

The Restoration Business Part 4: In Black and White—Reel One

By Grant Lobban

Previous parts of the Restoration Business looked at the continuing need for restoration, to prevent the loss of films by natural decay and human neglect. This time we move on to the technical aspects of the task. Although digital technology is becoming an important new tool available to restorers, its current high cost restricts it to the more "commercial" restorations, where the costs can be recovered from re-issues in the cinema or a release on video. Most projects still rely on traditional repair and photographic techniques. Even if computer processing is to be employed, the best possible original material still needs to be prepared for the initial digital scanning.

Finding the 'originals'

The detailed accounts of some of the more high-profile restorations describe the search for all the remaining material and its preparation for final printing. They may have been fortunate to find the original camera negatives in good condition to work with, or at the other end of the quality scale, having to make do with a worn projection print. In between there are many forms of "pre-print" elements, described as "dupes," "inter-positives," "inter-negatives," "lavenders," "one-light printing masters," etc. In the case of colour, "separation negatives," "master separation positives," "matrices" and "CRIs," are among the terms banded [sic] about. To understand what all these descriptions mean, and how they are dealt with by restorers, it's worth looking at a summary of the way motion pictures have been photographed and printed over the last 100 years, starting with black and white.

Professional film making has been almost exclusively based on the negative/positive process, in which the negative exposed in the camera, or some form of copy of it, is used to produce all the prints shown in the cinemas. What made it all possible, was the availability of a thin clear flexible base made of cel-

lulose nitrate. Some of the first pioneers obtained raw celluloid, cutting and coating it with light sensitive emulsion themselves, creating their own individual film formats, many with images close to the size of lantern slides.

The Kinetoscope

The first commercially successful moving picture device using photographic film was the Edison Kinetoscope, introduced in 1893. It was an individual "peep-hole" viewing machine loaded with an endless loop of film 1 3/8th inches wide with perforations along both edges, four on each side of the small 1-in. x 3/4-in. frames. This "Edison" format was essentially the same as the 35mm format used today. Other pioneers, both in the U.S. and abroad, were soon building cameras to produce their own films for showing in the Kinetoscope, or the many illicit copies of it. These same cameras were also being employed to make films for the first projectors, most of them being designed around the Edison format. Projection of moving pictures onto a screen, rapidly became the preferred means of presenting films to the public, including many now being liberated from the confines of the Kinetoscope's cabinet and shown on the big screen.

The 35mm standard

By the turn of the century, 35mm film was the most widely used and had already become the de facto standard gauge. Photographic manufacturers, like

the Eastman Kodak Company, were supplying pre-slit stock coated with emulsion similar to that used in early roll film still cameras, like the first "Kodak." The same type of film was used for both negatives and prints and the smaller movie frames resulted in less sharp and grainy images. Also some of the first prints were made on a matte or frosted base, making them less suitable for projection.

New and better stocks

In a short time, specific "Motion Picture" negative and print stocks were made available, the latter being on a clear transparent base producing a more contrasty and brighter picture on the screen. It was also slower than the camera film, making it easier to handle during printing. The first black and white emulsions were mono-chromatic, sensitive only to blue light. The camera negative's sensitivity was subsequently increased to include a little green, described as ortho-chromatic. This distorted the tonal scale of the scene somewhat, producing the paler skin tones seen in early silent films. To help compensate, "ortho" make-up was used, which included purple lipstick. The one great advantage of this limited colour sensitivity was that the film could be handled safely under red light during the manufacture, processing and printing.

Seeing the image

Some cameras had gates with cut away back pressure plates, allowing cameramen to compose the picture and judge the exposure required, by observing the image coming through the back of the film. In some cases, this could be done while the film was actually running through a spy-hole or viewing tube covered with a red filter. In later years, a black backing (anti-halation layer) was coated onto the negative's base to reduce light scatter, putting an end to this novel and useful feature.

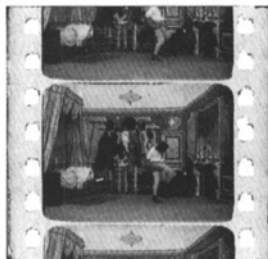
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MACHINES LICENSED BY MOTION PICTURE PATENTS CO.



PROPERTY OF SELIG POLYSCOPE COMPANY CHICAGO ILL.

35mm print from the turn of the century and before a common standard. The small Edison-type perforations would only run without damage on projectors with the correct sprockets



'Standard' 35mm film (SMPE 1917) with Bell & Howell perforations and the frame line midway between the perfs.



Kodak's symbols giving the stock's date of manufacture and a useful guide to researchers



Print Date

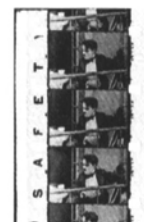
Kodak date code on Pathé print stock

+ L = 1931

Both
+ L = 1942
(British)

From the negative

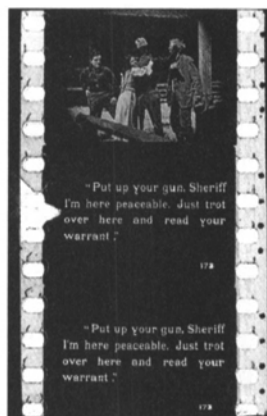
'From around 1923 the perforations used on prints were changed to the more robust Kodak-type sprocket holes (KS)



'Sub-standard' 16mm 'Kodascope' library print reduced from a 35mm original. For hire to home movie enthusiasts 1924-41



With no special duplicating films available, some of the early dupes ended up with high contrast 'soot and whitewash' images (enlarged from 35mm)



<<< LEFT - Silent film inter-titles were sometimes numbered. Now a useful guide to restoration

<<< LEFT - Early silent print with edge markings giving the producer's name and a copyright warning. The Motion Picture Patents Company was formed in 1908 and attempted to control the industry. It was unsuccessful and ceased in 1915.

Varying perforations

Although the Edison 35mm format soon became the accepted standard gauge around the world, the actual dimensions of the perforations and gate apertures varied between producers. Camera outfits often included a perforator to match their sprockets. The American Mutoscope & Biograph Co. perforated the blank stock in the camera, at the time of exposure. In 1911, the British camera maker Newman and Sinclair advertised a perforating service for its customers. Today, some experienced archivists can help to identify the films of individual producers by studying their sprocket holes and other physical differences. As the movie business grew, a common specification was needed to allow the interchange of films, which could be run on any projector. One particular problem was the different position of the frame-line relative to the perforations, which meant constant reframing. In 1917, the first standard issued by the newly formed Society of Motion Picture Engineers, was for 35mm film. This included perforations conforming to those made by the Bell and Howell perforator, introduced in 1907. This precision machine had already become the most widely used by the industry, including the stock manufacturers, for its already perforated stock.

Early processing

Before separate laboratories were set up, around 1900, the camera negative was developed by the cameraman himself and his helpers. They photographed

and processed their negatives to provide the type of image favoured at the time. Early primitive projectors demanded prints with a steady image, plenty of contrast with everything dead sharp. Some exhibitors even asked for no distracting camera movements and to see the performers shown full-length and not cut off at the knees! Some surviving prints now look pale and faded, but these may be examples of the lower density "limelight prints," which were also available for early projectors with poor light output. The processing was done by either winding the film around a drum and rotating it through troughs of chemicals, or on a pin-frame which was immersed in deep vertical or shallow horizontal tanks containing the solutions. Both methods allowed the forming images to be observed and, if necessary, the time in the developer could be altered to compensate for inaccurate exposures in the camera. The film could be "snatched" to prevent an over exposed negative from becoming too dense, or left longer to "stew," if under-exposed. In both cases, the printed image suffered a loss of quality. Many early negatives can vary greatly, in terms of contrast and density, throughout their length, adding to the task of making a satisfactory modern print. As a rule, darker negatives were preferred to help hide the inevitable scratches and other blemishes.

Rudimentary 'editing'

To save expensive stock, it was common practice not to make a print immediately. The cameraman would assem-

ble the negative in slate order and then hand it over to the director and his assistant. They would then subject it to numerous viewings to assess its content, select the chosen scenes and undertake the rudimentary editing of the time. After all this, even the first positive copies could already show signs of considerable wear, printed through from the negative. The final quality of prints also depended on the way they were printed. The most satisfactory, was the step-contact method, in some cases using the camera itself as a printer. The negative and print stock was run emulsion-to-emulsion in close contact through the gate, with the lens replaced by a light source, which could be an electric bulb, or even a gas jet. Another method was the continuous contact printer in which the two films passed over a common sprocket behind a narrow illuminated slot. It was operated by hand at a speed judged to give the correct exposure, after inspecting the negative as it passed over a red light. The latter method, often produced less steady prints with poorer definition, due to loss of contact between the two films.

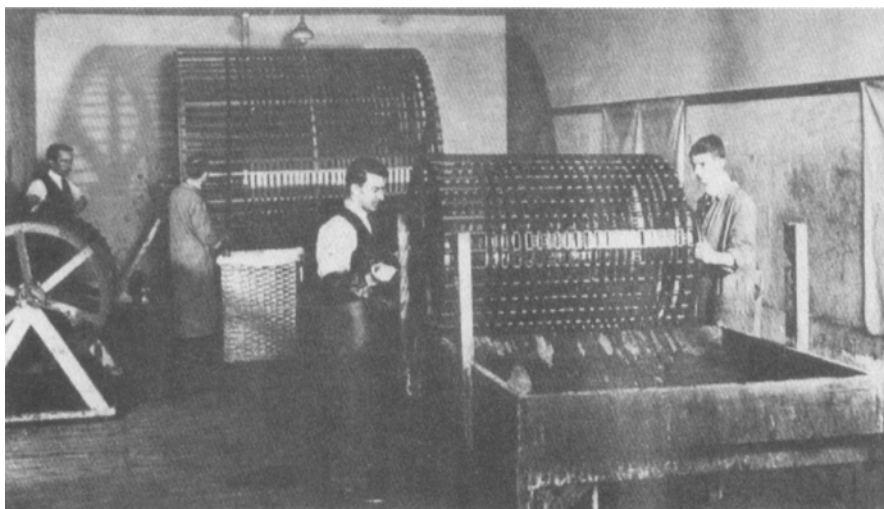
The projection printer

There was a third option, the projection printer, forerunner of the optical printer. For this procedure, two cameras faced each other, one of them set up as a projector to form an image of the negative in the gate aperture of the other containing the print stock.

Its first use was for creating trick shots, such as reverse action. If their projector mechanisms allowed it, many early projectionists, instead of rewinding the film at the end of the show, ran it back to the start through the projector, much to the amusement of audiences. The entertainment value of this comic effect was soon recognised and incorporated into the films themselves.

'Mass' production

At first, the showing of moving pictures was just a sideshow novelty, with a relatively small number of prints being shown exclusively by their makers, or sold outright to showmen. If a particular film proved popular many more prints were made for sale, with the original negative in danger of being run to near destruction. If a part was damaged beyond repair, it was sometimes replaced with an alternative take to



Early processing by hand, with up to 300 feet of film wound around a drum.



The Lumière's first film subject, workers leaving their factory at Lyon. This famous scene was filmed on three separate occasions. The original version, shot in March 1895, was the last to be discovered and preserved.

extend its working life. At a time when films were short, relatively cheap to produce, it was still a practical proposition to obtain a new negative by re-shooting the complete film.

Which version?

This often created a new version of a film, but still having the same title and catalogue number. Perhaps the first example of the confusion this can cause, was Lumière's first film, featuring workers leaving their factory in Lyon. This was first filmed in March 1895, soon after their "Cinematographe," combined camera, printer and projector was patented. After many private showings, the scene was photographed again in June to provide a better print for showing along with other short films to delegates at an important Photographic Congress in Lyon. It was this later version which was included in the programme presented to the first paying audience in Paris on the 28th of December, of the same year. This event has now become accepted by historians as "The birth of the Cinema." Before the existence of the two versions was generally known, it led to controversy during debates about which of the various movie pioneers filmed what first, and when. Some sharp-eyed researchers questioned the Lumière's claim that a film, allegedly shot in March, showed the workers in summer clothes and a branch of a tree, appearing at the edge of the frame, was in full-leaf. In fact the

workers were to be filmed a third time, with the original being the last to be discovered and preserved.

Business deals

In the early years, when the showing of motion pictures was still just a sideshow novelty, a relatively small number of prints were either shown exclusively by their makers, or sold outright to showman. Later, the individual films gained a wider audience by being swapped via a network of Film Exchanges. Eventually, it was the owners of the exchanges who bought the prints and then rented them out for a period of time to the exhibitors. In 1903, Edison produced a short narrative film "The Great Train Robbery." This event, together with the move towards the showing of films in permanent cinemas, marked the beginning of the theatrical motion picture business. Longer and more sophisticated films were now being distributed to exhibitors around the world.

More prints

With ever rising production costs, the original camera negatives were becoming increasingly valuable, and without a satisfactory way of making copies, they were still being used to make an ever growing number of prints. It soon became common practice to photograph an extra set of negatives. This was achieved, by either repeating the action, or using two cameras operating simulta-

neously. In this way it was possible to shoot both a domestic and foreign negative. Today, the search for material sometimes produces more than one copy of a particular film, but they may not always have been made from the same negative. When restorers try to make up the best copy from different parts of supposedly identical prints, they find it difficult to match the action, or there may be a noticeable shift of viewpoint, if the joins have to be made in the middle of a scene.

Even if, at the time, more than one negative was originally shot, making copy negatives was sometimes unavoidable, not forgetting the inevitable making of illicit prints.

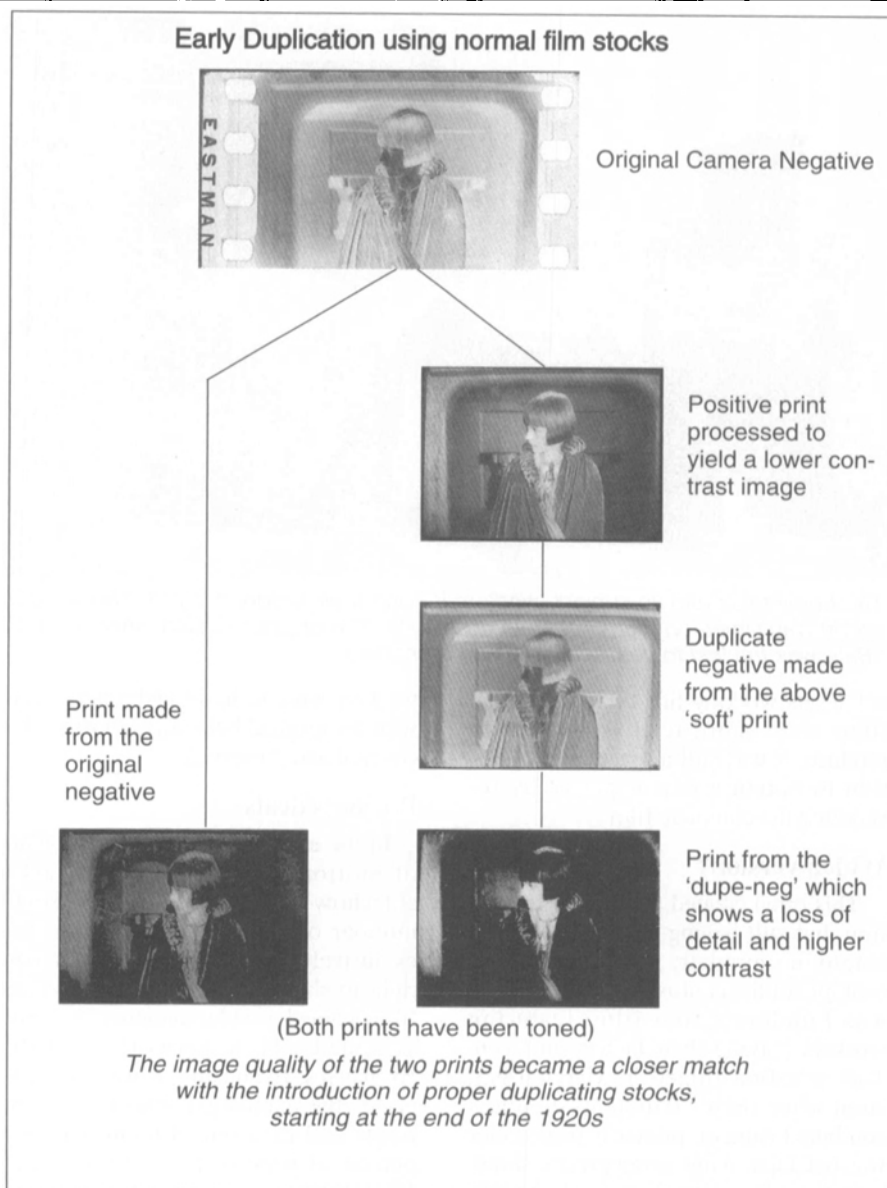
Quality considerations

Whenever a duplicate or "dupe" is made, there is always a marked drop in image quality, with an increase in the grain and contrast, together with a loss of detail particularly in the shadow and highlight areas. Being a negative/positive process, a duplicate negative cannot be made directly, but has to be made via an "intermediate" positive. If a normal and already contrasty projection print is used (as in most pirate copies), the new dupe-negative will produce prints with excessive grain and contrast, with the image often described as being made of "soot and whitewash" and looking rather like a poor photocopy of a photograph. However, it was possible to improve the results by creating a special inter-positive print, which although not suitable for projection, had an image with less grain and contrast and was more suitable for making duplicate negatives. Although still using ordinary negative and positive stocks, their exposure and development times could be manipulated. For example, the inter-positive could be given more than the normal exposure during its printing. This was compensated for, by spending less time in the developer, before the build up of too much grain and contrast. It was also possible to process the positives using "softer" working negative developer. Another technique is "flashing," in which the stock is given an initial overall exposure of white light, to lower the amount of contrast. Although the prints made from duplicate negatives derived from these "soft prints" were a little better, they were still not good enough to avoid printing from the

original camera negatives, which was to remain the accepted practice well into the 1930s and beyond. If early duplicating methods had been more successful, many more original camera negatives might have survived in better condition.

Special effects

Another practical advantage would have been the possibility of incorporating photographic effects, such as fades, dissolves and wipes, during the making of a duplicate negative. Throughout the silent era, almost all these effects were performed “in camera” during the original photography. Lenses with totally closing irises or variable shutters were used to create fades, with the negative being wound back for dissolves and superimpositions. In front of the lens, rudimentary wipes could be made via sliding or swinging mirrors and parts of the scene could be altered using painted glass shots. Matte boxes could be fitted with masks for split-screen effects, or used to obscure portions of the scene, with the unexposed area filled in at a later time and location using a counter-matte to protect the previously photographed part of the image. Although these special effects matched the quality of the rest of the negative, they had to be written into the shooting script. However, some of them, like fades and dissolves could still be added later to the processed camera negative using chemical means. One way to create a fade, in or out, was to suspend the chosen portion of the negative in a column of bleach which was then slowly drained away through a tap, progressively bleaching away the image. Dissolves, along with superimpositions, could be made by overlapping the negatives and running them together through the printer. Negatives are still found prepared for this procedure, with the layers of negatives held in place with spots of cement or tied together with threads of cotton through the perforations. However, many negatives didn’t live through the experience. It was a risky way of doing things, with the extra thickness of film often ending up ripped to shreds after first riding off, and then wrapping itself around the printer’s sprockets. Sometimes, only a few important prints were made this way, the rest using a joined in duped section made from one of the previous direct prints. Again, this means differences



between individual prints, with some having better quality effects.

Another way, was to make soft prints of the portions of the scenes requiring the fades or dissolves and then double printing them onto a dupe negative using a variable resistance in the lamp circuit to perform the transitions. Despite the difficulties, many silent film directors, like Alfred Hitchcock, exploited elaborate montage and multiple-image sequences. Like other innovations, audiences had to get used to them, before they became accepted as part of “the language of the cinema.” Apparently, some patrons thought that the projectionist was having trouble with his equipment, which was producing jumbled up images!

Captions & inter-titles

Silent films are often described as being a truly international medium. However, although there was no dialogue to listen to and understand, there were always the captions and inter-titles to consider. Much research is sometimes needed to ensure that a particular negative or print still has its originals. At the time, the opinion of many exhibitors was that, “the better the film, the fewer the titles.” Despite this view, some dramatic films, with a complicated story line could have as much as 30% of its total length made up of titles. After its initial big city release, a plodding drama may have had the number of inter-titles reduced or changed to more “jokey” ones to lighten the mood.

Even if still in the original language, some may have been simplified to match the literacy and reading skills of the local audiences. When sent abroad, the foreign negative or print supplied usually had each title reduced in length to only a few frames to save on shipping costs and any import duties based on footage. It was up to the local distributor to either restore them to the correct length using a projection printer, or enlarge a chosen frame to make a new title card. In most countries, they just served as a guide for the translation and position. Some producers included a discrete reference number in the design of their titles, which can be a useful guide to present day researchers.

Filmstock developments

During the period from 1922 to 1924, new black and white stocks were introduced, resulting in changes to both the photographic quality and physical characteristics. There was a changeover to faster and finer grained panchromatic camera negative. Being sensitive to all colours, it reproduced a more accurate tonal range, recording correctly the scale of brightness of the scene. In the studios, it allowed the use of tungsten lighting, with less reliance on blue-rich arc lamps and daylight coming through the roof of "glass house" type stages. The negatives now had to be processed in total darkness or very dim dark green safe lighting. Cameras, like the French Parvo, could no longer offer the option of viewing the image off the film itself while the camera was running. Print film remained monochromatic, sensitive only to blue light, so could still be handled safely in red light. However there was another change made to print stock. The Bell & Howell type perforations, flat at the top and bottom with curved ends, had proved ideal for camera negatives requiring great accuracy, but tended to split at the corners after repeated runs through a projector. These eventually led to rips and breaks, shortening the life of release prints. So just for prints, the B&H design was replaced by a new "Kodak" (KS) type, which was rectangular with round corners, which proved to be more robust for repeated runs. The change of shape is a useful, if only rough guide, to the date of manufacture.

Gathering information

Information on the print, which can be found away from the image area, can provide a wealth of information to the archivist, often more than the contents of the picture. If still intact, the leaders were sometimes embossed with the film-makers name. Melies did this, as well as punching a star in the first frame of his negatives. For copyright purposes, some producers printed their company name at intervals along the edge of the print. These could be easily lost during the printing of unauthorised copies, so another copyright notice was sometimes placed in the corner of the frame, an early form of today's electronic "DOG" (Digital On-screen Graphic). Others could be "hidden," somewhere in the scene, such as a picture on the wall.

Detective work

One of the clues as to a film's origin may be where the raw stock was made. In America and Britain, Eastman Kodak dominated the market, with DuPont also supplying much of the stock in the U.S. Kodak also manufactured its stocks in Canada and Britain along with Selo (Ilford). Other sources were Pathe in France, Gaevent from Belgium, German Agfa and Ferrania from Italy.

Edge markings

Apart from their name, film stock manufacturers began adding extra information at intervals along the margins of their stocks, in the form of a latent image which became visible after development. From 1915, Kodak began adding discrete "runic signs" to indicate the type of stock and where and when it was manufactured. A different set of date symbols was added to Kodak's British made stock in 1917 and to Pathé stock after Kodak's takeover in 1927. This information is invaluable to archivists, many of whom, know their date code tables off by heart. They don't necessarily indicate the year of production, but no film can pre-date the stock on which it was photographed. The code sequence appears on all kinds of stock, both negative and positive. On a straightforward neg/pos print, the original negative symbols appear clear, while those associated with the print show up in black. They may not always be the same year, but if close, would usually indicate an original print. On a

film, which has gone through many duplication processes over the years, the symbols can be much harder to decipher. Some types of printer didn't print them through or obliterated them. Also, at some of the printing stages, stock from a different manufacturer, without date codes, may have been used.

Key numbers

In 1923, Kodak added reference or "key" numbers to camera stock to be reproduced on rush prints to help film editors cut the camera negative to match the cutting copy or work print. Before this, it had to be done frame-for-frame by eye. This could be difficult on long shots or scenes with little action.

Sometimes blemishes proved useful as distinguishing marks. Also to be found on the films edges were the words "nitrate" or "safety." The former appeared on almost all 35mm stock, to distinguish it from the non-inflammable or "non-flam" stock introduced along with the new amateur 16mm and 9.5mm gauges. These less than the standard width 35mm, "sub-standard" formats, led to the development of more elaborate projection printers, now becoming known as optical printers, and needed to make reduction prints of professional films for home viewing. Many of these, like early 16mm Kodascope Library prints, were made directly from original 35mm negatives and were of excellent quality. Being on safety stock, some have since been enlarged back up to 35mm, as the only way of preserving subjects lost on 35mm nitrate through decomposition.

End of Reel 1....



To be continued in the next issue of the Journal...

Editor's note: This is the fourth article in an occasional series. Previous articles were published in the May and June 1998 issues of the SMPTE Journal.