée provoque l'apparition de champignons qui peuvent envahir toute la pièce de

stockage, comme le montre cette vue prise dans une cave d'une firme de production.

DIAPO 28 *P.R. éprouvettes — cultures champignons.*
Des cultures en milieu de Sabouraud (eau, peptone, gélose) ont permis de déceler quelques espèces de colonies fongiques qui affectionnent particulièrement la gélatine, notamment de la famille des Aspergillacés (Pénicillium Trichothecium rosae).

DIAPO 29 *Photogramme moisissures avant traitement.*
Les moisissures qui affectent les films mal stockés ou mal séchés forment des traces souvent indélébiles.

DIAPO 30 *Photogramme après traitement.*
. . . même après traitement.

AV → AR [Il faudrait introduire des substances antifongiques au cours du développement]

DIAPO 31 *Photogramme film "nitrate" sur manchette.*
La reconnaissance du support d'un film, nitrate ou acétate, pose parfois des problèmes, pour le stockiste qui le prend en charge. Diverses indications, sur les manchettes des perforations permettent généralement l'identification du support. Cas d'un film nitrate.

DIAPO 32 *Photogramme film "Safety" sur manchette.*
Le film de sécurité peutêtre identifié, en règle générale, par la mention "safety" sur manchette ou par la présence de traits spécifiques entre les perforations.

DIAPO 33 *P.R. test de combustion.*
A défaut, par un test de combustion par prélèvement d'un échantillon (le film nitrate, à gauche, flambant beaucoup plus rapidement). Une demi-image suffit largement.

DIAPO 34 *Blockhaus nitrate N.F.A.*
Avec quelques variantes, des installations de stockage sensiblement similiaires à celles du Service des Archives du Film existent dans plusieurs pays qui ont également considéré que les films étaient partie intégrante du patrimoine national.
● Cellules "N" a Aston Clinton (G.B.).

DIAPO 35 *Blockhaus enterrés Berlin — Est.*
Blockhaus enterrés en R.D.A., l'une des rares archives équipé pour la conservation des films en couleurs.

DIAPO 36 *P.P. Fichier stock.*
Toutes les opérations d'entrée et de sortie des films sont consignées sur un fichier stock, dont la gestion, encore entièrement manuelle, doit prochainement être automatisée par ordinateur.

DIAPO 37 *G.P. Fiche stock.*
Détail d'une fiche de stock. Au recto les entrées, au verso les mouvements du film.

DIAPO 38 *VERIFICATION — INVENTAIRE* (Insert).

DIAPO 39 *P.E. Salle de Vérification.*

La conservation en l'état étant assurée chaque film, bobine par bobine, va ensuite faire l'objet d'une prise en inventaire, à la charge de la section "Vérification".

DIAPO 40 *P.R. Vérificateur sur table.*

L'examen peut-être effectué sur une simple table de vérification, à l'oeil, l'opérateur relevant, selon une nomenclature normalisée, à la fois les informations d'inventaire et les informations relatives à l'état du document, bobine par bobine. Cette opération est très importante car elle permet d'établir, en quelque sorte, la carte d'identité de l'élément examiné, à raison d'une fiche établie par élément.

DIAPO 41 *Fiche d'inventaire.*

DIAPO 41 *bis*

Parmi les principales informations consignées, au titre du film, notons, outre le titre:

— la nature de l'élément
— le format
— le procédé image et le procédé son
— le métrage
— la présence de collures et leur nombre
— la présence d'intertitres ou sous-titres
— le type de cadrage
— les défauts du support, de l'émulsion, des perforations, de la bande son, ceci en conformité avec une norme relative aux détériorations subies par les films
— les informations documentaires (année de production, pays, équipe de réalisation, acteurs) seront ensuite complétées par la section "documentation", qui établira également un résumé succinct ou une analyse de contenu.

DIAPO 42 *Relevé de générique.*

Si l'élèment comporte un générique, celui-ci sera relevé, carton par carton.

La codification des éléments descriptifs du film, la syntaxe et la ponctuation dans la présentations des descripteurs doivent être conçus, autant que possible, pour permettre ultérieurement l'établissement d'une base de données exploitable dans un système informatisé.

DIAPO 43 *Appareil de mesure du retrait.*

Si le film présente du retrait, ce qui est fréquent pour les documents anciens, celui-ci sera mesuré en plusieurs points de la bobine et consigné sur les fiches, au moyen de perfomètres spéciaux. Ainsi trouve-t-on parfois des films qui ne font plus que 32,8mm de large et qui, bien entendu, ne peuvent pas passer sur des appareils standard. Le retrait, sur cet appareil, est mesuré sur 100 perforations.

DIAPO 44 *G.P. prise de tests.*

Les archives qui disposent de fonds "nitrate" importants et qui ne peuvent en assurer rapidement et globalement le transfert sur support de sécurité doivent établir des priorités. A cette fin, pour les films "nitrate", il sera procédé, en 2 ou 3 points de la bobine, au prélèvement d'une pastille destinée à mesurer l'état de décomposition plus ou moins avancé du support, selon une méthode mise au point par la Société Kodak à Rochester.

DIAPO 45 *P.R.bloc thermostaté.*

La pastille, chauffée dans un bloc thermostaté à 132°C, va émettre des vapeurs nitreuses qui réagiront, en un temps plus ou moins long, sur un papier chromatographique dont elles provoqueront la décoloration.

Selon le temps de réaction, de 10'à plus d'une heure, on pourra déterminer le temps de survie possible du support "nitrate", avant sa totale décomposition.

DIAPO 46 *G.P.résultats tests (éprouvettes)*

Les résultats sont enregistrés en 4 cotations.

Ainsi une absence de réaction après 1 heure indique que le film nitrate, entreposé dans de bonnes conditions, ne nécessite pas de traitement immédiat. Au contraire, une réaction intervenant en moins de 10' (cotation 4) ou même en moins de 30' (cotation 3) signifie que le document doit faire l'objet d'un contretypage rapide, sous peine de disparition définitive.

De nombreux essais comparatifs effectués avec des archives étrangères, et sur des supports de différentes provenances, ont prouvé le bien-fondé de cette méthode, base déterminante d'une sélection des urgences, c'est-à-dire des films les plus malades à traiter en priorité.

Cette analyse, objective, est la base essentielle du choix des documents à traiter en premier lieu, indépendamment de toutes autres considérations d'ordre artistique ou historique.

En outre, les bobines d'un même film affectées de cotations différentes sont stockées séparément; ainsi existe-t-il quelques "pavillons de contagieux".

DIAPO 47 *Fichier tests.*

Un fichier spécial porte trace de ces cotations, et de leur évolution, des reprises de tests étant pratiquées selon une périodicité définie.

DIAPO 48 *Table CTM 6 bandes.*

Très souvent, le Service dispose, pour un même titre, de divers éléments différents, tant dans leur continuité que dans leur métrage ou leur format. Une visionneuse spéciale permet la comparaison en synchronisme de ces divers éléments, en vue de la reconstitution de la version la plus complète, la plus conforme au document original. Cette visionneuse permet ainsi le passage simultané, en synchronisme, du négatif — lû en positif sur écran vidéo — d'une copie 35mm, d'une copie 16mm, d'un son optique ou magnétique 35 et d'un son 16mm, à 16 ou à 24 images/seconde.

DIAPO 49 *Galets interchangeables.*

Des galets (sprockets) interchangeables permettent, sur cette machine, de passer des éléments affectés de retraits différents.

DIAPO 50 *Visionneuse Zénon 35mm.*

Au contraire, pour la comparaison de copies de série en assez bon état mécanique dont plusieurs exemplaires auront été déposés, des appareils de vision et de contrôle d'état mécanique et optique à grande vitesse permettent une sélection des meilleures copies, les éléments en surnombre étant éliminés.

Ainsi, cet appareil d'inspection rapide, pour films 35mm, permet-il, tout en assurant la vision du document à grande vitesse, un arrêt automatique aux défauts les plus importants: mauvaises collures, perforations arrachées ou crantées, selon une programmation pré-établie. Il autorise l'écoute (et la vision) de la bande son audible à grande vitesse.

DIAPO 51 *Visionneuse Zénon 16mm.*

Même appareil, en 16mm. Cet appareil est très utile aux cinémathèques et

Sociétés de distribution, car il permet une vérification, non seulement de l'état du film, mais aussi de sa continuité.

DIAPO 52 *LABORATOIRE DE RESTAURATION* (INSERT).

DIAPO53 *P.E. Laboratoire* (vue intérieure).

Pour obtenir une qualité dans les résultats conforme à ses exigences, intervenir aussi rapidement qu'il le souhaite, être assuré d'une continuité dans les traitements propre à assurer la survie à long terme des films, effectuer des opérations techniques que les firmes privées ne peuvent prendre en compte, il est souhaitable que l'archive dispose d'un laboratoire intégré, fonctionnant de manière autonome et capable de prendre directement en compte la restauration des documents dont la programmation a été décidée.

Ce laboratoire assurera tous les traitements, physiques et chimiques, en tenant compte au moins de trois principes essentiels:

1.°) la restauration d'un film "nitrate" menacé de disparition n'interviendra qu'après une phase préalable de recherche, afin de s'assurer que le film qu'on se propose de restaurer n'existe pas, par ailleurs, dans une autre archive ou cinémathèque. C'est dire qu'une prospection aussi systématique que possible doit être menée, tant au niveau national que, si possible, au niveau international, afin de localiser l'existence éventuelle d'autres matériels disponibles pour les titres dont la restauration a été décidée. Cette localisation devrait être suivie, autant que possible, de la communication des éléments détenus par des tiers extérieurs, afin de comparaison du contenu et de l'état, avant tout engagement de travaux. Il s'agit d'une question complexe, compet-tenu des différences de statut des archives cinématographiques de tous les pays, et dont l'analyse pourrait faire, à elle seule, l'objet d'un séminaire de la FIAF.
En effet, il semble que, bien souvent, des travaux onéreux de restauration sont entrepris, de manière imparfaite, pour des archives à partir de l'unique élément dont elles disposent par un titre donné, alors qu'une matrice de ce même titre existe déjà chez un collègue.

2.°) Le support physique, la matrice de tout film restauré et contretypé par l'archive doit rester, en tant que telle, la propriété pleine et entière de l'archive, ou de l'Etat. Certes, le déposant du document de base peut avoir accès à cette archive, dans des conditions techniques strictement contrôlées, mais cette matrice, qu'il s'agisse d'un contretype négatif ou d'un interpositif, ne doit jamais sortir du Service.

3.°) Bien entendu, en aucun cas, on ne tirera directement une copie d'un négatif nitrate sans établir simultanément une matrice.

DIAPO 54 *(G.P. film collé).*

Techniquement, toutes les situations sont possibles. Voici par exemple le cas d'un film dont les spires sont collées, et qui parait indéroulable. Peut-être en effet est-il définitivement perdu, mais néanmoins l'espérance d'en sauver au moins quelquer images ne doit-elle pas être écartée.

DIAPO 55 *(Becher réhumidification — G.P. Kodak 1/54)*

Un traitement de réhumidification contrôlé, en présence d'une solution volatile d'eau distillée, de glycérol et d'acétone, par exemple, pourra parfois permettre de le sauver, en lui redonnant une certaine souplesse, du moins le temps nécessaire au tirage.

DIAPO 56 *(P.M. Armoire athermique).*

Le même principe peut-être appliqué sur une plus grande échelle, en armoire athermique.

DIAPO 57 *(Photogramme enlèvement de gélatine).*

Parfois, il est malheureusement trop tard.

DIAPO 58 *(G.A. Film Lumière friable, Kodak 2/47).*

A l'inverse, un film stocké en atmosphère trop sèche sera devenu friable, cassant, irrécupérable lui aussi.

DIAPO 59 *(Photogramme film rayé, avant lavage).*

Souvent, le seul élément encore disponible est une copie; elle présente des rayures, des moisissures, des taches diverses. Un lavage lent, éventuellement précédé d'un essuyage pourra permettre de compenser partiellement ces défauts de surface, notamment en regonflant la gélatine, avant tirage. Cette opération présuppose généralement un renforcement préalable des collures.

DIAPO 60 *(le même, après lavage).*

Le même film, après lavage.

DIAPO 6l *(Photogramme film huilé).*

Voici le cas d'un film huilé.

DIAPO 62 *(id° après traitement).*

Le même, après traitement.

DIAPO 63 *(G.P. Polissage)*

Un polissage ou un dépolissage, qui consiste à faire passer le film sur une meule en verre, en conjugant l'action de celle-ci avec celle d'un liquide approprié, afin d'éliminer certaines rayures superficielles dans l'épaisseur du support ou de la gélatine, peut aussi apporter une amélioration de l'état de surface.

DIAPO 64 *(Photogramme avant polissage)*

Film avant polissage.

DIAPO 65 *(le même, après polissage).*

Film apres polissage.

DIAPO 66 *(Photogramme, avant renforcement).*

Très souvent, un mauvais développement, un fixage insuffisant, une altération du support, accélèrent la détérioration de l'image, qui perd ses contrastes, pâlit. Un traitement de renforcement de l'image sera nécessaire.

DIAPO 67 *(le même, après renforcement).*

Le même photogramme, après renforcement (renforcement ou traitement au chlorure mercurique).

DIAPO 68 *(Réparation perforations).*

L'état physique, ou mécanique, des films est également un point important à considérer. Très souvent, l'archive ne dispose que d'une copie altérée, aux perforations déchirées, arrachées ou crantées, et présentant en outre un certain retrait. Quant les perforations sont arrachées sur une certaine longueur, il

convient généralement de les réparer, du moins sur un côté du film, de manière à permettre l'entraînement dans les machines de tirage. Si le retrait est nul ou peu important, on peut éventuellement utiliser une machine de type "Perfix" qui permet de renforcer les perforations, par apposition d'un ruban support perforé au pas standard.

DIAPO 69 *(Réparation perforations avec support à retrait, Kodak — Pathé 1/61).*

Par contre, si le retrait est trop important, et les perforations arrachées sur une grande longueur, le travail reste souvent purement manuel, par apposition de manchettes découpées dans un film ou une amorce nitrate présentant un retrait à peu près identique à celui de l'élément à réparer. De nombreuses heures sont ainsi perdues, et il conviendrait d'étudier des tireuses spéciales à repérage électronique du cadrage et à défilement continu, évitant les dispositifs mécaniques à griffes et "sprockets".

DIAPO 70 *(P.R. étalonneur, Kodak — Pathé 1/68 ou 2/68.*

On procède ensuite à l'étalonnage, opération qui consiste, pour chaque plan du film, à déterminer la quantité de lumière à admettre sur le film, lors du tirage, pour respecter la continuité photographique et chromatique de l'oeuvre. Ce travail, pour le noir et blanc, se fait généralement à l'oeil.

DIAPO 71 *(Tireuse Debrie).*

Ces travaux de traitement de surface et de réparations effectués, certains films, qui ne présentent pas d'autres altérations ou d'autres caractéristiques particulaières peuvent être tirés sur des appareils classiques, en usage depuis plus de 50 ans dans les laboratoires professionnels, telles ces tireuses para contact Debrie.

DIAPO 72 *(Tableau des formats).*

Il ne peut malheureusement en être de même pour certains documents, soit du fait de leur degré d'altération mécanique, soit du fait, simplement, de leur format.

Bien qu'Edison ait d'emblée adopté le 35mm à 4 perforations par image, de nombreux formats et systèmes d'entraînement ont successivement vu le jour depuis le 60 mm de Demeny jusqu'au S 8mm, en passant par le 50mm de Baron, le 75mm de Lumière, le 9,5mm Pathé-Baby, le 28mm Pathé-Kok, le 15mm à perforations centrales de Gaumont, le 17,5mm de Pathé-Natan ou d'Erneman, le 22mm Ozaphane.

Nous n'en avons pas dénombré moins d'une cinquantaine.

DIAPO 73 *Film Lumière.*

Voici par exemple un échantillon de film Lumière, à 2 perforations rondes par image.

DIAPO 74 *Chronophotographie MAREY*

Et un extrait de chronophotographie sur pellicule souple de 90mm, de Marey.

DIAPO 75 *Projecteurs anciens.*

Il est donc d'une part nécessaire de disposer, autant que possible, des appareils de projection originaux, pour l'examen et l'analyse de tels documents.

Voici, par exemple, 3 appareils de formats 17,5mm, 22 et 28mm.

DIAPO76 *Tireuse SAMOPRA 9.*

D'autre part de disposer de tireuses type Truca pour permettre la retranscription de ceux de ces formats spéciaux les plus utilisés sur les pellicules actuelles de 35 ou 16 mm.

Voici une tireuse optique spéciale construite pour le Service par la Société SAMOPRA et qui permet le transfert de films Lumière à perforation ronde, de films 9,5mm, 16mm, 17,5mm, 28mm, en 35mm ou 16mm, par simple changement des mouvements batteurs et des galets dentés d'entraînement.

Cette tireuse permet également de rectifier optiquement les divers cadrage d'origine pour remise au cadre sonore actuel, sans perte de portions de 1 image d'origine.

DIAPO 77 *Mouvements Batteurs SOMOPRA 9.*

Voici les mouvements batteurs interchangeables.

DIAPO 78 *Tableau des commandes SAMOPRA 9.*

Cette tireuse permet enfin la remise à la cadence actuelle de 24 images / seconde des films muets tournés à la manivelle, à des cadences qui varient très souvent entre 12 et 20 images / seconde. On doublera donc une image sur 2, sur 3, voire sur 4 après analyse de la cadence d'origine qui, pour un même film, a d'ailleurs pu varier selon les séquences.

DIAPO 79 *Cuve immersion.*

Enfin cette tireuse permet de travailler en immersion, le film baignant, au passage devant la fenêtre de tirage, dans un bain de trichloroéthane, ce qui, par réfraction optique, permet d'éliminer optiquement — sans les enlever pour autant du support d'origine lui-même — certaines rayures qui n'auront pu être éliminées lors du lavage ou des traitements de surface précédents.

DIAPO 80 *Photogramme avant immersion.*

Voici par exemple un photogramme d'un film non traité en immersion.

DIAPO 8l *Photogramme, après immersion.*

Et le même, après immersion.

DIAPO 82 *P.E. Tireuse MEES.*

Cette tireuse optique belge, qui devrait d'ailleurs être présentée au Congrès, permet sensiblement le même travail, mais à des cadences plus élevées, de l'ordre de 16 imagens/seconde, et autorise le tirage de films sonores. Elle travaille aussi en tirage humide.

DIAPO 83 *G.P. Tireuse MEES*

Elle comporte également des batteurs interchangeables.

DIAPO 84 *Tireuse Reynaud*

Dans certains cas très spéciaux, de telles tireuses ne peuvent cependant convenir et il faut avoir recours, à cause du format d'origine des documents, à des dispositifs mécaniques et optiques particuliers, construits de manière très artisanale, pour opérer un transfert.

Ainsi en est-il de cette "tireuse" qui a permis la retranscription sur film 70mm, au rapport I x I, de la bande originale de quelques 500 images peintes à la main sur celluloïd, de la pantomime lumineuse d'Emile Raynaud "Pauvre Pierrot" qui, réalisée en 1891, préfigure le cinématographe.

DIAPO 85 *4 stades restauration bande Reynaud.*

Voici d'ailleurs les différentes versions réalisées par le Service, à partir de l'original dont les images, de 5,5 cm environ de côté, sont enchâssées dans une monture souple.

- bande 2: reprise en 70mm (avant retouches)
- bande 3: montage sous caches et réalisation d'une bande en tous points

conforme à la bande originale, telle qu'elle est aujourd'hui à nouveau présentée, à Paris, sur un appareil semi-automatique conforme à l'original.

- bande 4: bande réduite en 35mm, avant reconstitution du fond de décor qui était projeté sur l'appareil d'origine, le "théâtre optique".

DIAPO 86 *P.E. reconstitution Théâtre optique, Kodak 2/70.*

Voici d'ailleurs la reconstitution du théâtre optique, dans lequel l'automate qui figure Emile Reynaud projette la bande, en marche avant et arrière, en synchronisme avec l'enregistrement de la musique originale composée par Gaston Paulin.

DIAPO 87 *Photogramme film Normandin.*

Avant l'apparition des pellicules en couleurs actuelles, par procédés additifs ou soustractifs, les copies des films muets étaient souvent proposées dans des versions colorées, d'abord au pinceau, image par image, puis un peu plus tard par le procédé plus automatique du Pochoir.

Voici l'un des tous premiers films peints, réalisé par Ernest Normandin en 1897, sur un appareil de son invention. A noter les 5 perforations par image.

DIAPO 88 *Photogramme "Chaudron infernal."*

Voici une image extraite du "Chaudron infernal" de Méliès (1903) réalisé au pochoir.

DIAPO 89 *Photogramme "la voix du rossignol", Kodak 2/67.*

Voici une image extraite du film de L. Starevitch "La voix du rossignol" (1922) d'une grande finesse de coloris, et où les teintes sont positionnées très précisément, sans bavure.

DIAPO 90 *Atelier coloris Pathé, Kodak 2/66.*

A cette époque, "l'atelier du coloris" de Pathé, à Vincennes, comptait plus d'une centaine d'ouvrières.

DIAPO 91 *G.P. Filtres couleurs.*

La retranscription fidèle de ces teintages ou colorations au pochoir, réalisée généralement avec des colorants à base d'aniline, sur les pellicules couleurs actuelles, pose évidemment des problèmes d'étalonnage et plus précisément de filtrage délicats, qu'il importe de maîtriser avec précision.

DIAPO 92 *Photogramme "la ville dorée".*

La couleur des extraits de films peints, dont certains ont 80 ans, a finalement assez bien résisté à l'épreuve du temps. Il n'en est malheureusement pas de même de la couleur dite "naturelle" de films plus proches de nous, réalisés au moyen des procédés actuels à plusieurs couches d'émulsion.

Voici par exemple un extrait du film en Agfacolor de Veit Arlan "La ville dorée" qui date de 1943.

DIAPO 93 *Photogramme couleur virée film récent.*

Cette image, extraite d'une copie d'un film plus récent, est également complètement virée.

Je ne m'étendrai pas trop sur ce problème, même s'il nous préoccupe tous beaucoup, dans la mesure où il sera par ailleurs traité dans ce congrès, notammen par Monsieur Charlton Bard. Il apparaît cependant que la situation, qui était ressentie il y a encore 2 ou 3 ans comme particulièrement dramatique pour les copies positives, dont aucun fabricant ne garantissait la pérennité des couleurs au-delà de 5 ans, paraît avoir aujourd'hui évoluée, avec l'apparition de

surfaces sensibles positives plus fiables. Mais peut-être les appels de Scorcese et de la FIAF y sont aussi pour quelque chose.

DIAPO 94 *P.E. bloc basse température.*

Pour palier ce risque, plusieurs solutions ont été proposées.

L'une, qui sera également présentée lors de ce symphosium, consiste à conserver les films à très basse température et en hygrométrie faible: — 7°C, 30% HR environ.

DIAPO 95 *P.R. porte bloc basse température.*

Cette solution a toutefois l'inconvénient, et de plus en plus aujourd'hui, d'être très onéreuse en exploitation; peut-être aussi le temps nécessaire de mise en équilibre du négatif, pour passer de — 7° à la température ambiante, rend son accès un peu long, quand on en a besoin pour un tirage urgent. Mais c'est en soi une solution séduisante pour la conservation à long terme.

DIAPO 96 *Schéma sélection trichrome.*

Une autre solution, présentée de manière très simplifiée sur ce schéma, consiste à procéder à une retranscription du film couleur sur pellicule noir et blanc, en en faisant 3 sélections monochromatiques sur 3 bandes distinctes, derrière 3 filtres B, V et R, chacun d'eux ne retenant que les radiations correspondantes à l'une des 3 couleurs. Ensuite, par superposition de ces 3 films noir et blanc derrière les mêmes filtres, on reconstitue la couleur, par synthèse additive.

Ce procédé a été quelque temps utilisé par les laboratoires, au moment de l'apparition des premiers films Eastmancolor. Mais le fait d'avoir 3 films distincts — outre les problèmes de stockage — introduit le risque, à moyen terme, d'avoir un retrait différent des 3 bandes, rendant toute superposition ultérieure aléatoire.

DIAPO 97 *Image Rouxcolor*

Une autre solution consiste, à la prise de vues, à diviser la lumière provenant du sujet et à "spécialiser", en quelque sorte, des parties de l'image enregistrée dans la rétention de radiations monochromatiques déterminées.

C'est le principe du Rouxcolor, ou chaque image comporte en fait 4 photogrammes N et B enregistrant le B, le V, le R, et le jaune.

Mais cette technique, avec laquelle fut notamment réalisé le film de Marcel Pagnol "La Belle Meunière" (1948), nécessitait également à la projection l'adoption d'une optique spéciale et quelques modifications qui en rendaient l'exploitation assez délicate.

Aussi fut-elle abandonnée.

DIAPO 98 *Photogramme sélection en 3 images successives.*

Une autre solution, pour la conservation des films en couleurs sur support achrome, reste actuellement à l'étude: elle consiste à effectuer la sélection, non plus sur 3 bandes distinctes, mais sur une seule bande, en images successives B, V, R évitant tout risque de retraits différents.

DIAPO 99 *Filtre rotatif de sélection.*

La même image étant reprise 3 fois derrière un filtre rotatif.

DIAPO 100 *Samopra XIII.*

Cette tireuse optique, comportant des magasins de 900 mètres peut permettre à la fois la sélection et la recomposition. Des résultats appréciables ont pu être obtenus, mais il reste à résoudre certains problèmes sensitométriques, de temps et de γ de développement, et le choix des

pellicules les plus aptes à la sélection. La recherche reste ouverte, en liaison avec les fabricants de surfaces sensibles.

DIAPO 101 *P.E. développement.*

En dehors des questions de tirage, un soin tout particulier doit être apporté aux opérations de développement, et un service d'archive, même s'il effectue certains travaux dans d'autres laboratoires, doit disposer de ses propres installations. En particulier, des normes doivent être respectées en ce qui concerne les conditions de fixage et de lavage des documents, en évitant notamment toute trace ou taches d'hyposulfite résiduel.

DIAPO 102 *Photogramme taches d'hyposulfite.*

A l'extrême, un film mal fixé, ou mal lavé, conduit à une image de ce genre.

DIAPO 103 *Le même, correctement traité.*

DIAPO 104 *P.R. éprouvettes test teneur hyposulfite, Kodak — Pathé 2/54.*

Des mesures d'hyposulfite résiduel doivent donc être effectuées sur chaque matrice établie pour la conservation à long terme, en connaissance des normes préconisées.

DIAPO 105 *LA RESTAURATION DES ELEMENTS SONORES.*

DIAPO 106 *Spécimens sons sur film.*

J'ai, brièvement, évoqué quelques cas d'espèce, pour ce qui est de l'image.

Mais, depuis 1927, le cinéma es officiellement devenu sonore.

En fait, diverses tentatives antérieures de synchronisation de l'image et du son ne peuvent être oubliées.

La diversité des procédés d'enregistrement et de restitution du son, depuis cette époque, implique elle aussi des traitements divers, en particulier en vue de l'élimination, ou tout au moins de la réduction des bruits de fond, souffles et parasites inhérents aux procédés techniques originaux.

DIAPO 107 *P.R. console de correction — mixage.*

En général, le travail de restauration doit être effectué en plusieurs étapes successives: le plus souvent, un premier transfert correctif s'impose, avec filtrages...

DIAPO 108 *P.E. local son optique.*

... avant report optique.

DIAPO 109 *Appareil de projection avec disques.*

En remontant dans le temps, se pose aussi la question de la restitution synchrone sur bande optique des premiers films, synchronisés avec des disques...

DIAPO 110 *Photogramme "le cinéma sonore en 1900".*

... Voire, comme sur cette image extraite d'un film produit en 1900, des films synchronisés avec des phonographes à cylindre: le cinéma sonore existait en effet... en 1900.

DIAPO 111 *DOCUMENTATION.*

DIAPO 112 *P.E. salle de Documentation.*

Même si son activité se situe aux seuls plans de la conservation et de la

restauration des films, aucune archive ne peut se dispenser d'un service de documentation — catalogage, capable de gérer un ensemble d'informations d'ordre à la fois technique, documentaire, historique et juridique.

DIAPO 113 *P.R. Bibliothèque.*

La documentation a notamment la charge de l'identification et de la datation précise des films les plus anciens, à partir en particulier d'un matériel documentaire très diversifié, dont les éléments sont rassemblés dans une bibliothèque de travail.

DIAPO 114 *Revues anciennes.*

Comme les ouvrages, les collections anciennes...

DIAPO 115 *Matériels publicitaires.*

... Les matériels publicitaires.

DIAPO 116 *Local "Censure".*

... Les documents administratifs, comme les dossiers de censure sont souvent du plus grand intérêt pour la reconstitution intégrale et la datation exacte des films.

DIAPO 117 *Diapositive affiche "Fontaine de Jouvence"*

Comme le sont les affiches.

DIAPO 118 *P.E. Local Photo.*

Comme le sont les collections de manuscrits, de découpages et de photographies...

DIAPO 119 *G.P. Photographies.*

Qui participent également, de différentes manières à la reconstitution du patrimoine cinématographique national, et facilitent l'établissement de catalogues des productions nationales.

DIAPO 120 *Banc-titre.*

A partir de cette documentation, porra-t-on ainsi souvent reconstituer le générique ou les intertitres absents d'un film muet, qu'il faudra alors filmer au banc de-titres, puis réinsérer dans le montage.

DIAPO 121 *Orchestre Fosse au Gaumont-Palace.*

Au temps du cinéma muet, les films faisaient fréquemment l'objet d'un accompagnement musical, du simple piano-bastringue improvisant parfois dans les tournées de province, à l'orchestre important, comme en témoigne cette vue, orchestre que dirigeait Paul Fosse, au Gaumont-Palace.

DIAPO 122 *Partitions musicales.*

Les partitions musicales d'accompagnement des films muets doivent également être recherchées par l'archive, car leur enregistrement permet parfois de compléter la restauration de l'image elle-même.

Nous avons pu le faire pour *"l'Assassinat du Duc de Guise"*, (1908), classique du film d'Art et allons le de faire pour l' *"Eldorado"* de Marcel L'Herbier (musique de J—F. Gaillard).

DIAPO 123 *Manchette "Pathé, 14 rue Favart".*

En l'absence, parfois, d'une documentation imprimée suffisant pour dater et caractériser un film ancien, voire en connaître l'origine, on peut dans certains cas, se référer par exemple à des repères relevés sur le support même des oeuvres.

Ainsi, la mention "Pathé Frères, 11 rue Favart" indique-t-elle indirectement les dates extrêmes possibles de production du document.

DIAPO 124 *4 photogrammes anciens.*

De même, en l'absence de tout générique, certains repères de production (copyright avant la lettre) introduits dans le décor, permettent-ils de situer l'origine du document, et de le dater, approximativement au moins.

3 — Marguerite Gaumont
2 — Coq Pathé
1 — Star Film
4 — Eclair.

DIAPO 125 *Fiche ENQUÊTE, recto-verso.*

Des fichiers spéciaux, constitués notamment à la faveur de recherches particulières effectuées pour des professionnels ou les milieux universitaires, recherches qui portent à la fois sur les données signalétiques des films et sur des analyses de contenu, contiennent aussi, par titres de films, des informations sur les sources bibliographiques disponibles — ce qui évite la découpe des journaux et revues — et surtout les localisations extérieures de matériels du film considéré, même si ceux-ci ne sont pas détenus par le Service.

DIAPO 126 *P.R. Fiche signalétique.*

Dans la mesure où l'archive ne peut disposer d'un ordinateur, par insuffisance de crédits, elle peut recourir, pour une gestion documentaire de type signalétique, à des dispositifs plus simples et moins onéreux, comme cette fiche signalétique lisible par une trieuse optico-électronique. La fiche peut comporter plus de 50 renseignements distincts et codés pour un titre.

DIAPO 127 *P.R. trieuse optique.*

Ainsi, peut-on répondre à la cadence de lecture de 900 cartes par minute, à des interrogations croisées du type: "sortez-moi les films américains de 1954, en couleurs, pour lesquels vous disposez à la fois d'une copie 35mm safety consultable et de photographies". Ou bien: "Quels sont les films muets pour lesquels des travaux de montage sont à effectuer?".

DIAPO 128 *Microfiche d'analyse.*

Complémentairement aux systèmes et dispositifs d'analyses de contenu destinés à faciliter l'accès à des stock-shots, sur la base d'un thésaurus préalablement établi, question que je ne traiterai pas ici, faute de temps, l'archive peut créer, pour faciliter l'accès aux oeuvres, dans une première approche, sans nécessairement manipuler les bobines de films, une microfiche d'analyse qui, à raison d'une image par plan — ou d'une image prise dans le film à intervalles réguliers — donne une vue d'ensemble assez précise du contenu du film. Ainsi en 4 ou 5 microfiches lisibles sur un lecteur classique, le chercheur pourra-t-il disposer d'une vue assez précise de la continuité d'un long-métrage.

DIAPO 129 *P.R. Ordinateur C.N.C.*

Bien entendu, le recours à l'informatique doit être envisagé dès que possible pour toute archive disposant de fonds importants à gérer, à restaurer, et à cataloguer. Il convient toutefois que le choix des matériels et des logiciels ne soit effectué qu'après des études approfondies, de manière à ce que la programmation prévue ne doive pas être constamment remise en cause. Il faut aussi, d'une part que l'archive soit suffisamment autonome dans la gestion de ses programmes informatiques, qu'elles ne soit pas trop tributaire d'organismes plus vastes, et que, d'autre part, les systèmes adoptés soient

compatibles avec ceux retenus par d'autres archives, cinémathèques, ou organismes professionnels intervenant dans la gestion ou dans la diffusion des films.

DIAPO 130 *P.R. bordereaux de saisie.*

Les premières applications informatiques dans une archive peuvent concerner la gestion des stocks, d'une part, le catalogue, d'autre part. Le personnel doit être familiarisé progressivement au langage et à la syntaxe informatique, par exemple en établissant, dans un premier temps, des bordereaux de saisie mettent en forme les données collectées.

DIAPO 131 *P.R. console plus imprimante.*

Mais, à terme, le dialogue direct avec l'ordinateur doit pouvoir s'établir à partir de consoles de visualisations, permettant l'interrogation directe de la base de données, les corrections, les sorties de listings sur imprimante.

DIAPO 132 *CONSERVATION DU MATERIEL MUSEOLOGIQUE.*

DIAPO 133 *P.E. Salle d'exposition.*

La collecte, la préservation et la restauration des appareils anciens, pour l'archive, ont bien évidemment un sens muséologique. Mais elles offrent aussi d'autres motifs d'intérêt.

D'une part, elles permettent à l'archive de revoir dans les conditions de l'époque, les films anciens — cas des projecteurs de films en formats aujourd'hui obsolètes.

D'autre part, parfois, de restaurer ces mêmes films, en utilisant les macanismes ou les optiques d'origine.

DIAPO 134 *Objectifs Hypergonar.*

Ainsi ces 3 premiers objectifs "Hypergonar", mis au point par le Professeur Chrétien en 1927 (prise de vue, tirage, projection) qui permettaient a l'époque...

DIAPO 135 *Vue prise avec Hypergonar.*

... Une prise de vues anamorphosée comme celle-ci, peuvent-ils aujourd'hui encore, être utilisée pour la restauration des films de cette date.

DIAPO 136 *Brevet Lumière, Kodak-Pathé 2/63.*

De plus, l'étude des brevets originaux, ici l'appareil Lumière...

DIAPO 137 *Brevet Lapiposcope.*

Ici le "Lapiposcope", appareil du au Sieur Lapipe, outre qu'elle permet de mieux connaître les conditions de réalisation de certains films anciens, peut parfois s'avérer une source technique très utile pour la mise au poit d'appareils ou dispositifs particuliers, mécaniques ou optiques, de restauration.

DIAPO 138 *P.R. Caméras Gaumont et Prozincki.*

Enfin, la présentation de ces matériels dans des expositions itinérantes, à côté d'affiches, de photographies, de documents, permet-elle d'entretenir des liens nouveaux avec des déposants potentiels, qui contribueront à enrichir l'archive.

DIAPO 139 *Schéma vidéodisque*

Un mot pour terminer, car je crois avoir quelque peu dépassé mon temps de parole.

Les techniciens de l'archive ne peuvent être seulement tournés vers le

passé; au contraire, ils doivent être attentifs aux techniques nouvelles susceptibles de contribuer à une meilleure conservation et une plus large diffusion du patrimoine des images en mouvement, comme le vidéodisque par exemple. C'est pourquoi un ou deux chercheurs au moins doivent être affectés en particulier à l'étude et à la recherche technique, à l'innovation et au dialogue avec les constructeurs et les industries techniques.

DIAPO 140 *Affiche "La Poule aux oeufs d'or".*

Car si le cinéma n'est plus tout à fait, aujourd'hui, cette "Poule au oeufs d'or" qu'il fût, en son âge d'or et de silence, pour certains hommes d'affaires avisés...

DIAPO 141 *Homme sur la lune.*

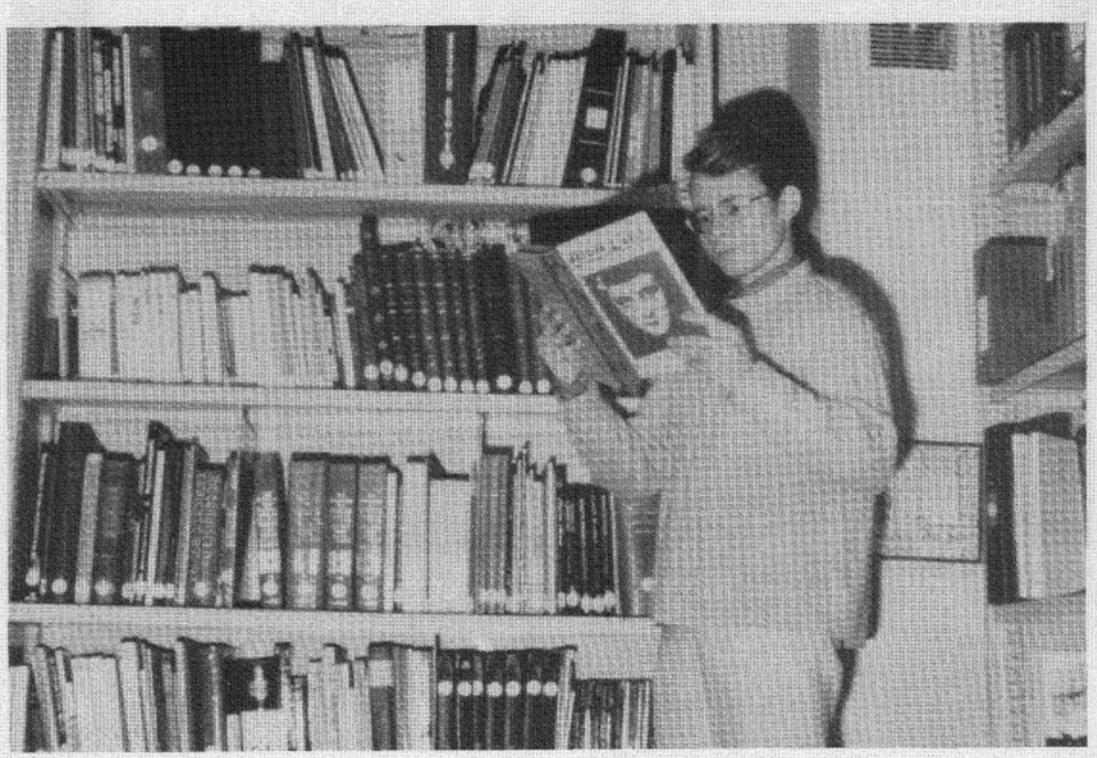
... De nouveaux horizons s'offrent à lui. Une caméra, un film accompagnaient les premiers hommes sur la lune. Nous avons, nous dit MAC'LUHAN, quitté la galaxie Gutemberg: le cinéma est du voyage; raison de plus pour être vigilant, et en porter le témoignage vers les générations futures.

DIAPOS 141
et 142 *Images numériques Méliès, Kodak — Pathé 1/79 et 1/80.*

... Fusse en utilisant, pour celà des procédés nouveaux d'enregistrement et de restauration des images, comme ces images numériques peuvent déjà nous le faire imaginer.

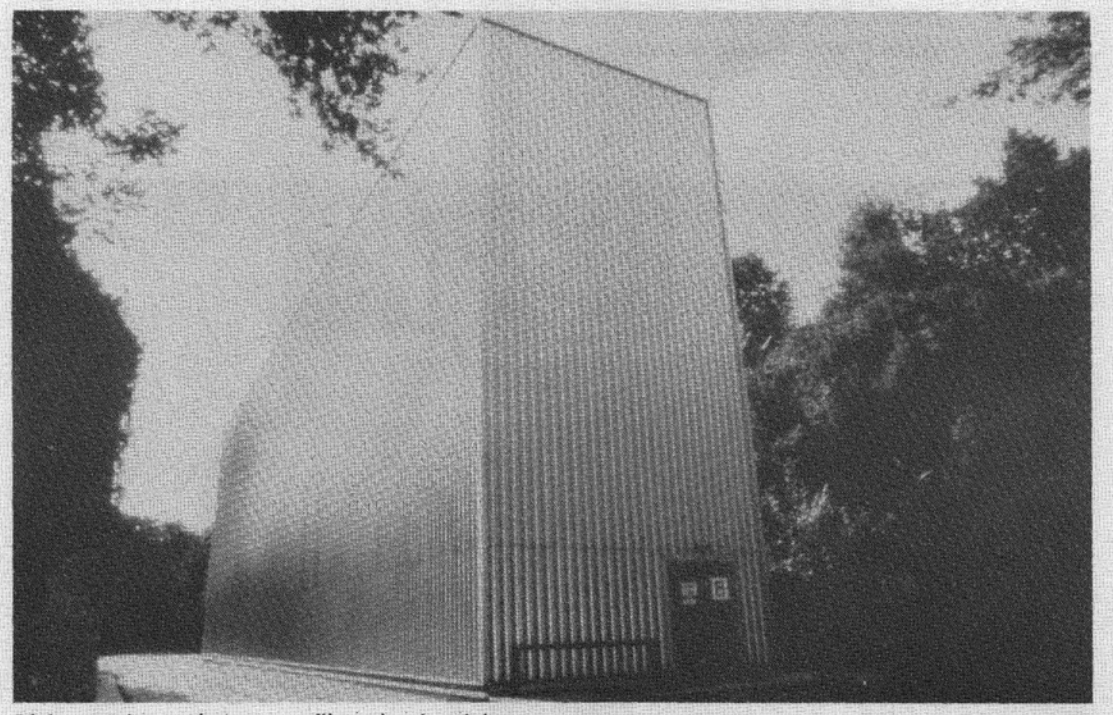
DIAPO 143 *Titre "Bonsoir".*

En vous priant de bien voulor m'excuser d'avoir été à la fois trop long et trop succinct, je vous remercie, Mesdames, Mesdemoiselles, Messieurs, de votre bienveillante attention.

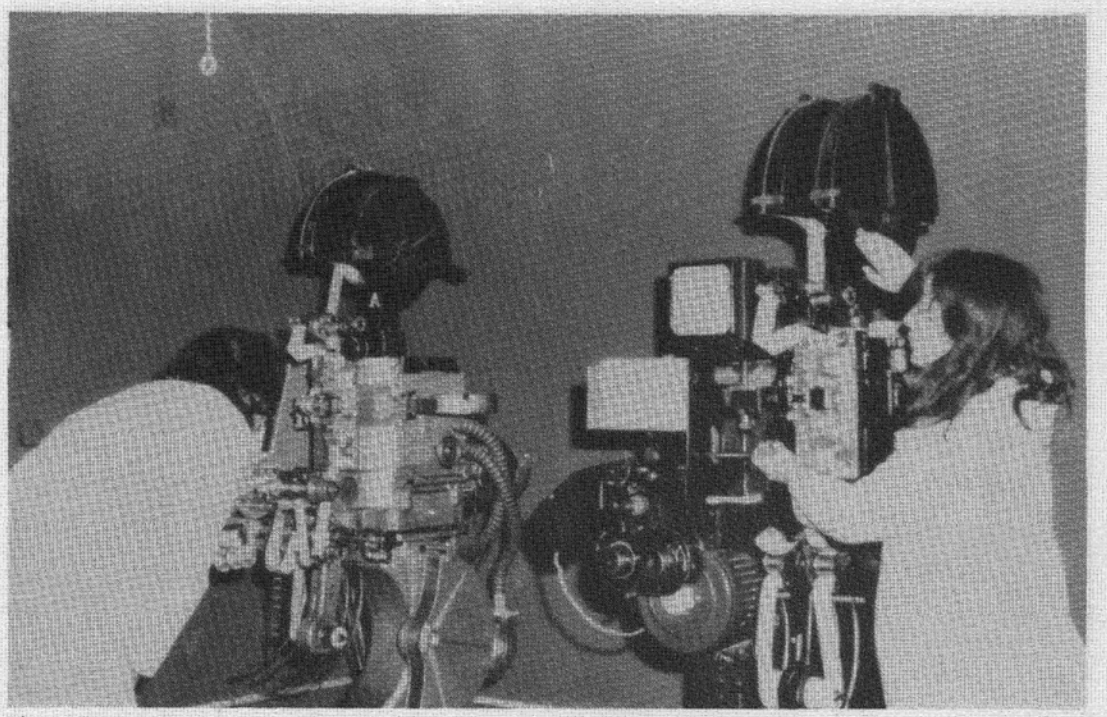


Bibliothèque de documentation

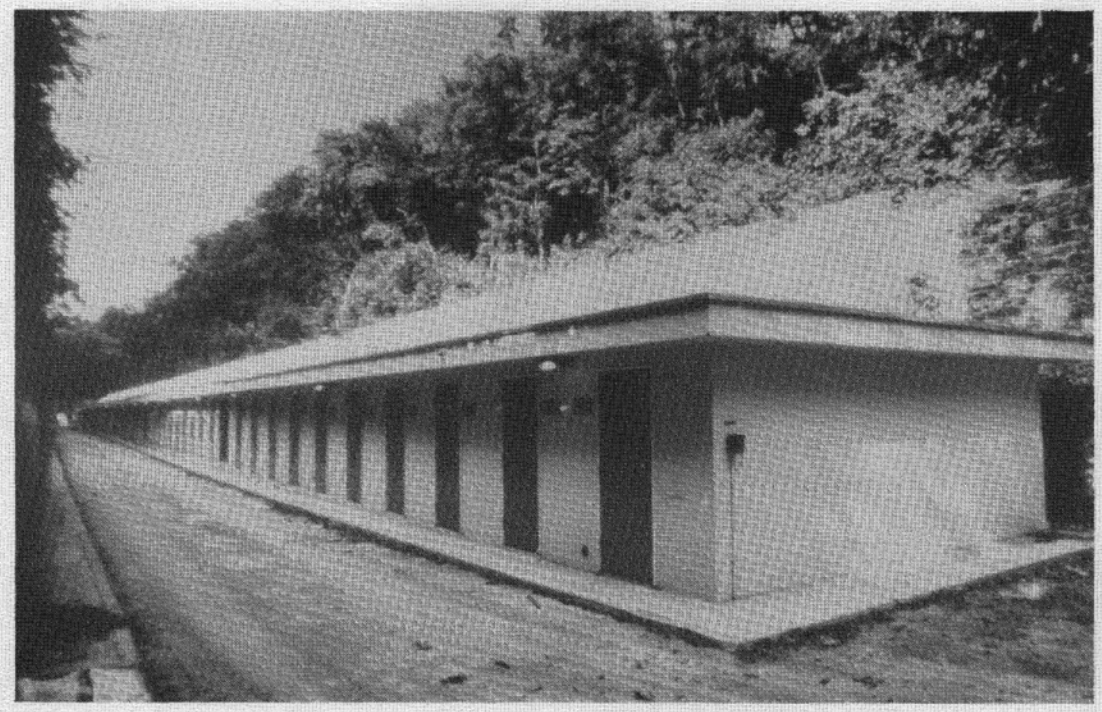
Une salle de Vérification



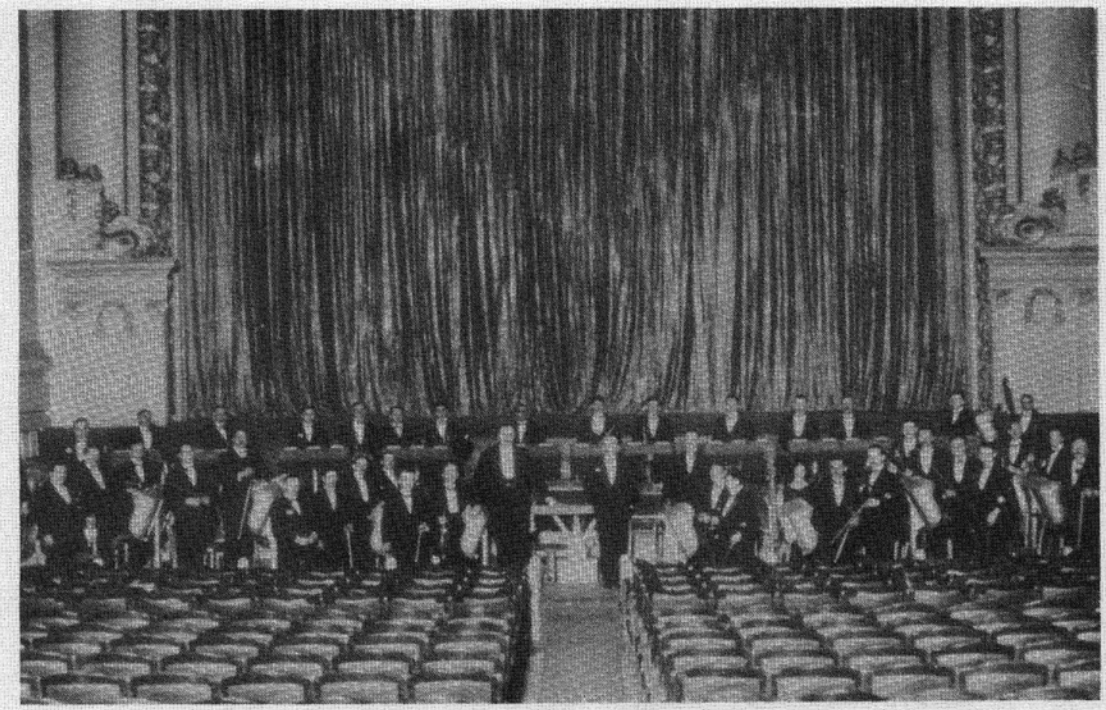
Bâtiment de stockage pour films de sécurité



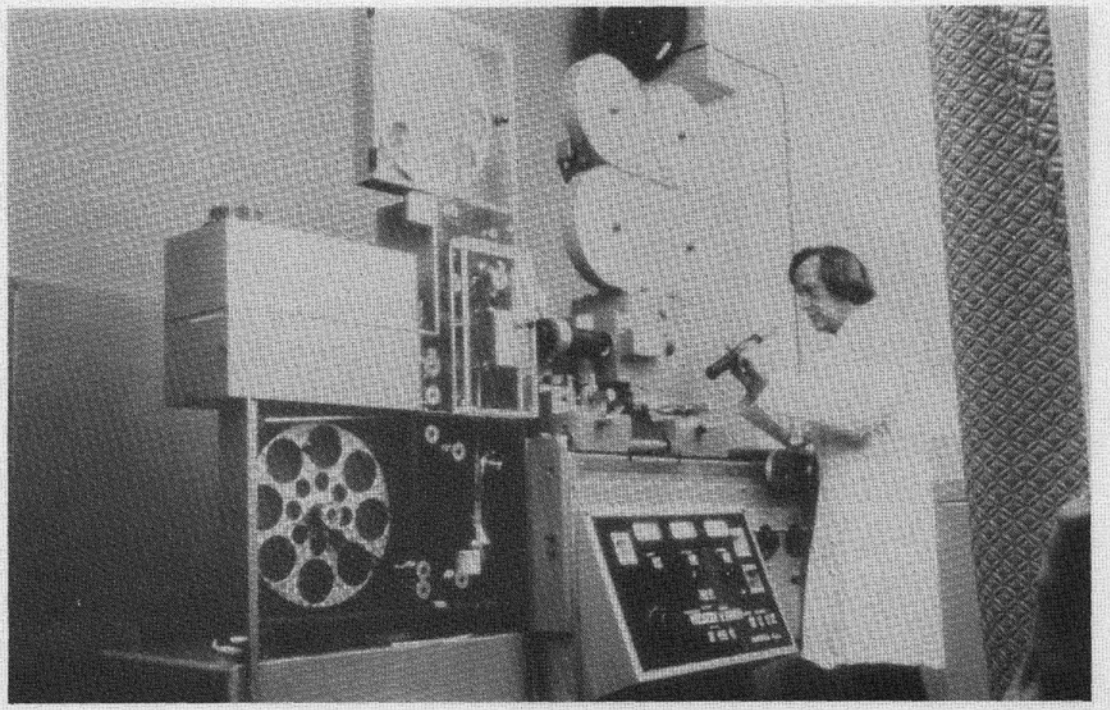
Tireuses 35mm
Debrie



Cellules de stockage pour films "nitrate"

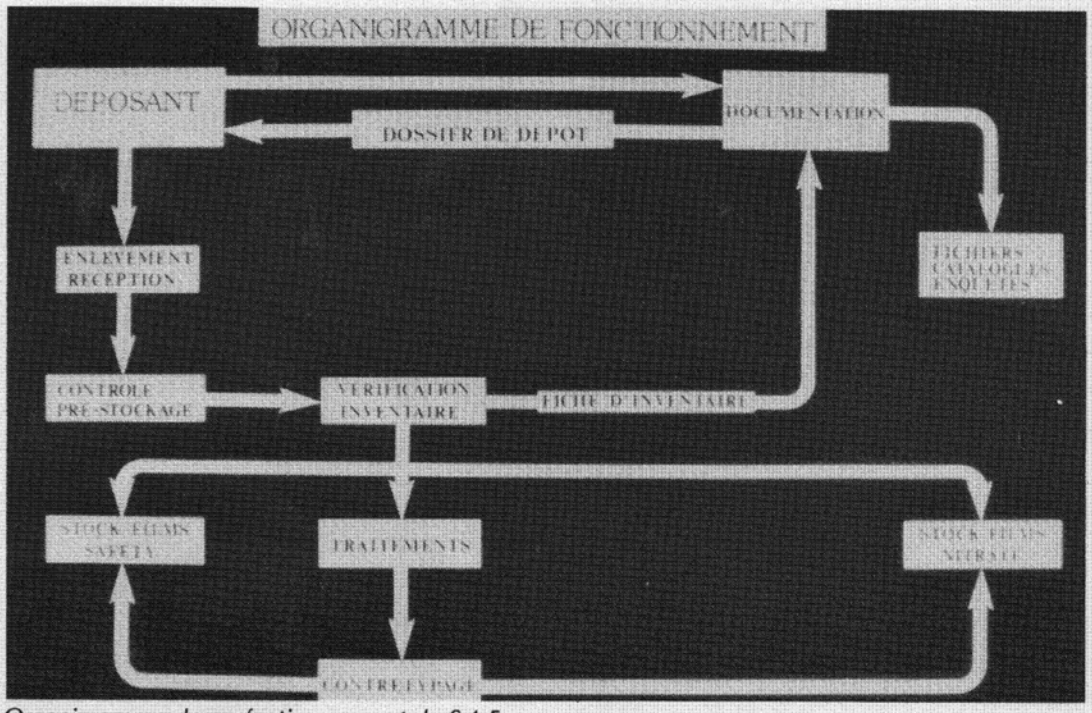


Dans les années vingt, l'orchestre de Paul Fosse au Gaumont-Palace, à Paris, accompagnant les projections de films muets

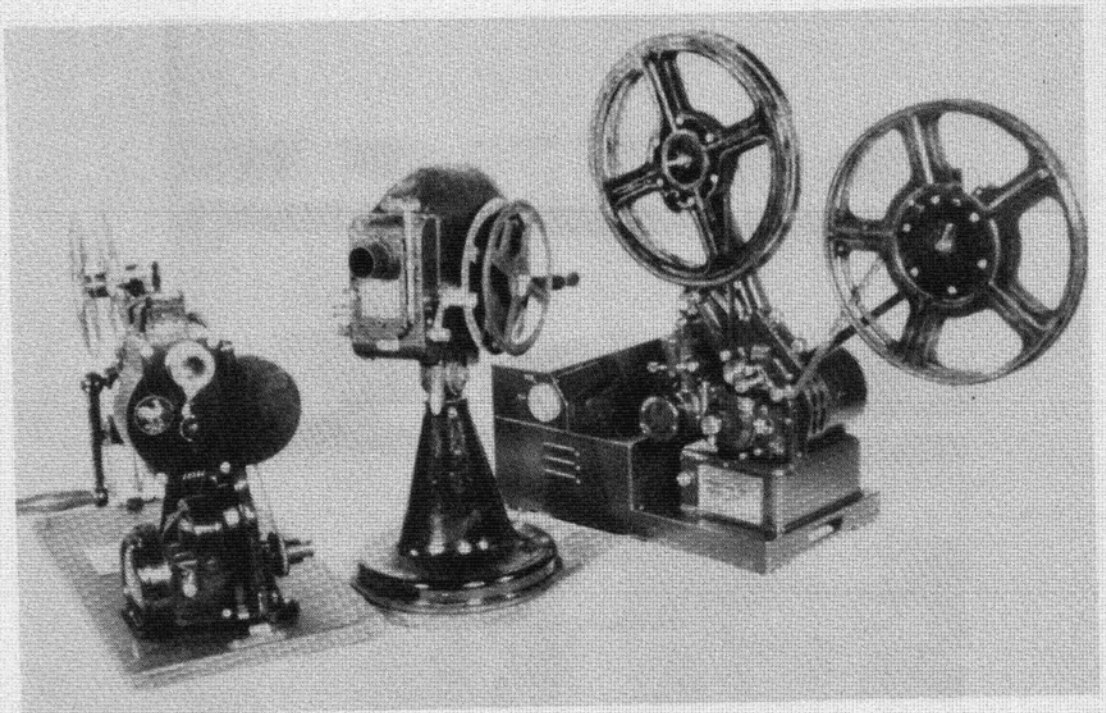


Tireuse optique spéciale "SOMAPRA"

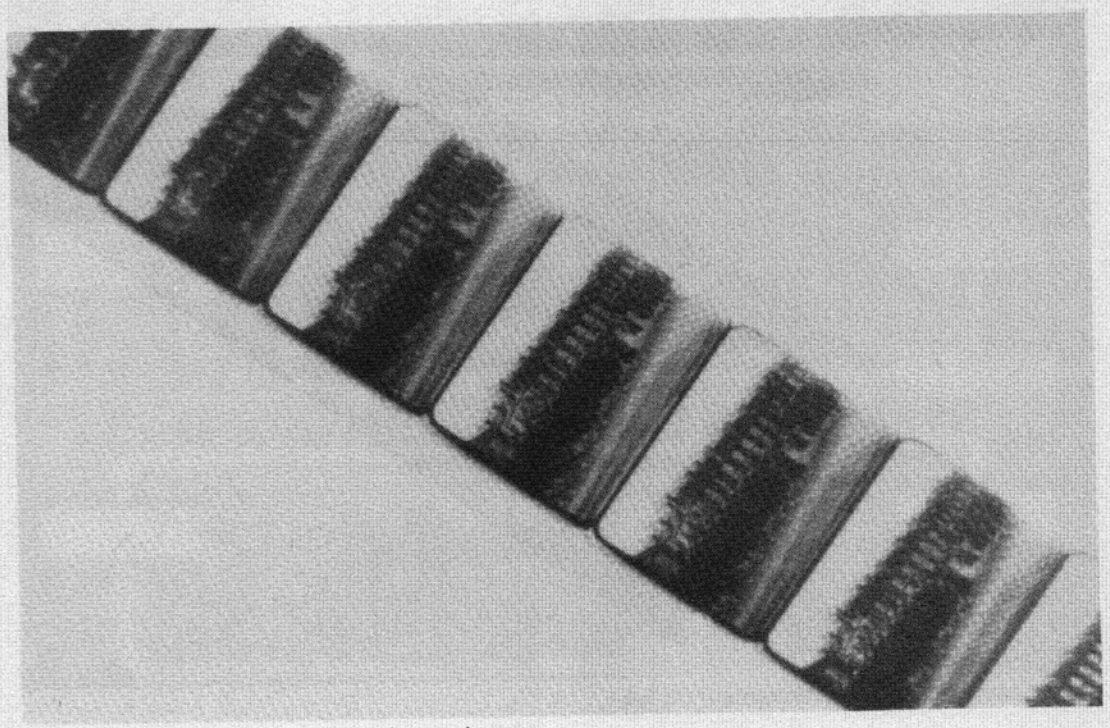
Décollement des films en armoire athermi



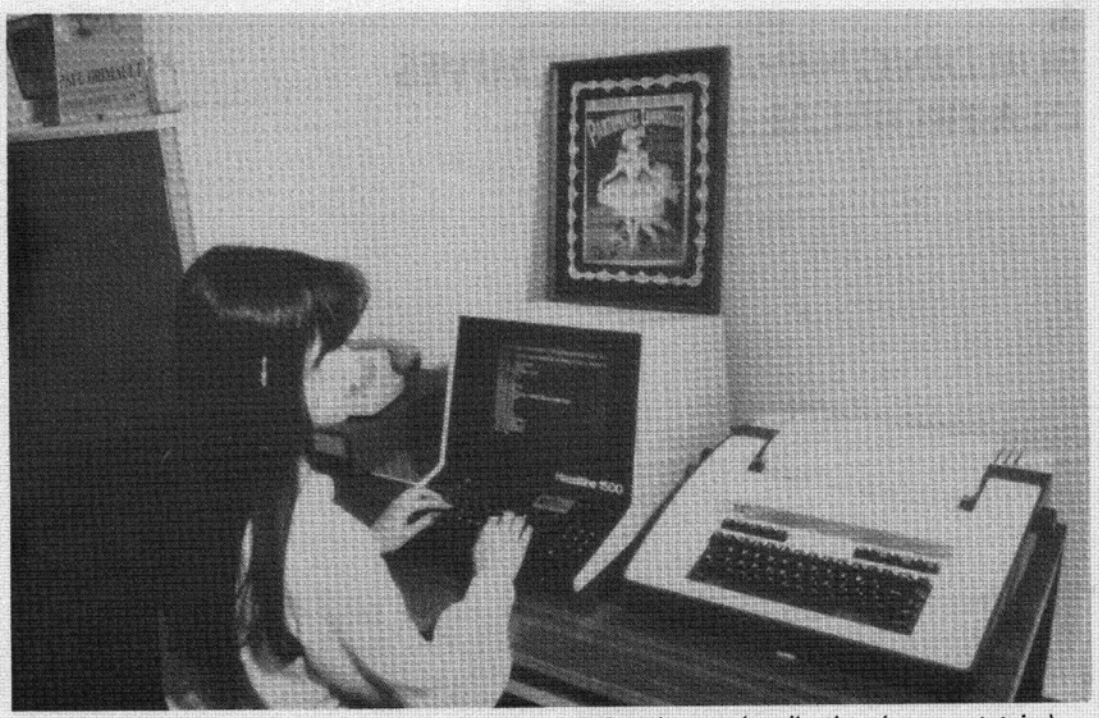
Organigramme de perfectionnement du S.A.F.



Appareils anciens de collection de gauche à droite:
– Pathé-Kok (28mm)
– Projecteur Gallus (22mm)
– Projecteur Pathe-rural (17,5mm)



Film lumière à 2 perforations rondes par image



Console de visualisation en terminal d'ordinateur, avec imprimante (application documentataire).

3.
BUILDING NEW FILM ARCHIVES IN A TROPICAL COUNTRY

Trinh Mai Diem
Cinémathèque Vietnamienne

The Film Archives of Vietnam were officially set up on September 22,1979 according to a resolution of the Council of Ministers of the Socialist Republic of Vietnam. It is a national establishment for storing films under the Ministry of Culture.

Their task is to receive copies of every film made in our country to keep and preserve them together with all films dealing with Vietnam made by foreigners that are available to us and to store in a selected way major and valuable film produced in foreign countries.

Now we have some 60,000 black-and-white or colour reels, about 10,000 film titles many of which are invaluable, especially those concerning our own country by foreigners and those made by Vietnamese film-makers themselves.

Owing to the fact that our Archives was set up recently, our experience on storing and preserving films in a tropical country like Vietnam is still rather poor. And yet we try dealing with some problems that our Archives has solved. They are, in our opinion, the problems that any tropical archives must face.

I — Tropical Climate Is Unfavourable for Storing and Preserving Films

This is our first concern.

As a country in a tropical region of South-East Asia with an inclement climate, Vietnam's temperature and humidity fluctuate greatly. They change not only according to the four seasons but within a single day as well. While in Winter in the North the temperature is nearly 0°C and the relative humidity is over 90%, in the Southern part of our country, the temperature is 28-30°C and the relative humidity is over 80%. In Spring and in a rainy season, the humidity in many areas reaches the point of saturation or nearly so. Moreover we Northerners have to fight natural calamities: tens of hurricanes come to our shore every year and floods are our constant threats.

In such a climate most of our films stored so far have been mouldy, faded or decayed. There are some films that were mouldy or faded even right in the making in studios.

In addition to that, equipment is lacking seriously; so many films have been mouldy. Consequently the emulsion of these films is destroyed — they smell sour and all the pictures on the films may be damaged. In the process of decay, the films swelled into balls here and there. And yet, a lot of pictures can be saved as some invaluable films of Lumière and Méliès were saved by the French Film Archives years ago.

So a conclusion can be made here is that mould is the most dangerous enemy for any film archives in tropical regions.

II — Storehouses and Preservation Equipment Are Essential for Any New Film Archives in a tropical region.

Thanks to the instructions of the Commission for Film Preservation of FIAF and of the UNESCO and through our experiences, we know that in order to store and preserve films well it is necessary for us to have film storehouses up to the standard together with their modern preservation equipment. In other words, they are essentials or decisive things for any Film Archives, new or old, in tropical regions or in temperate zones.

Newly-established film archives are mostly found in developing countries where their industries are still a far cry to perfection. So preservation instruments and devices necessary for these archives must be imported from foreign countries. All these constitute a typical feature and at the same time a great difficulty for any newly set-up archives.

Once these film archives are well-equipped with up-to-date facilities and well-informed with precious experience gathered from others, a new problem cropped up to them is how to apply or use these new facilities to the full.

That is a problem our film archives are trying to solve.

III — Training and Strengthening Coutingents of Staffs Constitutes a Decisive Factor for Any Film Archives.

In order to build a new film archives, in addition to the amount of films stored, storehouses and preservation equipment, it is necessary for the establishment to be well staffed with skilled workers and qualified cadres.

The contingent of cadres must be composed of all categories of specialists: technicians, documentalists, managerial and logistical workers. Among them technical cadres are most important and therefore their contingent must be formed before the setting-up of the archives.

But, unfortunately, most of the newly-established film archives are in developing countries, so there are not enough specialities for them all.

So another problem for them is that they need much more help and aid from long-established film archives and international organizations such as FIAF and UNESCO.

The visits or practising tours or crash courses for new apprentices to such foreign film archives as those of the USSR or the GDR are very useful for them. This is also a good experience for various film archives in the strengthening of their relationship, especially the new ones.

On the whole, documents and instructing manuals edited by FIAF and by its members are very helpful for newly-established film archives.

All these are indispensable in training and building contingents of staffs for new film archives. Nevertheless, staffs of new film archives, during their studies and absorption of the quintessence and precious experience of advanced film archives, must know how to apply what they have learnt into the real situations of each country, each establishment, especially those in tropical regions.

In addition to the three above-mentioned important points, which are essential to any newly-established film archives in tropical regions, there are still some more that are worth mentioning here.

Firstly, there must be rules and regulations for any newlyestablished film archives. The money necessary for building them or for their equipment in the early stage must be invested or at least subsidized by the State.

Secondly, in order to build any new film archives it is necessary to bring into full play all capacity of research, or scientific or technological institutes, or scientists at home or in foreign countries.

Thirdly, with our full knowledge and sense of responsibility, we know that film archives are not merely the properties of each nation but also a valuable possession of the whole mankind so there is no reason why we members of the FIAF will not help one another within our own capability, so as to at any cost safeguard the productions of the young Film

Archives on the one hand enable the developing countries that want to set up their own Film Archives but have not had enough necessary means to do so on the other.

On behalf of those who are in charge of preserving films in Vietnam we convey our sincere thanks to all individuals and organizations that have helped us in the course of building the Film Archives of Vietnam.

Thank you for your presence here.

POUR L'EDIFICATION D'UNJEUNE ARCHIVE DU FILM DANS UN PAYS TROPICAL

Intervention du délégué de l'Institut des archives du film du Vietnam.

Messieurs et camarades.

l'Institut des archives du film du Vietnam a été fondé officiellement le 22 Septembre 1979 — sur la décision du Conseil des ministres de la RSV.

l'Institut des archives du film du Vietnam est un dépôt de film, relevant du Ministère de la Culture.

l'Institut des archives du film du Vietnam a pour tâche de mettre en dépôt légal, d'archiver et de conserver tous les films de la Cinématographie, de la Télévision vietnamienne et les films sur le Vietnam produits par les pays étrangers. Il archive de caractère sélectif des oeuvres cinématographiques étrangères de valeur.

Actuellement, nous avons en archives environ 60.000 bobines de film noir et blanc et on couleur, dont 10.000 films de long et de cout métrage, beaucoup sont des films de valeur, on particulier, les films vietnamiens et les filme sur le Vietnam montés par des metteurs-en-scène étrangers.

Comme vous le savez, notre Institut a été récemment fondé. Il nous manque d'expériences dans l'archivage et la conservation des films dans la zone tropicale, comme dans notre pays. Néanmoins, nous tâchons de relever qualques problèmes que nous avons à résoudre, et d'après nous ce sont là des choses bien nécessaires pour un jeune Institut des Archives du film dans la zone tropicale.

1) Le climat tropical est dur pour la conservation et l'archivage de film.

C'est là une préoccupation de premier ordre pour tous ceux qui font le travail de conservation et d'archivage dans notre pays.

Le Vietnam est un pays de l'Asie du Sud-Est, il a un climat tropical très dur, les différences de température et d'humidité dans une journée comme dans les quatres saisons sont très compliquées. En hiver, pendant qu'au Nord, la température descend presque jusqu'à 0° et l'humidité est supérieure à 90%, au Sud, il fait toujours chaud avec une température variant de 28° à 30° et une humidité de 80%. Ainsi, dans un même espace de temps, dans notre pays, il y a beaucoup de zones climatiques avec la chaleur et l'humidité très différentes. Surtout au printemps et dans la saison des pluies, dans certaines régions, l'humidité de l'atmosphère approche au atteint la saturation. En outre, tous les ans, au Nord, nous devons faire face aux calamités naturelles: des dizaines de typhons se produisent. A cause des pluies abondantes, nous avons été toujour victimes de fortes crues et de grandes inondations, l'humidité est saturée dans l'atmosphère.

Dans de telles conditions, nos films sont souvent moisis, décolorés et rapidement défraîchis. Pire encore certains sont moisis et décolorés ou cours même du processus de production dans les studios.

A cause du climat tropical et de la pénurie grave des équipements techniques pour la conservation, nos films sont souvent moisis, d'où la détérioration de l'émultion sensible, ainsi les images se détruisent, dans cette période le film sent l'acide. En se décomposant, la

bobine de film se colle en durcissant. Alors que dans un climat tempéré où on peut sauver quelques métrages de l'image, comme en a fait la cinémathèque française pour les films inestimables de Lumière, de Méliès, etc...

De là, nous pouvons tirer une conclusion: la moisissure est l'ennemie la plus dangeureuse des jeunes archives du film des pays tropicaux.

2) Les dépôts et les équipements techniques de conservation sont des besoins essentiels d'un jeune Institut des archives du film dans un pays tropical.

A travers des documents de la commission de préservation de la FIAF, de l'UNESCO et nos expériences pratiques. Nous concevons justement que: Pour archiver et conserver bien les films, il nous faut des magasins de dépôt répondant aux normes techniques et équipés de moyens techniques de conservation moderne. Autrement dit, les dépôts et les moyens techniques de conservation sont la base et les conditions décisives d'un Institut des archives du film, bien que ce soit un jeune Institut ou un Institut fondé de longue date, dans la zone tropicale ou tempérée.

Ici, nous devons affirmer franchement que: Les jeunes Instituts se trouvaient souvent dans les pays en voie de développement. Dans des pays, líndustrie n'est pas encore assez développée. C'est pour cela que les moyens techniques nécessaires doivent être importés, c'est là une caractéristique et une grande difficulté pour un jeune Institut des archives du film.

D'autre part, une fois équipés de moyen technique moderne, et avec les expériences précieuses des Instituts modernes, les jeunes Instituts doivent savoir les utiliser de manière la plus rentable.

C'est le problème que nous tenons à résoudre...

3) La formation d'un contingent de cadres et d'ouvriers spécialisés est une condition décisive pour un jeune Institut des archives du film.

L'édification d'un jeune Institut des archives du film exige — outre des films à archiver, des dépôts et des moyens techniques — un contingent de cadre et d'ouvriers qualifiés. Le personnel d'un Institut des archives du film doit comprendre les techniciens, les cadres s'occupant du dossier et de la liste des films, et même les cadres de gestion et les cadres-fournisseurs dont les techniciens sont les plus importants et doivent être préparés à l'avance pour constituer un Institut des archives du film.

Comme ce qui est dit ci-dessus, les jeunes Institus des archives du film ont été fondés souvent dans les pays en voie de développement. Certains de ces pays ne sont pas encore assez développés pour former un contingent de cadre spécialisé suivant les exigences d'un Institut.

Ainsi, il importe que les Instituts des archives du film qui ont eu une longue date et beaucoup d'expériences ainsi que les organisations internationales FIAF et UNESCO prêtent leur attention et leur aide envers les jeunes Institut dans le travail de perfectionnement, de recyclage et de formation des cadres spécialisés, comme on a fait auparavant avec succès. Et ces travaux doivent être intensifiés encore plus.

Les visites, les courts stages sont les meilleurs moyens pour former et recycler les cadres spécialisés pour un jeune Institut comme on fait les Instituts des archives du film internationaux de l'URSS et de la RDA. Pour aider notre pays dans les premières années de la création de l'Instut vietnamien. C'est aussi la meilleur expérience de l'entre-aide des Instituts, surtout, pour les jeunes Instituts.

Les documents, les revues de caractère professionnel de la FIAF et des pays membres sont très utiles et efficaces pour les jeunes Instituts.

Toutes ces actions ont des effets positifs et réels dans le travail de formation et de création d'un contingent de cadres des jeunes Instituts. Au cours des études des expériences. Des Instituts des pays avancés doivent savoir les appliquer aux réalités de chaque pays, surtout, dans les pays tropicaux et cela pourait donner des résultats concrêts.

Les points importants sus indiqués sont aussi les besoins essentiels d'un jeune Institut dans les zones tropicales. Nous voyons encore d'autres facteurs, moins importants, mais qui ne peuvent pas être manqués dans un jeune Institut des archives du film.

Ce sont des statuts et des règlements pour garantir la création d'un jeune Institut, le fond investi pour l'édification et la base matérielle technique doivent être fournis par l'Etat ou assurés par l'Etat.

En outre, pour édifier un Institut, il faut mobiliser la force générale des services de recherche, des Institus scientifiques, des hommes de science et des techniciens du pays. Il faut encore étudier les expériences, les précieuses leçons des Instituts des archives du film dans le monde.

Enfin, avec un esprit de responsabilité, une fois que nous concevons que les films-documents sont non seulement les patrimoines nationaux propres à chaque pays, mais aussi un héritage culturel précieux de l'Humanité entière. Il n'y a pas de raison d'être que nos Instituts dans la FIAF se refusent l'aide mutulle selon leurs capacités pour conserver à tout prix les films documents des Instituts encore embrionnaires, mais encore pour créer des conditions favorables à la fondation des jeunes archives qui n'arrivent pas encore à concentrer suffisamment les exigences de base et les moyens nécessaires. Surtout, au point de vue scientifique et technique.

Enfin. Au nom de tous les travailleurs du Vietnam dans l'ceuvre de la préservation des films. Nous vous remercions sincèrement de votre attention et de votre aide envers l'édification de notre Institut.

Encore une fois, merci à tous.

ESTABLECIMIENTO DE UN NUEVO ARCHIVO DE PELÍCULAS EN UN PAÍS TROPICAL

Trinh Mai Diem
Cinémathèque Vietnamienne

El Archivo de Películas de Vietnam fué establecido oficialmente el 22 de Septiembre de 1979, de acuerdo con una resolución del Consejo de Ministros de la República Socialista de Vietnam.

El Archivo es una entidad nacional para el almacenamiento de películas, subordinada al Ministerio de Cultura.

Su función consiste en proceder al depósito legal, archivo y conservación de todas las películas de la Cinematografía y Televisión vietnamitas, como también las películas producidas por países extrangeros que se refieren al Vietnam. También almacena un número seleccionado de películas valiosas producidas en países extrangeros.

En la actualidad contamos con aproximadamente 60.000 rollos de películas en blanco y negro o coloridas, unos 10.000 títulos de películas de largo y corto metraje. Se trata de muchas películas de valor, especialmente aquellas producidas en nuestro país y las referentes al Vietnam que fueron dirigidas por extrangeros.

Como ustedes saben, nuestro Archivo fué fundado recientemente y aún tenemos escasa experiencia sobre el almacenaje y conservación de películas en un país tropical como el Vietnam.

De cualquier manera vamos a referirnos a algunos problemas que precisamos resolver y a aspectos que nos parecen indispensables para un nuevo archivo de películas situado en una región tropical.

1. — EL CLIMA TROPICAL ES PERJUDICIAL PARA EL ALMACENAMIENTO Y CONSERVACIÓN DE PELÍCULAS

Esto constituye una preocupación de primera magnitud para quienes se dedican a la conservación y archivo de películas en nuestro país.

Situado en el Sudeste Asiático, región de duro clima tropical, Vietnam sufre de grandes fluctuaciones tanto de temperatura cuanto de humedad, con complicadas alteraciones no sólo en relación a las cuatro estaciones sino también en el transcurso de un mismo día. En el invierno, la temperatura del norte del país es de aproximadamente 0°C y la humedad relativa ambiente supera el 90%. En el Sud del país siempre hace calor, con temperaturas que oscilan entre 28°C y 30°C y humedad relativa ambiente de 80%. Como pueden apreciar, en nuestro país existen simultaneamente varias zonas climáticas con temperatura y humedad muy diferentes. Especialmente en la primavera y durante la estación de lluvias la humedad atmosférica en varias regiones llega a alcanzar el punto de saturación. Además, en el Norte enfrentamos calamidades naturales: decenas de tifones azolan nuestras costas todos los años y debido a la abundancia pluvial hemos sido víctimas de crecientes y grandes inundaciones.

En tales circunstancias nuestras películas están frecuentemente enmohecidas, descoloridas y pierden rápidamente su lustre. Y lo que es aún peor, algunas ya se encuentran enmohecidas y descoloridas durante el proceso de producción en los estudios.

Debido al clima tropical y sus efectos nocivos sobre los equipos técnicos utilizados para la conservación de películas, éstas frecuentemente se encuentran afectadas por el moho, lo que destruye la emulsión sensible y daña las imágenes. Las películas durante esa fase tienen olor rancio. Debido a la descomposición, los rollos de películas se adieren y endurecen.

En condiciones de clima templado es posible salvar algunos metros de imágenes, tal como lo hizo la Cinemateca Francesa con películas de valor inestimable de Lumière, de Méliès, etc...

Nuestra conclusión es que el moho se contituye en el enemigo más peligroso de los nuevos archivos de películas situados en países tropicales.

2. — LOS ALMACENES Y LOS EQUIPOS TECNICOS DE CONSERVACIÓN SON NECESIDADES IMPRESCINDIBLES PARA UN NUEVO ARCHIVO DE PELÍCULAS SITUADO EN UN PAÍS TROPICAL

Gracias a la documentación de la Comisión de Conservación de la FIAF y de la UNESCO, y merced a nuestra propia experiencia práctica, sabemos que a fin de almacenar y conservar bién las películas es indispensable contar con almacenes sujetos a normas técnicas y munidos de modernos equipos de conservación. En otras palabras, estos son elementos esenciales para cualquier archivo de películas, antiguo o moderno, situado en regiones tropicales o de clima templado.

Debemos ser francos: los nuevos archivos de películas generalmente se encuentran en países en vías de desarrollo, cuyas industrias aún no poseen un nivel adelantado. Por ese motivo los medios técnicos necesários para los archivos deben ser importados del extrangero. Esto se constituye en una seria dificultad para los archivos de películas recientemente establecidos.

Una vez que cuentan con medios técnicos actualizados y gozan de la valiosa experiencia de los Institutos modernos, los nuevos archivos deben estar en condiciones de aprovecharlos al máximo.

Este es el problema que estamos tratando de resolver.

3. — LA FORMACIÓN DE UN PLANTEL DE ADMINISTRADORES Y DE PERSONAL ESPECIALIZADO ES UN FACTOR DECISIVO PARA EL FUNCIONAMIENTO DE UN NUEVO ARCHIVO DE PELÍCULAS

El establecimiento de un nuevo archivo fílmico requiere, además de las películas que serán archivadas, de los depósitos y de los medios técnicos, de un plantel de administradores y de personal especializado. Los funcionarios de un archivo de películas deben incluír directores, administradores dedicados al arsenal de películas y técnicos. Estos

últimos son los elementos más importantes y precisan estar debidamente capacitados antes del establecimiento de archivo.

Tal como lo hemos señalado previamente, los nuevos archivos suelen encontrarse en países en vías de desarrollo. Algunos de estos países aún no tienen condiciones de establecer un plantel de especialistas a la altura de las necesidades del archivo.

Por ese motivo es importante que los archivos más antiguos, que cuentan con una vasta experiencia, como también los organismos internacionales FIAF y UNESCO, continúen brindando su interés y apoyo a los nuevos archivos mediante un trabajo de capacitación, actualización y perfeccionamiento de un plantel de especialistas. Esperamos que este esfuerzo sea intensificado en el futuro.

Las visitas, los trabajos prácticos, son los medios más adecuados para capacitar y actualizar a los planteles de especialistas de los nuevos archivos, según nuestra experiencia con los archivos fílmicos internacionales de la URSS y de la República Democrática Alemana en los primeros años de la creación del Archivo de Vietnam. Este es el mejor método de intercambio de colaboración, sobre todo en lo que atañe a los nuevos archivos.

La documentación y las publicaciones profesionales de la FIAF y sus países miembros son de gran utilidad para los nuevos archivos.

Todas estas medidas producen resultados prácticos y positivos en lo concerniente a la creación y capacitación del personal responsable por un nuevo archivo.

Es necesario que los archivos de países desarrollados, al brindar su colaboración, lo hagan adaptándola a la realidad de cada país, especialmente en el caso de países tropicales, con el objetivo de obtener resultados concretos.

Existen otros elementos que a pesar de su menor relevancia no pueden estar ausentes en un nuevo archivo de películas. Se trata de los estatutos y normas que garanten la creación del nuevo archivo, los fondos necesarios para su construcción y las bases materiales y técnicas que deben ser brindadas o aseguradas por el Estado.

Para establecer un archivo es además necesario mobilizar los sectores de investigación, los institutos científicos, los hombres de ciencia y los técnicos del país. También deben ser estudiadas las experiencias, las valiosas lecciones brindadas por los archivos de películas de otros lugares del mundo.

Con espíritu de responsabilidad aceptamos el concepto de que las películas-documento no son tan sólo un patrimonio nacional, propio de cada país, sino una herencia cultural de gran valor para toda la humanidad. No existe ningún motivo para que los archivos miembros de la FIAF dejen de brindarse ayuda mutua, de acuerdo con su capacidad. Así, conservaremos a todo precio las películas-documento de los archivos que aún se encuentran en fase embrionaria y conseguiremos crear condiciones favorables para la creación de nuevos archivos que todavía carecen de los medios y condiciones básicas para tal fin, especialmente en lo que concierne al aspecto técnico y científico.

Finalmente, en nombre de todos los trabajadores que en Vietnam nos dedicamos a la tarea de conservación de películas, agradecemos sinceramente vuestra atención y vuestra colaboración en el establecimiento de nuestro archivo.

Muchas gracias.

4.
TECHNICAL HANDLING OF NITRATE FILM — STORAGE OF NITRATE FILM — STATUTES — STANDARDS — REGULATIONS IN THE GDR

Hans Karnstädt
Staatliches Filmarchiv der Deutschen Demokratischen Republik

A very large part of the collection of the Staatliches Filmarchiv der DDR still consists of nitrate filme. Currently we store approx. 120.000 reels of nitrate stock. In the GDR storage, transport and technical handling of nitrate film are governed by a number of legal clauses. Based on the regulations of labour protection and fire prevention, and the handling of celluloid, a decree was issued by the Ministry of Culture in 1969 to guarantee the protection of health and labour, and fire prevention when handling, screening, storing and transporting nitrate film. Listed in this decree which applies to all institutions that come under the authority of the Ministry of Culture, are those institutions which are currently entitled to store, screen and handle nitrate film material.

1. Provisions for fire prevention and constructional design

All premises in which nitrate film is stored or handled are exposed to fire risks. They therefore come under the highest category of fire hazard. The constructional design and the fire fighting appliances of such premises must comply with GDR standard TGL 10685, 17601 and the special construction engineering regulations. The storage rooms are to be classified in category 1 of resistance to fire. As a rule, smoking is strictly prohibited in all rooms, and fire, open light and individual electric radiators must not be used either. These restrictions must be brought to public attention by appropriate notices.

According to GDR standard TGL 30028-01, a stipulated number of small fire extinguishers must be ready for use in each work room and storage room. The standard also stipulates the make of the fire extinguishers and the distance at which they have to be mounted. In rooms is which technical work on nitrate film is performed, portable fire appliances must be installed at a distance of 10 m.

Work rooms and storage rooms need to have windows with pressure-operated blast vents attached to them, which open to the outside under the force of a specific pressure. The windows are required to have a unit area of at least approx. 25 m^2.

The windows of the work rooms must be neither barred nor wired. Windows that are meant to serve as emergency exits shall be marked as such and be kept clear at all times for evacuation. As an additional protection against sun beams blinds must be mounted in front of the outside windows of the storage rooms. Work rooms and storage rooms must have one type of heating only: collective heating. Each radiator must be covered with a guard which is to be mounted at an angle of inclination of at least 60 degrees.

Electrical plants and devices must comply with the electrical GDR standard, i.e. they must correspond to the degree of protection stipulated for technical work on nitrate film. It must be ensured that heated metal surfaces do not get into contact with nitrate film. All

electrical installations and devices that are installed in rooms where nitrate film is being stored or handled have to be examined twice a year.

2. Technical work

Work stations are to be organized such that the emergency exits leading to the main exit are at least 1 m wide. Emergency exits, staircases and corridors must be kept clear at all times.

Darkened work rooms must have emergency lighting operating independently of the general electrical plant and lighting up corridors and exists.

Only the quantity of nitrate film that is being worked on may be stored open at any work station. The remaining nitrate film that is not immediately being attended to must be kept in cans and film lockers.

Nitrate film may be handled in work rooms at temperatures below 30°C only. If in the warm season an increase in temperature cannot be prevented the technical work on nitrate film must be stopped.

The director in charge of the institution establishes for each room the maximum quantity of nitrate film that may be stored for technical work or storage.

Film cement and solving agents may be kept at work stations in such quantities only as are absolutely necessary for the process of work in hand. The quantity of chemicals must not exceed the daily requirements.

Film rejects of the work station must be discarded in containers made of non-inflammable material. The containers must be equipped with tightly closing lids and must be emptied daily.

Nitrate film may be screened only if there is no evidence of damage caused by storage. The projectionist is obliged to check film prints by rewinding them prior to screening.

Each film projector must be equipped with a loop switch which automatically actuates the closing of the projection and inspection holes in case of ignition of the film in the projector. In addition, an emergency stop switch must be attached to each film projector and to each entry and exit door leading to the projection booth.

For the safety of the projectionist a second person must be present in the projection booth while nitrate film is being projected. The person in question must be familiar with the safety regulations and must be able to switch off the entire installation in case of danger.

The Staatliches Filmarchiv has set up cubicles in a number of its work rooms in which nitrate film is handled, for further safety. Each cubicle is equipped with a rewinding table. If the reel of nitrate film which is being worked on were ignited, the fire would initially be restricted to that particular unit.

3. Film storage

Nitrate film must be stored in specially designed storage buildings or rooms only. No storage building must hold more than a maximum quantity of 100,000kg nitrate film, and the film material must be stored in separate rooms. The maximum admissible storage capacity per storage room has been established to be 2,500kg. According to this provision each room may hold a maximum of 1,000 reels of nitrate film, and each building a maximum quantity of altogether 40,000 (300m) reels of film.

Storage buildings with exits leading immediately into the open via corridors or staircases must have an emergency lighting system which operates independently of the regular electrical plant lighting up corridors and exits.

Only regular staff and persons who have been assigned to perform certain duties are admitted to the storage buildings and rooms. They must, however, be instructed of the nitrate film regulations before they attend to their work, or in the case of regular staff within 4 weeks after commencing employment.

Film must be kept in cans and stored on shelves of non-inflammable or flame-resistant material. The corridors between the shelves must be at least 1m in width and be kept clear for evacuation.

The outside edge of the film cans must be identified with a red mark, 1cm wide, and the lid of the can must bear a label "Nitrate Film" — "Inflammable".

A technical card is required for each print, giving date, place and results of each check and bearing the signature of the examiner. Delivery notes for nitrate film must be stamped in red with "Nitrate Film" giving data about the physical condition of the print concerned.

In the storage buildings and storage rooms film material only may be stored, with the exception of related material which is required for technical work and handling (e.g. empty cans).

Nitrate film material which is being stored permanently must be periodically inspected. Nitrate film showing damage obtained during storage must be singled out and stored separately.

The Staatliches Filmarchiv erected specially designed vaults for the storage of its nitrate film material. A nitrate vault of the dimensions 50 x 10m has 40 storage rooms. Each room has a size of 1.90 x 3.50m, and accommodates 88 film cabinets. They are made of 1.5mm steel plate, and the doors are double-walled and insulated with an intermediate layer of slag wool. Inserted for further insulation are asbestos plates in horizontal and vertical arrangements, approx. 200mm thick. Each steel cabinet holds 11 film cans which complies with the regulations for nitrate film, namely that the storage capacity of nitrate film must not exceed 1,000 reels in any given room. The vaults were constructed underground. In addition the following safety devices were installed: if at the outbreak of fire a temperature of 72°C is reached, a sprinkler system is released via a fused solder nozzle to give off water for spraying and cooling the cabinets. In each storage room there is a pressure flap which in case of fire opens to the outside signalling at the same time optical and acoustical alarm. Installed in the incoming and outgoing air ducts leading to the compartments of the air conditioning plant are fire flaps which are released via fuses. Although a number of these safety measures are not stipulated by law, we are of the opinion that the storage of nitrate film necessitates maximum safety.

Fire tests were carried out to test the operability of the steel cabinets in the nitrate vaults. Two wall cabinets with nitrate film were set up in one room. Inserted in the cabinets and in the film cans were measuring points for supervising the temperature in the course of the fire. A number of tests were carried out, some with sprinkler application and some without. It was obvious that the temperatures measured in the cabinets next to the one ablaze proved to be lowest, with additional water sprinkling system. Therefore an additional sprinkler system was installed in each nitrate film vault.

In all these tests the film reel located in the middle of a cabinet was ignited electrically, and after approx. 20 seconds thick smoke emerged from under doors and through windows. The tests showed that with the sprinkler system in operation the neighbouring cabinets had a surface temperature of maximally 82°C over a short period. The measuring points were attached to the outside door of the neighbouring cabinet immediately next to the cabinet that had been ignited. The temperature of the cabinets at the opposite wall was 61°C for approx. 5 minutes only. Since the film itself is not in contact with the walls of the cabinet, it is highly unlikely that it will ever reach the surface temperature measured at the outer cabinet walls. This assumption was also confirmed by the measuring points incorporated within a can of the neighbouring cabinets. The measuring point of a can accommodated in the cabinet above the burnt-out cabinet reached a maximum temperature of 36°C, whereas a temperature of max. 20°C was measured at the cabinet opposite. 30 seconds after the ignition the measuring point in the centre of the room read a maximum temperature of 174°C. This was, however, air temperature, as the flames did not reach the measuring point direct. In conclusion of these tests it can be said that, if fire breaks out in one cabinet, the other cabinets with an insulation of 20mm asbestos and with additional sprinkler operation, guarantee the safety of the stored nitrate film. This means, that, if for any reason whatsoever one cabinet ignited itself, only the cabinet concerned would burn out leaving the material in the neighbouring cabinets intact. Another test was carried out to this effect:

one reel located on the floor of the storage room was ignited and the flame temperature measured immediately above. A maximum value of 741°C was reached after 40 seconds.

Based on the decree issued by the GDR Ministry of Culture the Staatliches Filmarchiv der DDR has established a number of clauses on labour protection. The strict safety regulations in handling nitrate film, including regular instruction of the staff, have proved their worth in practice.

4. Film transport

Transportation of nitrate film in excess of 5,000m is reserved to vehicles of the Saatliches Filmarchiv only. Transportation by public transport is strictly prohibited. The vehicles are classified as special vehicles. In addition to a portable fire extinguisher each vehicle is equipped with another fire fighting appliance and a fire-resistant blanket to prevent fire extending to the goods loaded.

Film cans may be transported in transport containers only. The load must be secured against skidding and collapsing.

Notwithstanding the quantity and the physical conditions of the film material, nitrate film must not be transported at temperatures above 25°C in the loading space.

There is no smoking in the booth of vehicles transporting nitrate film.

5. Maintenance and repair work

Maintenance and any other type of work which involves the danger of spark formation by means of tools or any other electrically powered instruments and devices must not be carried out in the nitrate storage rooms or in any work rooms where nitrate film is being handled, until after removal of nitrate film. The workmen in charge of carrying out maintenance and repair work must be instructed accordingly before setting to work.

5.
DIALOGUE WITH A LABORATORY

Hans Karnstädt
Staatliches Filmarchiv der Deutschen Demokratischen Republik

To this day we have no evidence of any archives that have had a completely satisfactory working relationship with a commercial laboratory. There are, however, only very few archives that are able to dispense with the services of a commercial laboratory. In the course of its development, particularly in the first years of its existence, the Staatliches Filmarchiv depended on commissioning commercial laboratories with the copying of its film material. The result did not come up to optimum technical feasibilities and definitely not to requirements for the best possible preservation of archival film.

Our archives were founded in 1955. From the very beginning it has considered the printing of nitrate film on to acetate base one of its most urgent tasks. A contract was concluded between the archives and a commercial laboratory and an annual target agreed on. The archives were only the commissioning party, it had no influence whatsoever on any of the production stages including final quality inspection.

The laboratory set up a small department which was assigned to carry out printing for the Staatliches Filmarchiv only. In this department technical work was done on the printing masters in preparation for copying in contact printing machines. The film material was then included in the regular development process and subjected to the standard technologies applied by commercial laboratories. No consideration was shown for special characteristics of old film material; developing times remained unchanged, and no special type of raw stock was used, in a word our film material passed through a routine process. Often, only combined dupe negatives were made. Or, if separate negatives for image and sound were produced, the laboratory used raw stock of very steep gradation. The result was that, for instance, variable density sound was developed at conditions which produced an even poorer quality than would have been achieved with a combined dupe negative. The picture dupe negatives, and also the positives, were often copied with one printing light only. No corrections were made and no alterations in density within any one reel were considered either. The attention of the laboratory was primarily focused on employing its production to capacity, achieving high-output mass production in terms of film meters, and on making related high earnings. The general attitude was that it was not possible to improve quality of old and demaged material anyway. We gained this most deplorable experience which dates back to decades, in the early years of the archives, at a time when we had no experts in this field on our staff and were lacking in experience and knowledge.

The first step towards change was to introduce technical inspection of the copying process. This led to a major increase in the number of complaints, and a large part of the duplicated material had to be reprinted. It was, however, impossible to convince laboratory management of the necessity to adopt specific technological measures for the handling of archival film. We admit that unfortunately the quality of a large number of prints manufactured at that time is so poor that they must be recopied. This can be done because

we discontinued discarding the printing negatives as soon as we realized the principal shortcomings of that kind of relationship.

As there was no longer any basis for agreement the partnership with the commercial laboratory was broken off. The Staatliches Filmarchiv built its own laboratory which went into service in 1967. The capacity of our own laboratory of approx. 2 million meters per year does not, however, cover the existing demand of the Staatliches Filmarchiv for the copying of its own material.

Our original plans were to expand our laboratory. Unfortunately this is not possible within the foreseeable future. A few years ago we began, with the necessary funds on hand, a new partnership with a commercial laboratory at a higher lever. What are the new conditions? All items concerning collaboration are laid down by contract: output, quality criteria, methods of assessment and final inspection, deadlines, claims, etc. It was not easy to bring these changes about, since the demands made by the archives surpass those of other customers.

The contract provides, e.g. that each print must be screened for inspection by a representative of the Staatliches Filmarchiv. The laboratory is in charge of preparing for and performing this inspection. Minutes are drawn up of each inspection and confirmed by representatives of the two contracting parties. On receipt of the printing master by the laboratory a brief report is made about its mechanical quality. The criteria for the assessment of individual quality features of newly drawn prints are laid down in the contract to avoid unnecessary claims and superfluous discussions. It was agreed among other items, that only printing machines with a definition of 80 lines per mm must be used. The image position must correspond to grade 1 of the standard valid for film copying in the GDR. Also the copied material must be lint-free. The position of the soundtrack must likewise meet the same standard, i.e. no such deviations shall be tolerated as are permissible in laboratory printing for mass production. No faults in light intensity modifications are acceptable in any one reel, i.e. the newly drawn print must not be off printer scale. Maximum density variations must not exceed one printing light per reel. The quality of the splices must correspond to grade 1 of said standard. There must be an accurate change in the values selected for the printing effects of individual sequences. The surface quality must comply with grade 1 of the standard, i.e. the surface must not show any defects, unless they are so negligible that they do not become visible when the film is being projected. The state of the perforation must also correspond to grade 1, i.e. the perforation must not be damaged. Only up to three splices at the most are acceptable in any one reel, with their quality corresponding to grade 1. Splices must be carried out with the necessary care and must not show up on the screen.

Based on these and other criteria we are satisfied in general with the services rendered to us by commercial laboratories. It is also part and parcel of the contract that any lack in quality must be reported immediately or within a guarantee period of 6 months. In case of justified notification of defects the laboratory is bound to make gratuitous replacement of the rejected material within a period of 4 weeks. Any number of correction prints made for the manufacturing of a positive print must also be handed over to the Staatliches Filmarchiv. We consider this to be an important point as it enables us to check up on the actually manufactured material as compared to the quantity for which we are invoiced.

Qualified collaboration with a commercial laboratory makes high demands upon archives staff, too, regarding organization and professional qualification. The dialogue with a laboratory is only possible if it is conducted on the part of the archives, with the necessary expert knowledge, with the understanding of what a laboratory can do and what is required by the archives. All issues concerning a successful relationship between archives and a commercial laboratory have therefore been delegated to one of our best and most experienced specialists with a longstanding laboratory and archives practice.

The experience gained by these archives can be summed up as follows: The majority of commercial laboratories lack the technical devices and experience for handling archival film. However, we still think that it is possible for archives and a commercial laboratory to come to terms in a dialogue over mutually acceptable working conditions.

6.
EXPERIENCE WITH A SPECIAL PRINTING MACHINE FOR FILM WITH DAMAGED PERFORATIONS

Hans Karnstädt
Staatliches Filmarchiv der Deutschen Demokratischen Republik

Storing film material over decades in archives does not only involve changes of the emulsion, but deterioration of the mechanical properties of the film base can also be observed. The danger of damaging the perforation increases when such material is subjected to technical work and projection. Hence the large quantity of film material with perforation defects held by archives. There is still other film material with severely damaged perforation which does not permit either projection or viewing, and cannot be copied in a standard printer. It has been commom practice to repair perforation by applying perforated adhesive tape to the damaged parts in preparation for the copying process. The difficulty involved in this method is the fact that the adhesive tape available is suitable for slightly shrunken film only. In severely shrunken film the repair can only be made over the length of a few perforation holes at a time, as otherwise the shrinkage of the film would clash with that of the tape. As a result there would be a shorter displacement between the perforation holes of the two strips. This work must be done very precisely and is therefore extremely time-consuming. We know from experience that it took one staff member at our archives often up to one week to repair the perforation of a 300 m reel of film. In addition, applying tape to the damaged parts over the whole length of the film has an adverse effect on the position of the image and also on the definiton. We therefore needed a printer to copy film with severe tears to perforation, without previous repair. The Staatliches Filmarchiv der DDR commissioned the DEFA Zentralstelle für Filmtechnik to design and manufacture a special printing machine for copying 35mm film with damaged perforation.

The commission was based on the following tasks set by the Staatliches Filmarchiv:

- the special printer is expected to copy film with severely damaged perforation in the contact printing method; the perforation may protrude in parts and may be missing over several centimetres altogether on both edges; the inner edges of the perforation must however, still be intact so that they may be used for adjustment;
- the device is for image copying only;
- the device must be equipped with an exchangeable picture gate for copying silent and/or combined picture format;
- the device needs to be designed for forward run only; the printing speed may be rated in the order of 1 to 3 frames/sec;
- the device must accept film with a maximum shrinkage of up to and including 3% for printing, with the shrinkage possibly varying within one reel;
- the device must be able to print film of the perforation types referred to as Bell & Howell and of rectangular shape;
- in film with undamaged perforation the picture position error must be smaller than 20 μm;
- the electrical performance of the device must be rated so that it prints black-and-white and colour masters, negative and positive masters.

The basic setup of the special printer differs only slightly from a regular printer. The film transport, however, is completely different. The printer operates on the principle of a step-contact printer for copying image. The proper device is located at a table integrating the electrical and electronical components. The upper part comprises the components of drive, film transport, printing head and lighting of the printing gate. The device prints reels up to a length of 300 m. The films are being transported in intimate contact step by step, at a very low speed, 2 frames/sec., i.e. 300 m film is printed in 130 min. The most important feature of this type of printer is that it takes film with defective perforation over large distances on both sides of the film band. Printing is even possible with the perforation missing completely at one edge. To make up for this the inner edges of perforation must be fairly intact at the other side of the strip, and, the rest of the perforation bars must preferably still be available. They are absolutely necessary for adjusting the film at the picture gate. To adapt the printing light to the required printing levels, changes are effected by voltage alterations of the printing lamp and also by the insertion of pre-filters regarding light intensity and colour temperature. Based on the technology applied by our laboratory, damaged material is subjected to the first process only that is carried out by our machine. No provisions have therefore been made for altering the printing light from one scene to another by activating a control band.

Further explanations regarding the film path:

The printing negative and the raw stock are being fed separately to the picture gate. At the gate and the tension drive the two films are moved together past the aperture. They then pass on separately. While the above lying raw film is usually fed on sprocket drums which ensure uniform transport, this is not possible for the printing negative, due to the partially missing perforation. For this purpose provision was made for sprocketless transport by means of rubber rollers. Loops are formed in the paths of each film before and after the gate. Depending on the size of the loops the speed of the rubber rollers is controlled by means of actuators via sensing levers and microswitches to keep the two loops before and after the gate at a certain size. When, e.g., the forward loop is getting too large, the corresponding rubber roller moves slowly, feeding less film than is transported by the tension mechanism. If subsequently the loop becomes too small, a sensor is activated via a microswitch switching to a faster revolution speed of the rubber roller. With the loop becoming larger again the sensor is no longer activated and the rubber roller is reversed to a slower speed. The same system is accommodated behind the picture gate leading the film to take-up reels.

Some explanations regarding film transport and the adjusting mechanism

When designing the film transport and the adjusting mechanism for contact printing we were faced with the problem that printing masters have a different shrinkage than raw stock. The step-by-step transport is effected by a claw which grasps the printing master and the raw stock by means of two jaws for joint feed. The step of the claw is rated so that it has a value between the step for unshrunk raw stock and that for printing masters with an approximate shrinkage of 3%. The separate feeding of the printing master and the raw stock is followed by the opening of the contacts. Next, 4 pilot pins of the claw which are attached to the picture gate engage in the perforation. At this point the two films still pass in two levels, separated by a shutter, i.e. printing master and raw film are not yet in close contact. Two of the four pins are shorter than the others, and slightly oblique. They adjust the printing master in a longitudinal as well as transverse direction to the film transport mechanism. The rear pin remains set in the film transport direction, and it serves at the same time as adjusting edge for the printing master since with missing perforation the initially existing adjusting edge is no longer existent. The front pin which is flexible in transverse direction to the film, presses the printing master against the rigid pin. These two short pins keep the printing master in place, i.e. only at the perforation edges which are facing towards the image side. With this technique it is possible to print film with damaged

perforation where only the edges remain. Longitudinal adjustment is necessary, since varying film shrinkage requires film be moved different frame distances. The raw film on top is adjusted at the side in the well-known manner by a film path and in the direction of film transport by means of the two narrow pilot pins. They engage through the perforation of the printing master, and move the raw film forward by some tenths of a millimeter. This displacement of the raw film is effected always towards the direction of the film transport, since the life of the claw is smaller than the frame move of the unshurunken film. As opposed to this the longitudinal displacement of the printing master is effected towards or opposed to the direction of film transport, depending on whether the printing master presents little or severe shrinkage.

The aperture is located between the pilot pins and the claw. At the aperture which is lifted off during film transport the two films are brought together in close contact. Two different pairs of pilot pins are available for the two best-known types of perforation holes, rectangular and Bell & Howell perforations. The pin pair is exchangeable. To suit various formats and types of film, e.g. silent and negative/positive material, the aperture is exchangeable, too.

A brief explanation regarding the changing of the printing light

The voltage of the printing lamp can be changed by means of a potentiometer over an area of 18 printing levels. The setting of the various printing light grades can be read from an indicating meter. The second method of printing light variation applies two filter channels. In one of the two filter channels a control band can be inserted, with holes of various sizes, ranging from 6 mm to 22 mm. The other filter channel serves for the insertion of a pre-filter with grey and/or colour filters.

Final remarks:

This printing machine has been in use for some time now at the Staatliches Filmarchiv. The results achieved are considered to be very good. The work involved in the preparation of such damaged printing masters has been reduced to a minimum. This allows for more rational planning of the printing process for excessively damaged masters. However, the printing masters must still be subjected to a thorough examination before the printing process in order to achieve good results. Damaged perforation holes need to be cut down to prevent protruding corners from getting caught in the film path. This process is, however, by far not as time-consuming as the technology used before: application of tape over the damaged perforation parts. Furthermore, we have noted that the image position and the definition of copied material is much better in quality than that to which tape has been applied. We have introduced our new device in greater detail, as we know from experience that many archives are faced with the problem of handling and printing films with extremely damaged perforation. We are determined to demonstrate the feasibility of preserving damaged film ready for projection.

This printing machine was manufactured by the DEFA Zentral stelle fül Filmtechnik, 1197 Berlin, Gross-Berliner Dann 72. Archives showing interest in acquiring a device are asked to apply to said institution direct. Sufficient quantities of damaged material need to be available to exploit the machine over years. The Staatliches Filmarchiv is ready to copy material for other archives in especially complicated cases.

7.
BASIC FILM HANDLING

Harold Brown
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1. METHODS OF OPENING FILM CANS THAT ARE DIFFICULT TO OPEN

a. Using a screwdriver to lever the lid off:
beware of large reels as damage could occur to the film inside. This method should only be used as a last resort, as damage will also be inflicted on the can.

b. Edge of table on film rack:
this method is quite successful if the lid of the can is rolled up.

c. Karate chop method:
this is by far the best method but care must be taken as the film can easily fall out. It is not advisable to use this method on cans that have cut edge lids as one could easily cut oneself.

Recording data from a can to be discarded — information on labels, edge tape etc.

This is an extremely important practice as it may be the only clue to the identity of the material.

One also comes across bits of information inside the cans; for example, printer's instructions, light bands, editor's notes etc. These are all relevant bits of information and should be kept.

2. REMOVING A FILM FROM THE CAN

The method trat we have found to be the most successful is this: the can should be tipped onto its side or edge and then removed whilst it is still in an upright position. The reason for this is because if the film is loosely wound and an attempt is made to remove it whilst it is lying flat then there is a strong possibility that the centre of the reel could fall out.

3. CORE OR SUBSTITUTE IN THE CENTRE

a. The introduction of spacing to prevent damage to the film and to get a firmer wind. The inclusion of several multiple rolls is also advisable in order to pack out the centre of a reel with a large hole.

b. The effect that certain cores have on films, eg the grey plastic cores — these have been known to cause a film to go unstable (chemical composition reacts with the vital acid fumes).

c. Demonstrate the re-inserting of a film core.

4. WINDING ON A LARGE CORE

A large core is preferred because its larger diameter avoids so severe a bend in the film.

Emulsion out: The reason why a film is wound emulsion out is because when a film dries, the emulsion has the tendency to curl inwards — by winding it emulsion outwards it helps to counteract this action.

Protective leader: This should always be present at both the head and tail of a reel. Its function is to protect the film itself and also to ensure that the film does not get damaged in the lacing up process when being printed or projected. Protective leader is also useful in that information regarding the reel can be written on its emulsion surface, eg 13953KK — "TRIO" — COMB F/G D/Bs HEAD REEL 11 of 11

Reverse curl: Do not reverse a gross curl in a brittle film. This is likely to cause breakage of emulsion or base.

5. VIRTUES OF A FLAT WINDER

The chief virtue of a flat winder is that the film lies flat on the turntable (due to gravity) and there is no possibility of the film spilling out or loosing its centre.

In general it is preferable to use a flat winder to an upright when the condition of the film is rather poor and there are broken perforations.

6. CONTROL OF FILM WHILE WINDING

It is essential that the person who is winding the film is in complete control at all times and one should be able to stop the film at any given moment.

7. WINDING SPEED

In general the speed at which one winds a film is governed by the physical condition of the film. The film should be wound at such a speed that an even firm wind is achieved throughout.

8. MARKING THE FILMS

The correct identification and marking of reels is important. We at the National Film Archive inscribe the following information on the head and tail leader of each of our reels: LOCATION NUMBER — MAIN TITLE — DESCRIPTION — REEL NO — HEAD (OR TAIL).

Markings such as synchronisation marks should be clearly made and there should not be any doubt as to which sync mark should be used (i.e. 16 or 35mm Print sync Level sync etc.).

9. SECTION MARKING

Section marking is done only with good quality fine tissue paper — the paper should not be crumbly nor too stiff.

Paper marks are used for marking sections which are required for printing etc. There is a convention that arrows point to the wanted sections.

FILM FAULTS

1. Shrinking

This is what happens to a film as a result of loss of moisture and solvent. Water being present in both the base (cell) and emulsion.

Not all the solvent evaporates in the manufacturing stage, as some more evaporates subsequently and the film shrinks as a result.

From our own experience it would appear that the practical temperature for storage would be 13°C or 55°F, with 55% relative humidity. If you go to either extreme you will come up against various problems, such as: too high RH permits actions of fungus (mould); too low RH increases shrinkage and brittleness.

More important than trying to maintain an exact 55°, is to aim for a constant steady temperature/humidity.

The extent to which a particular film has shrunk can be measured with the use of an instrument.

2. Buckle

Buckle is a condition in which it is impossible for the film to lie flat, due to some part having shrunk more than another. This usually shows as the film forming an "arch" if the edges have shrunk more than the middle; as "edgewave" if the middle has shrunk more than the edge.

The conditions can be caused by treatments designed to eliminate scratches.

The film is buckled or contains edgewave, it can create quite serious problems when it comes to being printed. This is due to the fact that the film is not in perfect contact with the dupe stock.

3. Brittleness

This is due to the loss of moisture and solvent — the very same thing that causes shrinkage.

4. Scratching and removal of scratches

There are various types of scratches, for example there is intermittent scratching, continuous scratching (or tramlines), short fine scratches (sometimes called "rain"), transverse and diagonal scratches etc.

The seriousness of these scratches will depend on whether
a. they are on the base or emulsion or both, and
b. the depth to which the scratch penetrates the emulsion or base.

Base scratches can be physically diminished on the original film by "matting" or "polishing" or both, depending on the nature and seriousness of the scratches.

Scratches that completely penetrate the emulsion unfortunately cannot be removed, but scratches that merely pierce the surface can be treated. One such treatment is the emersing of the film in water. When the emulsion is soaked in water the gelatine swells and whilst it is in a moist swollen state the two surfaces of the scratch come together. When the film dries out the two surfaces should remain stuck together with the result that the scratch is

considerably reduced in size or even disapears.

If the lips of the scratch are not stuck together as previously described, the sharp edges of the scratch will be "rounded" so that their effect is less noticeable.

A warning in respect of washing is needed. If nitrate film has decomposed to any degree, the emulsion is likely to wash off completely. It is vital to test each piece of nitrate before washing.

PRINTED FAULTS

1. Vertical Jump

This is where the image on the screen appears to move rapidly up and down just a short distance.

This problem is more likely to occur when printing on a "Stef Printer" rather than a "Continuous Printer".

If a frame is not brought down to the correct position in relation to the piece of film stock on to which the image is being printed this vertical jump occurs.

It is usually due to damaged perforations or to the film carrying it on past the correct position.

2. Lateral Weave

This can happen in either a continuous or Stef printer and it arises when the original film is shrunk in width.

In either type of printer the film has to pass through some sort of channel which is just wide enough to accommodate 35mm film. This is alright as long as the film has not shrunk but unfortunately quite a lot of the original films have shrunk over the years quite appreciably and therefore are narrower. Consequently when they are being printed, they move from side to side thus creating the lateral weave.

3. Double Imaging

This happens on a continuous printer when printing skrunken film. If the original film is shrunk and the duplicating film has not, then the two film stocks will not move together — thus creating the double image.

4. Breathing

This is a result of poor contact between the original and duplicate stock. It may be due to the fact that the original is buckled and when printing takes place certain areas are in good contact thus giving a sharp image and in others the contact is not so good so therefore the image is not sharp and has the appearance of being out of focus — thus creating the breathing effect.

FADING OF TONED SCENES

Tinting colours the light areas and toning colours the dark areas.

If you take a black and white print and dip it in a bath of dye the same amount of dye is deposited and absorbed all over the film but where it is already black, if no light gets through at all, adding colour does not make any observable difference. Where there isn't any black you can see the colour — so effectively, tinting colours the whites.

Toning alters the silver from black opaque silver to an inherently transparent coloured silver salt. The colour will now be in what would be the blacks.

The problem with toning is that depending on the formula used, it is liable not to be permanent and can fade. The result is that instead of colour and white you are left with what amounts nearly to white and white.

FILM FORMATS

35mm: This is the original size from which virtually the whole commercial development of cinema began.

In origin it was Thomas Edison's Kinetoscope size and as the Kinetoscopes were distributed fairly widely around the world, so the films for them came into the possession of quite a number of people who then set out to make films and equipment themselves.

Originally 35mm stock was derived from slitting the film which Eastman made for still cameras which was twice the width (70mm or 23/4").

16mm: 16mm was introduced by Kodak in 1923 as an amateur home movie gauge. Originally the films provided were several, so that the film which came out of the camera was processed directly to a positive — it could be viewed.

9.5mm: 9.5mm was Pathé, home movie amateur gauge and was introduced at about the same time Kodak brought out their 16mm film.

9.5mm positive film has always been on safety stock but Pathé sold some 9.5mm safety copies which were made from duplicate negative dome of which negatives were nitrate. The main thing is that the nitrate material remained within the Pathé organisation and was never issued out to the public.

8R and 8S: 8mm was introduced by Kodak in 1935 and was produced by splitting 16mm. By doing this you had a picture which was half the width and half the height of 16mm in order to retain the normal picture proportions. In effect this gave you a picture area which was a quarter the size of a 16mm frame.

The "R" denotes the word "regular". It was only added subsequently when Kodak introduced "Super 8". Super 8 is still 8mm wide but the perforation is narrower so that the picture area is wider.

In order to maintain the proportions, the height of the picture was increased — this gave one a better quality picture than the Regular 8 due to the greater picture area.

17.5mm: The earliest 17.5mm film was introduced in 1902 by the Warwick Trading Company for amateur and under order of "Biokam". It was on a nitrate base and the Biokam was an instrument which was a camera, a printer, and projector all in one. This had a central perforation — the same sort of arrangement as was subsequently to be used in 9.5mm.

Ememann also introduced a similar film of the same width but with a slightly different shape perforation. Another form of 17.5mm was introduced by Pathé in the 1920s and was very similar in arrangement to Kodak 16mm — but just a little bit wider.

70mm: The American Mutoscope and Biograph Company used unperforated 70mm film around the turn of the century. The aspect ratio is approximately 3 to 4 and the picture occupies almost the whole of the 70mm of width with no perforations.

28mm: 28mm was introduced by Pathé in 1912 as an amateur gauge. All the positives were on safety film although the negatives were on nitrate.

The positives had a non-symmetrical perforation arrangement in that there was one perforation per frame on one edge and three perforations per frame on the other edge.

60mm: As early as 1896, 60mm films were known to exist. In the early days there were more than one form of 60mm film. The National Film Archive has some Prestwick film which is

60mm wide. It has four perforations per frame, similar perforations to the current 35mm pos perforation with approximately the same aspect ratio of 35mm.

Demeny, a Frenchman, also used 60mm film in his productions. The peculiarity about Demeny is that where in all the other gauges that are perforated there is an integral number of perforations per frame, eg 35mm has 4 perfs, 28mm has 3 perfs per frame, 16mm has 1 perf per frame etc. — Demeny's film was not like that — in each four frames there were 15 perforations.

65mm: This is an extremely rare film format. The only one that we know of is that of the Vinscope Company. The subject being the Corbett x Fitz Siminara boxing match in 1897. This format has five perforations per frame on each side. The proportions are approximate to the present 35mm pos perforation but the pitch is a little greater — giving one an aspect ratio of about 1:1.75 (proportionally wider picture than 35mm).

8.
THE ARCHIVING OF TELEVISION

Sam Kula
National Film, Television and Sound Archives

Archiving television is like wrestling with an octopus — no matter how clever you are or how fast you move, you are never really in control. There is always an extra arm, or a leg, that works loose and threatens to strangle you.

That comparison is not that farfetched for those of us who have faced the screen, surveyed the thousands of hours of film and videotape broadcast each year, and attempted to impose some kind of order on the never-ending flow of images. Controlling that flow is not easy. Not only does the sheer volume of production impose the necessity of selection from a universe of choices, but continuous innovations in recording technology and image manipulation threaten to overwhelm the archivist, *and* his budget.

First the technology. I must confess I used to be intimidated by the equipment necessary to record and reproduce high quality electronic images. Now I am terrified. In less than twenty years I have witnessed low band give way to high band, black and white pushed aside in favour of colour, 2 inch quadruplex challenged successfully by 1 inch helical, the advent of ENG and the minicassette, analog giving way to digital, and a host of advances all introduced with a ringing declaration: This is the future — buy now! Change is not an event in television, it is a way of life.

All the 'state-of-the-art' hardware that can work such miracles in image manipulation is impressive in its way, but not to television archivists who know about worms in apples. What about obsolete formats? How do you transfer low band tapes on high band machines? What do you do with video recordings that are incompatible with the equipment you have on hand? To be offered a half dozen VHS cassettes when you have just acquired a U-Matic VTR is annoying, but hardly fatal. To decide you will master all your tapes on the 1 inch 'B' format, however, only to discover that the industry around you has adopted the 1 inch 'C' format instead *is* a tragedy. The answer is caution and consultation before committing to hardware, and the maintenance of a museum of obsolete equipment to allow the transfer of *messages* long after the mechanics of the *medium* have been abandoned by the industry.

For those of us who are not electronic engineers the technology of television evokes the world of Flash Gordon, the flight deck of the Starship Enterprise, a mission launch at Cape Kennedy. Despite the jargon — time base correction, differential gain, chroma phase adjuster, sensivity threshold, velocity compensation, contour enhancement, hetrodyne modality, integration scale factor that obscures the descriptions of each 'new generation' of hardware, there *has* been solid progress. The television equipment manufacturers spawn generations faster than the Mediterranean fruit flies we used to study in biology, and the machines get better, more reliable, less expensive, and much more sophisticated every year. One-inch videotape can do practically everything that 2 inch videotape can do at half the cost; the 1/2 inch videocassette is replacing the 3/4 inch videocassete and threatens to

match its quality at half its price, and so on. The only thing that doesn't diminish in size year after year are the manuals required for maintenance.

What frustrates the humanist archivist most in the technical processing of television is that the system for generating and regenerating moving images and sound, transfers from one ribbon of oxide-coated ester to another, is sealed off from normal observation. Whether analog or digital, a videotape recording reveals nothing of its contents to the naked eye.

What goes on inside those shining metal boxes is a mystery, and yet success in archiving television is dependent on mastering the mystery. Somehow all this gleaming hardware has to be coerced or caressed into performing up to specifications and delivering as promised.

While the National Film, Television and Sound Archives is not a television production organization, nor a broadcaster, we recognized early on in the game that if the broadcaster were to take us seriously as an archives for television (and this is true of any television archives, many of whom are still treated as foundlings in the homes of the networks who own them), we would have to relate to them in two ways, technologically and operationally.

First we would have to develop the capacity to accession anything and everything they could or would deposit with us — any gage, any age, videotape or film — process it for control and long-term storage, and still be able to retrieve the images required and return it to them in copies manufactured to that elusive technical standard known as "broadcast quality". We learned very quickly that the only measure of an archive's performance in the 'real' world of the television broadcaster is the ability to deliver images, on time, *and* in the format requested. "Posterity be damned! We got to air tomorrow night"

To meet those pressures, control at every stage of processing is essential from Acquisition to final Cataloguing. The outstanding characteristic of electronic imaging to an archivist, even a moving image archivist nursed on celluloid, is the total anonymity of the medium, until it is played back on the appropriate equipment. What *is* on those tapes that are being cleaned, rewound, copied, or transferred from one format to another? What *is* in those numbered cans on the shelf? Are they preservation masters or reference copies? Are they here on loan or transfer, or on deposit for permanent retention?

The answers, of course, do not come from handling the cans. The answers must lie in internal control mechanisms that track the movement of all materials into and out of the archives. It is not just the numbers we use, it is the numbers the donors use, and the relationship between them, that must be constantly monitored, and when the conventional card file can no longer cope with the daily volume, the answer is reliance on yet another technology. Computers. Microprocessors that produce lists, print labels, catalogue cards, movement records, follow-up sheets on overdues, and dozens of other jobs that fill our days with busywork and our nights with anxiety: Which of the arms or legs is loose?

The second way in which the archives relates to the broadcasters that feed the collection is operational. The name of the game here is always immediacy. The "we need it yesterday" syndrome where *their* deadline, no matter how unrealistic, is suddenly *your* deadline.

Again technology to the rescue. In a country the size of Canada, with the chief production centers either 192 km to the east, or 584 km to the west, and the furthest production center almost 5000 km away, immediacy of access takes on another colouration. We use the broadcast network, of course, if the need really is urgent. The local station beams the signal via microwave or satellite to the production center in need. It doesn't happen very often, but it is comforting to know that the mechanism is there if need be. This year the archives installs a dish of its own, to pull signals out of the air as a monitoring device, and as a means of recording live transmissions in a crisis or during events such as elections or national celebrations where the broadcast record, if it survives, will only be the prerecorded segments on tape or film. This dish can't be used to beam signals out, but obviously that is the next stage, an uplink to accompany the downlink and thus really link our storehouse of images with those who feed those images into millions of homes.

Images, images, images. Television has a voracious appetite for moving images from every source and of every type imaginable. It feeds off old feature films, documentary footage of every description — the work of thousands of network and freelance

camerapeople around the world — and generates thousands of hours of videotape in the studio every year. Images range from talking heads, television for the ears, to spectacles shot with multiple cameras on the most elaborate sets and with all the dazzling special effects the electronic manipulation of images will allow.

The range is infinite, and if the archivist adopts the position that for every image a rational argument for retention can be made by *somebody*, for *some* purpose, then *everything* should be conserved. The only requirements then would be the space to store it, the staff to organize and service it, and the patience to sift through a haystack of trivial and redundant material every time someone needs a needle they *know* is in there, because the acquisition record says so, they saw it last week, or shot it themselves three years ago.

Since even the best organized television archives must be cost effective, especially when there is pressure on scarce resources and management is attempting to rationalize costs, any rational cost/benefit analysis must conclude that some selection is essential if the universe of images that flow across television screens is to be managed. Concede that point and the very large question remains: Which images should live, and which should die? The archivist playing God — the most difficult task of all.

Every category of television programming presents problems in selection, and each presents problems unique to the category. Not only must the television archivist make choices among news and public affairs broadcasts, but standards for selection must be developed for the less serious side of broadcasting. The sports, the soap operas, the situation comedies, which are the bread and butter of broadcasting. Programmes which are high in the audience ratings, but whose long-term research value has yet to be established.

Programming for children for example. Repetitious, inevitably, with a new audience every three to five years, but nevertheless changing in style, if not in content, and becoming more sophisticated in technique every year. How much, if anything, should be kept? A sample of every show at least once a season to mark the changes? In a more innocent time the very young demanded very little beyond a friendly face and silly costume. We have all seen what a healthy budget and an application of advanced instructional technology can do in the worldwide success of SESAME STREET. But what constitutes an adequate sampling of such programming? There is always the nagging thought that the young lady in the mouse ears, or the young man in the clown costume, will go on to success in television or in other fields. If they turn up in the Prime Minister's Office one day, will they blame the archivist for lacking the gift of prophecy?

As the educational level rises the programmes become more sophisticated in approach and more general in scope and appeal. The dividing line between educational television and popular telecasting is disappearing. Over the years every corner of planet Earth, from the depths of the sea to the edge of the solar system, and every aspect of human aspiration on it, have been explored in detail. In recent years we have seen programmes such as ROOTS or HOLOCAUST, whatever the critical reaction to them may have been, function as instant popular history: as far as millions of viewers are concerned they *are* the history. These landmark programmes are also part of the history of the medium, its coming of age, that should be conserved for that reason alone.

There are, however, many categories of programming in which the values are less apparent to the eye. Witness the quiz shows, the game shows, the award shows, the variety shows, the general entertainment series with no loftier ambition than to amuse, and to sell the sponsor's products.

And what of the commercials? There are those who argue, and persuasively, that the commercials are better made and more sociologically significant in documenting the society that produced them than the programmes they interrupt. Should they be conserved, and if the answer is yes, what constitutes an adequate sample?

The selection process is equally difficult whether assessing a large accumulation of series programming, or the output of the current broadcasting schedule. Again, repetition over months and years argues against the conservation of every episode, unless the broadcast organization served by the archives intends to repeat the series, sell them abroad, or to syndicate them on the domestic market. In the case of domestic drama, however, the 'soap operas', this does not apply as they are seldom repeated. Do we conserve samples, and

if so, what constitutes a reasonable sample? Is there a typical episode? If one considers DALLAS, the American soap opera that elevated the genre to prime time in a half dozen countries, does one keep the episode in which we all find out who shot JR (surely atypical for the series) or an ordinary episode in which there is only one marital infidelity and only one shocking revelation about past indiscretions.

Academic researchers will argue that it is precisely the changes that occur over time in these long running series that are sociologically significant and for that reason the whole series should be retained. The archivist begs off and offers the counter-argument that one series might be retained in its entirety *if* it could be identified as representative, but conserving all of them cannot be justified given the total volume of output.

Programmes such as these are never written or produced in a vacuum. If they are to retain the allegiance of their viewers they must incorporate contemporary attitudes toward every aspect of society, from alcoholism to Zen Buddhism. If the television archivist only serves the network, potential reuse will be the only criterion — including programming that documents the history of the network. If the archives is to serve a wider purpose, however, and meet the needs of academic researches, from a dozen different disciplines in the social sciences and the humanities, the selection criteria should obviously include those concerns, and consequently will be much more difficult to implement.

What are the images among the hundreds of choices available that should be scheduled for permanent retention? From one perspective every image is significant, and is self-advertised as such, and from another every one appears trivial, or repetitious, or meaningless when divorced from context in the programme schedule or the careers of those who produced it. 'Classic' performances in drama — think of Olivier in KING LEAR — may not be at issue, nor perhaps the contemporary dramas which mark the emergence of significant new talents, but so much of what passes for drama on television is so marginal that a version of Gresham's Law appears to apply: The bad programming drives out the memory of the good leaving an overall impression of mindlessness.

That is a danger, and FIAT, in its *Recommended Standards and Procedures for Selection and Preservation of Television Programme Material*, issued in 1981, proposed a delay factor of at least two years before the *initial* selection takes place. The delay recommended is five years for actuality material. *All* the material so retained should then be assessed. The hope is that even this limited historical perspective would result in a more judicious selection. Some would argue that the delay factor should be at least a generation, or 20 years. That would allow time for those minor players on the world scene, aspiring politicians, aspiring artists, to make their reputations, but it does not solve the archivist's dilemma of how to cope with the volume during the waiting period.

In the case of sports on television it is almost impossible to implement the FIAT recommendations. The volume is so great that even the producers in this field are overwhelmed, and do not argue for total retention. In practice they themselves impose selection in order to be able to retrieve the shots or sequences that can be used for retrospective mini-documentaries — the flashbacks that constitute sports history for millions of viewers.

But again, what should be sampled — the typical match or the atypical one with the sensational play or the record-setting performance? Do we restrict retention to the semi-finals or finals of competitions, knowing full well that perhaps the most interesting match, the one heralding the emergence of a new star performer, took place earlier on in the series? And how much is enough if the championships are not annual events, but week-long tournaments as in tennis, with dozens played every year worldwide?

We have moved in my lifetime from fragmentary newsreel coverage of the Olympics to comprehensive television coverage of every sport. We hold over 400 hours of the 1976 Montreal Olympics, in two-inch videotape and 3/4 inch videocassettes. A monstrous investment in tape stock, storage space and processing cost. We have never been able to fully catalogue the footage so we cannot retrieve the 'big' moments on demand. We can only lead the researcher to the sport concerned by date of competition. We assume this situation can be duplicated in every city in which the Olympiad has been telecast through worldwide satellite transmission in recent years. The same is probably true of World Cup Football. Are

we not guilty of an enormous duplication of effort when so many other images are not being conserved, or even recorded for conservation, at all?

The categories are endless, and I suspect that discussing the topic in this way is a disservice. In archiving television you are not permitted the luxury of concentrating on one aspect of production, and then only concern yourself with distinctions among productions in the category. The full range of programming has to be considered every day, and it is unlikely that the archival staff will contain experts in every field of the arts, let alone every other human activity that television will record and document sooner or later.

Obviously the answer is consultation. Advisory committees with representatives from the critical community who may be expected to rank the performances in some order of significance and from the subject specialists who can evaluate the content and place the production in some sort of context. These advisory committees can only advise, of course, the final decision must be that of the archivist: There may be administrative or programming considerations that argue for retention even though none of the other selection criteria may have been met.

Whatever the method, programmes on the arts are among the most difficult to reject, or deselect. There is always some professional career consideration that argues for retention. The history of television is a chronicle of 'firsts' and almost every one of these broadcasts incorporates some historical moment. It may only be that it was the first time a certain performer appeared, or a piece of music was played. There is an aphorism in archives science to the effect that old age must be respected; the older the document is, the more valuable it is likely to be. Old age is, of course, a relative concept. In television, such are the losses that have already occurred, it may only be a matter of a decade. Given the losses, estimated as high as 50% for the first decade of broadcasting, should everything older than ten years be retained?

The problems associated with the management of programming in categories such as music, sports and general entertainment, difficult as they may be, appear childs' play when compared with the sheer volume and variety of the material generated in documentary, public affairs and news programming. News alone, in the era of electronic news gathering (ENG), can generate three thousand cassettes every month in a major network, and with an intake that huge it is all too easy to either drown in a sea of images because processing for fundamental control cannot cope, or to throw out the baby with the bath water in the rush to discard.

If edited footage arriving at the archives at that rate, or even half that rate, presents a set of interlocking problems in accessioning, cataloguing and technical processing, the unedited footage presents processing problems of yet another order of magnitude. If control is lost at the outset and the videotape or cassettes are divorced from the cameraman's log, or daily report, or the production number, it may be next to impossible to identify the footage. Where was it shot? Who is in it? What is it supposed to be? It may be evident from a single viewing or it may remain a mystery until the production data finally does arrive and can be matched with the tape itself, if it can be found!.

A similar problem is generated by documentaries which arrive as edited footage — the programme as broadcast — but accompanied by 30 or 40 rolls of outs and trims that may be very valuable material, and still virgin as it was never broadcast. Again, careful control measures are essential to keep the fragment identified with the broadcast and yet allow them to be indexed independently so that they can be retrieved when required.

Even with actuality material, the record of television's role as an observer and reporter in the world around us, and occasionally as a participant or as a catalyst as well, the question of how much is enough is raised. American Presidents, for example, as a group, are among the most televized people in the world. There is very very little that they do while in office that is not recorded by the media, usually two or three media operating independently. Should all of it be retained? All television archivists have experienced the frustration of offering a researcher hours and hours of videotape only to be told that the one shot they are looking for is not there. That shot, of course, is the one the archives discarded as irrelevant or redundant.

Somewhere along the line, these potentially troublesome decisions have to be made, and the responsibility usually rests with the archivist. To take another example, it is widely

held that the War in Vietnam was probably the first conflict fully televised from beginning to end. As a 'television war' that endured for more than a decade, it generated tens of thousands of hours of videotape as well as hundreds of thousands of meters of newsfilm, not to mention photographs by the tens of thousands, and audio recordings that can also be measured in the tens of thousands. If only a tenth of that material is in archives, surely that is media overkill. How much is enough?

If the question is to be answered, there are other factors to be considered. There may not be as free a flow of information across international boundaries as Unesco would like, or at least not an equal flow in both directions between the developed and underdeveloped countries, but television images do travel, and as they play their part in the news and public affairs broadcasting in other lands they come to rest in many archives. It is not just the American archives, therefore, that are struggling to control and process the White House 'feed', the daily output in images, but archives in a dozen other countries are doing so as well. Somehow this situation leaves a good deal to be desired if one contemplates the efficient management of moving images as a worldwide collaborative effort.

One of the obstacles to cooperation, as the members of FIAT have discovered, is the absence of international standards for the description of television material to allow effective international exchange. Not only are no union catalogues available, but the mechanisms for establishing a data network will first have to be developed. The minimal data list that has been proposed is an important step in the right direction, if the member archives can be persuaded to adopt it.

Satellite communication has added to the problem while it holds the promise of a solution. World events, a Papal tour for example, are beamed simultaneously to dozens of networks and recorded by them for use at a later date if the live transmission arrives at an awkward hour, as it is bound to do in at least half the world. The same images then end up in a dozen archives. But properly harnessed the immediacy of response possible with satellite communication could allow an archives to rely on securing the image required from another archive thousands of kilometres away rather than attempt to duplicate the holdings. Any television archivist will argue that even *that* is not fast enough when the producer wants it yesterday, and there are endless copyright questions to be considered, but the availability of such a service should diminish the obligation all television archivists have assumed to maintain a universal bank of images, as though operating in total isolation. Meanwhile the images continue to flow across millions of television screens, and pile up in television archives. Formats change, the equipment is modified to allow more recording on smaller cassettes, thereby benefiting the archives by reducing the storage space required, while compounding the problems in processing. As the camera equipment becomes more compact, the recorders become more mobile, and as the capacity of the cassettes increases, more and more images result from any one reporting assignment. Why risk recording only five minutes of an important address when you can record the whole event? When the camera/recorder combination unit becomes as ubiquitous as the reporter's notebook, and as portable, the volume of images produced around the world will explode to the point that selection will no longer be an option, it will be a necessity.

How much is enough? The smart answer is just enough to meet one request, and the next, and the next, but without overloading the system until no requests can be met.

Maintaining that critical balance just this side of collapse has always been the challenge. There have always been archivists willing to accept that challenge, usually beginning with very little in the way of resources with which to work. They know that if the debate on just how much impact, sociological and cultural, television has had, and is having on our society is still in progress, there can be no question that the medium is a vital segment of the public record. It will be impossible to understand the history of the last half of the 20th Century without consulting that record.

9.
LONG-TERM STORAGE OF VIDEOTAPE

Jim Wheeler
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I. INTRODUCTION

Successful long-term storage of videotape recordings is definitely possible. We have played back videotapes that have been stored for more than twenty years. The ultimate life-span of videotape is as yet unknown, but we do know what is required to lengthen it. Many years of experience and hundreds of hours of investigation are behind the information contained in this report. Most of the knowledge on the care and the storage of magnetic tape has been developed during the past twenty years, and we are still learning. This knowledge has been gained by experience and tests performed on professional videotape recorders, so the information in this report pertains mainly to the widely used one-inch and two-inch videotapes.

Videotape recorders are sophisticated, precision machines that are in the vanguard of our high-technology industry. A video recording is made with a magnetic head as narrow as a human hair and traveling a mile a minute over a thin film of flexible polyester. It is not surprising that such a precision recording requires tender, loving care if all the information is to be properly retrieved after long storage. The following information has been prepared to increase the user's probability of recovering all of that information many years after it has been recorded.

II. OPERATING ENVIRONMENT

A dust-free, smoke-free, humidity and temperature controlled environment is always preferred when working with a high density media such as videotape and film. The ideal environment for tape is 35-45% RH and 65-70° F. Figure 1 is a generalized illustration of the cost tradeoffs.

Some of the components of which tape is made, are hygroscopic and absorb or lose moisture, depending on the humidity. Tests indicate that tape handling on a videotape recorder is dependent on the absolute humidity rather than on relative humidity. Absolute humidity is the amount of moisture contained in a given amount of air. A psychrometric chart

NOTICE — The information contained in this report is based on experience, theoretical investigations, and accelerated tests. By following the recommendations made in this report, the life of the information recorded on tape will be increased, but there is no guarantee that all information recorded on tape will be permanent. This presentation was adapted from a paper the author presented to the Society of Motion Picture and Television Engineers.

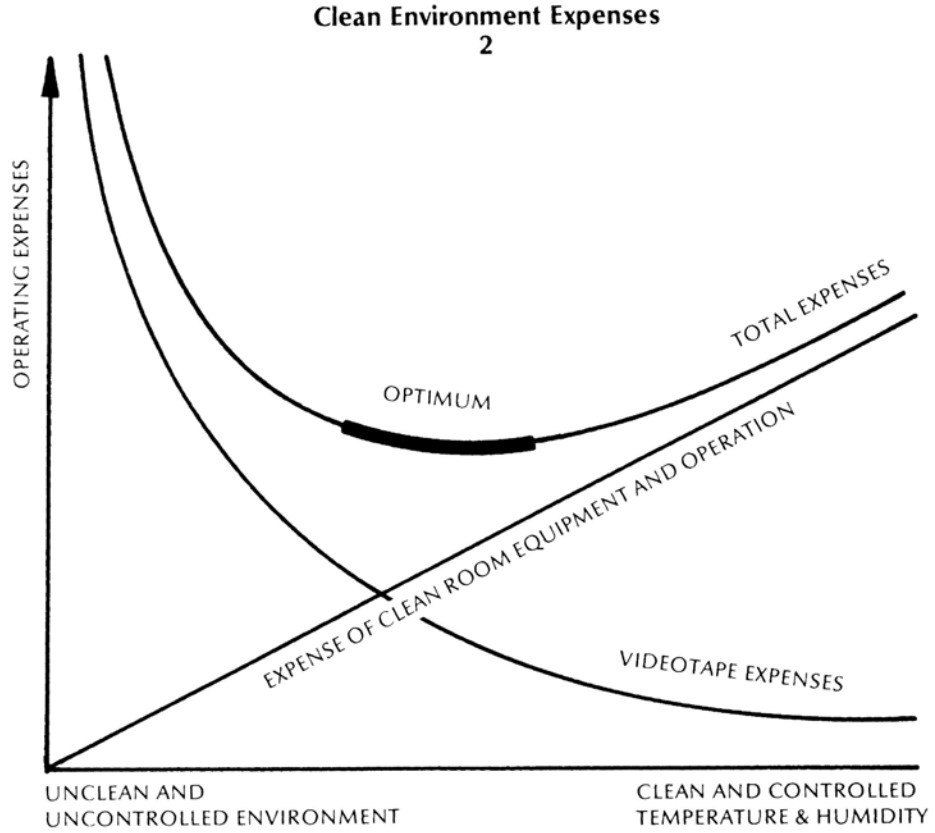

FIG. 1

can be used to determine absolute humidity. Figure 2 is a plot of constant moisture curves, with the "normal" room environment of 68°F and 40% RH assigned a value of 1 (.006 pounds of water for one pound of dry air). Doubling the moisture content will produce curve 2, tripling it will produce curve 3, etc. Experiments show that a good tape and recorder will operate properly up to around curve 4 or 5 — provided 100% RH never occurs. Any condensation of moisture on the tape surface will cause the tape to cling to the tape guiding surface and tape movement will probably stop because the water destroys the air film between the tape and the guides.

Tape should never be kept in a hot-wet environment for very long because of the deteriorating effect of such an environment. Investigations with tape with polyester-urethane binder systems (most commonly used videotapes) shows that hydrolysis can occur in a hot-wet environment, causing the binder to deteriorate. The rate of deterioration depends on the type of binder system used. If the binder is allowed to deteriorate to the point at which all of the ester molecules are consumed, the tape will be permanently degraded. [9] Before the point of total degradation, the tape should be capable of being restored to a condition that is at least suitable enough to be copied.

The Bertram-Eshel report [10] has temperature-humidity curves that illustrate the regions in which the binder is consumed, stable and reconstituted. Although the hydrolysis curves in the Bertram-Eshel report are not the same as the constant moisture curves of figure 2, they are close enough to use only the one set of curves.

Moisture curve 2 of figure 2 approximates the upper tape storage limit of figure 40 in the Bertram-Eshel report [10] and provides a reasonable definition for the low end of a hot-wet environment. This applies to unrecorded tape as well as archival tape. If a tape has been subjected to a hot-wet environment, it should be placed in a cool-dry (low moisture) environment for several days before use.

No matter what environment a tape is recorded in, the tape should *always* be rewound in the environment in which it is to be stored.

Constant Absolute Humidity Curves

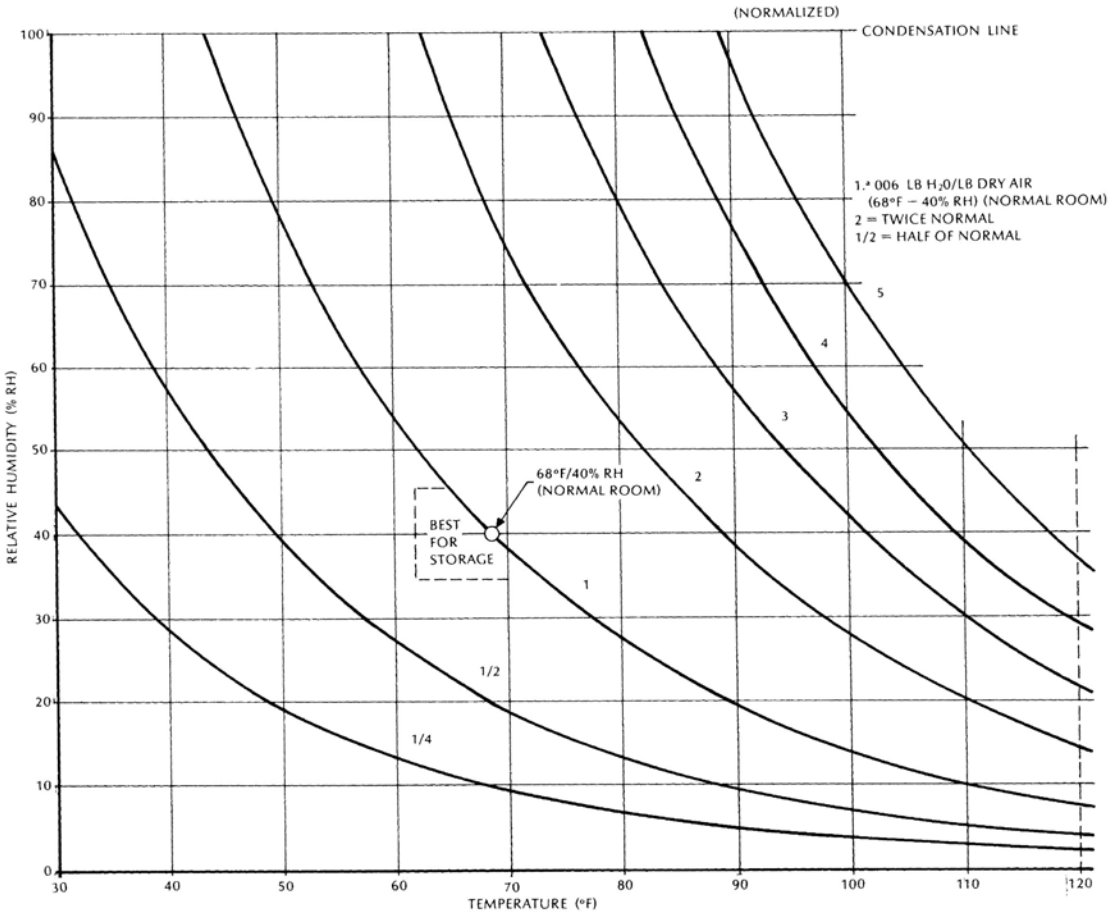

FIG. 2

III. TAPE PROBLEMS

A. Foreign Contamination

The operator should touch the tape as little as possible to avoid contaminating it with the oily residue from fingers. Oily areas attract other contaminators which will migrate along the tape each time the tape is shuttled. It is a good practice to touch the tape only during threading and to cut off the leader when it becomes wrinkled or dirty. The tape should always be wound off to one reel for removal. Never remove the tape from the guides when in the middle of the reel because the exposed section will become damaged as well as contaminated. Also, do not leave the tape threaded on the transport for long periods of time. Leaving it threaded on the transport even overnight is undesirable.

B. Contamination From Tape

Contamination can result from running the tape on a transport that has oxide, polyester, or backcoat that was shed from the last reel of tape used on the machine. If the reel to be used for archival storage is itself shedding, it should be copied to another tape for long-term storage.

C. Tape Imperfections

No high-density storage media can be made in large quantity without having some imperfections. A tape with large imperfections should not be used for long-term storage. A technique for determining if the tape has gross imperfections is to check it on a special tape-certifying machine.

These machines usually clean the tape as well as provide a record of the surface condition of a portion of the tape. A better method is to check the tape end-to-end, using an RF dropout counter. This is a much slower method but it is a good indicator of the tape condition. A third method is to personally monitor the recorded material, with the VTR dropout compensator switched off.

D. Tape Binder

There are many oxide formulations in existence. Not only do oxide-binder characteristics differ among the various tape manufacturers, but they sometimes even have variations within the same tape type.

People who manufacture tape use a screening test to predict the longevity of the binder-oxide. This test will not guarantee the performance of the oxide-binder, but it should expose any tape made with an especially bad batch of binder. It is good archival practice to buy tapes in large quantities and request that all the tape be from the same batch. This way, one or two reels can be subjected to an accelerated life test as described in the appendix.

IV. TAPE WIND TENSION

Tape wound at low tension will have a loose pack. In storage, stresses in the pack will cause the layers to creep, and, eventually, a wavy pack distortion will likely result particularly if subjected to environmental changes. If a reel with a loose pack is subsequently wound on a machine with fast acceleration and/or fast stop, the tape in the pack will slip, and permanent tape damage will likely result. A loose pack can be determined by holding the reel with one hand and pulling the tape end with the other hand. If the pack is loose, the pack will rotate.

Tape wound at an excessively high tension, on the other hand, will create large internal pack pressures which can damage the oxide surface.

It is difficult to define an ideal wind tension because of the many variables: outer pack radius, winding speed, flange windows, backcoat friction, physical condition of the tape, and the tension "profile" of the wind machine.

An attempt will be made here to describe each variable briefly.

a. Pack Radius

A small ratio of outer radius to inner radius (R_o/R_i) is desired. Since $R_i = 2.25''$ is standard for all professional videotape recorders, R_o is the variable. The moment of inertia of a reel of tape varies with the fourth power of the radius. This means that the larger the radius the more likely pack slippage will occur during acceleration or deceleration. In short, reels with a small diameter are preferred over reels with a large diameter.

b. Flange Windows

Windows allow entrapped air to bleed out. Less air means better layer-to-layer stacking and, therefore, less pack creep.

c. Backcoat Friction

Higher backcoat friction decreases the potential of pack creep because of better layer-to-layer stacking. Unfortunately, a very high backcoat friction can create machine friction problems when the tape is being played.

d. Physical Condition of the Tape

If one (or both) edge of the tape has been damaged, the layers will not pack closely together when the tape is wound. Scratches on either the oxide or backcoat, or other surface irregularities, will also tend to decrease the layer-to-layer stacking.

The tape should be wound in the same environment in which it will be stored. However, it is permissible to wind at a temperature a little higher than the storage temperature and/or a humidity that is a little lower than the storage humidity.

e. VTR Wind Tension Profile

Constant torque winding, with an increased tension near the outer radius of the reel, induces a preferred wound-in tension pattern. It is believed, however, that the tension pattern is not a critical parameter and that constant tension winding is reasonable — at least for reels up to 10 1/2" diameter [10].

The tape wind speed and the rate of reel deceleration at the end of the tape are very important. Typical wind speeds are between 300 and 500 inches per second, and speeds this high will create entrapped air. Deceleration time should be longer than a half second for a 1-hour reel of tape. The most desirable situation would be to wind archival tape on a machine with constant torque wind characteristic, at about 100 ips wind speed (or less), and with a reel deceleration time greater than one second.

V. TAPE STORAGE

A. Tape Storage Room

The room used for tape storage should have the following characteristics:

1. Temperature and humidity control
2. No window that will allow the sun to shine directly on the tape.
3. Located close to the VTR area.
4. Low dust level.
5. Fire resistant construction.

B. Storage Environment

The "best for storage" region in figure 2 was determined by considering hydrolysis, tape pack mechanics, and practical limitations. The *ideal* storage region would be at a lower temperature and have smaller temperature and humidity variations. If the tape is stored at a low temperature, the tape should sit for a few hours at the working-room environment before it is used.

If a tape has been subjected to a hot-wet environment, it should be stored in a cool-dry environment for a few days. It should then be wound in the same environment in which it is to be stored. If the pack is loose, this should be done at a slow tape speed.

C. Guidelines for Storing a Reel of Tape

1. Use only back-coated tape.
2. The tape must be wound end-to-end before being put into storage. Stopping in the middle of the reel will create pack tension distortions.
3. Wind the tape onto a rigid hub. *Never* store tape on a hub with a rubber sleeve because the soft material will compress and cause the tape layers to go into a compression condition.
4. The end of tape degrades with usage, so prior to storage, cut off any damaged or greasy section. This will provide better adhesion for the holddown tab as well as increase the life of the tape and of the video heads. Cut off any residue from the adhesive tab prior to playback.
5. Secure the end of the tape with an approved holddown tab. Never use any holddown tab that leaves a sticky residue. 3M holddown tab tape #8125 is good.
6. Store the tape in a quick-seal plastic bag and/or a sealed container. This will minimize the effect of fluctuations in the room environment and contact with air. *Never* seal tape in a container or plastic bag while it is in a high humidity environment because of the potential of future moisture condensation inside the container.
7. Store in an upright position — preferably with the reel suspended by its hub.

VI. REWIND INTERVAL

Figure 3 shows the significance of storage temperature in determining the permissible rewind interval. Fluctuations in temperature will shorten the time between

Estimated time period between rewinds by using *only* creep rate criteria

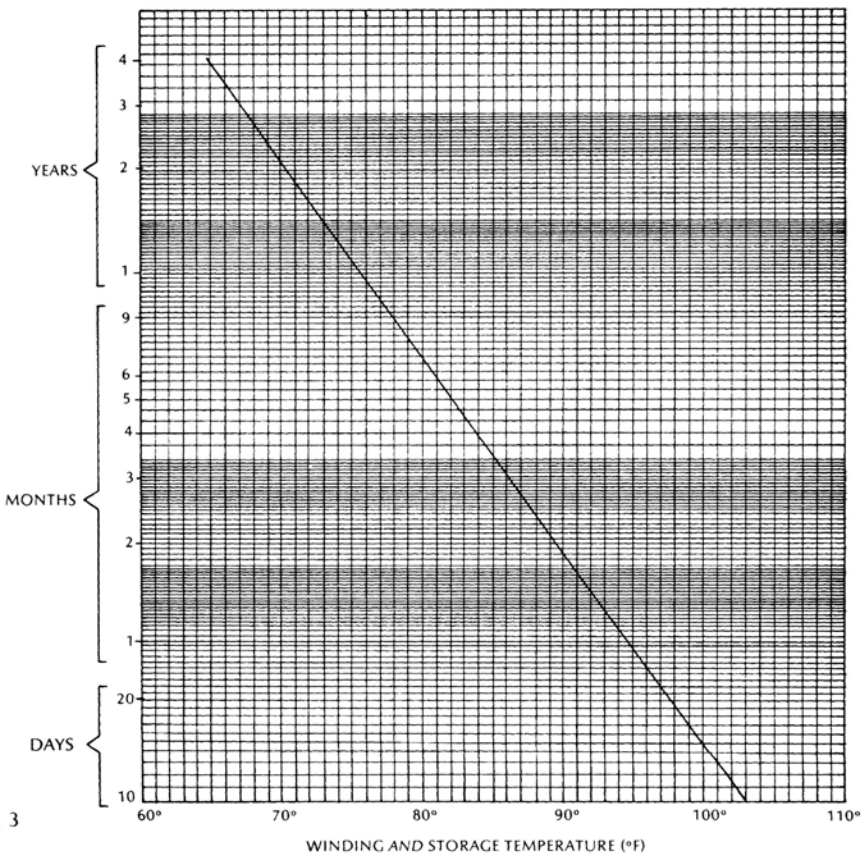

FIG. 3

Note: This curve is very general and should not be extrapolated below 65°F

required rewinds. A radical change in the environment (such as an air conditioner failure) is difficult to account for analytically [10].

Three methods for establishing rewind time are listed here:

1. The curve in figure 3 can be used to approximate the rewind interval. If the tape storage environment is reasonably constant, the curve can be used without modification. If there is any short-term environmental variation, the curve must be modified. For an example, assume the tape was wound at 65°F. The curve shows that it should be rewound in 4 years. If the storage temperature increases to 85°F for one day, subtract 250 days [10].

2. Use a friction tab (pressure pack sensor) placed in control reels. This is described in detail in the appendix.

3. Rewind tapes every 3 years. This should be done on a tape winder or a VTR that has been adjusted for slow acceleration, deceleration and wind speed. Each tape should be visually monitored during winding to determine if there is any damage.

However, if all of the suggestions listed in the tape storage section are followed, and if the tape is normalized on a slow acceleration/deceleration machine before being used, the time between rewinds can be increased. A rewind interval of ten years should be satisfactory.

VII. MAJOR CATASTROPHY

Archival information stored on any type of material should be protected from damage by fire or water. As with film, magnetic tape cannot tolerate high temperatures. Temperatures above about 150°F can cause permanent damage to the tape. A tape that has been damaged should be copied as soon as possible after the damage occurs.

Tape that has been subjected to high temperature should first be allowed to stabilize at room environment for about a day. After that, it should be run slowly on a tape machine, then copied to another reel of tape, using a time base corrector. Both tapes can then be kept in the archives.

Combustible materials should not be stored in the vicinity of archival tape. Steel shelves and cabinets are recommended. Special master tapes should be stored in a fire-proof vault in which the environment is controlled.

CO_2 type or Halon type extinguishers should be kept in or near the tape storage area. These two types will cause little or no damage to the tape.

Water on the tape or reel should be removed as soon as possible. One method starts by first removing the flanges. The water can then be removed by using either compressed air or a lint-free towel. Another method is to wind the tape off the reel, clean the reel, and then wind the tape two or three times. No matter which method is used, the tape should be rewound to relieve the pack pressures and to remove any moisture within the pack.

If a tape has been soaked in water, it must first be dried with a lintfree towel. Then, it should be suspended by the hub, in an oven, at approximately 120°F, for about three days. After it has normalized back to room temperature for at least a couple of hours, wind it at high speed a couple of times on a tape winding machine with few (if any) guides that contact the tape surface. The tape should now be in a useable condition and should be copied as soon as possible.

VIII. BRIEF RECOMMENDATIONS FOR PROPER CARE & HANDLING OF VIDEOTAPE

A. VTR and VTR Work Area

1. The room should be dust-free and temperature-humidity controlled.
2. Smoking and eating in the immediate work area should be prohibited.
3. Reels (even empty ones) should be placed in their proper container for protection.
4. Do not leave tape in a hot place, such as near a heater or in direct sunlight.
5. Check the VTRs regularly for mechanical and electrical alignment.

6. Keep all VTR tape contact surfaces clean.
7. Train personnel in proper care of VTR and tape.
8. Use a tape cleaner and certifier for cleaning and winding tapes.

B. Tape and Reel

1. Use backcoated tape on a rigid hub. Non-backcoated tape and tape wound on a rubber-ringed hub require frequent rewinding.
2. Handle the reel by the hub and do not squeeze the flanges.
3. Cut off damaged end of tape.
4. Do not let the end of tape contact a dirty area — such as the floor.
5. Carefully thread the tape onto the take-up reel so that the end is not folded.
6. Leave several feet of blank tape before starting the recording.
7. Check for edge curl by playing the tape for at least fifteen minutes and observing that the tape packs flat on the take-up reel. Any signs of a deformed edge is bad.
8. Wind the tape completely from one end to the other to relieve stresses before storage.
9. The tape should be wound in the same environment in which it will be stored.

C. Tape Storage

1. Store tape in a cool-dry environment.
2. Secure the end of the tape with an approved holddown tab. Never use a holddown tab that leaves a sticky residue.
3. Store the tape in a sealed (or semi-sealed) plastic bag and/or a sealed container.
4. Store the tape in an upright position — preferably with the reel suspended by the hub.
5. Establish a procedure for winding and documenting tapes and assign one person to be responsible.
6. Establish a program for rewinding tapes every 3 years or when necessary.

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X. APPENDIX

A. Screening Test for Bad Tapes [10]

There is no way to guarantee that a tape will have perfect data recovery after several years of storage but, there is a method for determining whether or not a reel of tape has an exceptionally poor binder. Use one reel from each tape batch to be tested, and proceed as follows:

1. Check for RF amplitude and dropout rate at room environment.
2. Place the reel at 80-95% RH/130°F for three days.
3. Remove the reel to normal room environment for at least 24 hours.
4. Recheck the RF amplitude and dropouts.

A good tape will have the following:

RF dropout count less than double the original count.

Minimal evidence of oxide shed.

If the tape fails any part of this test, there is a high probability that it would degrade in long-term storage.

B. Recording a Tape for Long-Term Storage

1. Clean all tape path components.
2. Check playback settings using a standard reference tape.
3. Check for tape edge curl, by playing the tape to be recorded for at least fifteen minutes and observing that the tape packs flat on the take-up reel.
4. Set the record drive on the tape to be recorded.
5. Wind the tape end-to-end to relieve stresses that could cause permanent time-base problems.
6. Bulk erase the tape.
7. Record. Start with a minute of color bars.
8. Rewind to the beginning without stopping. Stopping in the middle will cause uneven pack stresses.

C. Pack Pressure Sensors [10]

Stainless steel foil can be placed in the tape pack to determine when the pack pressure is so low that pack creep can occur.

Use stainless steel foil that is only. 001 inch thick and it can be obtained from a metals supply firm, or feeler gauge stock can be used. It should not have sharp edges, and the surface finish of each piece must be the same. Each strip should be about 1/2" wide and 2" long (for 1" videotape).

To insert the foil, wind the tape off its hub. Manually wind on about five turns of tape. Place the foil through the flange windows so that it protrudes out both sides. Manually wind on a couple of turns of tape and check that the foil is properly positioned. Wind the tape completely onto the reel. Attach a force gauge (with a clamp) and determine how much force is required to move the foil. Write this number in a conspicuous place on the tape storage container.

About twice a year, the tab should be checked to determine how much force is required to move it. When the force has decreased to about half of the original force, the reel should be rewound. The pack pressure can be allowed to decrease to about 1/4 the original force if the tape is never allowed on a fast accelerating VTR before it has been rewound on a lower acceleration machine.

A single control reel can be used for a group of tapes stored within an interval of a month or two of each other. There must be a control reel for each category of tape grouped by pack diameter and tape type. Or, rather than placing tabs in packs of different diameters, the tab can be placed in only the larger diameter packs. Tabs in each tape type are necessary because of the difference in layer-layer friction between the different tape brands.

Another variable is the machine the tapes were wound on. If all the tapes are wound on the same type of machine, then this is not a variable. If different types of machines are used, tabs are required for each type because each machine type may well have a different wind tension profile.

D. Transporting Videotape

1. Seal tape inside a plastic bag and inside a sturdy container.
2. When tape is to be shipped along with an unknown cargo, pack the tape in a container that will provide at least half an inch of space between the tape and any adjacent package.
3. Try to minimize environmental extremes during shipment — such as setting for hours on a loading dock in the hot sun or freezing cold.
4. Airport security X-ray scan systems will *not* de-magnetize tape. Hand held metal detectors *will* de-magnetize tape.

E. Tape Defect Definitions

1. Skew or Country-laning

The variation in *straightness* of the edges of the tape with respect to a theoretical tape centerline. Independent of tape width variations.

2. Width Variation

Independent variation of each edge of the tape with respect to a theoretical tape centerline. Independent of tape skew.

3. Lipping or Edge Curl

A stretched tape edge causing the diameter of the tape pack near the edge to be larger than at the center.

4. Buckled or Wavy Pack

Deformation of the circular form of the tape pack. The pack periphery feels lumpy by touch. Can be caused by and edge-curled tape wound too loose.

5. Cinching

Actual fold-over of tape within the pack. This results in cracked oxide and permanent tape damage. Caused by a loose pack being wound on a machine with fast acceleration and/or fast stop.

6. Washboard, pleated, corrugated surface.

A form of cinching where the tape surface has several folds close together.

7. Loose pack

By manually pulling on the end-of-tape, the outer portion of the pack can be easily rotated. In the extreme, voids can be observed in the pack.

8. Blocking

The adhesion of the oxide of one layer to the back of the adjacent layer. Caused by tight tape pack subjected for a long time to a hot-wet environment.

9. Bands

Stresses in the tape that are parallel to the edge and run the full length of the tape. A tape with this problem will have one or more evenly spaced bands across the tape. Banding is not a problem on helical recorders.

10.
ARCHIVING OF NEWS ON ENG

Stellan Norrlander
Swedish Television

The intention behind this headline is to give an example and a picture of where a single television organization like the Swedish Television stands to-day concerning this problem and perhaps give other organizations some ideas in this field, to facilitate their work.

I think I should first explain what ENG means. Those letters are short for Electronic News Gathering. In this case you do not use a common news film team but a team that is equipped with light electronic cameras. Their shots are not recorded on a film but on videotape, either on semi-professional cassettes, usually U-Matic High Band, called BVU, or on 1" videotape on movable or stationary 1" tape machines.

A similar term is EFP, Electronic Field Production, which is not used for news purposes but for other productions, e.g. theatre, with light cameras and 1" videotapes. I leave this out from what I am going to say.

There are indubitably several advantages connected with the ENG method. One thing is the prompt availability of the recorded material; another, that you can immediately see what you have recorded by instant playback. Another again that you can send home your material by air, using TV link connections; you don't have to rely on terrestrial transports, more or less slow. It is also possible to turn over into colour in, e.g., a black and white television station in some region outside the capital. If you use film you will have to build laboratory facilities for colour film and so on and that will include quite important investments, compared to the purchase of some light electronic colour cameras. The possibility of re-using the original cassettes for financial reasons is also obvious.

The problems for the archives are several, however, and of different kinds and they grow when it comes to archiving items recorded by the ENG method:

1) The cassettes themselves are not quite suitable for archiving.
2) There are costs connected with transferring what is recorded on a cassette to, e.g., 1" tape.
3) The cassettes are very handy in many senses, too handy in the sense that they are easy to move and re-use.
4) There are difficulties in getting items on cassettes/ videotapes ready for viewing, e.g. by a customer, in the archives.
5) There might be increased difficulties in getting information about a specific item on a cassette from programme departments.

1) The cassettes themselves are not quite suitable for archiving.

By this I want to point out that the SVT (the Swedish Television), using cassettes as working instruments, does not like to use e.g. U-Matic cassettes for long-storage purposes. I

know that many technicians point out that there are no significant differences between the tape itself in a U-Matic cassette and in a 1" videotape, and that may be so, of course.

But it is also true that repeated copying from one cassette to another beyond the fifth or even seventh generation quite soon gives copies with a bad dissolution — not good enough for broadcasting and certainly not for archiving and further copying, all due to the reduced capacity of the equipment, as compared to, e.g.,1" professional machines. It should be mentioned, however, that experiments in copying U-Matic cassettes made a couple of years ago by the Portuguese television gave, in some cases, astonishingly good results.

Another reason for rejecting cassettes as an archiving medium is the simple fact that these semi-professional machines have a comparatively short life, only a few years. Then there is a change of format. We have had 2" machines for at least 25 years and may hopefully count upon the same life for the 1" machines.

Finally, the cassette itself is sometimes exposed to mechanical failure.

2) There are costs connected with transferring what is recorded on a cassette to, e.g., 1" tape.

Film is ready to be stored in the archives immediately after transmission, without any dramatic procedure or costs. With ENG items on cassettes, whether you store them as they are or especially if they have to be copied into an archival format, e.g., 1" tape, it will cost money and threatens to deprive the news departments of the financial benefits they might have gained by turning over to ENG in the first place. E.g. they might be prohibited from using the cassettes again.

3) The cassettes are very handy in many senses, too handy in the sense that they are easy to move and re-use.

The small and handy size of the cassettes invites re-use, invites to use them unofficially by storing them in small, more or less private archives, in editing rooms and in offices, instead of delivering them to the central archives, invites them simply to get lost easier than common film or 1" tape.

4) There are difficulties in getting items on cassettes/videotapes ready for viewing, e.g. by a customer, in the archives.

The SVT archives have met with great difficulties in getting viewing possibilities in the archives on items recorded by the ENG method, whether it is still on cassette or transferred to 1" videotape. The reason is partly lack of machines available for showing the contents of the tape. Especially the 1" machines which are too expensive to be at the sole disposal of the archives. The solution should be specific simpler cassette copies, e.g. on VHS format, just for archival use in cataloguing and for research. But there you are again: an extra cost compared to the earlier use of film and very often unexpected for the people responsible for the news departments.

5) There might be increased difficulties in getting information about a specific item on a cassette from programme departments.

Because of the above-mentioned fact it has been increasingly important to get information of the contents of news cassettes and news tapes from the news departments themselves. Here is a vast field for difficulties, indeed. Also here the solution should be special cassettes for archival use only. Those cassettes should of course be completed with information on paper, as before, such as shot-lists and different lists of programme contents and so on.

The SVT is now on the threshhold of making definite decisions on how ENG material ought to be dealt with afterwards.

First there will be a general recommendation concerning format for archival storage: it seems that 1" videotape will be the rule, 2" when it comes to earlier material, already recorded. When transferring is made from old to new videotape, 1" will be used for the new one.

News items, initially made on 1" tape, follow this recommendation. For news that originally are made on BVU cassettes, the procedure will probably be as follows:

News from the central news departments in Stockholm may stay on their originally transmitted BVU cassette and be stored by the news department for some two years. After that the storage will be on 1" tape in connection with the central archives. In fact we have in Sweden, for local reasons, two possibilities for storing on 1" tape; but since it does not matter which one is chosen for our principle argumentation, I leave out that particular discussion. The archives will also be provided with a viewing cassette, type VHS. A condition is that the archives are to be provided constantly with information of the contents, to be immediately put in a direct access computer system.

The news in the regions will be kept in the respective regional office on 1" or on BVU cassette for two year after transmission. After that period — in fact during the following summer — a selection is made including a final transfer, if necessary, to 1" tape and the tape is sent to the central archives, in Stockholm. In the meantime, information will be provided in the same way as for the news in Stockholm and put into the computerized catalogue, for quick access also by others besides the regional office in question. A VHS-copy is also sent to the archives, for viewing and cataloguing purposes.

Of course there might be different experiences and different ways of dealing with this problem. However, these are briefly the lines along which the SVT seeks a solution and they may perhaps serve as a contribution to a short discussion or questions, now.

11.
COMMENT LIRE ET RELIRE LES ANCIENS PROGRAMMES ENREGISTRES SUR BANDES MAGNETIQUES 2 POUCES

Philippe Poncin
Institut National de l'Audiovisuel

Voici une étude sur les conditions de réutilisation des bandes vidéo professionnelles et sur leur histoire qui est brève, mais riche en expérience.
Mon but est de donner le maximum d'informations techniques et pratiques sur la *constitution des supports magnétiques* utilisés jusqu'à maintenant pour l'enregistrement vidéo de qualité professionnelle, et sur *l'évolution des magnétoscopes* et de leurs organes essentiels (têtes magnétiques, guide de contacts têtes-bande, standards d'enregistrement et réglages électroniques).

Ce rapport repose sur l'expérience de techniciens et d'ingénieurs qui ont étudié et exploité les bandes magnétiques 2 Pouces et le système quadruplex.

M'adressant à des responsables d'Archives Télévision et d'Archives Film, j'ai l'ambition de faire mieux connaître les prouesses réalisées par les chercheurs dans ce domaine et de vous communiquer cette étrange passion pour la beauté des réalisations techniques.

Ensuite, j'essaierai de vous montrer les difficultés que nous pouvons rencontrer avec les enregistrements les plus anciens, que ont seulement vingt ans, et quelques *défauts caractéristiques de l'enregistrement magnétique*.

On parle souvent de révolution dans le domaine de l'enregistrement quand AMPEX commercialise son premier magnétoscope quadruplex en 1956. En fait, ce procédé a été adopté pour des raisons d'économie et de délais de transmission (en particulier pour transmettre des programmes identiques à l'Est et à l'Ouest des Etats-Unis).

I — QUE SONT NOS BANDES DEVENUES?

a) Particularités des bandes vidéo.

En dehors des différences de largeur, certains pourraient être tentés d'utiliser une bande audio sur un magnetoscope; ce serait une expérience douloureuse, au moins pour l'usure des têtes vidéo, et l'image originale risque de disparaître à la lecture, sous une importante "chute de neige" grise.

Retournons rapidement sur les bancs de l'école, pour rappeler quelques chiffres sur la *constitution des bandes vidéo*:

- les bandes audio et vidéo sont bien également des supports plastiques enduits d'oxydes magnétiques. Mais chacune se caractérise par sa rugosité, par la répartition des particules dans l'oxyde et par les propriétés magnétiques de ces particules.

— *Qualité de surface:* la rugosité des bandes audio est de l'ordre du micron (millième de millimètre), mais le signal vidéo est beaucoup plus complexe que le signal audio et ce "grain" n'est pas acceptable car les pertes de signal dues à un mauvais contact tête-bande seraient trop importantes.

Aussi, est-il nécessaire de réaliser un *polissage spécial* (appelé aussi calandrage), qui rend la face active des bandes vidéo très lisse et brillante.

Par contre, le support présente une couche dorsale mate qui évite les glissements, améliore le rembobinage et évite l'abrasion de l'oxyde magnétique par le support.

— *Répartition des particules magnétiques:* il a fallu obtenir une granulation trés fine des oxydes mais aussi une excellent dispersion des particules dans le liant qui les fixe au support.

Voici ce *qui ne peut pas être vu* sur la bande: les cristaux qui sont sélectionnés ont des dimensions *l'environ 0,3* μm et 0,03 μm. Ils sont orientés au moment du couchage par un champ magnétique (opération difficile, parce que les particules agissent les unes sur les autres).

— *Propriétés magnétiques des particules:* elles doivent constituer ce qu'on appelle des *monodomaines*, qui possèdent deux états magnétiques opposés et stables, ce qui s'obtient par le choix des composants (dopage) pour obtenir la structure physique et géométrique des cristaux optimale.

La fabrication des bandes est donc particulièrement délicate, tant pour l'opération de *couchage* (et d'élimination du solvant à cette étape sans laisser de bulles), et de *découpe* pour obtenir des bords symétriques et francs, que par *le choix des particules* et celui du liant *organique* (haut polymeré dont dépend la stabilité de la bande en particulier vis à vis des variations d'hygrométrie. CF. études de CUDDIHY).

L'orientation des particules dispersées dans le liant ne peut être visualisée que par l'analyse par diffraction d'électrons:

— qui révèle cette étonnante *structure en plume*, donc "relativement" orientée.

b) Particularités de l'enregistrement vidéo:

Retournons une fois encore sur les bancs de l'école pour l'autres chiffres sur le magnétisme et l'*enregistrement magnétique*:

Depuis l'aimant de FARADAY (en 1830), de nombreux savants ont cherché les clés de l'électromagnétisme:

— on connait dans le tableau périodique des éléments, la propriété de certains métaux (le FER, COBALT et NICKEL), de présenter au niveau atomique un caractère magnétique, et

— la réciprocité entre phénomènes électriques et magnétiques avec les lois de l'induction électromagnétique

La réalisation d'une tête d'enregistrement et lecture vidéo est née de ces recherches:

— l'entrefer d'une tête sur un bloc de magnétoscope quadruplex a une dimension *d'environ 1 micron* (ou moins).

— et voici ce qui se passe pour un point de la bande qui conservera une induction magnétique après être passé devant la tête: propriété de rémanence; c'est-à-dire que *les particules fixes* (qui ne bougent pas!) dans l'oxyde vont garder un état magnétique qui dépend de la valeur du champ existant dans l'entrefer de la tête à cet instant.

— et ces états magnétiques pourront être relus ou bien effacés (selon les lois de la courbe d'hystérésis et selon la coercitivité des particules).

Voyons maintenant en pratique d'autres chiffres:

— un magnétoscope quadruplex et son bloc de têtes. La bande défile à 39,7 cm/s (chiffre proche du défilement à 38 cm/s pour certains enregistrements audio). Et le disque qui supporte les têtes tourne à 250 tours/second.

— unpremier chiffre impressionnant; la vitesse relative tête-bande est de 144 km/h. Et cela pour une tête dont l'entrefer a 1 micron de large et sur des *pistes de 250 µm de large.*

— sans revenir sur ce choix, rappelons que l'enregistrement vidéo se fait en *modulation de fréquence*; à chaque niveau du signal vidéo, correspond une fréquence instantanée, et pour le standard 625 1 HB, ces fréquences varient entre 7 et 9 Mégahertz, l'enregistrement se faisant pratiquement au niveau de saturation.

Pour simplifier, disons que la tête enregistre des signaux carrés et chaque information sera caractérisée par sa durée; c'est-à-dire que la tête inscrit sur la piste des informations dont *la longueur d'onde varie entre 3 et 5 microns* (nous laissons de côté les subtilités de la modulation de fréquence et l'influence de l'épaisseur de la couche magnétique et de l'enregistrement en profondeur). Les phénomènes essentiels se passent bien au contact tête-bande dans le guide où la bande est appliquée avec précision face aux têtes et à des dimensions de cet ordre.

— les autres informations (signal audio et impulsions de références) sont enregistrées par des têtes fixes sur les bords de bande. (d'où l'importance de la qualité de découpe de bande).

— Autres chiffres. Le dépassement d'une tête neuve par rapport au disque est de 25 microns, et à 12 microns, on considère la tête usée (ce qui est contrôlé par une jauge spéciale). Comme on le verra plus loin, beaucoup de défauts proviennent de ces réglages très délicats.

Enfin, pour récapituler, voici un chiffre éloquent, qui rapprochera ceux qui ont travaillé sur support vidéo et sur support film.

Chaque tête inscrit les informations a 150 km/heure et enregistre 16 lignes utiles par piste; c'est-à-dire qu'une ligne est inscrite sur 2,5 mm de bande.

— Nous reverrons plus loin ce qu'on appelle un "drop-out" correspond (selon les normes UER) à un affaiblissement du signal lu supérieur à 20 dB pendant plus de 3 µs (donc 2 cm sur une ligne d'un écran moyen); et, problème pour les fabricants de bandes, à un défaut sur *seulement 0,1 mm de bande.*

— *Mais globalement* il faut deux trames en NB pour définir une image, et quatre trames en couleur, avec les repères image et couleur. Et cela correspond de fait à *16 mm de bande en NB* et donc environ à *35 mm en couleur.* CQFD. élémentaire mon cher WATSON!

c) Evolution des caractéristiques des bandes.

— Revenons aux bandes; nous avons dégagé certaines propriétés électromagnétiques. Voyons en pratique:

— lorsque nous lisons les notices des fabricants, nous trouvons des *performances mécaniques* (limite d'élasticité, charge de rupture, épaisseur); en fait on ne trouve pas de grandes différences si on compare des supports de même épaisseur (cf. test du CMC Technology Corporation).

— Par contre pour les *performances électromagnétiques* il s'agit non seulement de *comparer* les caractéristiques: coercitivité, efficacité en vidéo et en audio, rapport signal à bruit, pertes de signal maximales admissibles, mais aussi de vérifier la *compatibilité* des bandes d'origine diverse pour un même réglage des équipements. Sinon on risque de trouver des bandes enregistrées à un niveau trop faible ou trop fort, qui seront difficiles à effacer et a enregistrer, ou qui auront de nombreux drops-out.

Sans revenir sur les raisons historiques de sa création — (méfiance vis à vis des fournisseurs d'outre-atlantique à une époque où la fabrication n'était sans doute pas encore stable et les livraisons en France peut-être moins sélectionnées que celles pour les USA) — nous avons la chance et l'avantage de disposer en Freance depuis 1969 *d'un laboratoire d'essai* systématique des bandes neuves professionnelles.

Vous pouvez voir les premiers magnétoscopes VR 1000 livrés en France, utilisés depuis 1960 et reconvertis pour ces essais en 1969. L'installation actuelle comporte une douzaine de magnétoscopes de type VR 2000-AMPEX et TR22-RCA, dans un local climatisé (20°C, 55% hr).

Le laboratoire vérifie chaque année environ la moitié des bandes achetées par les organismes de TV (actuellement 8000/an).

Les rapports établis chaque année à l'occasion des marchés de fournitures permettent de constater les défauts rencontrés et quelquefois des lots entiers sont renvoyés à un fournisseur (sont entrés en compétition dès 1969 Memorex, 3 M, RCA puis AGFA en 1974, AMPEX en 1975 et FUJI en 1977).

Les essais systématiques conduisent à rejeter 5 à 15% des bandes livrées en décelant: des défauts de bord (variation de largeur ou relèvement des bords), des drops-out trop nombreux, des bandes qui déposent, des défauts de couchage ou de polissage.

Dans l'ensemble les rapports indiquent une assez bonne compatibilité des bandes entre elles.

Deux étapes importantes *en 1964* (avant les essais systématiques) passage du Low Band au High Band et définition des normes couleur, puis introduction des bandes à "haute densité" vers *1970-1971* avec des couches à oxyde de chrome (plus grande coercitivité, amélioration de l'efficacité et du rapport signal à bruit, mais courants d'enregistrement et d'effacement plus importants).

A noter que ces vérifications systématiques se font *en vraie grandeur* par enregistrement et relecture vidéo et audio, alors que les machines (type RECORTEC ou ELCON) utilisent des enregistrements longitudinaux de type audio. les résultats sont enregistrés sur papier automatiquement.

Rappelons aussi l'évolution de la constitution des têtes (mélange alu-fer-silice) dans le but de diminuer leur usure. La durée de vie actuellement se situe entre 200 et 600 heures. A titre indicatif RCA assurait, en 1957 il est vrai, pour le magnétoscope TRT-1 A une vie des têtes de 100 h environ et une vie des bandes pour 100 passages seulement.

Les rapports d'essais systématiques constituent une information tres utile sur la fabrication des bandes que nous retrouvons aujourd'hui en Archives.

Ce travail sera je l'espère, poursuivi pour les supports 1 Pouce et 3/4 pouce broadcast.

Les diverses études seraient en elles-mêmes l'objet d'un rapport entier sur les dispositifs mis au point non seulement pour compter les collants ou les drops, mais aussi par exemple les rayures ou bien la mise au point de cette *machine automatisée pour recycler les bandes vidéo.*

Rappelons au passage qu'il est possible de vérifier l'orientation longitudinale ou transversale des particules dans le liant, ce qui a confirmé des qualités divergentes en audio et en vidéo.

Finalement ces information sont notées sur une fiche avec le numéro attribué à chaque bande, fiche qui ne devra pas quitter la bande au long de sa "carrière", sorte de carnet de santé, où seront notés les enregistrements, lecture-antenne, visionnages, réenregistrements ou vérification en archives, ce qui nous est aujourd'hui une aide précieuse.

Ainsi, sur quelques 50.000 bandes 2 Pouces, conservées actuellement à l'INA, 9 sur 10 environ ont leur fiche d'origine.

II — Y A T'IL QUELQUE CHOSE A VOIR?

a) aspect extérieur: le contenant

Donc pas de difficulté pour trouver à l'INA une bande vidéo (je ne di pas si vous voulez une émission particulière).

Supposons la, arrivée en régie technique.

On peut remarquer l'évolution des containers, qui sont pratiques et solides (mais qui

pourraient dégager des vapeurs nocives en cas d'incendie), ainsi que la nécessité des arrêts de bande.

Et nous utiliserons toutes les informations inscrites sur les diverses étiquettes, fiche de production et bien sûr la fiche bande (de l'intérêt de conserver aussi papiers et cartons!).

b) défauts mécaniques ou physiques

Les plus fréquents et les plus visibles sont les *défauts de bord de bande*, apparents au niveau des ouvertures des flasques (cf. étude de la B.B.C. sur la corrélation défaut de bande et ouvertures).

On utilisera si possible d'ailleurs sur la bobine réceptrice du magnétoscope une flasque transparente pour voir les défauts d'enroulement.

Un défaut même minime est dangereux parcequ'il nuit à l'enregistrement du son, ou de la piste de contrôle. De plus, il se propagera au moment de l'enroulement, ou encore, il sera un obstacle infranchissable pour les têtes vidéo, d'ou: cassure ou arrachement de la bande et destruction des têtes elles-mêmes. D'ou l'importance des précautions à prendre pour obtenir un enroulement parfait, connaître si possible le nombre de collants mécaniques (occasion de choc pour la tête ou d'accumulation de poussière), et nettoyer et rembobiner la bande intégralement avant lecture.

c) visualisation des pistes enregistrées:

Le grand point faible de la bande magnétique comparée au support film, malgré certains points de concordance que nous avons constatés, reste qu'il n'y a *apparemment rien à voir* (pas plus que pour un courant même intense circulant dans un conducteur), et pour cause puisque l'état magnétique se décèle au niveau des particules enrobées dans la couche d'oxyde et même au niveau moléculaire.

Pourtant, il existe un moyen de visualiser rapidement si une bande est enregistrée, comme on voit si un rouleau de cire est gravé ou si une piste optique est révélée.

A l'aide d'un *révélateur ou loupe magnétique:* boîtier transparent qui contient en suspension dans un solvant des particules ferro magnétiques, qui vont être attirées par les endroits où l'induction rémanente sur la bande est la plus forte.

On peut voir l'information inscrite sur un ticket de métro parisien, sur une bande son 35 mm ou sur la piste de contrôle d'une bande 2 Pouces.

Ce moyen suffit pour repérer globalement les tops d'image (opération indispensable pour effectuer un collant mécanique correct), *mais ne permet pas de visualiser les informations de l'image*, dont nous avons donné les dimensions (2,5 mm par ligne avec 500 points, soit des *créneaux* du type de ceux vus sur le film 35 mm magnétique mais de longueur variable entre 3 et 5 microns).

Voyons maintenant la machine de lecture.

d) Choix du magnétoscope

Depuis les matériels de 1956, avec la seconde génération de 1962-1964 avec la définition des normes couleur, et la troisième génération vers 1970, il y a eu effectivement des progrès technologiques importants:

— le passage *LB — MB — HB* (Low, Middle et High Band) avec choix de nouvelles fréquences de la modulation enregistrée;

— l'amélioration des *composants électroniques* (tubes, transistors puis circuits intégrés et microprocesseurs);

— le progrès de l'électronique *d'asservissement et de compensations* des défauts d'enregistrament et d'erreurs de base de temps.

On peut voir la différence d'encombrement des équipements et l'évolution des recommandations des fournisseurs entre 1956 et maintenant (AMPEX et TCA puis TOSHIBA, IVC et BOSCH FERNSEH pour les matériels 2 Pouces).

Les matériels récents sont plus sophistiqués mais il est souvent préférable d'utiliser pour nous des matériels de la 2 *ème génération*, qui "encaissent" mieux les défauts enregistrés ou les défauts mécaniques.

Il est indispensable que les services d'archives récupèrent ces machines et les maintiennent en bon état.

Certains ont été modifiés pour travailler dans les *standards particuliers* établis dans certains pays, par exemple le "819 lignes Noir et Blanc" en France.

Un défaut de standard en lecture correspond à une mauvaise analyse dans le temps des informations ligne, et donc un défaut de balayage sur le moniteur.

Pour mémoire vous pouvez voir la différence entre les deux standards N et B à 819 et 625 lignes avec un document transféré récemment.

Autre questions avant la mise en route: le chargement de la bande.

Il y a eu des magnétoscopes 2 Pouces à chargement horizontal et vertical, mais vous ne risquez guère *un mauvais chargement* du moment où la couche magnétique se trouve en contact avec les têtes; par contre:

— pour les systèmes 1 Pouce BouC l'enroulement diffère avec la couche magnétique vers l'intérieur ou vers l'extérieur.

— pour des bandes codés spécialement (par ex. des bandes semi professionnelles destinés à des médecins), on peut avoir inversé les pistes audio et contrôle pour des raisons de discrétion.

e) Mise en route du magnétoscope.

Jetons un oeil sur la mise en oeuvre de l'appareil de lecture et des organes essentiels à son bon fonctionnement.

2Voici le *schéma géneral* depuis la bobine débitrice jusqu'à la bobine réceptrice:

— passage sur le bras de tension et les guides avant le bloc de têtes.

— on a vu déjà l'importance du guide du bloc de tête, alimenté en air comprimé (4 à 5 bars), pour régler par aspiration la courbure de la bande, et contrôler le contact tête-bande, au moment de la relecture des pistes.

— le cabestan lisse qui va entraîner la bande à vitesse constante et régulée par rapport aux repères image.

— les autres têtes de lecture pour le son et les tops d'asservissement.

Les organes de commande et de contrôle, outil du technicien d'exploitation, pour le réglage des signaux vidéo et audio et le contrôle des asservissements et compensateurs.

Rappelons que le *reglage du guide*, est le plus pointu; par exemple dans la procédure d'essai d'échantillons de divers fournisseurs, il est indiqué de monter des morceaux de bande bout à bout pour s'affranchir de ce réglage; en effet avec un magnétoscope VR 2000 Ampex lisant une mire enregistrée par ex., on constate que les défauts de guide peuvent être légèrement différents à chaque démarrage.

III — QUE VOYONS-NOUS ET QU'ENTENDONS-NOUS FINALEMENT?

Quels peuvent être les défauts enregistrés sur la bande *et spécifiques à l'enregistrement magnétique?*

Je passe sous silence les défauts dûs au support film pour les documents passés au télécinéma (autre sujet d'études et de recommandations).

— Pour mémoire voici la fameuse "neige" qui peut apparaître en début de bande sur une partie non enregistrée avant les références habituelles.

Et voici la mire de référence du systême UER à 625 lignes (avec, puis sans chrominance), lue dans de bonnes conditions.

— Mauvaise *vitesse de défilement*: les informations de chaque ligne apparaissent avec trop d'écart pour être recalibrées et le récepteur perd toute référence (contrôlez votre vitesse!).

— Mauvais *centrage des pistes*: les têtes perdent plus ou moins d'information en fréquence ou lisent plus ou moins de "neige", jusqu'à perdre les références indispensables.

Retour à la case précédente.

Pour une trés faible erreur, un moîrage apparait (vous roulez sur le bas côté!).

— *Défaut de perte d'information*: on a vu qu'un défaut notable apparait pour une absence d'oxyde ou un obstacle sur environ 0,1mm; à fortiori pour une bande rayée sur toute sa longueur (à ne faire qu'exceptionnellement).

Après cet intermède douloureux et indépendant de notre volonté, voire du à la malveillance d'une certaine catégorie de personnel, revenons à nos défauts de réglage

● Voici l'aspect assez connu dú à un mauvais contact *tête-bande*; qui entraîne des pertes en fréquence du signal vidéo et ces décalages de base de temps entre les premières et dernières lignes lues par chaque tête (cet aspect est plus ou moins comique selon le sujet).

— Un autre défaut dû à la position en *hauteur du guide*, qui entraîne un autre décalage pour chaque tête de lecture.

Nous allons voir maintenant un autre réglage essentiel qui intervient à l'enregistrement, puis à la lecture et doit correspondre au meilleur rendement pour chaque tête et globalement à un niveau identique du signal FM:

— le réglage des *courants d'enregistrement*. A la limite, si une tête est encrassée ce défaut apparaîtra pour les lignes qui lui incombe.

— de même le réglage *d'égalisation des têtes* en lecture se fait en optimisant le signal relu qui peut être trop faible ou trop fort et apporter du bruit de fond ou des pertes d'information aux hautes fréquences (c'est-à-dire aux transitions rapides).

Ces divers défauts typiques nous ont permis de revoir les problèmes essentiels et habituels en exploitation magnétoscope et surtout ceux des contacts tête-bande; ce sont ces réglages qui posent problème à la relecture de bandes anciennes qui ont pu être enregistrées dans des conditions limites.

D'autres défauts apparaissent *en montage électronique*, spécialement:

— soit parce qu'un défaut de bord de bande déforme les signaux de contrôle image ou les références couleur;

— soit parce que l'on doit faire fonctionner le magnétoscope avec un degré d'asservissement le plus exigeant, en phase et en vitesse, non seulement avec lui-même mais avec des signaux de référence externes. Après avoir signalé tous ces défauts, disons que beaucoup de bandes se relisent trés bien!

Voici maintenant un défaut plus exceptionnel mais qui a provoqué des angoisses à plus d'un technicien.

● *les effacements aléatoires.*

Il arrive qu'un roulement à bille d'un des guides soit suffisamment aimanté pour effacer à chaque tour, à la même hauteur sur la bande, les points de la bande qui passent. Ce défaut équivaut à une très fine rayure (il est variable et difficile à photographier). Surtout pour le technicien, le phénomène peut apparaître et disparaître longtemps avant de le localiser. Et il ne suffit pas toujours de démagnétiser chaque pièce du chemin de bande. Avis!

Après les hommes des cavernes, les scribes égyptiens sculptant la pierre et les écrivains de l'antiquité.... chacun ses soucis!

A titre de travaux pratiques, je vous présente rapidement la réalisation d'un *collant mécanique* tel qu'il était pratiqué jadis en montage ... et qu'il nous arrive de devoir refaire quand une bande casse (par ex. à l'endroit d'un ancien collant):

— voici l'appareil avec microscope (grossissant 40 fois) et le révélateur (fer carbonyle).

— les deux parties de la bande et la coupe au niveau d'un top de contrôle image pour garder l'enchaînement en lecture (sinon le récepteur "décroche").

— l'application du collant métallique très fin sur la dorsale.

Attention les normes UER sont strictes! (pour mémoire n'oubliez pas que le son est enregistré avec 9 images d'avance sur l'image).

Voici un appareil indispensable en tout cas et bonne chance!

Il est souvent question des risques d'effacement des bandes enregistrées. Voici une petite expérience, plutôt curative contre ce genre d'angoisse:

Effacement progressif par aimant permanent

Avec un petit aimant, d'induction de 1000 gauss environ, (on ne peut perturber un enregistrement en dessous de 10 à 50 gauss) le rapprocher trés lentement jusqu'à être en contact avec la dorsale.

Je ne vous fais pas entendre les clocs caractéristiques sur l'enregistrement son l'effacement de piste contrôle empêche toute stabilisation de l'image en lecture. Le danger existe donc bien mais pour une valeur d'induction qui ne se rencontre qu'exceptionnellement.

Mais nous voici en fin de bande. Vous pouvez compter les flocons.

Il est l'heure de nous quitter. Merci.

Ce rapport n'aurait pas existé sans l' expérience et les connaissances que m'ont transmis certains et en particulier messieurs René LAMMER, Maurice OLIVIER et Jean VARRA, cadres techniques à l'INA; ni sans les documents empruntés à certaines publications et les excellentes photographies de Monsieur L. RUSZKA.

Cette étude devrait être suivie d'autres, par exemple:

— Procédés de restauration des bandes vidéo.

— Evolution des techniques d'enregistrement pour préservation (nouveaux supports et formats, nouvelles technologies).

Vos critiques et vos suggestions seront les bienvenues.

12.
COMPARISON OF FILM AND VIDEO DISC AS A MEANS FOR PRESERVATION

Henk de Smidt
Nentherlands Filmmuseum — Amsterdam

Introduction

Since 1950 there has been much progress in all aspects of image registration. Sensitivity, grain, sharpness, emulsion constancy, colour reproduction and stability have been improved in the past thirty years.
The total quality of film can be expressed as the surface of a triangle of which the sides represent the functions of grain, sharpness and colour rendition. By applying new grain structures the sides of the triangle, and therewith its surface, can be enlarged.
Although not applicable to cine-film at the moment, the introduction of a new grain structure under the name "T Grain" is spoken of.

Beside the development of film material technologies a new technique, namely that of electronic image registration, has been developed during the last few years. The triangle which we used for photographic materials is also applicable to electronic image registration.

Total image quality is a complement of its sides: noise, sharpness and colour rendition. Also here the three sides are not completely independent. In H.D.T.V. techniques one speaks of a definition of 1125 lines/picture and 30 pictures/second.

Special techniques are investigated at the moment, to perfect total image quality.

Electronics technology is developing very fast and therefore it is necessary for us to try and reach a good integration of film and electronics for the benefit of preserving image material.

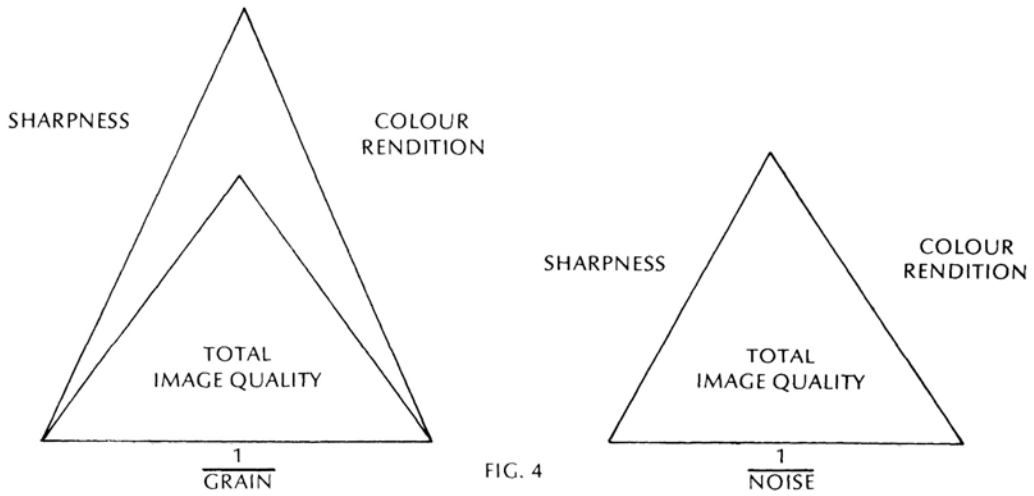

FIG. 4

TELDEC	RCA JVC	PHILIPS	THOMSON CSF
mechanical	capacitive	optical reflection	optical transmission systems

Video disc mastering and duplication diagram

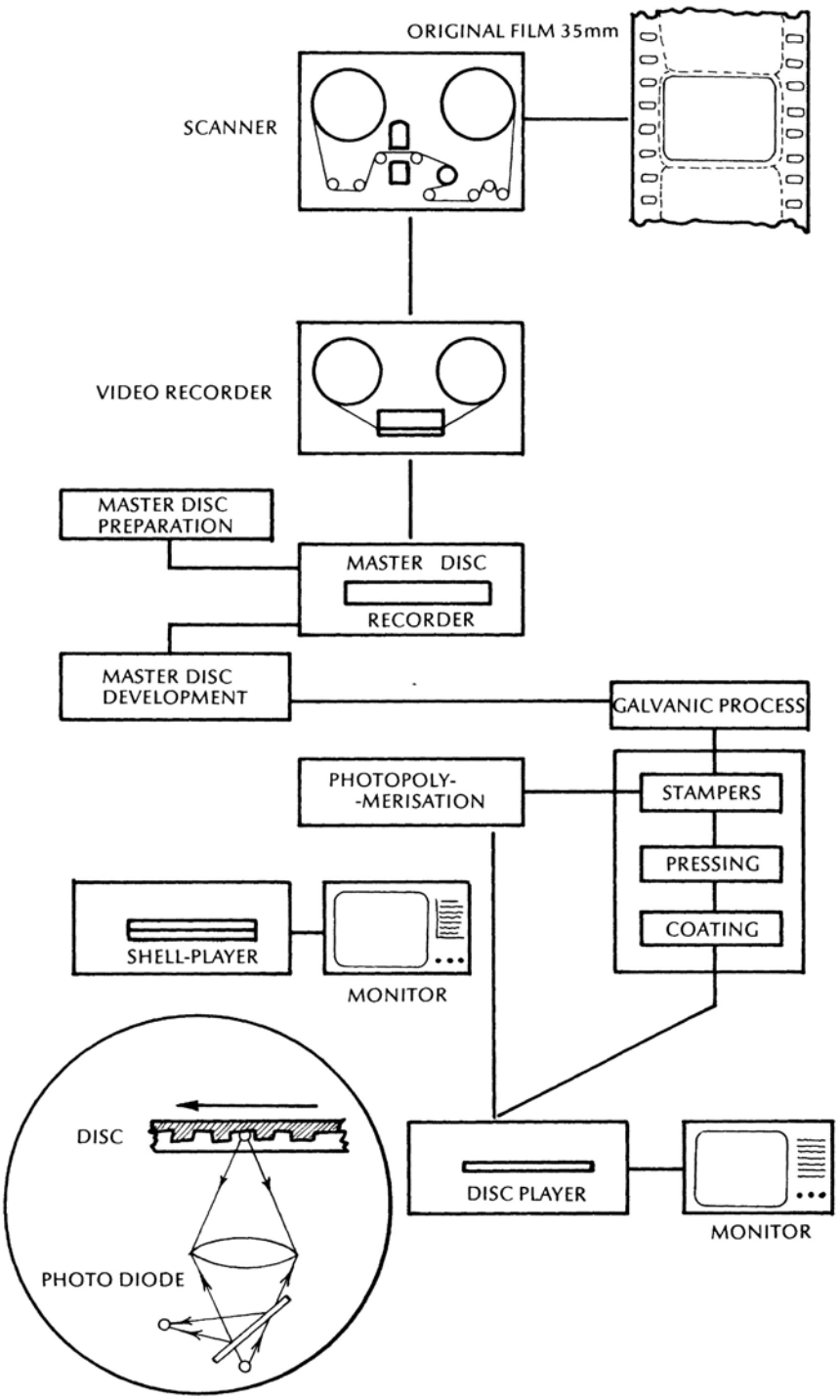

FIG. 5

The RCA video disc works with a capacitive read system, in which the track of the disc is read with a diamond needle. With 450 revolutions/minute the playing per side is 1 hour. It contains one audio channel. The disc is put into a plastic container, the caddy. The view of RCA is that its product is a consumer article.

J.V.C. has also introduced a capacitive Video Disc system. Only track following is done with the help of a servo system.

In 1970 Philips chose wittingly for an optical reflection system. With 1550 revolutions/minute, maximum playing time per side is 1 hour. When still pictures are necessary the playing time is reduced to one half-hour per side. Because of the optical readout of the image information there is no wear on the disc even with still pictures. In 1972 the V.L.P. was presented to the press.

Thomson CSF has introduced a Video Disc for industrial use. The discs are vulnerable because the information tracks are situated at the surface. For the archives the metal stampers are of importance for long-term storage, but for daily use only the copydisc is the obvious medium.

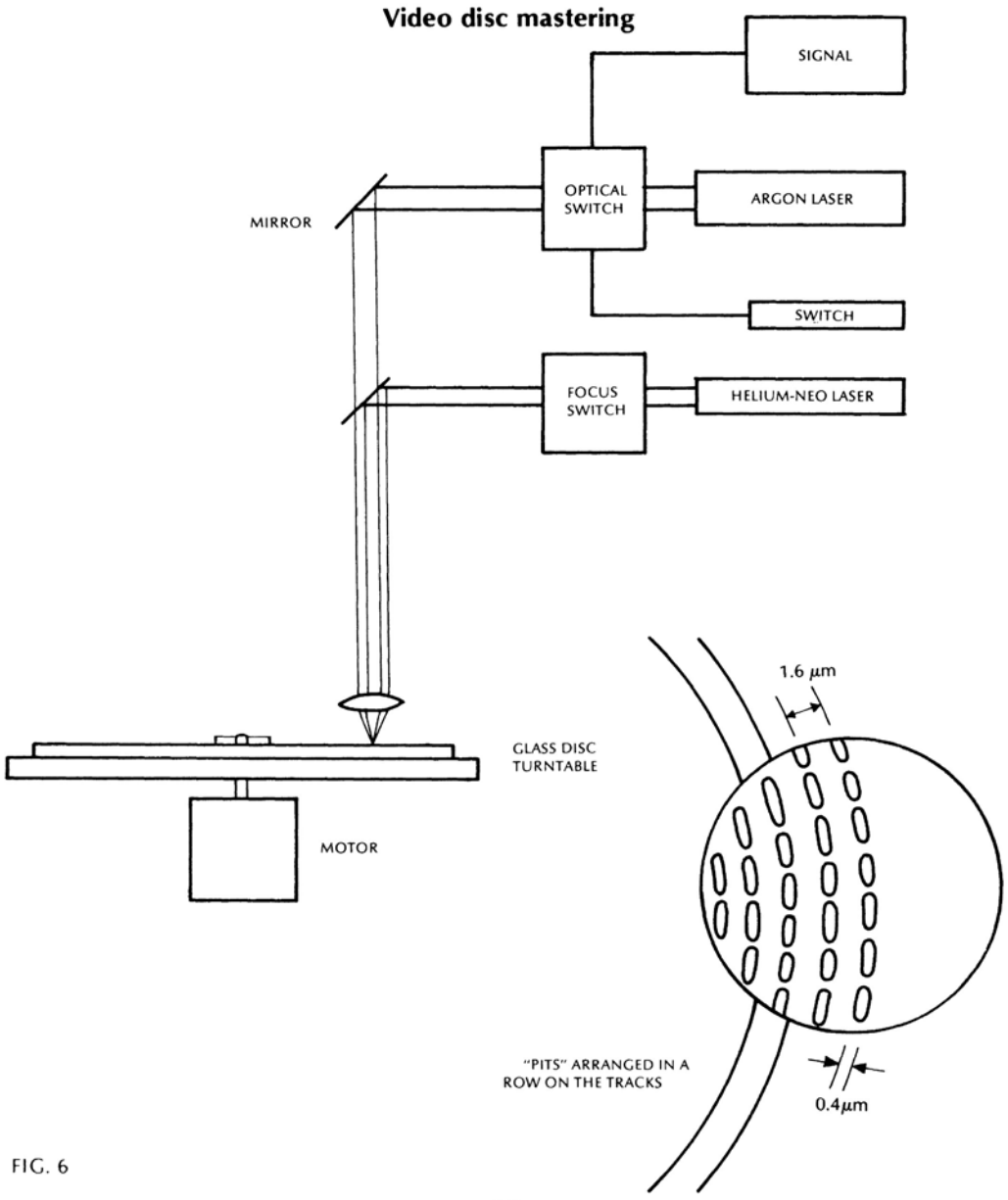

FIG. 6

Advantages of the Video Disc (Active Play Discs) compared to Film

For discs less storage space is needed and they are more easily accessable. The metal disc stamper has a longer life expectancy and damage can be avoided. Also the copydisc is less vulnerable.

The players are easily handled.

The search for any subject on the disc can be done within 30 sec.

Freeze Frame, Slow Motion, Frame by Frame, Fast Forward are possibilities for documentation and studying of the archive material.

The disc can be played in forward and reverse directions at normal speed.

For storage of discs no voluminous temperature and humidity installation is necessary.

Disadvantages of the Video Disc compared to Film

Loss of definition: Scanning leads to loss of resolution.

Noise: Occurs during every electronic transfer (for example, tape to tape); this can be compared with the grain in film.

Dropouts: Damages introduced during the pressing process.

Limited in formats: 70mm film cannot be handled because it results in loss of image information.

Improvements for the future and further developments

Increase of resolution.

During the scanning of the film a projection method should be used for determining colour and contrast.

These data must be put into a computer, scene per scene, before the proper scanning has taken place.

Experiment in comparing images, reached in different ways

The first step for this experiment was done during a meeting of the Preservation Commission in Versailles. In discussion was the transfer of film on video disc as a matter of preservation.

From different countries 35mm film material was received: from Dr. Struska (Czechoslovakia), Mr. Brown (Great Britain), Mr. Karnstädt (East Berlin) and from the Netherlands.

The targets of this experiment are:

1. Video disc used in movie picture preservation
2. Video disc used for transfer to film (Image Transform System) [Actually Color Film Services in London are not capable of handling 35mm at this stage. They still use a digital transfer system for 16mm film]
3. Studying the loss of image sharpness

Other points are given by Dr. Siakkou

1. Time base correction
2. Signal/noise ratio
3. Spectral density
4. Colour balance
5. Colour rendition
6. Dropouts

The first experiment was carried out in London with the help of a Rank Cintel scanner. The Disc was of good quality but the contrast was on a level too low for reproduction techniques. While we were still studying the results of the first disc, a new scanner was

introduced by Bosch Fernsehen, the FDL 60 with a digital storage and CCD sensors. The second experiment was carried out by this FDL scanner. We will show you on the left screen a copy from an internegative; at the right, with the video disc as an intermediate. Finally want to express my thanks to Mr. Compaan, Mr. van Veldhuysen and Mr. Jongenelen of J.V.R. for their personal contribution in this matter.

Diagram Experiment in comoarison with images

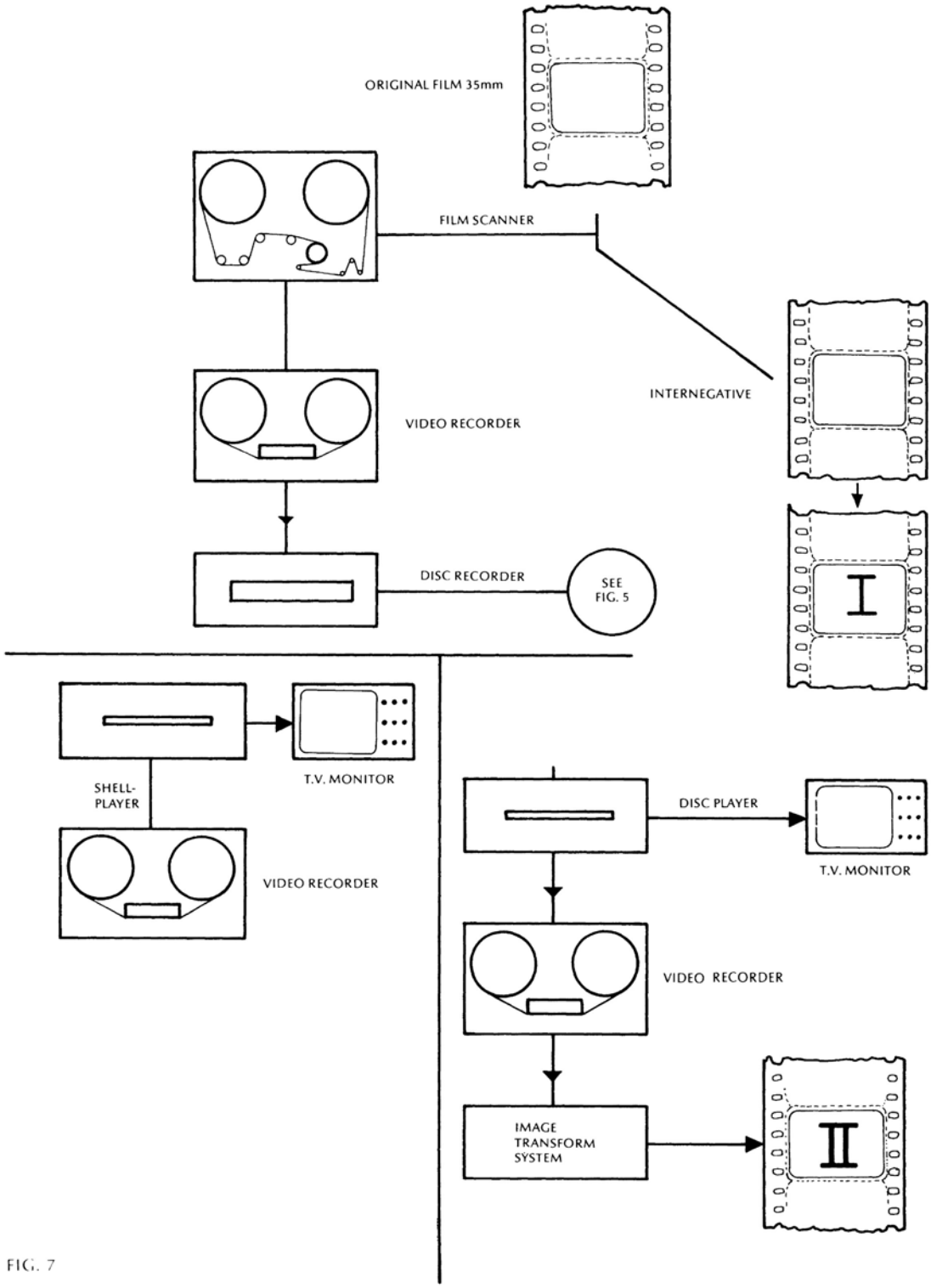

FIG. 7

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13.
A REPORT ON TESTS ON THE BEHAVIOUR OF FILM MATERIAL IN TIGHTLY-SEALED CANS.

Fritz Moschke
Staatliches Filmarchiv der Deutschen Demokratischen Republik

To meet the economic requirements of our time it is imperative to devote ever more attention to the use of energy and to reconsider technical processes under that aspect. In film archives this includes definitely the entire technology of film storage.

Due to its chemical and physical properties film tends to be rather costly in long-term storage. This concerns above all the storage conditions of colour film and the energy that is required to establish relative air humidity of 20-30% at a temperature of minus 7 degrees. The problematical nature of these considerations prompted us about 2 1/2 years ago to carry out the following test: a metal (300m) film can was sealed airtight by means of rubber glue, and equipped with measuring instruments such that it was possible to read the relative air humidity and the temperature prevailing inside the can from the outside.

As had not been expected otherwise, the temperature inside the can adapted rather quickly to the outside temperature, and after 6 hours we found differences in temperature of 20°C adjusted. The air humidity behaved in a different way. But before I come to this let me give you some figures: a (300m) film reel has a volume of approx. 1,470cm³, the volume of a (300m) film can accounts for 2,490cm³, leaving a residual volume filled with air of 1,020cm³. One (300m) film reel weighs 1,925kg at room temperature of + 23°C and approx. 65% relative air humidity. Approximately 34g of this accounts for water. One liter of air contains 0.0134g water under equal climatic conditions. The humidity content of air is insignificant as compared to the water content of film. If film is being kept at a constant temperature it does not release any humidity to the surrounding air. This danger is, however, imminent with large temperature variations over longer intervals. When it occurs it leaves condensation water forming inside the can.

The measurements performed by us on a sealed film can over a period of 6 months, under fluctuations in temperature of a maximum value of 20°C during day and night, indicated fluctuations in the relative air humidity of a maximum value of 5%.

The closed and sealed film can was also exposed to extreme heat, i.e. + 60°C for approximately 5 hours. After cooling down to the ambient temperature the initial values were restored. The can was then stored, closed but not sealed, for 2 years at room temperature (22°C). The fluctuations in temperature were in the range of maximally 8°C (day and night), and the humidity of the room varied between 50-65% daily. The micro-climate prevailing in the can did not register any of these short-term fluctuations. The values of humidity remained constant at the upper limit, at 63-65% relative air humidity.

The tests which we have carried out represent no sensational new discovery. All they do is to confirm in a different way the starting point for the development of the Magic Box in Sweden. By means of measuring technology we have proved that although the micro-climate in an airtight closed film can adapts to any fluctuation in temperature, the air humidity shows hardly any variations.

The experiment performed by us also confirms the necessity of drawing off humidity from the film before welding or sealing it in cans. From an energy point of view the same applies to the storing of film under the conditions of low temperature storage.

We consider it to be useful to continue testing the behaviour of film under various external conditions. It would certainly add to the efficient operation of an air-conditioning plant if detailed data were available about how the micro-climate in a film can adapts to ambient values.

You may know that the Staatliches Filmarchiv der DDR has decided in favour of low-temperature storage. We are determined to retain that technique. But since we, too, are obliged to use energy in a rational manner, we will continue following up other methods of film storage.

I shall not give any further explanations about the construction of our colour film vaults, as I understand that a related written material is on display.

14.
QUE PEUVENT FAIRE LES FÉDÉRATIONS POUR SOUTENIR LES JEUNES ARCHIVES?

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Instituto Nacional de Cinéma
Maputo-Moçambique

Tout d'abord, nous tenons à souligner que nous ne pouvons que nous réjouir de la coopération qui s'établit entre les archives de cinéma et les archives de télévision, dont ce symposium technique est un exemple concret. Ceci car dans la plupart des pays en voie de développement nous nous devons d'assurer la sauvegarde des images sur les deux supports.

Au cours de la tenue de ce symposium, les 15 jeunes archives présentes ont eu à se poser très souvent la question: "que peuvent faire les fédérations pour nous soutenir"? Cette question nous a menés à poser d'autres questions, comme par example:

— "pourquoi les fédérations doivent-elles nous soutenir"?

— "que pouvons-nous faire nous-mêmes"?

Une conclusion s'est très vite imposée à nous:

Le développement futur des jeunes archives est basé sur leurs propres efforts:

Nous sommes généralement conscients du fait que le développement des archives récemment créées ou à créer se base sur les efforts de ces archives. Ces efforts, dans notre contexte, veulent dire volonté de débuter un travail dur, avec sacrifice et souvent dans l'anonymat le plus complet. Ces efforts signifient aussi avoir l'imagination pour trouver les réponses les plus adéquates aux nécessités de chaque pays et utiliser les moyens à notre disposition, généralement très insuffisants, de la façon la plus rationelle possible.

Il nous faut aussi être capables d'adapter les nécessités et les moyens dont nous disposons aux exigences d'une activité scientifique et rigoureuse comme l'est la tâche de la préservation des images en mouvement. Cela ne signifie nullement que nous devons renoncer à l'analyse de l'expérience accumulée par les archives ayant une plus grande tradition et se trouvant à un niveau plus développé. Cela ne signifie nullement que nous ne réitérons pas l'appel urgent que nous dirigeons aux organismes et aux institutions qui, d'une façon ou d'une autre, peuvent collaborer à l'établissement et au développement de nouvelles archives. Cette coopération est chaque jour plus urgente mais elle sera inutile si une volonté ferme de faire face aux problèmes n'existe pas au préalable de la part de chaque archive. Cette coopération sera inutile s'il n'existe pas de notre part un travail immédiat pour débuter nos activités.

Les archives peuvent difficilement se développer dans des pays ne possédant pas une législation politique clairement définie dans le domaine de la communication et de la préservation du patrimoine national. Cependant, attendre l'existence d'une législation en ce domaine pour débuter notre activité constitueraít une grave erreur. L'expérience nous indique qu'une archive en activité, qui puisse démontrer

aux autorités et à la société l'existence d'un travail concret, se trouve en meilleure condition pour faire pression afin d'obtenir une législation nationale qui prévoit des aspects comme le dépôt légal, le soutien financier, etc. . .

D'une certaine manière, il est possible d'affirmer sans tomber dans l'erreur que l'existence au préalable d'une législation n'est pas imprescindible pour débuter les activités d'une archive nationale d'images en mouvement. Cependant, une législation oeuvrant dans le sens de protéger et soutenir le travail de cette archive se fait nécessaire à un moment déterminé.

Il serait aussi illusoire de penser que nous devons attendre l'existence de l'infrastructure technique idéale avant d'initier la tâche de recueil et de préservation du patrimoine national d'images en mouvement. Telle attente peut signifier la perte à jamais d'une partie importante de ce patrimoine. Il est donc, pour les raisons indiquées, fondamental de débuter immédiatement le travail de récupération et de préservation et, au fur et à mesure que ce travail se développe, de trouver les ressources technologiques adéquates pour élever le niveau technique et scientifique de notre travail. Nous devons souligner ici que bien des recommendations existent en ce qui concerne des données comme la température et le degré d'humidité; vouloir imiter les archives développées en ayant recours à des moyens techniques sophistiqués constituerait une grave erreur. Cette attitude peut conduire à la passivité, d'une part, et à la dépendance technologique d'autre part.

Chaque archive devra chercher et trouver les réponses les plus adéquates au type de matériel qu'elle possède, aux conditions géographiques et climatériques dans lesquelles elle se trouve, en accord avec ses disponibilités économiques.

Dans ce domaine, les conseils et l'expérience des archives plus vieilles peuvent être d'une utilité sans limites, surtout pour éviter que les ressources dont nous disposons soient utilisées de façon erronnée.

Nous voulons vous faire remarquer que tout le soutien de la part des fédérations en général, et des différentes archives membres en particulier, peut être d'une très grande importance, mais nous insistons sur le fait que ce soutien ne pourra jamais se substituer à nos efforts. Cependant, sachons que la possibilité de croissance de nouvelles archives et leur participation au sein des fédérations est une forme de croissance de ces organisations. De la même manière, la reconnaissance des fédérations peut servir, en plusieurs cas, à sensibiliser les autorités nationales de l'importance du travail des archives.

Signalons enfin que le travail des jeunes archives, la sauvegarde de patrimoines nationaux d'images en mouvement, produiront aussi des bénéfices pour les archives plus développées, dans la mesure où ils rendront accessibles à celles-ci une partie encore inconnue ou ignorée de la production mondiale, élargissant ainsi les horizons de l'histoire cinématographique et enrichissant de façon significative la culture de notre temps.

Que peuvent faire les Fédérations pour soutenir les jeunes archives?

Le symposium technique de Stockholm, le thème proposé, "*L'Archivage des Images en Mouvement au 21e Siècle*", la façon dont l'organisation a été établie, pourraient en eux seuls constituer une réponse à la question posée.

D'ores et déjà, Stockholm doit figurer dans l'histoire des Fédérations en ce qui concerne la création et le développement d'archives d'images en mouvement dans les pays dits sous-développés. La possibilité qui a été donnée à 15 représentants de jeunes archives de ces pays de participer à ce symposium est l'aboutissement d'une convergence de volontés, condition préalable au développement et au progrès. La convergence dont je parle est surtout le résultat de l'enthousiasme et des efforts de la Cinémathèque Suédoise et en particulier de Mme Anna-Lena Wibom. Elle est aussi le résultat de la garantie de soutien des Fédérations et en particulier de la FIAF, d'une part, mais aussi d'organisations suédoises et internationales comme l'Agence Suédoise pour le Développement (SIDA), l'Institut Culturel Suédois et l'UNESCO d'autre part. Cette convergence de volontés et d'efforts a

permis que d'autres volontés, toujours éloignées, souvent méconnues, du Vietnam à la Bolivie, de la Thaïlande au Mali, puissent répondre à l'appel qui leur a été adressé.

Tous ces efforts, toute cette énergie, doivent être poursuivis.

Il est de notre responsabilité à tous de garantir que la semence jetée sur la terre labourée germe et donne les fruits attendus. Cela exige de tous attention, patience, persévérance dans l'effort et surtout volonté de réaliser un espoir et des objectifs qui nous sont communs.

Cette volonté n'a rien d'innovateur au sein des Fédérations. Permettez-moi de citer M. Raymond Borde de la Cinémathèque de Toulouse, malheureusement absent, qui dans son livre "Les Cinémathèques" indique: "Au congrès de la FIAF en 1956 à Dubrovnik, une recommendation votée prévoyait 'une aide de premier établissement aux cinémathèques nouvelles, sous forme de prêts limités ou illimités de copies de films ou de matériel divers, à la discrétion des membres de la FIAF et selon leur moyens"...

Raymond Borde nous indique aussi: "Au congrès de Moscou en 1964, Jerzy Toeplitz avait fait voter la résolution suivante: 'La FIAF fait appel à tous ses membres pour qu'ils viennent en aide à tous les pays en voie de développement et à tous les états récemment créés en vue de l'organisation de cinémathèques chargées de conserver leur production nationale et de réunir les trésors de l'art cinématographique mondial" (...)

"Au congrès de New York en 1969, le problème a pris un aspect nouveau: l'aide aux jeunes cinémathèques. Un latino-américain a secoué la torpeur de l'establishment en disant dans quelles conditions d'atroce dénuement les 'small and and young archives' stockaient leurs films sous la chaleur des tropiques. La Cinémathèque de Toulouse, qui avait le souvenir encore frais de ses espérances et de ses déboires, a fait aux riches, au nom des pauvres, trois propositions toujours valables:

1. — Prêt illimité des copies superflues:

Cette proposition pourrait se formuler de la façon suivante: lorsque les clauses de dépôt lē permettent, aucune copie, si elle est encore utilisable, ne doit être détruite sans être proposée aux cinémathèques débutantes;

2. — Echange de copies:

(...) Il serait extrêmement souhaitable qu'à l'occasion des congrès annuels de la FIAF, les demandes et les offres prennent une plus grande ampleur. Les jeunes cinémathèques pourraient ainsi savoir ce qui est recherché et ce qu'elles peuvent pouvoir espérer obtenir;

3. — Intervention auprès des distributeurs:

(...) "Au congrès de Mexico en 1976, la FIAF crée une Commission pour l'Aide aux Pays en Voie de Développement et entreprend une enquête à l'échelle mondiale dans les pays qui n'ont pas de cinémathèque" (...)

Fin de citation.

Si cette volonté n'a pas toujours produit les résultats concrets attendus, cela est dû pour une grande part au fait qu'au sein même des Fédérations, la connaissance des problèmes et des besoins communs et spécifiques des jeunes archives n'est pas toujours acquise. Il est évident que les problèmes et les nécessités varient selon chaque archive concernée. Il est évident que les problèmes et les besoins des Archives en Inde ou aux Philippines ne sont pas les mêmes, et certainement très différents de ceux du Congo ou de la Bolivie. Il n'en est pas moins évident que certains problèmes et nécessités nous sont communs et pourraient être résolus avec le soutien des fédérations.

Je n'aurai pas la prétention d'établir ici un relevé total de tous les aspects que peuvent revêtir les actions de soutien menées par les Fédérations, mais de fondalementalement essayer de tracer le cadre et les lignes générales dans lesquels un programme de soutien aux jeunes archives pourrait être mené à bien.

Répétons-le encore une fois, ce qui n'est pas de trop, que les succès dans l'établissement d'archives d'images en mouvement dans nos pays dépend fondamentalement de notre travail. Le soutien des Fédérations est essentiel pour assurer un

rythme plus accéléré de notre développement, mais ne pourra jamais se substituer aux efforts locaux qui pourront être menés.

Si vous me le permettez, je caractériserai les problèmes auxquels nous faisons face en 3 axes principaux:

1. — *La carence d'infra-structure technique de conservation et les problèmes ayant trait aux options technologiques à réaliser par nos pays, à économie débile et non producteur de technologie.*

Dans ce domaine, nous lançons un défi aux capacités des techniciens des archives membres des Fédérations que — nous en sommes sûrs — ils sauront relever. Confrontés à des situations nouvelles tant au niveau climatérique, économique et infra-estructure, comme au niveau de l'integration et de l'adoption de technologies à des environnements divers et à des stades d'évolution socio-culturels différents. Les techniciens membres des Fédérations devront trouver des solutions nouvelles à des problèmes nouveaux — avec notre concours, bien-entendu.

2. — *L'absence de cadres dûment qualifiés qui puissent assurer correctement et avec un peu plus que leur enthousiasme les tâches de conservation, de cataloguage, de documentation et de diffusion.*

Permettez-moi d'attirer votre attention sur le fait que, si nous acceptons que l'élément humain est le facteur principal du développement, sachons donc mobiliser toutes nos capacités dans un effort commun, capable de fournir à ces enthousiastes d'autres continents — qui en fait nous ressemblent beaucoup — les connaissances nécessaires à la réalisation de leur travail. Ce n'est qu'ainsi que nous assurenrons le développement d'archives là où elles ne font que naître ou n'existent pas encore.

3. — *Le 3e aspect fondamental de nos problèmes est la nécessité presque vitale que caractérise notre activité de production. Nous nous devons d'assurer cette activité de difusion pour garantir la continuité et le développement de notre travail.*

Je ne m'attarderai pas plus sur cet aspect, mais me permettrai quand même de vous rappeler encore une fois les propositions de M. Borde déjà citées. Cela va sans dire que nous faisons nôtres les propositions, encore valides, de M. Borde.

Etant donnés ces préalables, nous aimerions indiquer aux Fédérations quelques formes de solutions nous paraissant être viables, réalistes et nécessaires, afin de garantir que l'intérêt croissant qui existe de par le monde pour l'établissement d'archives d'images en mouvement puisse être correctement maintenu en éveil. A cet effet, les Fédérations devraient assurer la diffusion ample de toute l'information relative ayant trait à ces organisations et aux archives membres, ainsi que de la législation existente et des lignes d'orientation générale nécessaires à l'établissement d'archives d'images en mouvement. En établissant des mécanismes de contact souples et permanents, il serait souhaitable que des canaux de liaison soient établis avec les commissions techniques de conservation.

Cette liaison permettrait la saisie des problèmes caractéristiques des pays à climat tropical par les techniciens des archives développées et pourrait ainsi garantir le suivi des projets de création d'infra-structures techniques, par le biais de la fourniture de l'expertise nécessaire aux techniciens locaux.

Elle permettrait aussi de fournir les indications exactes relatives à l'équipement de base indispensable aux jeunes archives, évitant ainsi que des erreurs déjà commises le soient à nouveau. Nous ne pouvons pas nous permettre dans le cadre de nos moyens limités de faire des investissements coûteux s'avérant ne pas être les plus indiqués. Enfin, cette liaison aurait comme effet la découverte de solutions nouvelles par l'adaptation de moyens techniques locaux à la pratique de l'archivage des images en mouvement.

Afim d'assurer aux jeunes archives la possibilité d'établir leurs services de documentation, il serait souhaitable que les Fédérations poussent leurs membres à suppléer aux nécessités existantes en fournissant de la documentation aux archives jeunes et en facilitant la pratique des échanges.

Au niveau de la formation, il est nécessaire de faire le relevé systématique des nécessités existantes et d'assurer la liaison entre les divers projets dans ce domaine. Une action particulièrement sentie devra être menée afin que les archives développées acceptent des stagiaires et afin de soutenir les initiatives locales de formation.

Des efforts importants decront être poursuivis auprès d'organismes nationaux et internationaux, notamment auprès de 1'UNESCO, afin que ceux-ci soient amenés à soutenir des initiatives diverses visant à l'établissement et au développement d'archives d'images en mouvement.

Soulignons ici l'importance des projets existants ou à créer à l'échelle régionale. Etant donné les carences que chacun de nos pays connaît, il semble plus rationnel et plus efficace de concentrer nos efforts sur des projets régionaux dont peuvent bénéficier plusieurs pays. Ainsi, il serait souhaitable que, après les séminaires sur la sauvegarde des images en mouvement organisés avec le soutien de l'UNESCO en Amérique Latine — et bientôt dans d'autres continents —, il soit envisagé l'étude de la création de Centres régionaux de préservation des images en mouvement qui pourraient constituer des centres de formation de techniciens dans les divers domaines. Les séminaires régionaux ne doivent ainsi pas constituer une fin en eux-mêmes, mais seulement le premier pas vers le développement des archives.

Enfin, et en accord avec une recommandation de l'UNESCO dans ce domaine, il serait souhaitable que les Fédérations puissent dynamiser les archives membres à participer à des programmes conjoints visant l'accès des jeunes archives à l'information et à la production cinématographique des périodes communes de notre histoire. Notre responsabilité devant l'Histoire en tant que conservateurs de cette histoire ne peut être totalement remplie sans l'accomplissement de cette condition. Il est bien entendu nécessaire de garantir à tous les niveaux que l'accès à cette production cinématographique doit signifier la continuité de sa conservation. L'attitude de la Cinémathèque du Portugal et des Cinémathèques de l'Angola et du Mozambique dans l'établissement de principes et de méthodes de travail dans ce domaine doit constituer un exemple pour toutes les autres archives et doit être soutenue par les Fédérations.

Afin d'assurer la réalisation de ces tâches, il semblerait nécessaire que les Fédérations revoient l'organisation de leurs structures en garantissant que les problèmes des jeunes archives puissent trouver écho auprès des Fédérations.

Voilà énoncés quelques problèmes et propositions qui nous paraissent refléter la réalité du monde d'aujourd'hui et des objectifs communs que nous proposons d'atteindre. Soyons conscients que tout ceci sera lettre morte si la convergence de nos volontés n'est pas réalisée. Nous tenons ici à manifester notre gratitude aux personnes et aux institutions qui ont rendu possible notre contact, qui, nous l'espérons, sera poursuivi. Très en particulier, nous tenons à remercier la Cinémathèque Suédoise et sa directrice, Mme Anna-Lena Wibom, sans laquelle notre rencontre n'aurait pas été possible, les institutions suédoises et l'UNESCO et, bien entendu, les Fédérations d'Archives du Film et de la Télévision.

L'histoire nous montre que la politique de la main tendue est vouée à l'échec. Sachons donc définir clairement le cadre de notre coopération et nos responsabilités respectives, afin d'être dignes de ceux qui nous ont précédés dans l'histoire de la conservation et de la sauvegarde des images en mouvement.

Merci de votre attention.

15.
A GENERAL INTRODUCTION TO COLD STORAGE

by Tomas Dyfverman,
Profilm, Stockholm

For the last twenty years I have been involved in film and tape *production* only so I am no professional expert on storage. I believe the reason for asking me to talk to you on this matter is that, for the past 3 years, I have been secretary in an industry-wide group called "The Colour Film Savers." This group was formed in Sweden in 1980 by some quite experienced professionals from the film industry, in particular from film laboratories, production organizations, the Film Institute and Swedish Television — and the group included film technicians, camera-men, and so on. We started to look into the quite concrete problem of dye fading in about 300 old Swedish colour feature films. We had to stop the fading cold — if you see what I mean.

The first Swedish colour feature films were produced in the late forties and the problem area — the time period — we immediately had to look into was approximately from the time the acetate film material was introduced on the general market (ca. 1951) until the mid-sixties when things got better, and also around 1974 when the newest generation of colour film stocks came in and quite another situation developed.

So our first objective was to form a policy on how we could possibly save all this material, with an outlook to come up with a solution that could be used for other types of films as well and not just in Sweden.

Our first approach to the problem was the conventional one. We obviously realized the importance of and the need for controlled temperature and relative air humidity (RH). We needed to keep both at a low and steady level, so our first proposal was to build a conventional storage vault to be operated at a temperature below zero degrees Celsius and with traditional humidity control. This is obviously a very useful way of dealing with the whole problem of old colour films fading. However, the costs involved were enormous. As most of you may know, the high cost of storing colour films for long periods of time without fading is not primarily due to the cost of refrigeration but to the need for control of the relative air humidity and thus the absolute water content in the films within the store. We found that the costs of storing 300 feature films in a relatively small installation are in the region of 1.5 million Swedish Kroner which is something like US$ 200,000. This was thought by all involved to be too expensive so we started to work really hard on new ideas.

Up to this point we had been more or less automatic, if I may call it that, and a lot of ideas started circulating in this group. One idea that came up at an early stage had to do with the fact mentioned earlier that controlling relative humidity is so expensive. We were in touch with a lot of other film libraries around the world — but not just with film libraries. We talked to people who were storing still pictures, and to museums storing wooden and textile objects from different cultures. All of these people had problems with the high cost of control of the relative humidity. The impression we got was that most people not only had to pay vast amounts of money to get these control systems set up, but most of the systems were

also technical failures. That is, in spite of good planning, a lot of money, and using seemingly good consultants, many of these air humidity control projects were failures and they could not be made to work until maybe 2, 3, or 4 years later than first planned and then only after adding more machinery, spending more money and consultancy hours. The records of progress were not impressive.

So we were afraid, to be quite honest, about suggesting this type of installation.

Needless to say, we knew from all the facts available, that the control of relative air humidity is as important as the temperature control. The problem is that at temperatures below the freezing point of water, the costs of controlling the relative humidity multiplies by 10 or even 20. It is relatively inexpensive to control air humidity at temperatures above zero degrees Celsius but when you go below it becomes difficult and expensive. Most manufacturers ask whether it is possible at all because they believe that there is nothing but ice. They do not know that it is possible to discuss the control of relative humidity at freezing temperatures. The few manufacturers who *did* know about these problems could not measure relative humidity at such low temperatures. We had to teach them and to point out what instruments they should buy, etc. So we were quite afraid.

The next idea came up: Let us reduce the amount of space that has to be air-conditioned and let us reduce the circulation in this reduced space, all in order to cut down the costs of low relative humidity. So we started thinking about absolutely vapour-tight boxes. We designed special boxes of aluminum that could hold from one up to possibly ten feature films each. These boxes were quite expensive. Even so, our costing procedures showed that this would be a system much more cost-effective than controlling vast vault spaces. We thought of having a small room with perfect climate control, opening the box, putting the film into it (after the reels had been stabilized in the room for a couple of days — or maybe a week — even two weeks) and then sealing the box perfectly, maybe even welding it together. That was one idea.

Another idea was to connect these boxes through air tubes to a central RH and temperature control unit. This sounds complicated, but the financial aspect of the whole thing was rather attractive. We were quite deeply into this, and we almost did it that way. However, an even better idea emerged after approximately two years of work, namely to use inexpensive bags instead of aluminium boxes — and this is how we came up with what is now called the Film Conditioning Apparatus System (FICA). Instead of aluminium boxes and instead of using a complete room with RH and temperature control, we used a specially built machine which is like a small moveable room. This machine makes it possible to condition the film before we seal it in the bags which look like ordinary paper bags but consist of layers of aluminium and polyethylene as well.

Now, a very important aspect of this has been the view on how to look at the traditional curves representing the relationship between relative humidity and temperature. I am quite sure that you have all had these curves burnt into your minds and you probably remember that when you lower the temperature the RH goes up. When we started out we thought that there would be almost no water present at all at minus 18 C or minus 25 C. However, the absolute amount of water in a sealed bag obviously does not change with temperature at all. The smaller the amount of air in the container the smaller the problem with relative humidity becomes. This was the key to the bag system. Actually the bag system works better than the box system, because there is less air surrounding the film. In the bag system, it is quite sufficient to condition the film at room temperature to about 20% RH, extract as much air as possible out of the bag and seal it. It is then possible to store the film at any temperature between room temperature and minus 25 C without having to worry at all about these traditional diagrams and about RH control at below zero temperatures. In this way, we remove the necessity to control the amount of water in the storage vaults. The cost of our projected application will be cut by approximately 80% because RH control equipment is no longer needed and we can therefore use a different method when building these vaults. They no longer have to be moisture-proof. All that is needed is a temperature control and this allowed us to use perfectly common, large-series, module-produced freezing rooms or refrigeration rooms just as they are used in places such as restaurants and hotels. So instead of having to build something very, very specialized from scratch which only a few

consultants in the world can handle for you, you can go to almost any company producing freezing rooms or refrigerator rooms in modules and ask for a quote, whereafter you can play the manufacturers up against each other and use all the usual tricks of the trade to get a good price.

Well, these are sort of three stages that we went through trying to develop a method which would be cost-effective, flexible, require a minimum capital outlay and confine the advanced technology involved as much as possible to our machine which was not involved in the storage at all but is just a conditioning unit.

I think that in papers to be presented later today, you will get the exact figures indicating how colour film behaves at different temperatures and the role of RH — so I am not going to talk about these technical details. I am sure you are all aware of the explosive increase in longevity of colour dyes as the temperature is lowered. It is not just a minor improvement, it is a multiplication factor that is quite astounding and as a result, colour film should last for centuries.

16.
VIDEOTAPE AND ARCHIVES: FIAT AND FIAF QUESTIONAIRES INTO POLICIES AND PRACTICES OF MEMBER ARCHIVES AND TELEVISION PRODUCTION ORGANIZATIONS

Sam Kula
National Film, Television and Sound Archives

During the past two years both FIAF and FIAT sent out questionnaires on the archiving of videotape. FIAF asked its members whether they were archiving videotape and if so what were the relationships between videotape and film that were developing in their organizations. The FIAF questionnaire was a little more ambitious. It was sent to just over 700 organizations (including all members and observers in FIAF and FIAT) that were listed in international directories as television production organizations or organizations that were likely to hold videotape as a production or archival resource. The questions were intended to establish how much videotape was being held and how it was being stored. Regrettably both surveys went out in only one language, English, and this factor, particularly in the case of the FIAT questionnaire, may have contributed to the relatively poor response.

In fact both surveys were somewhat less than a scientific sampling. The FIAF questionnaire was returned by 30 members, or roughly 45% of the total membership and those were primarily the older and well-established archives. The FIAT questionnaire was completed by only 74 organizations, a little over 10% of the organizations surveyed, and eleven of those reported that they held no videotape at all. This figure is not as disappointing a return as it would appear to be because the FIAT survey net was very coarse and included many organizations in which television production or the archiving of television was unlikely to be a significant activity. Nevertheless the returns were so scattered that the results merely indicate current policies and practises of a small segment of the potential number of organizations now involved with videotape in one way or another.

Since the two surveys had different objectives, it has not been possible to amalgamate the results. To do so would be partially redundant in any case as many of the FIAF members also answered the FIAT questionnaire. What the FIAF questionnaire reveals is that while 19 of the 30 respondents would accept videotapes (or video discs) for preservation if film were not available, at the end of 1980 only three of them actually had videotape accessions that totalled more than 5% of their total acquisitions. In fact, only three archives (the same three one would assume), had been offered a video cassette copy of an original film production as a substitute for the film itself, and only three of them had a "special" storage area designated for videotape and video cassettes.

On the other hand, when asked if they stored video cassettes and video masters in the "same storage space" as the films the response was evenly split — half replied that they did, half reported that they did not. Regardless of now the videotape was stored only one archives reported any storage problems with videotape, and that was a technical problem relating to play-back.

Perhaps that positive experience explains the faith with which film archives appear to approach videotape. When asked what they knew about "the durability of the manufactured tapes", all the respondents who replied said nothing. Again, when asked what

system, standard, gauge, etc, would they accept as meeting minimum requirements for videotape preservation, all 26 archives who replied indicated that they knew of none. What was even more depressing was that only 2 archives indicated that they had conducted research or experiments in relation to storage conditions, longevity in use, etc.

And yet, although the limited experience has been positive, the suspicion is still there. When asked if they would accept a video cassette as a means of safeguarding a film 22 archives said no, and only four said yes. That the decision may not be final is indicated by the response to the question "have you had any discussions within your archives about film preservation on videotape or video disc"; 17 archives reported that there had been some discussion.

Almost half the archives responding to the FIAF questionnaire (12) had at least one of either a video recorder or a player (usually in the same machine) at the time of the survey, although only 3 archives had staff "responsable" for either handling, processing or conserving videotapes. For most of these archives the use of videotape was confined to video cassettes for study purposes on their own premises — only 3 archives attempted to use videotape in the restoration of film. Incidentally, 17 of the respondents charged for the cost of the viewing service.

Part of the problem with regard to access to both equipment and stock is that 16 of the 28 respondents reported that neither videotape equipment nor videotapes were manufactured in their country.

To place the results of the FIAT survey in some perspective, the 63 respondents holding videotape can be divided geographically as follows: 13 from North America, 7 from Latin America, 18 from Western Europe, only 2 from Eastern Europe, 7 from Asia (Japan, Hong Kong, Indonesia and Brunei), 13 from Australia and New Zealand, 2 from the Caribbean and, regrettably, only one from Africa. As you can see, not a particularly even distribution. Another way of looking at the breakdown is the television system used: 35% of the respondents who answered this question were on NTSC, 59% were on PAL, and only 2% were on SECAM. Again, not a particularly even distribution.

Unfortunately we neglected to ask the respondents to identify the primary function of the organization. Based on FIAF and FIAT membership lists, the directories we consulted, and the name of the organization, I would say that 49, or slightly over 75% of the respondents were television broadcasters or television production companies, with the other 25%, or 14, being archives and libraries.

In relation to hardware 52% of the respondents with 2-inch quadruplex VTR's had Ampex machines, 17% had RCA and a little over 3% hand Bosch, with the same percentage owning Hitachi. With regard to 1-inch helical 'C' format machines, 48% had Ampex, 24% had Sony, almost 10% had Hitachi, with the rest scattered among N.E.C., Marconi and Phillips. 22% reported 'B' format, and that, of course, was the Bosch.

Moving to smaller formats, the Sony 3/4-inch U-matic appeared to be the overwhelming choice, selected by over 76% of the respondents, followed by JVC with 23%, and Panasonic with 17%. Very few of the respondents had 1/2-inch format machines with less than 2% reporting for Panasonic and a similar percentage for Quasar.

One of the objectives of the FIAT Survey was to establish a world-wide inventory of videotape equipment so that those holding videotapes that cannot be played on equipment currently in use would have some place to turn to effect a transfer. Regrettably this survey, attempting as it did to cover too much ground did not elicit sufficient information on equipment held by the respondents to constitute the basis for such an inventory, and in any case the response was so scattered that the results would not be a reliable guide. In other words I would hesitate to refer an archives in Southwest Africa to an archives in Western Europe to effect a transfer if I was unsure whether a neighbour much closer to hand held the equipment required.

However where the respondents of this survey have provided make and model numbers these will be listed by make and model number and this information will be available through the FIAT Secretariat. With this list as a base I am proposing that we conduct another inquiry solely on the equipment question.

Turning to videotape holdings it was not possible to derive any estimates on total volume in custody from such a scattered sample. Averages would be meaningless as the difference between the volume reported as held varied from six hours of 3/4-inch cassettes at the low end to 30,000 hours of 2-inch quadruplex at the high end. All one can surmise is that the volume is large and growing. When asked to indicate the brands of tape and the formats of which they held in excess of 1000 hours, there were 101 listings, many archives holding in excess of 1000 hours of each of several brands and formats.

Tape preferences were, as might be expected, heavily weighted in favour of the major manufacturers with the remainder widely scattered among other brands that are or were available. In relation to 2-inch quadruplex videotape, for example, 60% listed 3M as the source, 46% listed Ampex, 35% listed Fuji, and 22% listed Agfa-Gevaert. In 1-inch helical (open reel) the leadership shifted with 44% listing 3M, 41% listing Ampex, 31% listing Sony, 25% listing Fuji, 16% listing BASF, and 11% listing Memorex.

In the smaller formats Sony was the overwhelming choice for 3/4-inch video cassettes with 71%, followed by 3M with 57%, Fuji with 32%, Ampex with 25%, BASF with 22%, Memorex with 16%, and Agfa-Gevaert with 11%. As indicated, 1/2-inch format equipment was held by less than 5% of the respondents, and so tapes stocks held in that format were correspondingly low.

That preferences in videotape stock are likely to change with experience and as dictated by operational requirements is indicated by the responses to the next series of questions. While almost 27% of the respondents now buy only one brand of stock in each format, close to 35% reported that they anticipated changing the brand, and the same percentage, 35%, reported that they had already discontinued a brand. On examination the brands or types within a brand that were reported as being discontinued had more to do with evolution of video recording technology than dissatisfaction with quality, although at least one respondent reported switching from 3 M to Ampex and vice versa, and from Fuji to Sony and vice versa because of quality complaints. The other shifts were obviously the result of abandoning a format (3/4-inch for 1/2-inch) or a shift from black and white to colour, or low-band to high-band.

On the handling of videotapes, fully 28.5% reported that they evaluated new stock, with 13% evaluating every tape (a substantive undertaking), 13% every hundred tapes, and a little over 3% sampled every batch. The evaluation equipment may have involved a number of different machines, but only three (Elcon for 3/4-inch, Recortec for 3/4-inch and 2-inch, amd Ampex VPR-2 for 2-inch) were mentioned by name.

The problems encountered with new and used stock ranged from drop-outs in any format to partial erasure and print-through — although only one respondent mentioned that problem and then only with pre-1965 tapes. In particular 26% of the respondents reported difficulty with flaking (described as oxide shelving in some reports); 12% had difficulty with splices (an operational rather than manufacturing problem one presumes); 22% experienced problems with flanges (including two archives recounting difficulties with the adhesive deteriorating on the foam backing of 3M's 479 and adhering to the videotape edges); and 19% reporting problems with cassettes jamming. A number of respondents reported white powder formations related to excessive levels of humidity, but as these appear to respond well to standard cleaning devices, and do not damage the tape, the problem may not be serious. What may be more serious is the binding agent deterioration reported in some pre-1965 black and white quadruplex tape, the 'stickion' problems encountered in some one inch tapes, the edge damage caused by faulty or scattered windings, the creasing caused by faulty machines, and the edge damage reported in 90 minute reels that may be due to the sheer mass of the tape on the hub. Fully 28.5% of the respondents experienced some problem with videotape stock, new and used. One had to admire the approach of the respondent who reported that they did not archive 'problem' videotapes, and thus had none.

Despite the problems, 73% of the respondents reported that they could play back all the tapes they hold, and only 13% reported they could not play all of them back. Obviously a significant percentage either didn't know whether they could (a reasonable position once the collection is over a thousand) or ignored the question. Unfortunately the questionnaire

did not ask how many tapes could *not* be played back. It may be simply a matter of obsolete formats and the requirement for museum-type obsolete play-back equipment rather than due to a breakdown in the structure of the stock.

In examining the custodial policies of the respondents it is obvious that there is little consensus on what constitutes approved standards, or little adherence to standards if there are any. When asked, 38% of the respondents indicated that they held more than one copy of a program, but because they were not asked they did not volunteer an estimate on the percentage of their collections that was so protected. Nevertheless 35% of those with multiple copies store the preservation copy (one assumes that is the original or the one closest to the original) and the viewing copy in separate locations. Unfortunately that indicates that 67% are unable to do so, or are not willing to accept the administrative inconvenience of keeping track of titles located in two or more locations in the storage area.

As to conditions of storage, 14% held videotape at between 10 and 15°C, 41% stored at between 15 and 20°C, and 29% held it at temperatures over 20°. One hopes that implies room temperature ranging between 20° and 25°, with 25°C as the outside limit. The variations on humidity levels were equally striking. Fully half the respondents held videotape at between 40 and 60°RH, with 27% opting for 40 to 50% and 25% opting for 50 to 60%. One assumes 50% was the optimum level with both groups. However, nearly 10% of the respondents reported storage conditions of between 60 and 70%, with 2% over 70%, at the high end — low high was not indicted. At the low end 6% reported storage conditions between 30 and 40% and 2% held their tape at under 30%. One hopes not *much* under what is widely regarded as a dangerously low level for all brands of videotape.

The temperature and humidity levels reported by a number of the respondents may only have been a goal as 40% of the respondents reported difficulties in maintaining constant levels. Roughly 16% had trouble with temperature, roughly 16% had trouble with humidity, and roughly 10% had trouble that apparently resulted from a combination of faulty controls on temperature *and* humidity.

On the question of how videotape was shelved, vertically or horizontally, there was obviously some confusion as to how this question should be interpreted. Yes the shelves in each case were horizontal! Although 100% of the respondents answered the question on video cassettes (83% shelve video cassette vertically, 17% shelve them horizontally), only 71% reported that they shelved open-reel videotape vertically. The others maintained a discreet silence. There should, in fact, be little question that all open-reel videotape should be stored vertically in the manufacturer's container.

On the even more contentious issue of rewinding videotape very few of the respondents indicated that they were following suggested recommendations on periodic rewindings of videotape in store. Only 3% of the respondents reported that they rewind every six months, another 2% rewind every 12 months, another 2% every 24 months, and 73% only when the videotape is withdrawn for use. It would appear, therefore, that thousands of videotapes are being stored without benefit of periodic rewinds, which should make many of us feel less guilty, but tells us nothing about the condition of the videotapes in long-term storage under these conditions.

On a less contentious, but equally troubling issue, 70% of the respondents reported that they wind open-reel videotapes heads out, while only 5% reported that they wind them tails out. The remaining 25% may alternate them, or simply shelve them in the condition in which they arrive in the repository. In fact 46% of the respondents reported that they do not rewind tapes before placing them in store, while 40% not only rewound them, but did so to the tension recommended by the manufacturer.

As indicated in the preface to this analysis, the surveys were not representational, either by geography, demography, or institutional affiliation, and thus should not be used as a basis for assessing the state of the art in television archives. The surveys do confirm, however, that there is a wide range of materials with, apparently, very little in guidelines or standards to assist the archivists assuming this responsibility. There may not be sufficient consensus at the moment, there has certainly not been sufficient research and experimentation on which to base standards, and so we can only hope that symposia like this one can both amalgamate the existing data and stimulate more scientific enquiries into videotape conservation.

I think it important to build on the basis of these first inquiries to achieve the goal of a world-wide inventory of equipment in operational condition. The survey has also helped introduce the work of the federations to potential affiliates, and leaving aside the question of membership, it is important that we establish that mutuallity of interests that links manufacturer, broadcaster and archivist throughout the world.

17.
EVALUATION OF QUALITY IN MOTION PICTURE IMAGES AND SOUND USING FIAF TEST FILM CURRENTLY UNDER DEVELOPMENT

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In my statement entitled "Future tasks for the FIAF Preservation Commission" (Mexico, June 1982) I pointed out the importance of FIAF establishing standards for preservation work just as the Society of Motion Picture and Television Engineers (SMPTE) does for film and television work etc.

Whether archives have their own printing and processing plant or have to rely on a commercial laboratory, it is imperative that the technicians be able to evaluate the results of all the duplication and processing operations involved.

Evaluation of quality is difficult, not only because archival films are quite often marred by previous heavy use and perhaps deterioration which conceal blemishes introduced during printing and processing, but also because subjective factors influence the overall judgement.

The aim of this test programme is to develop a test film which makes it possible to quantify the various quality factors and thereby makes quality assessment mostly objective.

Firstly, it was necessary to establish a vocabulary for things that can go wrong and to make sure that elusive parameters which can vary from day to day, such as film tension on the printer, were recognized. We then decided to consider quality factors such as resolution, flare, contrast, density, and steadiness using a Bell and Howell Model C continuous printer and an Arri step printer as representatives of two groups of printers known to have quite different characteristics, such as light source, type of contact, registration, and movement.

The current programme (changed slightly since the presentation in Stockholm) consists of the following items:

(a) Refinement of tests to eliminate unwanted variables such as density variations

(b) Production of a single test strip master followed by a series of masters with various degrees of artificial shrinkage (0 to 2.6% in increments of 0.2%)

(c) Test of full range of printers: 1) contact printers such as Bell and Howell, Arri, panel (wet gate) printers, and Bell and Howell Sound, panel (wet gate) printers for sound; 2) optical printers

(d) Expansion of item (c) to include printers in FIAF archives and associated laboratories interested in participating in the programme

(e) Accumulation of results and, based on these, development of FIAF standards for high quality archival printing

(f) Investigation of ways of making such test procedures easily available to interested FIAF archives and associated laboratories.

PROGRESS REPORT:

(a) *Refinement of tests to eliminate unwanted variables such as density variations, in resolution and flare measurements*

The test negative used consists of two sections:

1) A focus chart consisting of horizontal and vertical rulings spaced at 20 different intervals ranging between 11.7 and 117 line pairs per millimetre (lppmm). The full set of rulings appears in centre frame and at each corner (see frame blow-up (perforation simulated)). This chart was exposed at a range of negative densities onto Kodak panchromatic high contrast stock type 5369. In every case, negative resolution was better than 117 lppmm.

2) A flare test consisting of 48 frames. The first 24 frames contain a 3mm diameter spot of progressively increasing density, the remainder of the frame being black. The second 24 frames contain a corresponding series of spots, this time surrounded by clear film. In printing, any light scattered from this surround area that falls into the centre spot manifests itself as an increase in density as compared with the black-surround series.

These two negatives were printed onto Gevaert black-and-white positive stock type 561 at a range of exposures, on a 35mm Bell and Howell Model C continuous contact printer running at 180 feet per minute (fpm), and on an Arri step contact printer running at 12 frames per second (fps). The prints were developed to a control gamma of 2.5. Resolution was assessed by microscope examination of the rulings at centre frame and at one corner. On the model C, the non-sprocket driven edge was selected for the corner readings. Density was measured using a Brumicro densitometer fitted with a 2mm aperture.

Results: 1) Resolution (see graphs 1, 2, 3 and 4)

i) Inspection of results shows immediately that in the case of heavy prints from light negatives, positive image spread limits resolution very severely, whilst in the case of light prints from heavy negatives, negative image spread is sufficient to render fine lines in the positive completely invisible. Optimal results appear where negative and positive image spread cancel each other most accurately. (In some of the lighter prints edge results were better than centre results and this may be due to some unevenness in the printer field resulting in higher densities at the edge). Results are charted in graphs 1, 2, 3 and 4.

ii) Where negative and positive densities are optimal, two factors emerge: firstly, that the step printer shows the better results (consistently 93 lppmm), and that edge results are comparable with the centre; and secondly, that the continuous printer resolves vertical lines better than horizontal lines (74 to 83 lppmm as against 58 to 65 lppmm). Edge results are not significantly different from centre results, but this printer does show less consistency in resolution, pointing to a variability in the slippage that is undoubtedly the cause of these results.

Results: 2) Flare

Graphs 5 and 6 are plotted of positive density against negative density at a number of printer exposures (light values (LT) shown at top of graphs), for the black-framed negative series (no flare) and the clear-framed negative (with flare). Greater printer exposures result in more light coming through the clear surround and correspondingly more flare. Flare is more evident in lighter printer density spots where it is greater in proportion to the true exposure.

The results show that the two printers tested show equivalent amounts of flare at similar print exposures, and that the two printers produce comparable contrast prints. As they are both contact printers, lens flare is not relevant and the flare that is evident is presumably a result of light scatter within the emulsion of negative or raw stock.

Conclusion (a)

These tests show no startling results. However, they serve to refine the test procedure for tests on further printers, and establish a point of reference for further tests using artificially shrunken negatives. A negative density of 2.20 to 2.50 combined with a positive

density in the same range appears ideal. This is produced in the middle ranges of normal printer lights, and is a sufficient exposure to produce measurable flare densities.

(b) *Report on preliminary tests using artificially shrunken film*

Five foot sections of the focus chart negative referred to in (a) were shrunk to various degrees by extraction of plasticizer. (Buckle wave and curl could also be introduced by extraction resulting in test film which would resemble old nitrate more closely. However, it would introduce too many variables at this early stage of the programme). These sections were then spliced together and printed on the machines used in previous tests onto black-and-white positive stock. Horizontal and vertical resolution were assessed under the microscope.

Results: 3) Shrinkage

Measurement of image dimensions confirms original measurements of film dimensional shrinkage (using Krumm Shrinkage Gauge. See Table 2). Shrinkage was found to þe equal in both longitudinal and lateral dimensions.

As a precaution, each sample was wound through a film synchroniser. Sample D rode out of the sprocket teeth very quickly. The others ran satisfactorily.

TABLE 2

Sample	% Film Shrinkage	% Image Shrinkage Compared with Sample A$^{\gamma}$	Synchroniser Operation
A$^{\alpha}$	0.30$^{\beta}$	0	OK
B	0.65	0.50	OK
C	1.60	1.50	OK
D	1.90	1.85	Would not run

$^{\alpha}$untreated; $^{\beta}$negative pitch $^{\gamma}$measured through microscope

Results: 4) Printer Operation

Both printers ran successfully with no loss of position in any sample. The Model C printer was operated at 60 fpm for best results.

TABLE 3

Sample	% Shrinkage	Arri lppmm Centre	Arri lppmm Edge	Model C lppmm Centre	Model C lppmm Edge
A h$^{\alpha}$	0.30	73	83	58	65
v$^{\beta}$		73	83	65	65
B h	0.65	73	73	47	58
v		73	73	58	58
C h	1.60	73	83	12	12
v		73	73	42	33
D h	1.90	83	83	12	12
v		73	73	42	26
Print Density (Max)		1.85		1.98	

Negative Density: 1.58

$^{\alpha}$h = horizontal lines; $^{\beta}$v = vertical lines

Results: 5) Resolution

Results are tabulated in Table 3. Unfortunately the negative density was lower than the optimum previously determined. However, suitable print densities for this negative were

produced. The results indicate little or no quality loss on the Arri printer, but massive image movement on the continuous printer, in the greater degrees of shrinkage.

Conclusion (b)

The low results on the continuous printer appear as a double image: the resolution figures are only an approximate indication of the extent of the image displacement.

Further tests are obviously required, with shrinkage in lesser increments (from 0 to 2.6% shrinkage in increments of 0.2%) and with more appropriate negative densities.

Additional Printing Tests (Sound Tracks)

We are currently photographing some sound negative (high frequency; variable area) for shrinkage, and will then carry out the previous range of tests for image on Bell and Howell, Arri and panel (wet) printers; and Bell and Howell sound and panel (wet) for sound. Shrinkage to be in steps of 0.2%.

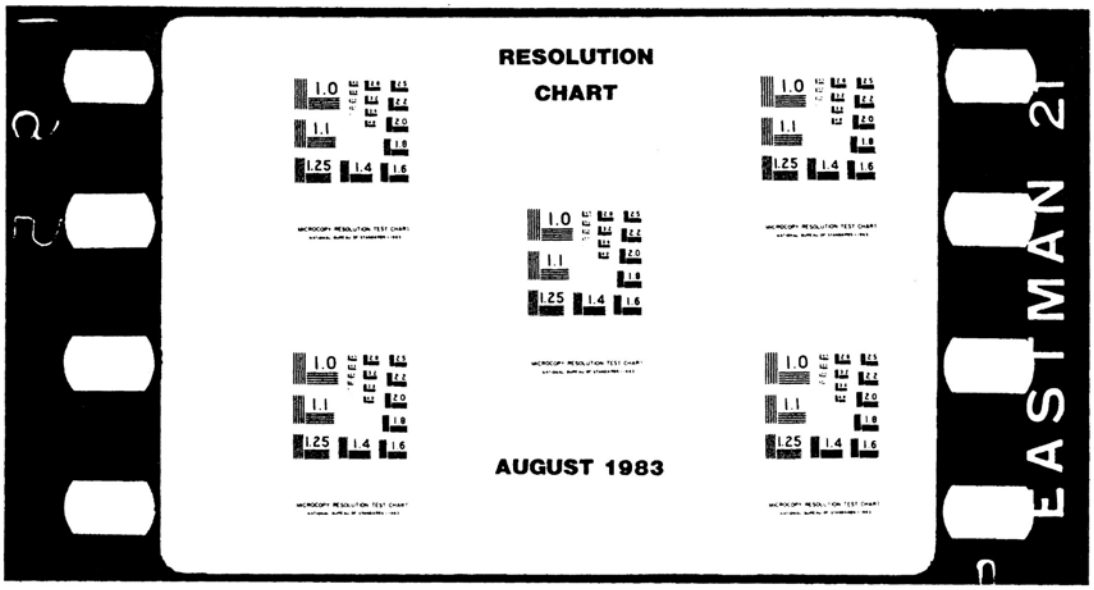
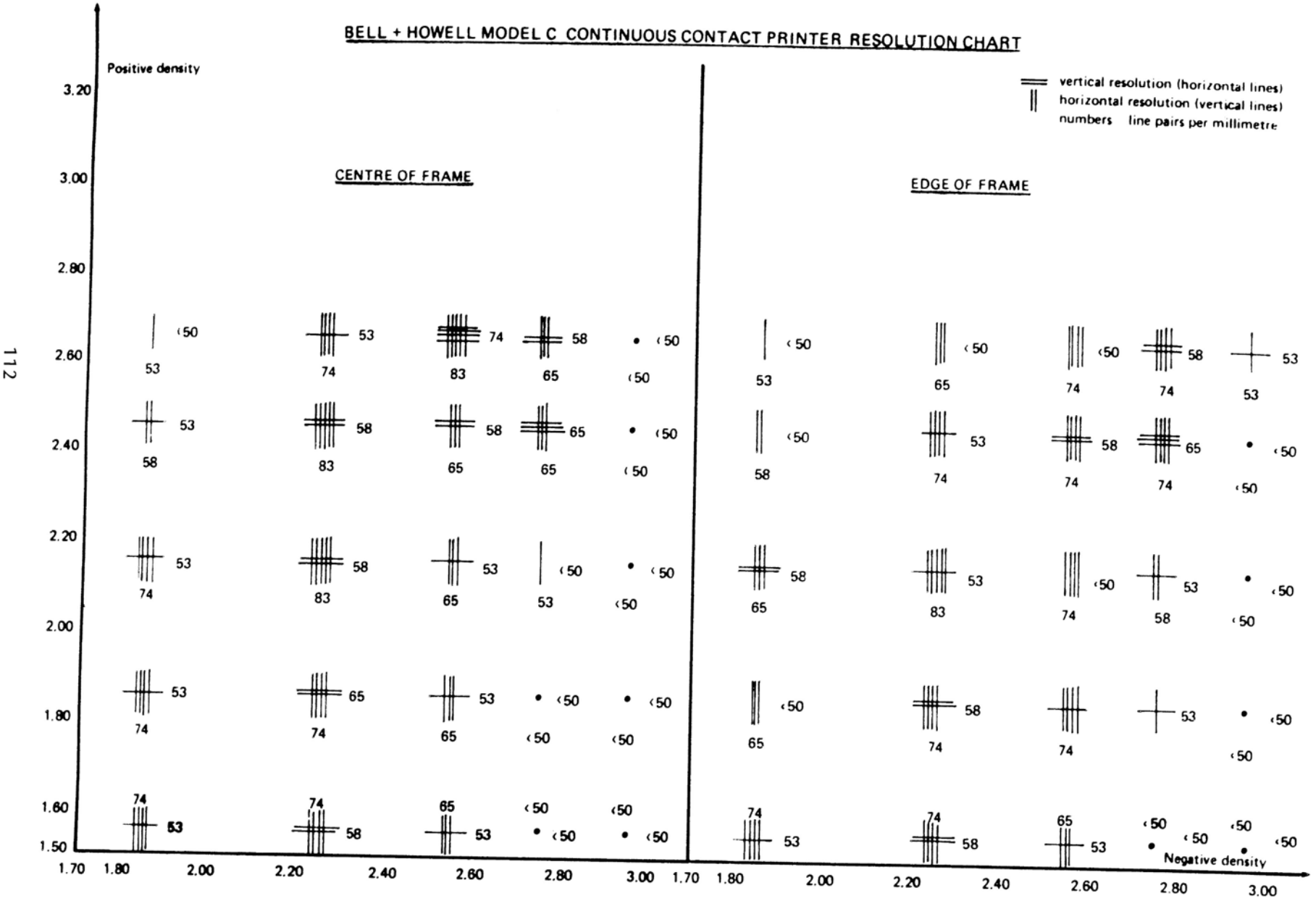


FIG. 8

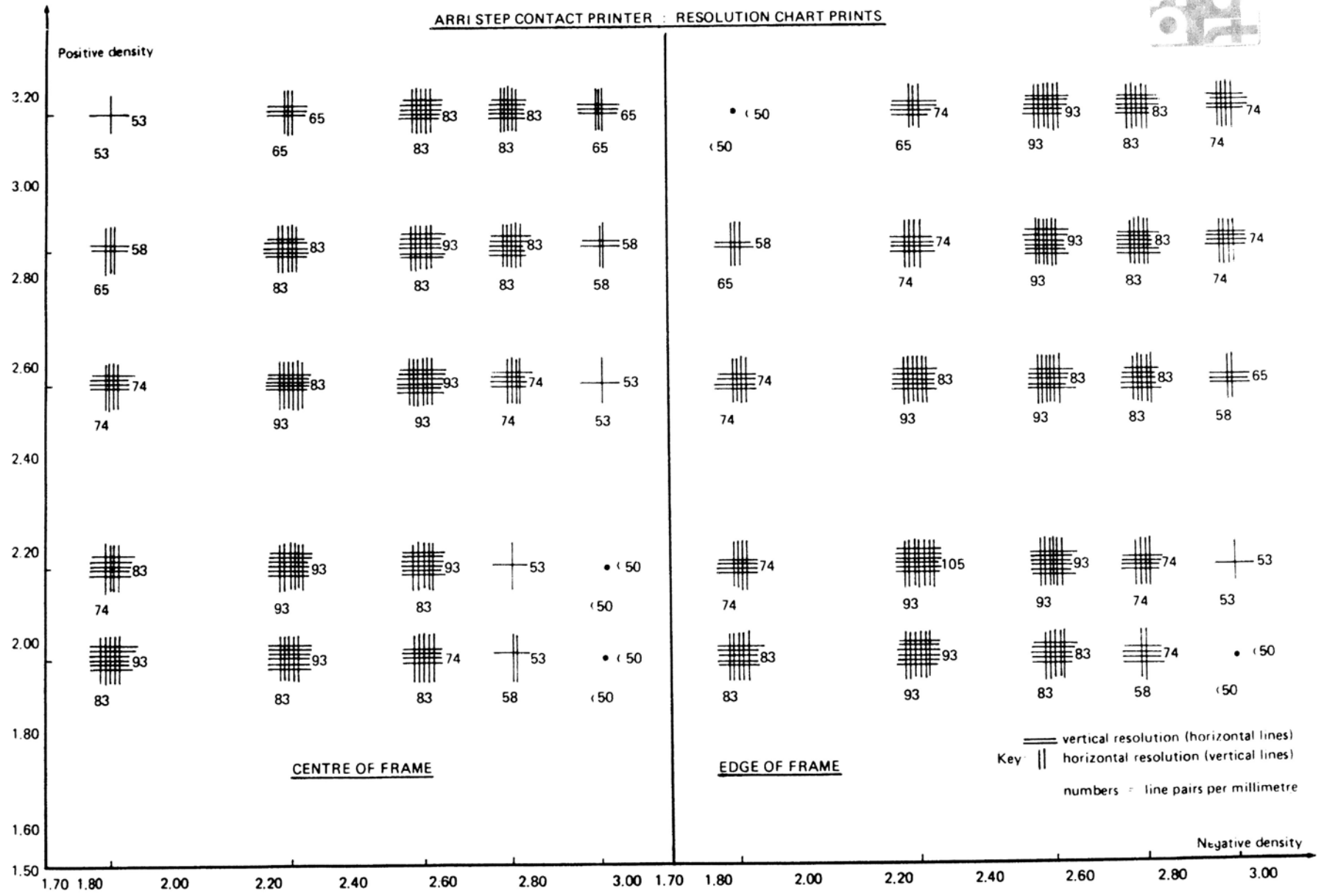
TABLE 1 RESOLUTION GRID SCALE

Nominal value	Actual lppmm	Graph symbol	Nominal value	Actual lppmm	Graph symbol
1.0	11.7		3.6	42.0	
1.1	12.8		4.0	46.7	
1.25	14.6		4.5	52.5	
1.4	16.3		5.0	58.3	
1.6	18.6		5.6	65.3	
1.8	21.0		6.3	73.5	
2.0	23.3		7.1	82.8	
2.2	25.7		8.0	93.3	
2.5	29.2		9.0	105.0	
2.8	32.6		10.0	116.6	
3.2	37.3				

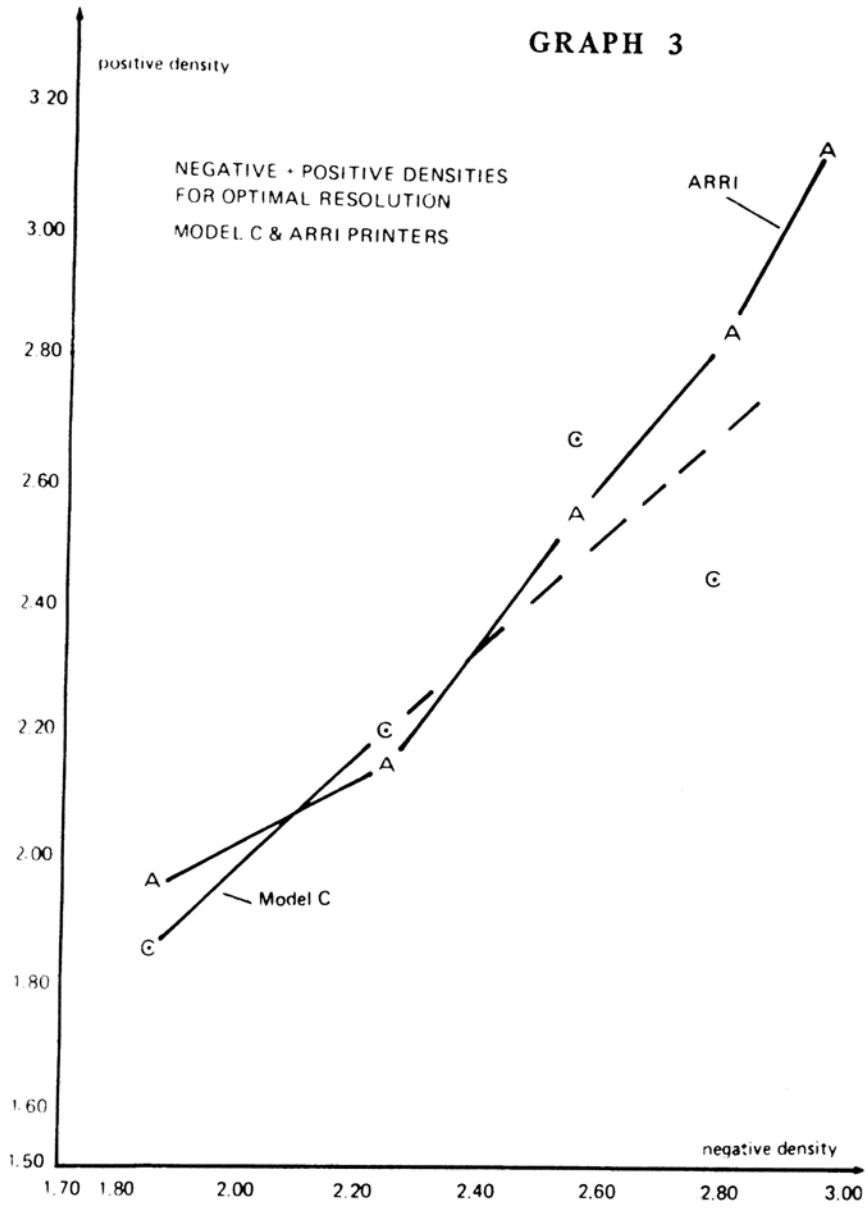
GRAPH 1


BELL + HOWELL MODEL C CONTINUOUS CONTACT PRINTER RESOLUTION CHART
Positive density
vertical resolution (horizontal lines)
horizontal resolution (vertical lines)
numbers line pairs per millimetre
CENTRE OF FRAME
EDGE OF FRAME
3.20
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.50
1.70 1.80 2.00 2.20 2.40 2.60 2.80 3.00 1.70 1.80 2.00 2.20 2.40 2.60 2.80 3.00
Negative density

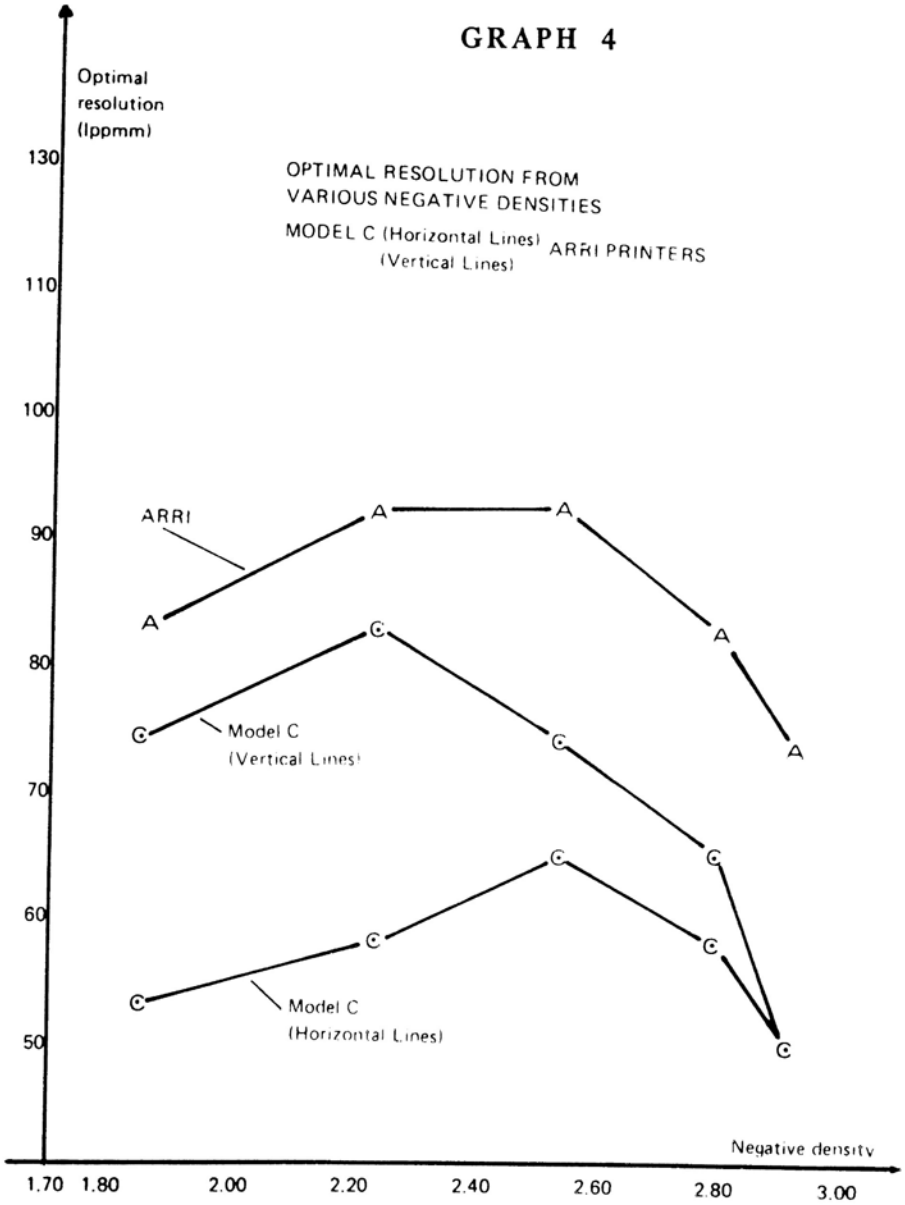
GRAPH 2


ARRI STEP CONTACT PRINTER : RESOLUTION CHART PRINTS
Positive density
3.20
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.50
1.70 1.80 2.00 2.20 2.40 2.60 2.80 3.00
CENTRE OF FRAME
EDGE OF FRAME
Negative density
1.70 1.80 2.00 2.20 2.40 2.60 2.80 3.00
Key
vertical resolution (horizontal lines)
horizontal resolution (vertical lines)
numbers = line pairs per millimetre

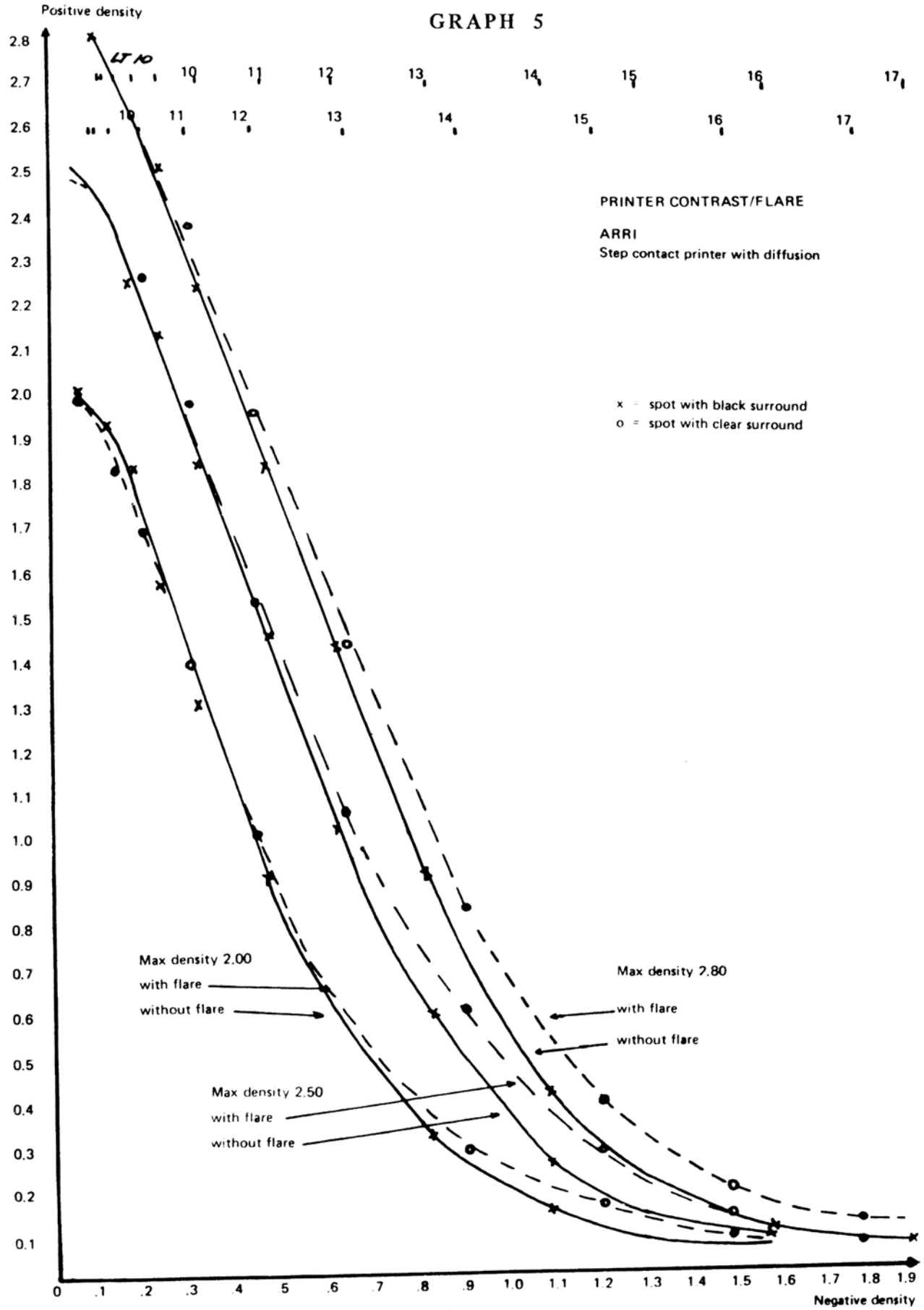
GRAPH 3



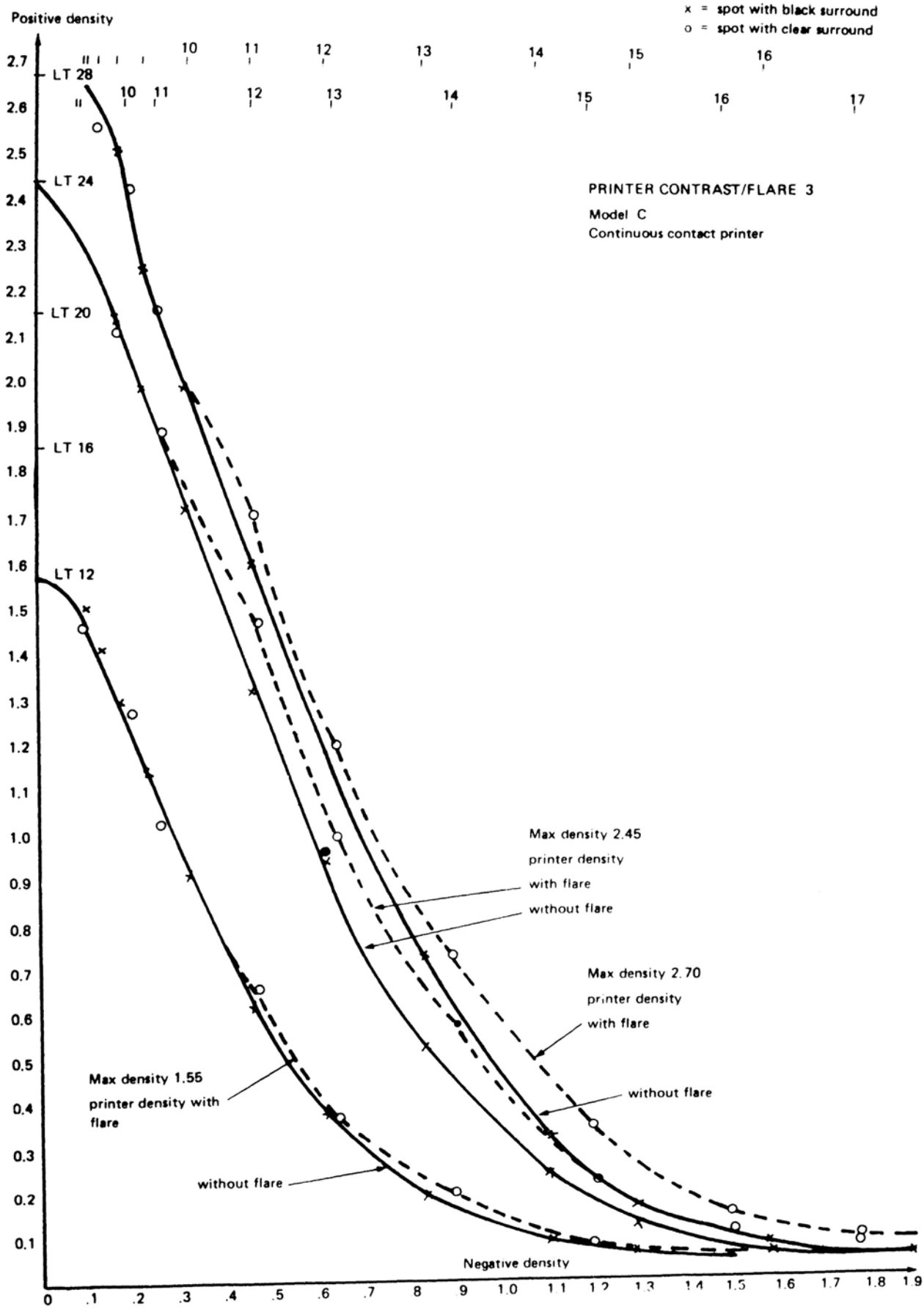
GRAPH 4



GRAPH 5


Positive density
Negative density
PRINTER CONTRAST/FLARE
ARRI
Step contact printer with diffusion
x = spot with black surround
o = spot with clear surround
Max density 2.00
with flare
without flare
Max density 2.50
with flare
without flare
Max density 2.80
with flare
without flare

GRAPH 6


x = spot with black surround
o = spot with clear surround
Positive density
LT 28
LT 24
LT 20
LT 16
LT 12
PRINTER CONTRAST/FLARE 3
Model C
Continuous contact printer
Max density 2.45
printer density
with flare
without flare
Max density 2.70
printer density
with flare
without flare
Max density 1.55
printer density with
flare
without flare
Negative density