Forox

ROSTRUM CAMERA COURSE HANDBOOK

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ROSTRUM CAMERA COURSE

The course is conceived as seminar of "State of Art" Rostrum Camera techniques. It is designed to cover as many as possible of the techniques and problems encountered by the rostrum cameraman in a commercial A/V production house. It is also designed to introduce Producers and Designers to the systems and possibilities of Rostrum camera work. It is however a very specialised course and one will expect the participant to have a broad general knowledge of Audio Visual. It should also be noted that while the course will offer a wide variety of hand-on tuition, there is no substitute for experience; so it can by no means be seen as a complete training in camera work, rather it is a sound grounding. It will however offer a springboard for those who want to go into the deep end of Rostrum camera work.

Equally these notes are seen as an adjunct to the course and not as a complete manual in themselves. Hopefully they will serve the participant as a memory aid when new techniques are encountered in the field. Each rostrum cameraman must work out his own routes to a given end, and these routes must be individually tailored to the equipment available and to the level of craftmanship attainable. Most things are possible, and the impossible is far more fun, but takes longer to work out.

DESIGN FOR AUDIO VISUAL
Communication and craftsmanship

In the future the designer or producer of an Audio Visual will be able to sit at a computer and have his thoughts interpreted by the computer and delivered out of the brother computer in his clients office in the form of slides and audiotape - or even their telepathic equivalent. However at this time, one would find this concept farfetched and ridiculous. The task, though, is the same and the problem remains to be solved without resort to the infamous "information technology". The designers brainwaves have to be made into hardcopy in the form of slides and tape, and essentially the problem involves two discussable abstracts; communication and craftsmanship, and can involve that indefinable abstract: art. The designer must be able to communicate with both the client and his production team. Much of A/V involves both briefing people and interpreting briefs, and if this can be done correctly the rest boils down to diligent application of the craft.

On the visual side the basis for this communication between designer, client and production team must be some kind of storyboard. The more detailed the storyboard, the tighter the communication within the production team will be, and the greater the likelihood that the production will match the designers original concept. The form that storyboard takes, is therefore, very important to the success of the production, and it must carry information that is relevant to the members of the production team. It must be the brief for photographer, picture researcher, graphic designer, rostrum camera man and programmer; and it must make some sense to the client! Every designer, or studio has their own idea what the blank storyboard looks like, some are very simple, and some very complex. Rectangles in proportion to the final screen format, boxes to insert cue numbers, screen allocation, projector numbers; all are laid out graphically on the storyboard sheet. Some storyboards have extra small production check boxes: Photography, artwork, picture research, rostrum, etc. Whatever the design of the actual sheet, the object remains the same: the show is designed screen state by screen state, and the tasks and schedules allocated to the various individuals of the production team. At this design stage, the inter-communication of the team is very important, and even though the rostrum shoot is one of the last things on the schedule the rostrum cameraman must be involved to check that the work commissioned is suitable for the camera and the time allowed. Questions should be answered at this early stage, not bodged up later. Should large format cameras be used? Is it necessary for colour enlargements to be made? Is the artwork camera ready? Or does it all need to be reduced to lith-film at specific field sizes? Are special camera grids required? Both the graphic artist and the rostrum cameraman should make very sure the designer is not hiding any particularly difficult problems.

The next fundamental part of any production is the creation of a workable schedule. The organisation of equipment, people, deadlines, and the correct order of priorities is particularly important to the success of the commercial A/V work. Work forwards, work backwards; allocate rostrum time, slide mounting time, programming time, location work, studio time. Give everything deadlines. Try and make these workable deadlines, both from the production team's point of view and the client's. It is always particularly important to make the client well aware of the production problems and instill in him the necessity of meeting his deadlines. There are endless stories of shows that were meant to have three months of production time, that have been finally cut to two months because of lack of incisiveness on the client's part. The lesson to be learnt is one of educating clients and of making allowances for their corporate decisions taking longer than allowed for. For the rostrum cameraman it is particularly important that he gets realistic allocations of time, and that he manages to make these stick. If location photography and editing goes over schedule, this usually backs up to the rostrum work. Any delay in graphics also has the same effect. However it is usually par for the course that the rostrum camerawork can not take longer than schedule, and it usually ends up that the rostrum cameraman is the one who has to burn the candles at both ends. The cameraman should therefore make sure he is working with a team that are producing what is wanted for the camera. There is a very true cliche that goes something like: the cameraman and camera are only as good as the material put in front of them.

There is in fact a very good case for scheduling in what might be called a rostrum "Dry Shoot" day, when all the pictorial material and artwork are reviewed by the whole production team, with particular care being paid as to whether the material will work under the rostrum camera or not. And if the material is not going to work - how it can be made to work. This would be the time where the cameraman should be able to air his misgivings about the ways any particular sequences are being prepared. This should also perhaps be the day when the visuals are finally cleared with the client. It is usually worth getting mistakes or misconceptions cleared up previous to the actual camera work rather than having to make costly reshoots at a later date.

Everybody wants their slides yesterday - time is the most precious commodity in camera work. The cameraman should therefore be looking for time saving techniques and technologies. As a broad generalisation - time spent on preparation for the rostrum is usually time saved. There is nearly always an elegant approach to rostrum camera work and it is usually this kind of approach that pays dividends. An elegant approach is one that uses the combination of the equipment and the talent available in the most economic way. Almost every project will present different production problems and almost every studio will have different combinations of equipment and talent available.

DESIGN FOR AUDIO VISUAL

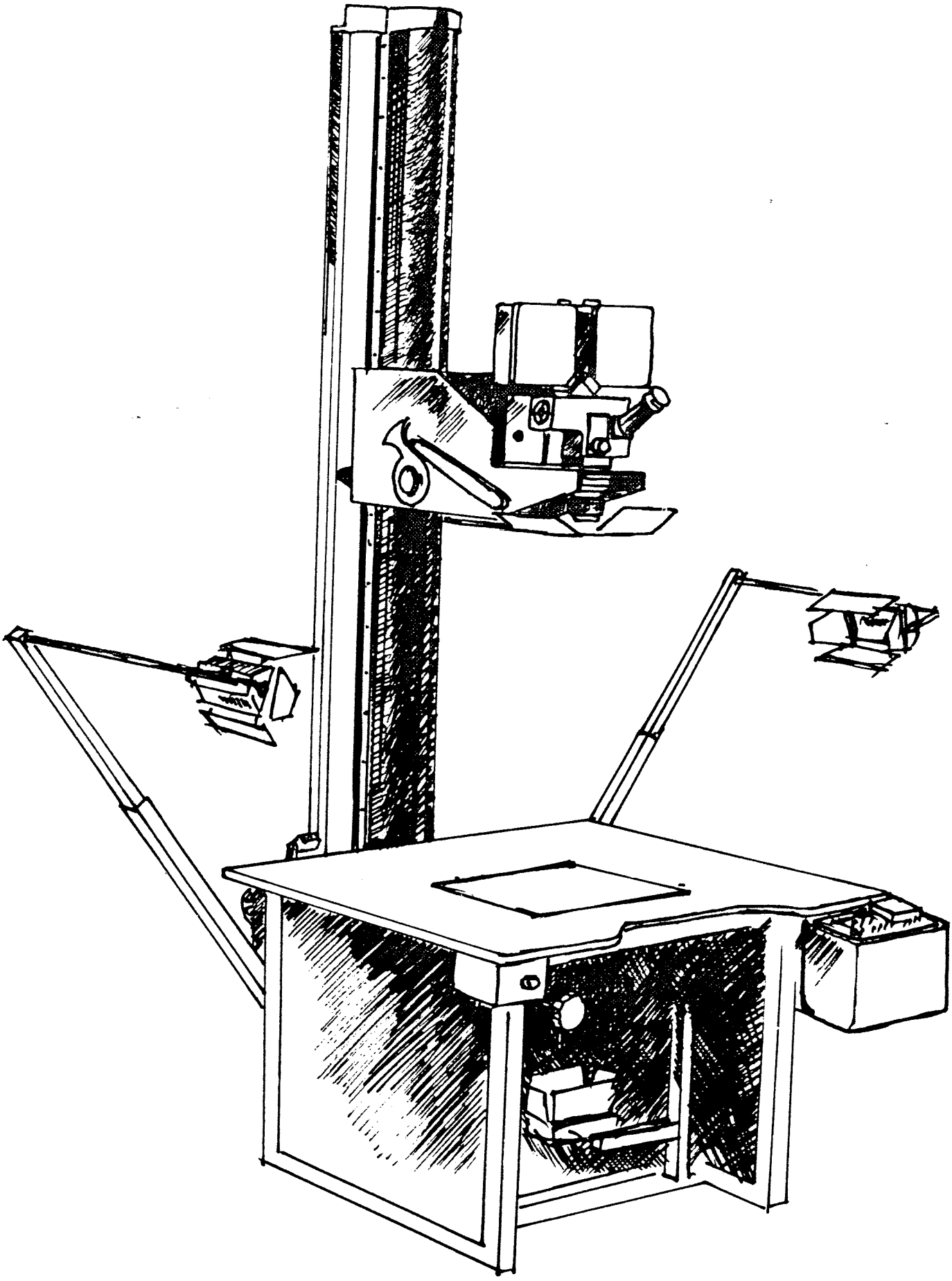
More than one way to catch the monkey

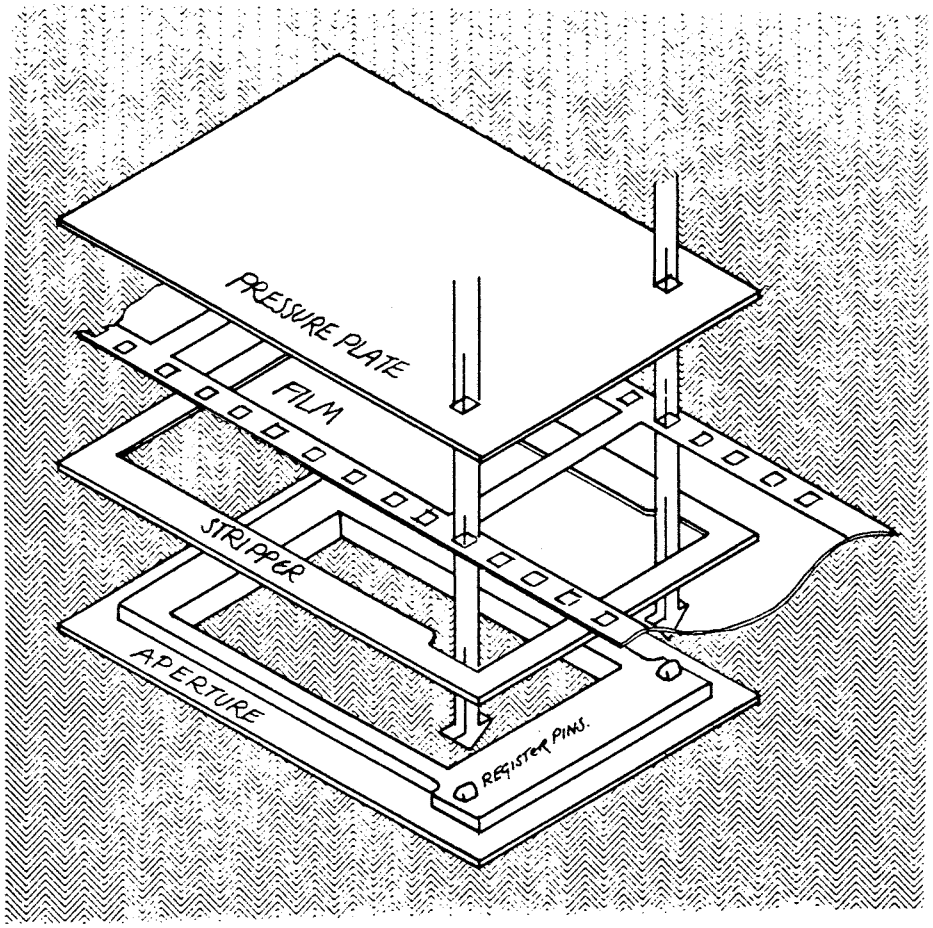
There is no ideal combination of equipment and talent that can be laid down as a pre-requisite to entering the slide production side of audio-visual. Many producers of A/V show work primarily as brokers for their clients, buying services and talent where they need them; and have no investment in equipment and employ no production team. They commission freelance photographers and artists, and then take the package to a Rostrum facilities house. Other producers will have limited facilities and only need to go to rostrum camera for more complex registered sequences. Many rostrum facilities will have no permanent graphic artist. Many graphic artists will buy their process camera work from their local printers. And even the larger production houses always seem to be missing one crucial piece of equipment to the outside observer. However this tells us little about what should be considered correct practice within the terms of reference for a manual on Rostrum camera work, except that there are many ways to catch the monkey.

The answer, then, is to look for the most practical route to any given end in terms of the particular job's parameters, and to design the content so that it does not break the rules of the particular route chosen. The combinations of talent and equipment available must be considered in relationship to the end result, and the time and budget available. Extra talent and extra equipment needed must be itemised and budgeted for. None of these parameters ever present themselves in the right order, but in the ideal world, the slides of a show start life as sketches on a storyboard. Though even the storyboard is usually produced with a particular set of parameters in mind. But certainly at the stage when the necessary work to realise the storyboard is commissioned, the parameters of the job must be defined, and this means going into all the details of equipment and talent available. Details such as the size of the light box of the rostrum's dichoic head must be known if bottom lit artwork is to be used, as this will define the maximum field size for process camera work. Equally artwork must be produced to a size that is suitable for the process camera. And then for multiscreen work - what way are the multiples going to be shot? If the format is simple and an accurate animation compound is available, multiples can be made using the table, if not then grids must be made up.

The rostrum camera, therefore is only a central piece of equipment within a chain of equipment, and rostrum camera work is equally a craft that cannot be left in isolation from all the other crafts involved. The understanding of all the crafts involved, and the

equipment, is therefore essential to a rounded knowledge of rostrum camera work. The input material can be broken down in photographic originals and artwork, and this input material can then be put through a number of processes before it even reaches the rostrum camera. And subsequently the right slides and combination of slides must be handed on to whoever is programming the show. Too many people approach the Rostrum camera with the idea that it is a piece of machinery that, magically, in itself, can produce them the slides for the show.

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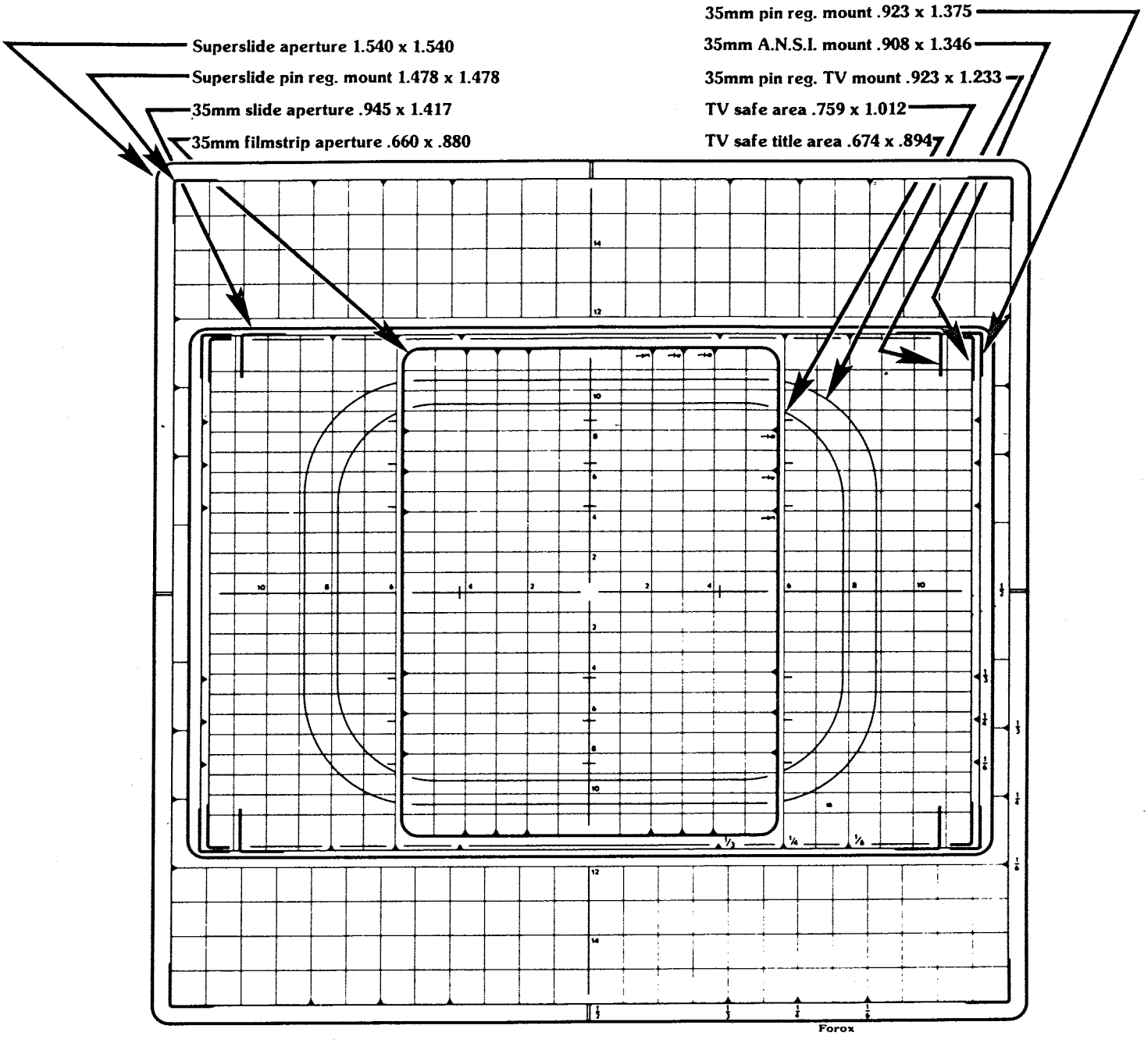
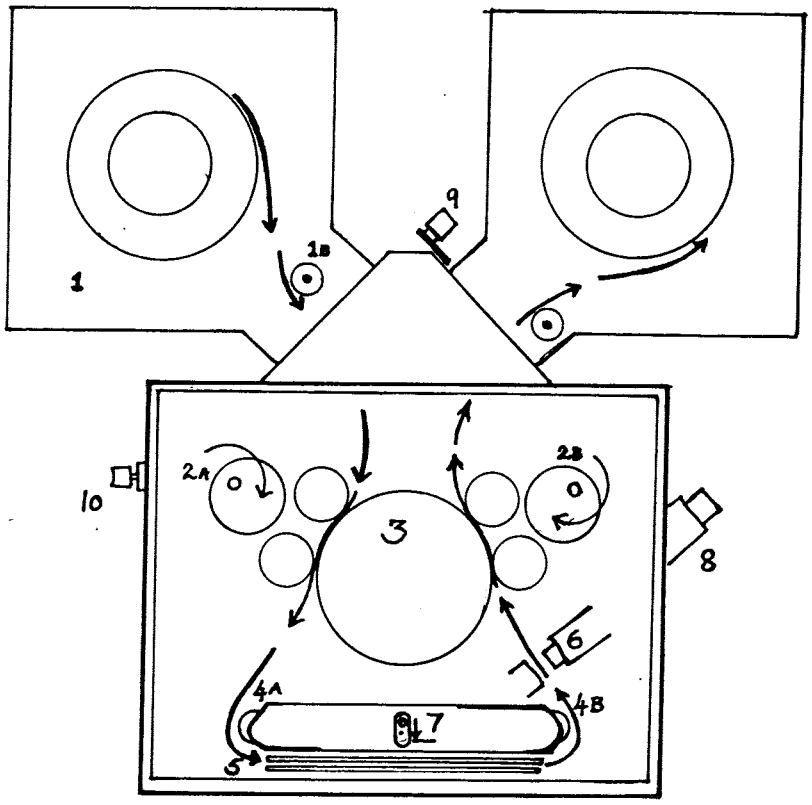


GRATICULE OF FOROX CAMERA,
showing various image sizes

FOROX — Short Instructions



Loading Magazines

Work in appropriate safe lights, or total darkness. Release catches and open magazine. Position film to unwind clockwise. Feed the film through the right trap rollers. The film should run below the guide roller 1B., with the emulsion side away from the roller. Replace the cover.

Threading the Camera

The magazine has a mushroom stud on the back which locates in either of the shoes mounted on the take-up motor brackets. The mouth of the magazine seats into the triangular block on top of the camera. To put the magazine on the camera pull 1 foot of film clear of the magazine. Feed this through the triangular block. Move the magazine diagonally towards the camera. Locate mushroom stud in shoe, and then seat the mouth of the magazine in the triangular block. Open the film rollers 2A and 2B. Thread the film between the large sprocket wheel (3) and the roller 2A, close roller 2A. If the power is not switched on, switch power on at this stage. Next, lead the film round the left hand idler roller (4A) and then between the pressure plate and tripper plate (5), round the right hand idler and up the right hand side of the sprocket wheel.

Make sure the film is properly centred on the idler roller 4B and passes through the jaws of the notcher (6). Pull the film tight past rollers 2B., and with the other hand close the roller down onto the large sprocket wheel. The perforations of the film will not correspond to the teeth of the wheel. Ease the tension on the film until the perforations drop onto the teeth and rollers 2B click shut. Advance some film through the camera, and pass the end through the right hand side of the triangular magazine seat. Push the film through the mouth of the take-up magazine. Place the magazine on the camera. Attach film to the take-up spool. Before closing the camera and take-up magazine,fire some test exposures to check the movement (watch the action of pin (7) to make sure the pressure plate is going all the way down). Close the camera door . Put the lid on the take up magazine.

Advance ten frames and return the frame counter to zero. Notch the film if necessary. The Camera is now ready to shoot.

Operation of Camera

The control console is so designed as to perform whatever is switched "on" in the correct order from one push of the expose button. The camera light sources are also led to this panel. Listed below are switch combinations to achieve various camera functions.

1. To wind on blank frames:

View	off
Shutter	off
Advance	on
Forward/reverse	forward (to wind back use reverse)
Continuous	off
Preset count	off
Time expose	off

2. To make single exposures returning to "view" each time:

View	on
Shutter	on
Advance	on
Forward/reverse	forward
Continuous	off
Preset count	off
Time expose	on

If the time expose switch in on, the appropriate time must be set on the clock. With the time expose in the "off" position, an exposure of ¼ sec is made.

3. Continuous exposures and advance for a preset number of frames:

Switches as in 2 above but with:

Continuous	on
Preset count	on

The camera will shoot (or advance) the number of frames indicated on the preset counter. To set this number; lift the cover above the counter and while depressing the tab to the left of the counter, press the digit buttons underneath the cover, one click for each digit. The tab to the left of the counter also resets the counter to the chosen number.

When in use the counter will subtract one digit for each film movement (forward or reverse), and when the counter reaches zero the camera will be inoperable until either the counter is reset or the "preset count" switch is switched "off".

Lighting Switches and Dimmer

The top light and bottom lights are switched by their own toggle switches. The dimmer circuit dims the light only between exposures. Top lights and bottom lights don't switch on together; with both switches on, only the top lights will work.

The Dichroic light course is usually switched from the "accessory" switch.

Indicator Lights

Power on/off. The light will light when the power is switched on.

Expose. The expose light situated above the expose button on the console will light if an exposed frame is left in the aperture at the end of any particular sequence (i.e. making exposures when in reverse or when the camera advance is switched off).

Single frame. When the half frame or film-strip aperture is in place this lamp will light.

Film Notcher

A plunger (8) in illustration, is located on the right hand side of the camera. This notches the edge of the film to locate the beginning and end of runs. The notch is 2 frames ahead of the frame in the gate. To shoot 36 frame lengths: shoot 36 frames, adv ance 4 frames, notch, and then shoot the next 36 frames.

One way of getting this right is to set the preset counter to 36 and shoot with preset count "on" and Continuous "off". The camera will operate in the single frame mode until 36 frames are shot and then stop. Switch preset count "off", shutter "off" and time expose "off". Advance 4 blanks, notch, reset preset counter, switch on Preset count, shutter etc., and shoot next length.

Removing the Exposed Film

A film cutter is located on the triangular magazine seat, behind the mouth of the take-up magazine. To remove exposed film from the camera, advance 10 frames, remove the magazine partly from the camera and swing the cutter (9) in the illustration, forward to cut the film.

Out of Stock Alarm

When the film in the feed magazine is exhausted a switch in the camera is released. This shuts off the camera and sounds a buzzer. The red button (10) in the illustration, is pressed to bypass this end of end of film switch and allow exposed frames to be wound out of the camera.

THE ROSTRUM CAMERA AS A TOOL FOR AUDIO VISUAL

The principal components of a rostrum camera are the camera body; the camera carriage which travels up and down on the column; the copy table; the control console and the lighting.

1. The camera body is nothing more than a specially worked still camera. It is only by taking advantage of the camera's special features that one can really begin to do more than can be achieved with an ordianry S.L.R. and a macro lens on a copying stand. And indeed full understanding of the functions of a rostrum camera will extend the use of the S.L.R. on a copy stand. So where is the camera particularly special? In two senses the camera has the ability to be worked very accurately. Firstly, the film transport is designed so that the film is placed against the gate with extreme accuracy in relation to the perforations of the film. The gate of camera has two pins or pegs onto which the perforations of the film are placed by the pressure plate, and it is this that ensures the very precise relationship between the frame area of the film and the perforations of the film. This feature is called pin registration and is a major feature that is exploited in many ways. However, it is a feature that is irrelevant without a really accurate viewfinder. The focusing screen or graticule, of the camera is engraved with all the necessary information to place images exactly in the designed plate on the frame, and is also centred and calibrated to the gate of the camera. The camera also uses bulk film stock and magazines.

2. The camera column and carriage enables the camera to be tracked accurately up and down. The carriage also normally has a cam and lever system to maintain the focus automatically over most of the height of the column. The cam is driven by the movement of the carriage up and down the column and working through a lever extends or retracts the bellows on which the lens is mounted.

3. The copy table is a flat table onto which everything else is bolted. It is set up level and perpendicular to the camera axis. It has a bottom lit aperture or mountings for a dichroic light course. It also has top light arms to light a flat copy.

4. The control console: all the operating switches for the camera and lights are located on this one panel. It is also designed so that when the expose button is pressed, all the functions that are switched "on" are automatically performed in their correct sequence. There are also a time exposure clock and two frame counters. One frame counter is the reference along the length of the film. The other is used for making a pre-determined number of exposures as one group, and is called the "preset" counter.

Many other components may be added to this basic set-up: Animation compounds, shadowboxes, slit scans, off-centre lens and cams, interchangeable film movements, aerial image projectors, and, of course, computer control.

However, returning to the basic camera set-up, it is possible to look at the camera's features one by one and identify areas of work that are linked to each.

At a prosaic level a rostrum camera is a copying camera, and in many ways is ideal for copying both transparencies and top lit artwork. Most cameras have facilities to copy transparencies from 35mm to 10 x 8 and indeed it is usually very easy to crop about a ¼ of a frame out of a 35mm transparency and go even smaller with a little effort. By using duplicating stock and the diochroic light source it is simple to produce a very good duplicate transparency. The camera comes into its own however when long-runs and numbers of sets are required. Top lit copying is also very simple by virtue of the automatic focusing since the camera is sized by changing the camera height.

The rostrum camera is the central link in the process of producing registered slides and this must be considered one of its primary purposes. The chain of events to make registered slides begins with camera preparation, through to rostrum shooting, to mounting in register mounts, to aligning the projectors and finally projecting the sequence.

The registered slide, while seeming to require a very complicated and disciplined approach, is in fact the A/V designers liberator. Almost any juxtaposition of images or relationship of screen areas can be realised with the correct approach. Careful technical drawing and carefully shot original pictures, plus registered rostrum camera work, realised a 360° panorama show for the G.L.C. The fact that the rostrum camera can be used to copy transparencies that have been accurately placed on cell against a camera line-up grid, with great accuracy, became the axiom that freed the designer to conceive the show. On a mundane level, build-ups of information over a series of slides can be achieved. Panoramas with seam-less joints between the screen areas can be achieved. And indeed where projection throw is limited and keystoning would normally ruin registered effects, the slides can be shot with an inbuilt bias to compensate for the keystoning.

Looking at the "very complicated and disciplined approach" the least understood area is camera preparation. The register slide chain goes like this:

1. A line-up grid is drawn. This is an accurate proportional represenation of the screen area, with the centre of frame or frames marked. As the line-up slides for the projectors are also shot off this drawing, more information is usually added to facilitate the focusing, sizing and alignment of the projectors.

2. The visual content of the show is then analysed and sorted into different categories of approach. In practical terms this means taking decisions about the field sizes to which one is going to work and the processes that are going to be used. These processes cover four main areas of show content: graphic artwork that can be shot at the size it has been prepared at; artwork that has to be reduced and processed to be in exact pro with the pictorial content; transparencies that are to be copied in register; and special effects - other material that are most simply achieved free-hand under the rostrum camera directly.

3. The material is prepared for Rostrum.

4. The rostrum camera shoot. This can be looked upon as the final assembling of material at one size and in register. The size being the 35mm slide or whatever.

5. The film is mounted in register mounts, the projectors accurately lined up, and hopefully the whole thing works.

So back to "preparation for Rostrum" and the four main areas of show content or input.

Firstly: Graphic artwork that can be shot at the sizes at which is has been prepared or "Camera Ready Artwork" in the jargon. Perhaps the most obvious of these is "Top lit Colour Artwork" and cartooning. Artwork is prepared on cell against a grid, and is made up frame by frame as coloured Artwork. Cut-up pantone papers, animation paints, felt-tips, illustrations, and many other graphic techniques are used. Many artists prefer this way of working and for shows where the graphics require a strong style this approach is ideal. The work must be clean and neatly presented. For complicated pieces a "dope" sheet or illustration list should be made, and all the cells referenced to this sheet. When working on acetate it is essential that all the materials are uniform and that blank cells are provided where necessary for long build-ups.

A spin-off of this style of working and the cameras ability to shoot in exacting registration is to prepare artwork as line artwork with colour patches for sandwiching. The artist prepares line pasteups that are designed to be reversed, and at the same time prepared colour patches that are S/S to the line work. All the line Artwork is shot and then without moving the camera the colour patches are shot. The final slide is a combination of the two shoots, the line film (a reversal of the artwork) is sandwiched together with the colour shoot, producing coloured graphics out of black!

The third area of Camera Ready artwork is pure line work. Typically,the masks for a show are prepared this way.

The second main area of Rostrum Camera input is Artwork that has to be reduced onto film. This is mainly B/W line artwork for conversion into colour slides, but many masks must also be treated in this way, particularly where they need to be in pro with transparencies for matting effects.

Work is prepared on cells and reduced onto lith film at 5 x 4 or even onto 35mm film. Which ever way is used, great care must be taken over the sizing and the ability to maintain the register. Some process houses have modified their process cameras to work in register. This involved fitting two peg bars to the process camera. One on the Artwork stage and one on the camera back. Pre-punched lith film is then used as the camera stock. This has a tremendous advantage since no "griding up" is required. Neg-pos and pos-pos lith stocks are used. Likewise artwork can also be converted to 35mm lith on the rostrum camera, but it requires greater skill to maintain the register when using this method.

The third main area of rostrum material is the copying of original transparency material. In this is included splitting for multiscreen shows and simple copying. Overall colour balance and grading of the pictures is of primary imortance along with accuracy in work for multiscreens.

Specialist copying stock is used for this work - typically the Kodak dupe stock 5071 - and colour balance is achieved by juggling the filter pack as in Pos-Pos printing. Great care must be taken in the judging of tests against the originals.

In multiscreen work the originals are laid up on cell against the appropriate grid; the camera lined up on this and then the material for each screen is shot off. Many simple formats can be achieved without using a grid, but it is my personal experience that the use of a grid is always advisable and becomes absolutely essential where the number of screens is more than three or the joins are not standard. Splitting without the use of a grid is usually done on an animation compound of some sort, but even with this kind of aid the accuracy of the work is always debatable. The use of the grid where large numbers of splits are required of the same size of original is also extremely quick. It is well worth noting that most camera work takes longer than allowed for in estimates, and while laying material up on cell takes an inordinately long time, reshoots of work that is on cell are very quickly achieved.

The forth main area of rostrum camera work is special effects and "one off" shots that are best achieved under the camera. Much skill and ingenuity are used by cameramen in this area. Most of these areas will be covered in detail under seperate headings.

DESIGN OF VISUALS

The finished slides in an A/V show start life as sketches on a story board. Every producer has their own idea of what should go into a storyboard, but basically it is a sheet with a number of boxes drawn on it in the same proportion as the final screen. The sketches are drawn into these boxes to represent each individual screen state or cue. Each cue is given a number to represent its place in the show and which also becomes the reference number for A/V or pictures in general. So the script is illustrated move by move. The completed storyboard then is the base for the rest of the production. Indeed in many cases it forms part of the contract with the client.

Try and previsualise the final show right from the word 'go'. Try and decide on paper what kind of approach is going to be taken with the original photography. Visualise the graphics. The storyboard then becomes the brief for both graphic artist and photographer. The photographer will be aware of the final format to which he is working and equally aware of the graphics which are going to be mixed with it.

Also at this stage, the grids for the rostrum camera should be put in hand. In the ideal world, both the photographer and the graphic artist are given accurate rostrum camera grids from the start. Rostrum camera grids are a 'tool' that are unique to slide shows, but that borrow many of the techniques of film animation. Slide shows have few standard formats of screen shape, and this especially applied to multi-screen shows where any number of screen areas can be together to create an overall image.

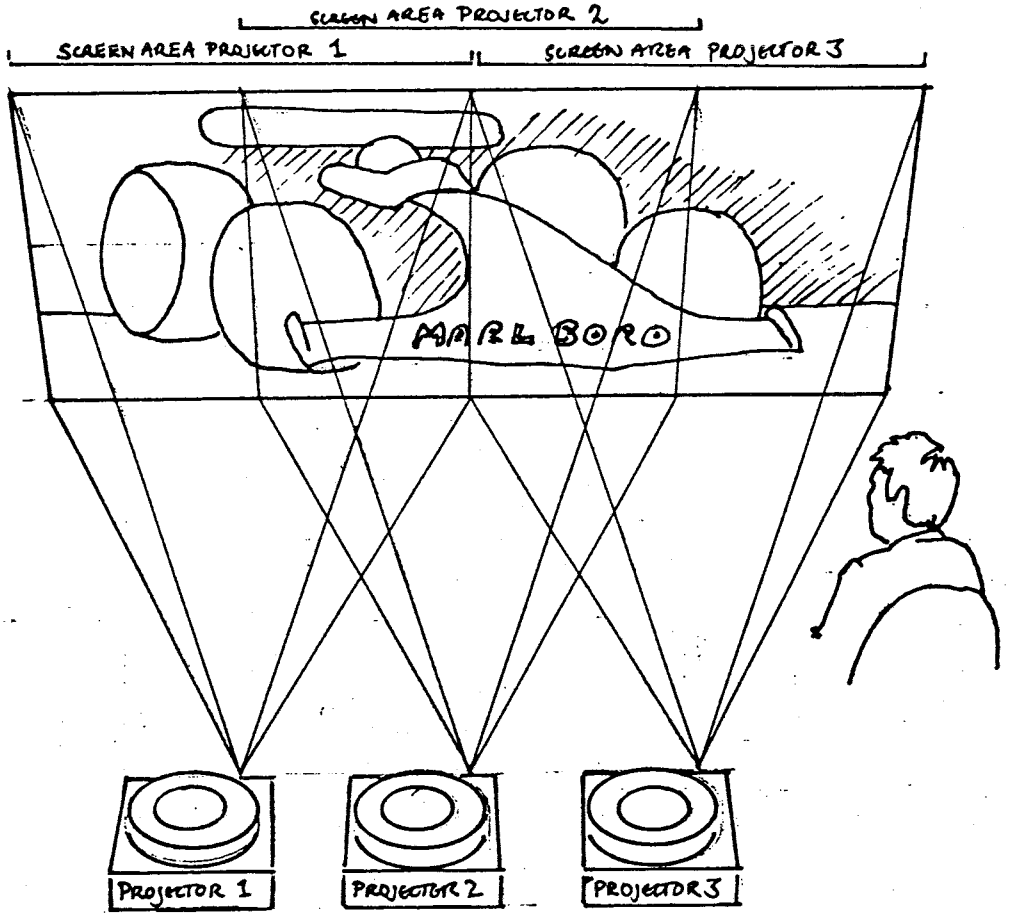
One such format that is becoming the nearest thing to a standard is the so called one on two format. (See drawing). This format uses three banks or stacks of projectors. Each stack is precisely aligned relative to its neighbour; in such a way that the two images of the outside stacks butt join exactly, while the third or central stack is centred on this butt join. A complete 'seamless' panorama is made by projecting three slides that have been precisely copied from an original in the same proportions as the screen format. These are then sandwiched with 'soft edge' mask that fade one slide into the next. To enable accurate cropping, design and projection a grid is used at all stages in the production of the slides.

All grids are drawn against the accurate specification of the slide mounts that are finally going to be used. The common size of the projected image in a mount is not 36 mil by 24 mil. It is 34.7 mil by 23 mil. Rectangles with their centres marked are drawn in these proportions and in the overall chosen format of the final screen configuration. This is best done at as large a size as is convenient. Other information can be carried on the grid as well. (See drawing of grid for the one on two format). The grid is the tool that enables all the slides of a show to be made in exactly the right proportions, to each other no matter what size the original material is.

The Use of the Rostrum Camera Grid

Having made the original drawing for the grid, make a series of reductions as line film positives. This is done on a high quality process camera where the lens distortions are minimal. The size that these reductions are made depends on the size of the original material that is going to be used to make the slides. For the sake of simplicity it is best that as few sizes as possible are used. Typically there is one grid size for commissioned artwork and several for photography.

The line film positives are taped to cells that are punched out to fit on 'peg bars'. The artwork is done on more of the same cells in frame by frame sequences. The use of punched cell and peg bars insures that each piece of artwork falls exactly in its designed relationship to the cropping of the grid. Artwork prepared in this way is said to be 'registered', with much the same meaning as a printer uses'registered' to refer to overlays that have precise relationships to one another. The grid is then used to line up the rostrum camera. The camera is centred and then sized to fit the exact cropping indicated by the grid, a series of slides are made of the grid, and then the grid is replaced by the artwork which is shot piece by piece. The rostrum camera maintains the original standard of registration by positioning the image in an exact relationship to the perforations of the film stock. The same process is used to make copies of the photographic material for the show. All the slides are now registered and sized to common cropping "Register" slide mounts are used so as to maintain the registration. These mounts are made to very fine tolerances and have pegs incorporated in them to accept the film perforations. The projectors are then finally lined up using 'line-up' slides shot off the original grid, thus insuring that the original designed relationships realised on screen.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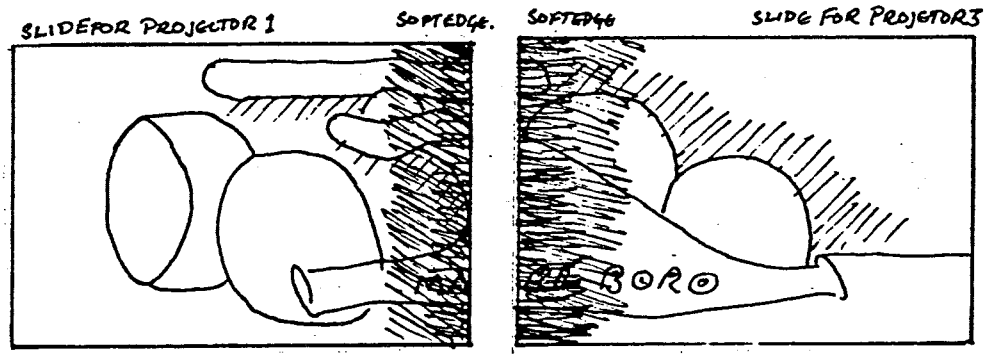
SCREEN AREA PROJECTOR 1
SCREEN AREA PROJECTOR 3
MARLBORO
PROJECTOR 1
PROJECTOR 2
PROJECTOR 3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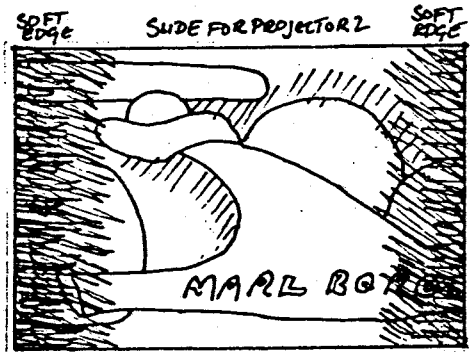
SOFT EDGE.
SOFT EDGE
SLIDE FOR PROJECTOR 3
BORO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SLIDE FOR PROJECTOR 2
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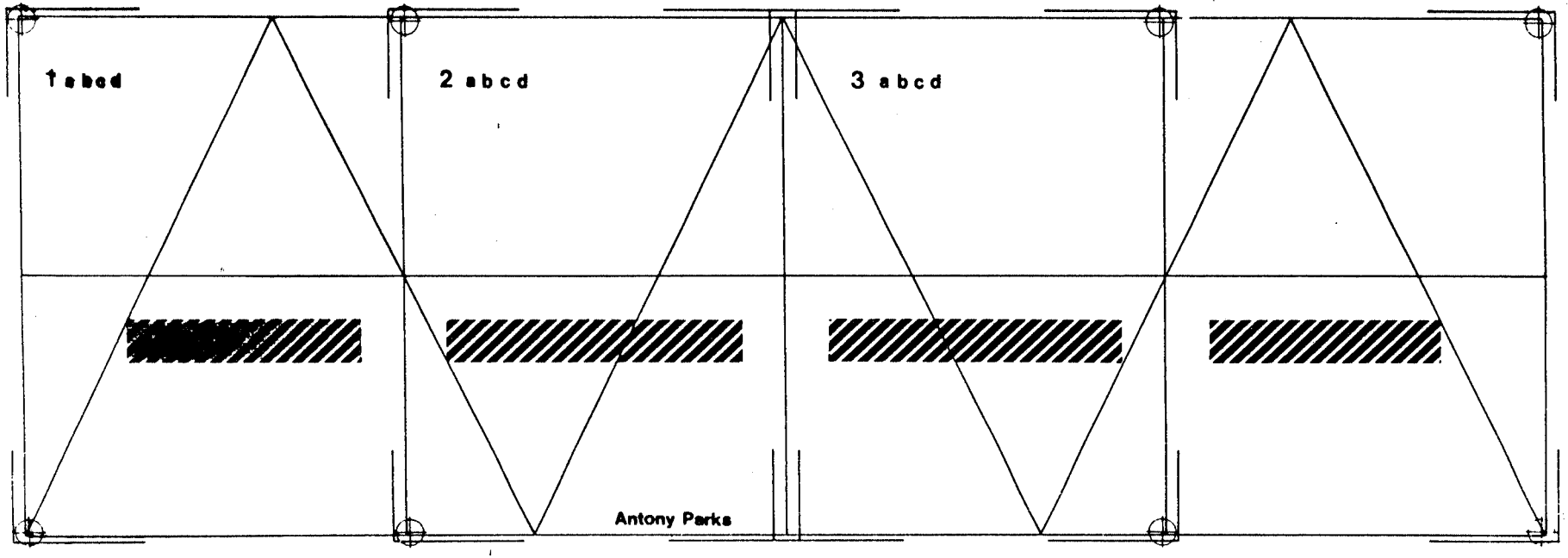
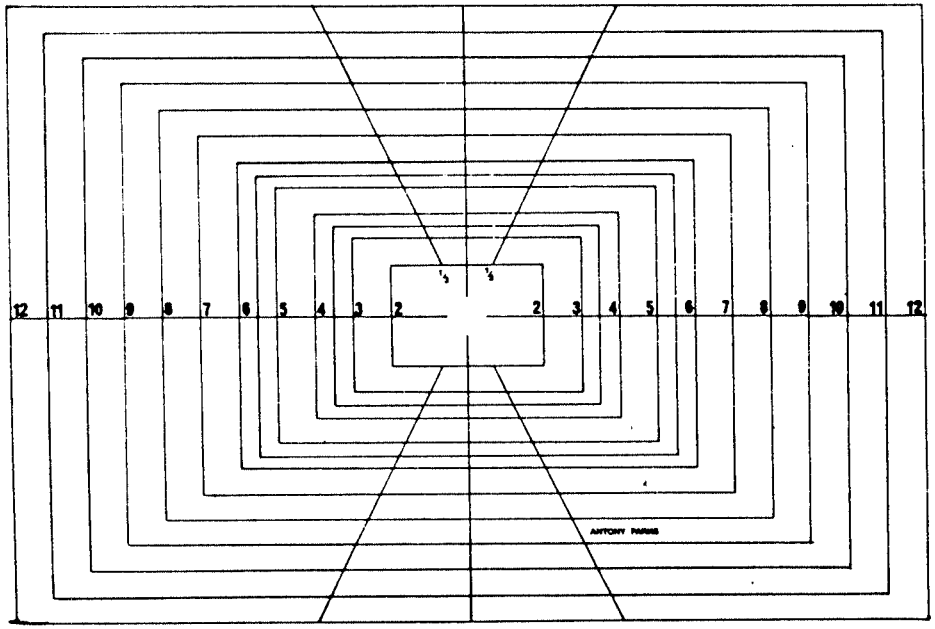
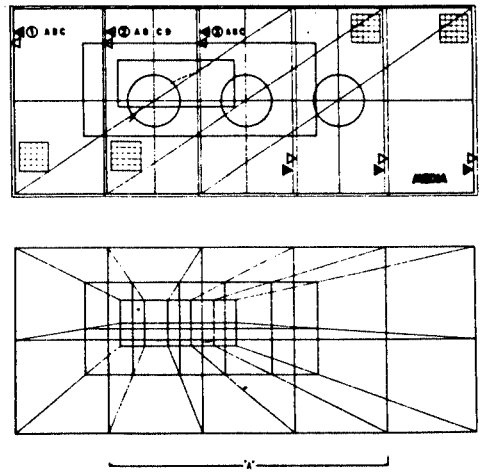
MARL



MULTISCREEN GRID FOR SPLITTING FOR ONE ON TWO FORMAT.



UNIVERSAL GRID WITH VARIOUS FIELD SIZES.



SPECIAL GRID FOR GRAPHIC LAYOUT AND ROSTRUM CAMERA WORK. USED ON THE SHOW "A HEAD OF OUR TIME".

What is "In Register"?

"In Register" is a term borrowed from the printing world and applied to a number of photographic and kinographic crafts. To be able to work in register is to be able to split images up into a number of parts and then reassemble these parts into a whole without it being apparent that this final image is made up from several parts.

In colour printing four separations are made from a colour original, four separate printing plates are made, and four passes through the printing press are made. If the registration system fails at some stage the final page will be out of register, an effect that most people will be familiar with.

Crafts such as silk screening, etching, dye transferance, movie titling and special effects all have their own ways of working in register. In general photography and A/V elements have been borrowed from all of these crafts.

WORKING IN REGISTER – GENERAL PHOTOGRAPHIC PRACTICE

ACME Standard Peg Bar System

A peg bar registration system borrowed from the animation trade. Used primarily with pre-punched acetate that is available in two sizes known as 12 field and 15 field. (The maximum size that can be drawn on a 12 field cell is 12 inches by 9 inches). An ACME punch can also be bought and cells, paper or film, punched to fit the peg bars.

Work is usually done on a light box: the peg bar is taped down to the box and the first cell placed on it. The primary piece of artwork is taped to this cell. A new cell is placed on top of this and the second piece of artwork is lined up to exactly match the first. These two pieces of artwork are now said to be 'registered' or 'in register'. The build up of artwork is continued in this way until it is complete. (The word 'artwork' or 'A/W' is used in this context to cover anything from tracing to films, from hand cut masks to line film contacts. 'Cells' refer to pre-punched sheets of acetate).

Artwork can also be prepared directly onto the cell with normal graphic materials such as letraset lettering, block-tack and animation paints. (See section on use of graphic materials). Some companies who are in the audio-visual trade also use process films that are pre-punched with modified process cameras that have cell bars both on the artwork end and the camera end.

The registered cells are then taken to the rostrum camera, or copy camera. The top cell is then lined up in the viewfinder of the camera and the peg bar is taped to the work surface. The top cell is typically a line-up drawing or 'grid' against which the camera is sized and focused. The first cell is removed and the shooting sequence commenced.

KODAK Register Punch and Printing Frame

Kodak register system relies on a very similar idea to the Acme standard. It does however tend to be used in a different way. People seem to work mainly with contacts when using this system, and indeed the frame is designed to make contacts in register.

Unexposed film is punched to fit over the pegs. This can be virtually any film or paper stock, including line films, Kodaliths, matric films, colour print paper or transparency enlarging stock. Obviously this stage of the process is carried out in the appropriate dark room conditions. The peg bar is built into a glass faced printing frame with a hinged tensioning back. (Kodak peg bars are available separate from the frame and they do in fact make them in two sizes which can be very convenient. The smaller of the two is very useful for working with small pieces of acetate and small artwork or overlays and can be used in the same way as the ACME Standard System). Pre-punched cell is not readily available for the Kodak system, so the user has to invest in the punch; the punches are, however, considerably cheaper than the Acme system.

Unexposed punched film is put onto a peg bar taped to the base board of the enlarger, and the first of the series of exposures made. Without moving the enlarger the process is repeated as often as necessary. The processed film can then be contacted back in register using the contacting frame. In this way the required series of masks, or separations can be prepared onto exactly registered pieces of film. The appropriate colour film or paper can then be printed in contact and exact register with its masks or whatever.

Overlays on Hinges

A third way of preparing registered artwork is very familiar to graphic artists; they overlay on a tape hinge. These overlays can either be additions or changes to opaque copy that is mounted on board; or they can be artwork on acetate also hinged onto acetate, or a board with a hole cut in it to allow the copy to be shot bottom lit. This is always a simple and effective solution and should not be disregarded as a poor relation to working with the peg bar, as there are moments when the use of the previously mentioned approaches are entirely inappropriate.

The number of overlays is limited to a maximum of four unless some very complex cutting of the overlays and the hinges is envisaged. It is of course possible to dispense with the hinges and work entirely on crop marks on the base piece of artwork. These crop marks should be kept out of 'frame' when making the copies. This system is particularly useful when working with very large overlays where the use of the standard peg-bar system would be difficult to handle. In this context the skill of the craftsman is of great importance to the working of the registration effect.

Registered Enlarger Neg Holders

Some 5 x 4 enlargers can be modified to have, or come with, register systems in their neg holders. They basically have a neg holder that has a pin system to accept punched films; and the neg holder itself is located in a very accurate mount in the enlarger housing. Originals and their overlays or masks are punched to fit the pins and successive exposures made in the ordinary manner. Attention must also be paid to ensuring that the film or paper on the easel is kept in exactly the same position during the successive exposures. This is done in one of two ways;either the film is put in the printing easel and not moved during the entire series of exposures, or the film is itself punched to fit a peg-bar that is attracted to the base board of the enlarger.

The Pin Registered Camera

A pin registered camera is usually a rostrum camera, though not all rostrum cameras are pin registered. Pin registration refers to the perforations of the film being pushed on two pins before the exposure thus ensuring that the frame area of the film is in an exact relationship to the sprockets. This of course means each successive frame is shot in exactly the same place in relationship to the sprockets; or more importantly that multiple exposures can be relied on to be entirely accurate. There are two 35 mil S.L.R. that can be used to approximate pin registration, the Cannon F1 and the Nikon F1 and F2, however this is not in the sense of making multiple exposures but in the frame to frame sense. There are also a number of versions of the Nikon F3 on the market that have been modified with pin registration.

Making Multiple Exposures in Register

One of the most important techniques to crack in any particular set-up is how multiple exposures are going to be made in exact register. The answer had to be appropriate for the equipment used.

Almost the first exposure made with an enlarger is a 'registered' multiple exposure: the strip test. If the successive exposures were not made in exactly the same place, the test would be a complete jumble of images. Therefore the simplest way of maintaining register is to always insert the paper carefully against the stops of the enlarging easel. This is of course assumed in everyday darkroom practice when a number of matching prints are required; check a set of prints done in this way and see if the sizing or even position on the paper changes from print to print. The first use of this is when making multiprints against tracings. This can be taken a long way further with a rudimentary register system in the neg holder of the enlarger, and even without a register system very accurate multiple exposures can be made in this way, with the aid of careful tracing to ensure line-up.

With the copy-camera there are basically two approaches to making multiple exposures; one relies on opening the shutter on the camera and making a series of exposures on the lights, and the other relies on being able to recock the shutter without moving the film. Both systems need the artwork to be accurately registered. On a copying set up, when Flash is used as the primary set up, the procedure is very simple; the first piece of artwork is lined up, the camera set to 'B' and the shutter opened. The flash is then fired manually. Next piece of artwork and next flash, and so on until the multi- exposure is complete. The shutter is then released. Tungsten lights pose more of a problem as the length of the exposure must be accurate. The simple system is to put the lights on a timer, the other way is to manually switch on and off the lights. With this latter technique it is best if long exposures are made as these can be timed with greater accuracy. Both techniques require that the ambient light be minimal to avoid fogging, and it is usually best if the lens cap is replaced between each part of the exposure.

On many S.L.R. cameras it is virtually impossible to recock the shutter without moving the film,and even on cameras where it is meant to be possible, great care must be taken to avoid film movement. Basically, the film advance must be disconnected from the shutter cocking mechanism, and if there is not a specific button or lever to do this, the film rewind is normally engaged and the shutter cocked with the wind-on level. Most double exposures rely for accuracy on the balance of tension between the cassette and the take up spool, and to get this right requires practice and patience. Refer to the manufacturer's manual for exact instructions.

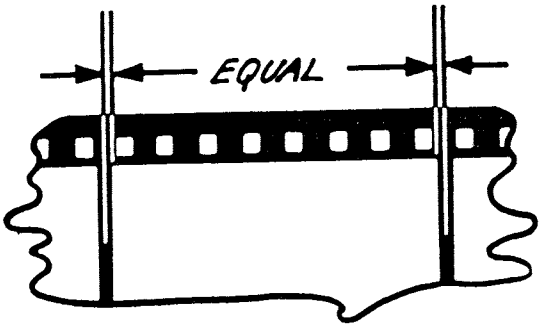
2¼" cameras such as the Hasselblad are ideal for making very accurate double exposures, as the magazine can be lifted while the shutter is recocked. Hasselblad bellows are also very useful in this respect as the lens and the shutter are operated separately from the rest of the camera.

5 x 4 cameras are also ideal in that the shutter is on the lens board and so independent of the film holder.

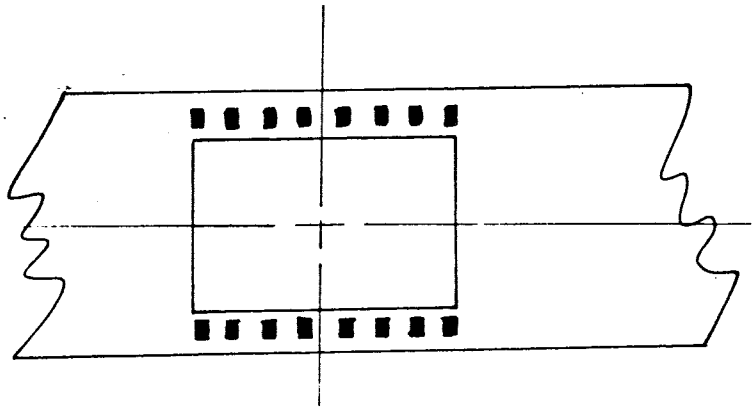
Accurate multiple exposure is one of the features on rostrum cameras, and other specialist copying cameras.

Registered Slide Mounts

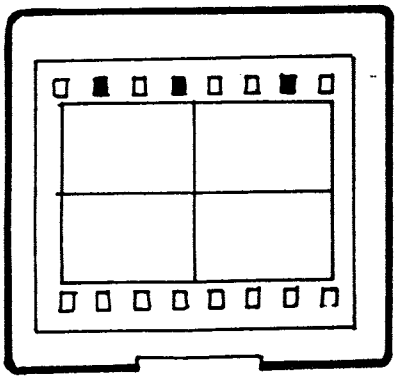
Registered slide mounts are designed primarily for the projection of A/V shows where registeration is critical and the slides have been made on a pin-registered camera. However, if the frame to frame registration of your normal S.L.R. is good enough, or you have a pin registered camera, these mounts are very useful for shooting registered sequences. The easiest to use are made by an American company called WESS, and imported by PAV Ltd. in Greenwich. The mount itself has what might be considered a miniature peg bar to accept the sprockets of the film. Thus the same relationship between the sprockets and the frame area is maintained as in the pin-registered camera. For copying these in register, a simple tight fitting three-sided jig is made up to locate the slides accurately under the camera.



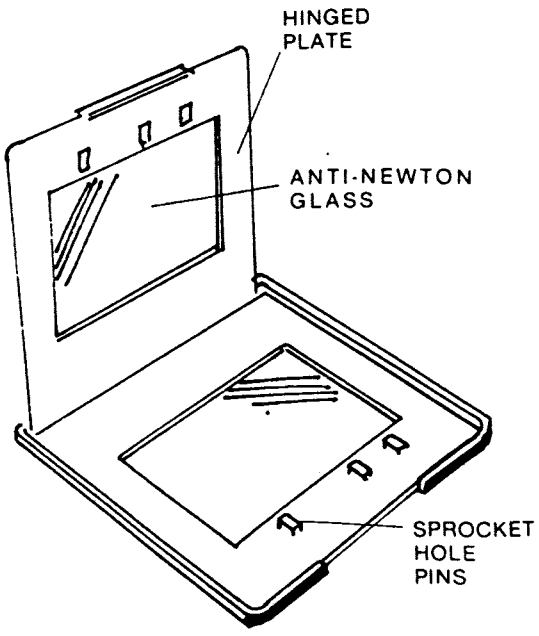
PIN-REGISTRATION ENSURES THAT THE FRAME AREA OF THE FILM IS ALWAYS IN A PRECISE RELATIONSHIP TO THE PERFERATIONS OF THE FILM.



THE GRATICULE IS USED TO CENTRE THE IMAGE IN THE FRAME AND THEREFORE AGAINST THE SPROCKETS.



THE RELATIONSHIP IS CONTINUED IN THE REGISTERED SLIDEMOUNT.



THE REGISTER SLIDE MOUNT.

THE 3 MAIN FILMS FOR ROSTRUM CAMERA USE

DUPLICATING STOCK KODAK 5071

Kodak's Ektachrome Slide Duplicating Film 5071 is the most commonly used stock. The film is available in two widths; 35mm and 46mm and is packaged in lengths of 30 metres. It is balanced for tungsten sources, but requires additional filtration for fine colour balancing. Normal E6 processing is used and the processing of ordinary camera films is unaffected. It is designed for good colour reproduction and has an appropriately low contrast. The film is intended for exposure of ½ sec to 5 seconds. The film is batched and tested by Kodak, and color correction data is printed on the box, to make for easier adjustment from batch to batch.

There is usually a considerable wastage of film involved in testing this stock so it is advisable to minimise this wastage in percentage terms by buying as much film as possible. A minimum order should be about 10 rolls, and when ordering it should be specified that they are all the same emulsion number. In ten rolls the wastage in testing will initially be about 5%, and this can be reduced with practice and very constant processing. The film has very good keeping properties if it is stored in a refrigerator.

A camera log book should be used to note all the information about any particular shoot. In operating terms details of the original and field size, the filtration and exposure should be noted, for commercial information the number of frames and amount of time taken will be noted against job numbers and other appropriate data. It is also essential that emulsion numbers and all test information is accurately noted and that, when a test is evaluated, the successful combinations, or recommendations, are noted down. In this context it is also well worth shooting reference numbers and other information actually onto the first few frames of each test. The log book will then become a standard reference source for information about exposure and filtration for any particular job.

Using 5071 with Colour Printing Filters

On basic copy/rostrum set-ups the facility for copying slides is literally a sheet of opal glass let into the work surface an inch or so above another sheet of clear glass (the filter tray) and illuminated from underneath by a 3,200°K lamp. There is usually little in the way of instructions as to how this should be set up and almost every rostrum cameraman has his own particular tricks.

The light source is the first priority. Check that the bulb is indeed a 3200°K bulb. Then this source has to be controlled; 5071 is very sensitive to the near ends of both Infra-red and Ultra-violet. To control the ultra-violet end use a u.v. filter with a very steep cut off such as the 2B Kodak (Kodak's recommendation) or the 2E Kodak (my recommendation). These are both gelitine colour printing filters and can be bought the same size as the rest of the filters. The make of the rest of the gelitine filters is not too important, but filters should not be muddled up. Buy a complete set of colour printing filters at as large a size as possible (minimum of 15 cms square). The light source should be masked down on the film tray to the size of the filters. Use a piece of black card with a square cut of it to the appropriate size and tape an acetate wallet to it to prevent the filters being blown around by the fan. This should ensure that only filtered light reaches the transparency.

Infrared filtration — or not?

As mentioned above 5071 is very sensitive to the near infra-red. However, the two effective filters (Kodak's 304, and Balzer High Vacum's Calflex C) are both expensive and small in area. These filters minimise the difference in duping, between various different stocks or originals. The transparencies that are to be copied change their transmittance of infra-red from make to make due the the physical characteristics of the base material used. So a Kodachrome will transmit a different amount of infra-red from a Ektachrome E6 transparency, so by using a infra-red cut off, the difference in required filter packs can be minimised, and in many cases ignored. However, without the infra-red cut off it would be necessary to have different packs for each different stock.

One is therefore faced with three choices: One, ignore the problem and test each stock individually, and try and restrict the originals used to only E6, and, say, Kodachrome. In this context it is well worth replacing the glass filter tray with a glass such as Pilkington Antisun green which acts as a partial infra-red cut off and reduces the filter pack considerably. The second choice is to use the 304 or equivalent when working with 35 mm and 2¼'s and use a different set-up of filters for larger field sizes. The third choice is to make a special filter drawer that is considerably lower than the normal level, thereby spreading the filtered light over a larger area of the opalled glass. Care must be taken when doing this to maintain adequate cooling around the filters.

THE DICHROIC FILTER HEAD

The Dichroic Filter head usually consists of an Enlarger lamp with series of 3 glass filters of the secondary colours that are introduced into the path of the light with a system of cogs and clams, and an infra-red filter. These are usually set up on the horizontal axis. The filtered light then passes into a mixing box that basically consists of a white reflecting surface set at 45^{0} to reflect the light vertically through a sheet of opalled perspex. This is normally protected by sheet of clear front glass, which is set flush into the camera work surface.

As the amount of yellow filtration is increaed, the yellow filter glass is introduced into the light source, and so through all the filters. On most dichroic sources the amount of filtration shown does not necessarily correspond to any of the units used in gelitine filters; however, most cameramen use gelitine filters to view their test through and access any changes that are necessary. The Dichroic source can also be used to dial in plain colours for use in shooting graphic slides. A mechanical dimmer is usually incorporated.

Testing 5071

No starting points for filtration seem to correspond from camera to camera, and about the only generalisation is that when a infra-red filter is used the pack will change by about 15 to 20 yellow and about 40 cyan towards the "red" section of filtration. My standard approach to making a first ever test on a camera is based on whether there is an infra-red filter fitted or not.

First Ever Test with No INFRARED FILTER

Set the camera up for 1 to 1 duping from 35 mm. Set the aperture to F11 and the time will be bracketed a stop either side of 1 second. Make a selection of 35 mm slides of known original stock (E6, Kodachrome and E4). These slides should be of subtle colouring so that any subtle change is noticable on the dupe. Set up the filtration at 00Y 00L. Shoot each original at ½ sec, 1 sec and 2 sec. Change the filtration the 10Y and 10C and shoot again. Repeat this in units of ten till about 40Y and 40C is reached. DO NOT FORGET TO MAKE NOTES AND SHOOT IN MARKETS THAT INDICATE THE STOCK NUMBER, FILTRATION AND EXPOSURE BRACKET.

First Ever Test with INFRARED FILTER

The test is basically the same but starts with about 20Y and 20M and progresses through 10Y and 10M, 00Y and 00M, 10Y and 10C, and 20Y and 20C. With a Dichroic use the low light setting. Both these tests use what amount to units of red or green it should therefore be fairly easy to find the nearest result and add one filter value to it to get the optimum filter pack and exposure.

Assessing Tests

The test and the originals are laid out on a light box and the one compared with the other by looking at the test through gelitine filters. Once the test that is nearest and the amount added filtration is established these two are simply totalled

For example if the test exposure of 10Y and 10L was considered correct when 5Y and 5M were added, the optimum filtration would be worked out thus:

10Y + 10C	Original test.
5Y + 5M	Required alteration.
-5Y - 5C	(Magenta expressed in negatives of cyan and yellow
10Y + 5C	Totalled to give new optimum filtration.

An optimum filtration would then be worked out for each original stock and a new test made to check these assumptions.

Establishing the KODAK Datum Base for any light source

All 5071 is batched and numbered by Kodak. It is also tested for filtration and exposure and these values expressed in terms of what must be added to a "Daturn" Filter pack and exposure. This information is printed on the box the film comes in.

3/1983 5071 - 842 - 274

+10L -50Y -1.5

3/1983 is the expiry date.

5071 is the stock.

842 - 274 is the batch or emulsion number.

+10L -50Y is the exposure factor and is given in F stops.
(i.e. this stock needs a decrease of 1.5 stops in exposure from daturn).

To establish your own Kodak daturn base for your light source, SUBTRACT the filtration and exposure data on the box from your filtration and exposure obtained from the test.

	10Y + 5C	at f11 at 2 sec	(test result)
	+50Y - 10C	+ 1½ stop.	(minus Kodak data)
	60Y - 5C	at f11 at 5 sec	
or	65Y + 5M		(-5C expressed as +5Y +5M)

This 65Y + 5M f11 at 5 sec is your particular light source's theoretical "Kodak Datum base". And in theory all you have to do obtain new filters and exposure values for a new batch of 5071 is to add the new box data to your own Kodak Datum Base.

If your new batch is marked up + 15C - 55Y - 1.0 simply add this to your datum base to get a starting point for tests.

	65Y	+5M	(light source Datum)
	-55Y	+15C	
	- 5Y	-5C	(+5M expressed as -5C -5Y)
	+ 5Y	+10L	(new test start for filtration)

Decrease the exposure by 1 stop, so f11 at 5 sec becomes f11 at 2½ secs.

It should be emphasized that continual assessment of the quality of dupes is essential. And that it is always best to make the time to do an individual test for any particular job.

It is also worth having a standard piece of A/W made up to do tests for the additive printing of colours for graphics.

TOP LIT STOCK – KODAK 5018 EPY 50 ASA

Kodak's EPY is the most commonly used stock for toplit A/W copying. It has fairly good colour rendition and is of medium contrast. It's speed also suits this kind of use.

Polarizing the light source

Setting up top lits for opaque copy requires a knack. Obviously the lights must be equal distance from the camera centre. They should subtend an angle of about 40^{0} to the centre of the artwork. Lower than this and they will cause too much shadowing on cells and paste-up. Higher than this encourages reflections. Barn doors should be used to limit the spread of light, the down-ward face of the camera should be in shadow. The shadow board of the camera should also be used whenever possible and this should be faced with black velvet. It is often necessary to make-up card extensions for the shadow board. The lights themselves should be fitted with polorizors and both polorized in the same axis. A polorizor is then fitted on the lens. To set this polorizor in its correct axis, place a bunch of keys or similar shiny object under the camera, and with the toplights on, rotate the polorizer on the lens while looking through the camera. At one point it will be seen that the high light on the keys goes very suddenly to very dark blue or even black. This is known as setting the polorizors to "Black". The effect this has on Artwork is to reduce the specular reflections off the actual grains of pigments that the artwork is made with. This increases the saturation of colour and the apparent contrast of the film used. It does also eliminate a lot of the problems associated with shooting through glass and acetate, but big reflections on "flare" are not eliminated by polorizing. Paint the ceiling black, move the lights, buy metres of black velvet and you'll get it eventually. Also whenever you want to shoot something out of black use either black velvet or high gloss black paper such as Astralux Black. Don't use a black "flint" paper or "back drop" paper.

Field Size, and Exposure

The field size is normally described as the length of the longest side of the projected image of the camera's reticle. In precise useage it must be defined which bit of the reticle is being referred to. Full frame Field size referes to the rectangle that represents 36 x 24; Projected image refers to that rectangle that represents the edge of the slide mount. On a rostrum camera that has autofocus the exposure changes in relationship to the field size, (the autofocus system extends and retracts a set of bellows as the camera travels down and up the column).

So each field size could be given an exposure factor. However, the simplest thing is to make a "grading" test and to write this down as guide set of exposures. ("Grading" is the matching of colour and or exposure or even contrast throughout a rostrum shoot).
In this case the grading test consists of shooting a single piece of Artwork at a number of different field sizes and at a range of exposures for each. And then evaluating these and choosing the exposure at each size that gives an even saturation of colour throughout the series.

The result produced here is based on a aperture of f8. (It is normal practise to bracket on the time exposure and not the lens. One; there is less chance of moving the lens, two; the time can be adjusted in finer increments). A field size of 1¼" was chosen and this was increased by 1¼" for each step of the test. Having reached 10 inches there is a far smaller change in exposure necessary.

Grading Test Result, EPY, aperture f8.

Field Size	Time Exposure
1¼ inches	6 sec
2½ "	4 sec
3¾ "	3 sec
5 "	2½ sec
6¼ "	2 sec
7½ "	1.5 sec
8¾ "	1.2 sec
10 "	1 sec

This test or similar can be applied to all the stocks on the rostrum camera, used with all different combinations of lights. Some studios mark this information on the column of the camera, presonally I put it in the log or on a paper taped to the work surface, and use the column marker for other more transitory information.

Shooting Artwork on Cel

There are three main problems with A/W prepared on cell. The first is to get the right combinations of cells shot in the right way. It is essential that the Artist provides a dope sheet that relates the assembly of each frame to the cell numbers. This should be checked through with the Artist to make sure that it works in the way it should. Also check you have the right pegbar system.

The second problem is keeping the artwork clean and undamaged. Each cell should be interleaved with tissue; and should remain this way. Lighter fluid, anti-static clothes and soft brushes should be used for gentle cleaning. Unscratched pieces of float glass should be used as platens.

The third problem is build-ups of cells and maintaining even colour back grounds. Each piece of acetate acts as a very small amount of neutral density, so the more pieces of cell that are put on a back ground the darker the back ground becomes. Differences in thickness and actual material should be avoided. With small numbers of cells the problem can be overcome by changing the exposure slightly for each cell. However, where a build-up requires more than 3 cells is advisible to use blank cells to make up the number of cells in anyone shot to the total involved in the build-up. These blank cells must be kept very clean but by using them it is possible to maintain a very constant background colour.

Contrast Control

Is usually done by adjusting the process. Cutting the process reduced the contrast and pushing increases the contrast. This however will also induce some shifts in colour, which can be compensated for by using colour correction filters. In this context it is well worth noting that different film stocks and different lighting will produce different results. Try 5071 as toplit stock, EPR with flash, EPT, even long lenths of Kodachrome are available, and other manufacturers make other stocks.

Colour Correction

Very few pieces of toplit artwork shoot the way they look. The best approach is make up a swatch of materials that are going to be used for a job and shoot a test, and then select the materials that give the combinations that are wanted. Where this cannot be done it is however possible to shoot toplit artwork as if one was printing additively. Each shoot will need three exposures using three different filters.... the system is tedious.... however, is possible using it to make very good transparencies of difficult colours. These transparencies can be duped, or used in combination with bottom lit A/W. It is also worth mentioning in this context that it is always better to work off the original tranie, not the expensive R-type that your client has had made!
Educated clients produce work that is easy to shoot, and get the results that they have been led to expect!

The same process also applies to tungsten stocks, the favourite here being ektachrome 50 A.S.A. tungsten. Again rate at 15 A.S.A. or 30 A.S.A. and conpensate in the process, to adjust the contrast.

Tungsten and Daylight stocks have a particular use as 2¼ duping stocks, as there is no special dupe stock in 2¼ format.

The most successful mix I have tried in 120 stocks is EPR (64 A.S.A. Daylight), converted for tungsten light, rated at about 30 A.S.A. and cut by 1 stop in the processing.

Kodak list a 35mm dupe stock for flash exposure but I have never tried it.

Disadvantages against 5071:

1. More grain.
2. More contrast.
3. Less subtle colour copying.

Advantages over 5071:

1. Easier to colour balance.
2. Easier to change batches.
3. Available in 2¼ roll films.

Kodak brochures as follows refer:

Copying slides - S12, S30, S200
Dupe stocks - E38 - E39

SLIDE DUPLICATING STOCKS

5071, a specially formulated film for copying slides, is only available in long lengths of 30mm. It comes in two sizes, 35mm and 46mm, the latter being a specialist audio-visual film for making "superslides". It is processed in E6 chemicals with a normal development cycle. It is either loaded into cassettes or shot in cameras with bulk loading magazines. Kodak gives it no A.S.A. rating but it is normally somewhere near 3 or 6 A.S.A. For copying it has 2 outstanding features; one, its very very fine grain, and two, its lack of contrast.

It is however, a tricky stock to use. It varies from batch to batch and, since testing is very time consuming, it is worth buying it in bulk. The film is sensitive to ultra-violet and infrared light and the ideal light source has very steep cut offs at both ends of the scale. When using gelatine filters, a Kodak 2B or 2E should be included in the filter pack. The Kodak 304 infrared cut-out is an expensive glass filter and can be omitted, though the filtration will then rise to amounts approaching 60Y and 60C. The infrared is however much more essential if the originals to be copied are of mixed original film stocks. It is very difficult to make good copies of Agfa tranies without the 304. It is also useful to use a glass such as Pilkinton's Antisun Green as the support for the filters. This works as a partial infrared cut-off and reduces the filter pack considerably.

Physically the basic set up for copying slides is as follows: 1. Camera, with macro lens and appropriate tubes. 2. Slide to be copies in a carrier. 3. Opal Glass. 4. Filter Pack, on 'antisun' glass. 5. 3,200 degree Kelvin light source. (3.,4., & 5. will be replaced by the Dichroic source in most rostrum cameras. Make sure this is fitted with infrared cut-off).

Colour balance tests are made in much the same way as for colour printing. Select three or four transparencies as a standard and make a test that goes through several exposures at a number of different filtrations. Have this processed and evaluate it against the originals, using the filters themselves as a guide to the amount of change to be made in the filtration.

6121 is the equivalent for use with the enlarge or plate camera, and it is very similar in feel and result in 5071.

Daylight and Tungsten Stocks for Slide Duping

Any Daylight stock can be used to make dupes with a flash light course. The source can be very simple, a flash head under a sheet of opalled perspex; or sophisticated as in the ILLUMITRAN set-up. The main problem comes in maintaining the quality or the originals in terms of contrast and subtlety. Working with daylight films does make colour balancing very easy. Favourite stock would be ektachrome professional 64 A.S.A., or 30 A.S.A. and with the E6 process adjusted to compensate (cut by two or one stop). This will lead for an overall blue feeling to the copies, but this is easily compensated for with some magenta and yellow filtration.

LITH FILM

Lith film is in one way the most simple stock to use but almost because of this it seems to be the stock that most people have trouble with. It needs care and consistancy in processing. And the better the Artwork the better the results. Always make sure the Artwork is as precise as possible. Use the correct materials, good blacks and good whites are essential as the more distinct the contrast the more latitude is given by the film. Clean film is also important as drying marks and scratches show when projected. For work where matching positives and negatives are required it is particularly important to expose and process with absolute precision, as the size can be exaggerated in either exposure or process. This particularly applies to process camera work were sheet lith film is shot and then contacted, and a lot of care is needed to develop a system of shooting and processing that is correct. There is nothing worse than having made a series of mattes and counter mattes than finding that everything has drop shadows round it when shot.

Other stocks and more uses of these three basic stocks will be discussed under individual techniques.

GRAPHICS AND MATERIALS

Toplit Colour Artwork

This is the classic area of graphic artwork for the rostrum camera and the direct descendant of movie animation. Artwork can be prepared in any graphic style. There are very few rules as to what works and how things should be done, though some areas such as work with acetate cells are thoroughly defined. It is also the area where most studios cut their teeth before complex rostrum facilities are available. Most toplit work requires very simple camera facilities; but conversely requires graphic artists who are at least very good craftsmen.

In classic cartooning the work is painted completely on acetate. There is usually a set of cells for the backgrounds, a set for the Action and a foreground set. Each set of cells will have its own peg bar which will be moved in the appropriate direction. It is for this reason that many animation compounds have trackable peg bars on their own with their own counters, which can be moved independently of the actual surface. Very thin acetate is used so that large numbers of cells do not build up too much thickness. The actual line outlines of the drawings are drawn on the top surface of the cell. This is usually done in ink, Rotring pens and ink can be used particularly on a "keyed" surface such as "Art Cell", however, it is more correct to use a ink such as Rotring "T", a "non-etching" ink for drawing films, which must be used in pens such as the Rotring "graphos". The cells are turned over and the painting is done on the back of the cells this elimates brush marks. Small details are filled in first, and then the larger areas. The paint must be thick enough to cover evenly, without heavy blobs that will rinkle the cells. Special animation paints are available from specialist animation suppliers. Alternatives can be made up with goauche paints mixed with small amounts of white emulsion; or use quick drying enamels sold for painting models. Model paints have two advantages one, there are gold and other metallic colours available; and two, they can be applied to the top surface of the acetate using an airbrush, without being too fragile. (Metallic colours need careful shooting without the polorizor on the lens).

A very common way of making coloured artwork on cell is to use Pantone coloured papers or self adhesive film. Again neat craftsmanship and very clean work is necessary for good results. Too many overlays with pantone paper will make too great a thickness and make for shadowing. Dry transfer lettering is used to label the diagrams etc. When using these materials check for "due" marks in a racking light and clean these carefully with a lint free cotton cloth and lighter fluid.

A very effective spin off of working in this way is to make up all the actual graphic content as line Artwork using paste-up and block tak or rubi lith. This artwork is then matched on cell with colour batches. The two piles are then shot separately, the one on lith film, the other on transparency stock, the lith frame being sandwiched with the transparency to make the final slide.

This is particularly effective where a illustration is needed next to text. The illustration can be made up as colour Artwork with a plain colour back ground that corresponds to the text area. The line A/W then consists of a window mask for the illustration and the text as paste-up.To work this successfully it is either essential the camera is not moved between the two shoots, or that there is very accurate grid to line-up and size the artwork under the camera.

Many other individual techniques have been developed. One company I know had a computer type setter long before they made slides. They now make very good artwork for slides by photocopying computer setting on a photocopy machine loaded with coloured paper. Simple, quick and adapted to a particular slection of hardware. Another idea is to paint on the back of lith film positives or negatives, or 3M colour key material. Anything goes.

Line Artwork

Much of rostrum camera import can be described as line A/W. There are a number of rostrum camera operations that do nothing but convert line artwork into colour slides. Lith masks are one of the producers most important design tools. Lith A/W is needed to make mattes and counter mattes for double exposures. Different studios have developed individual production processes. There are probably more special effects and opticals used in the A/V industry than in the movie industry. Several entirely different "special" effects are frequently used in one show, and in many ways it is only noticed that these are "special" effects when they don't work. Almost everything that is done poses new problems, every system needs continuously modifying. Every job requires that the work is categorized into various slots in a Designers experience, and then related to the resources of talent and hardware available. Line Artwork required almost more understanding of A/V and Rostrum camerawork than toplit colour. The artist needs to know exactly how the artwork is going to be used, not only at the rostrum camera but also at the programming stage. It is no good an artist making artwork up for four slides where only three projectors are available. Is this a projection superimposition or a camera double exposure? is a question that must be answered at the artwork's commissioning.

So the brief and storyboard are particularly important for line Artwork. A list of various categories of Artwork needs to be drawn up. What masks are needed for sandwiching in with slides? What soft edge masks are needed, and are these to a standard format? What mattes and counter mattes are needed? Is the graphics such as can be done using additive colour work, or with negatives all need to be contacted back to positive? Once these questions are answered the particular graphic techniques are usually very simple, and again as long as the correct artwork and information is given to the rostrum cameraman, the camera work should be fairly simple as well.

Lith masks for sandwiching are usually prepared as camera ready Artwork, against some kind of grid or camera line-up. This can either be a standard piece of artwork that has all the various proportions of the camera graticle marked on it, or a special one off grid that has various design elements that are unique to a particular show. This grid is used in the form of a film positive that is taped to a cell. Each mask is then cut of rubi lith or block tak to the appropriate proportions. If possible all this kind of artwork for any one show should be done at one field size. Each cell is marked up with appropriate information such as the number required off each mask. It is also very useful to mask the top right hand corner of each frame with a notch or number. This is done in the area of the frame that is between full frame and the projected image, and serves to identify the correct way round for any particular mask.

Mattes and counter mattes begin life in the same way, but then must be reduced to appropriate size to fit the pictures that are being matted into each other.

There are basically two ways to reduce the artwork. If all the material is 35mm size the mattes can be shot as a shoot on the Rostrum camera. Each transparency is then mounted in a Register mount sandwiched with its appropriate matte. The matting is then done in a series of double exposures with the camera set for 1 to 1 dubing. It is best if the artist cuts both Positive and Negative mattes for this system, to avoid the tedious process of making registered contacts at 35mm. Many of the full pallette of camera effects can be achieved off 35mm mounted slides, but great care must be taken to maintain register and the compounding of errors can make the system unusable in certain circumstances. In other cases the artwork must be reduced using a process camera. Again any particular system used is only as good as the craftsman using it, so in designing a system it is well worth making it work in a way where as few errors as possible can be made.

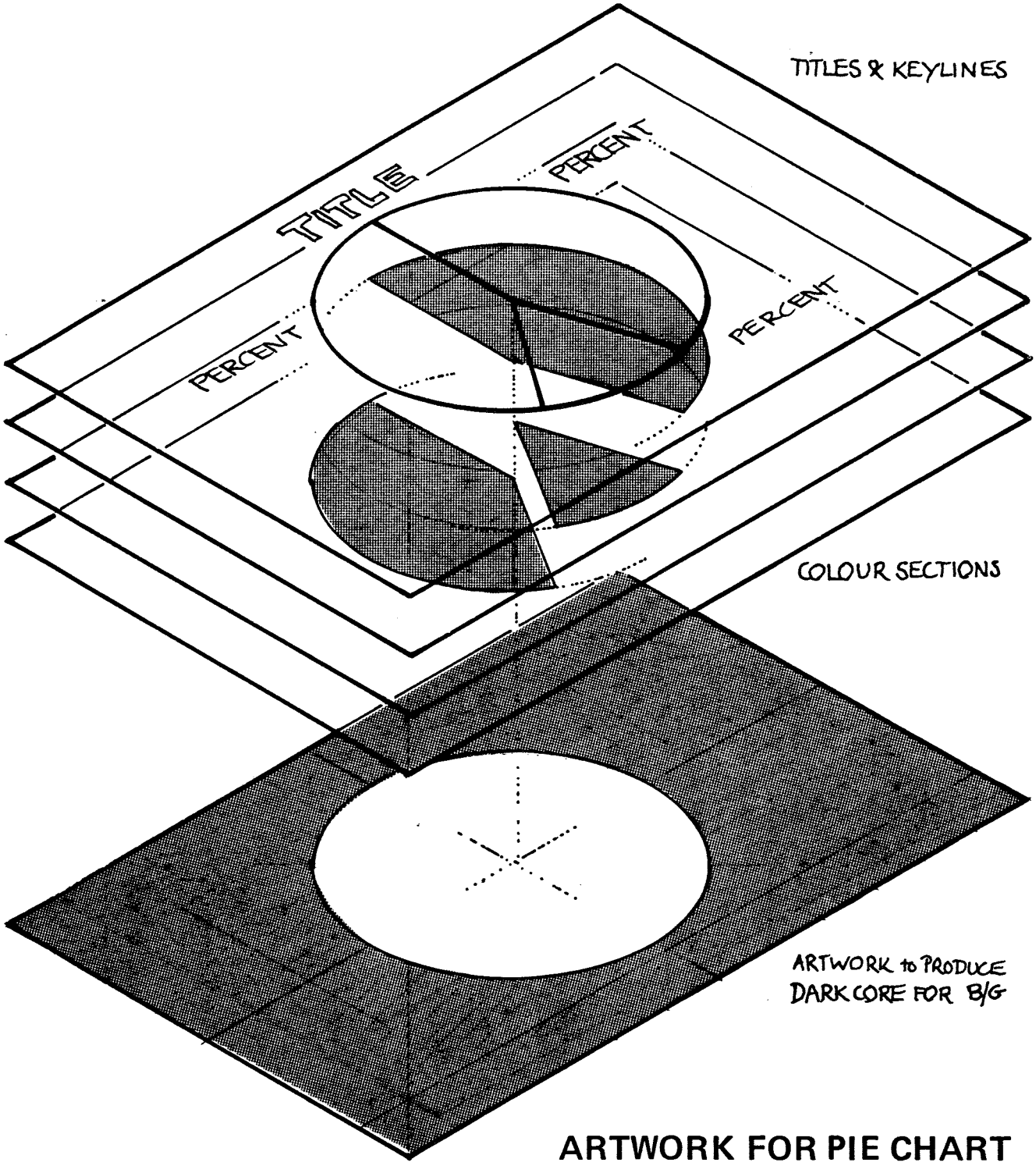
Line Artwork for making colour slides follows very similar rules. Again the artist must have a clear idea of what is wanted by the client, and what is needed by the rostrum camera man. There are two golden rules for this kind of artwork:

One - always work to a constant field size.

Two - make a cell for each colour.

Lets follow an example of making a series of pie-charts. The company's livery is a mid grey and the client wants all the graphics done on this grey. The lettering and key lines are to be reversed out in white. The segments are to be green, maroon and blue. It is a single screen show. Knowing his trade the Artist realised this cannot be done using the additive techniques and each colour will need a separate mask.

1. Artist chooses a field size for the whole sequence, this of course means that all the labelling etc., can be ordered in a selection of cap heights common to all the charts. The primary circle is masked up, with areas left around it for the labelling.



ARTWORK FOR PIE CHART

2. A common piece of A/W is made to make a "Dark Core" matte to put in the grey background.

3. The coloured sections of each chart are made up to make discreet "clear core" mattes for each.

4. The labelling and keylines are made as one cell for each chart.

5. A first pass is made on the rostrum using lith film and all the A/W is shot onto 35mm stock. It is then sorted and mounted in register slide mounts, and viewpacked in shooting order.

6. With 5071 and the camera set for 1 to 1 dubing, all the various line slides are double exposed together.

The neatness of this operation was that every slide could be made up using negatives only. And indeed 35mm negatives at that. However, in this instance the artist boxed very cleverly. Firstly all the artwork is what might be called "mutually exclusive"; none of the masks have been cut so that the colours overlap. Secondly the client was not offered coloured lettering on the grey background,and thirdly the key lines could be expected to remove any minor inaccuracies in the artwork. In fact had the client wanted coloured lettering it would have made it necessary to produce in register positives of the lettering to be used as masks on the background. In practical terms this would have meant making 35mm register contacts, or more preferably making all the negatives on sheet film at a more workable size.

PRODUCING COLOUR SLIDES FROM LINE ARTWORK

The production of full colour slides from black and white line artwork has become a business in itself and is based on many crafts and techniques. It is similar in concept to giving a printer a piece of black and white artwork, with or without overlays, and specifying to him that each piece must be printed in such a colour. The printer will then make a block for each colour and print each colour in turn and in register with the subsequent colours. So, briefly, to achieve a final piece of paper with a graphic image printed in a number of colours, the image must go through an artwork stage, a blockmaking stage, and the final printing. The process of producing graphic colour slides is exactly analogous; there is an artwork stage, a process stage equivalent to blockmaking, and a final rostrum stage equivalent to printing. There are however two basic differences: one, the camera works with coloured light sources and not inks, and two: paper is essentially white before it is printed on, and film essentially black before it is exposed. Further the rostrum camera can be used to manipulate the "blocks" in ways that are not possible on the printing press. The topics to be looked at are therefore: Artwork, Process Work and Camera Work.

Artwork

The preparation of artwork is essentially a standard topic and has been touched on elsewhere in this manual. However, to summarize, all styles of line artwork production can be used, and where possible an overlay for each colour should be made, and equally where possible the artwork should all be produced to one size, and if it is not, careful consideration must be given as to when in the process the odd bits are going to be scaled. Where photographic input is required in register with line artwork, the difference in physical size must be considered and these designed round. This can involve techniques such as either shooting photographic material on large formats, or enlarging material to large formats, so that the artwork can be traced from the images in register. Rotascoping can also be used where appropriate. This essentially involves making tracings from accurately projected slides, and where the camera does not have this facility, an accurately aligned projector can be used. Registration systems should be used and an accurate description of the camera's final cropping should be given in the form of a line up grid.

Process Work

The artwork is then taken to a process camera (or in some cases the rostrum camera), and the "blocks" are made. The blocks however, consist of sets of registered lith film negatives and positives. The process involves sizing and focusing the artwork, shooting and processing the lith film, contacting negatives to positive, and maintaining the registration. In the sizing and focusing stage there are two sizes that must be considered in the design stage: the size of the original A/W and the size of the final reduction, and these must take into account the obvious size restrictions of the rostrum camera light source and the process camera. In this context, it is usually worth having a tracing, or the lith film positive, of the screen format at the final size for the rostrum. Then the artwork is placed on the artwork stage of the process camera. If the artwork is already on punched cell, a peg bar should be used. Many process cameras in A/V production houses have been modified to use a peg bar, on both the artwork stage and the film plane. With cameras that have vacuum operated platens care must be taken that the vacuum system is not destroyed by the pegs of the peg bar. On many cameras this will mean that ACME standard pegs have to be used taped to the top of the artwork platen, but that Kodak Low Pin peg bars can be used in the film vacuum. Where an ACME peg bar is used, taped to the top of the normal platen, a clean sheet of glass should be used as a platen. Card should be put on top of the film when a Kodak Low Pin peg bar is used in a vacuum film holder, as glass will be cracked when the vacuum is applied. On process cameras that have no vacuum, it is worth considering drilling holes in the platens to match the peg bar pegs. In this way ACME standard punching can be used for the lith film. There are, of course , a great number of alternatives that can be worked out. Film sizes, field sizes within those sizes, thickness of cell, single punching, double punching, all these subjects can be debated, and the systems evolved in any particular production house will probably have at least one unique feature. Let me give you two examples of the "block making" process. The first is a title sequence for a six projector single screen show. The brief was to design an animated sequence around a grid that opened in perspective, to reveal a perspective plain and the company logo. The artwork was drawn on paper mounted on A3 cells punched to ACME standard. A base grid had a number of overlay cells that made the animation, there were also masks to make the opening in the grid. A camera line-up grid was also drawn. The system was as follows:

1. The camera line-up drawing was placed on the artwork platen and centred. The peg bar was then taped down.

2. The camera was then focused and sized, so that the line-up grid was reduced to a 6x4 field-size. A "small" Kodak low pin peg bar was then positioned on the film back, so that the 6x4 field-size was in the middle of a sheet of 10x8 film.

3. The first piece of lith film was then punched, placed on the Kodak bar, covered with a piece of card, vacuumed and then exposed. This first negative would eventually be contacted, again on a peg bar, to positive, to provide the rostrum camera grid.

4. The rest of the artwork was then dealt with in the same way.

These negatives then formed the camera ready artwork, with exception of the few that had to be contacted back to positive. This system was ideal for this kind of artwork, as the artwork was produced in register, and the lith film negatives need no subsequent re-registering.

The second example involved animating a series of Møybridge's photographs of movement analysis. Here a very different route was chosen, because the artwork (being the page of a book) was not in register. The sequence of 24 photographs was first shot onto Pan X 35 mm film on the rostrum camera. During this shoot each photograph was carefully positioned using Moybridge's original background grid plotted with the camera viewfinder. The individual shots were also vignetted. A neg holder in a 5x4 enlarger was then "modified" to take a pin registered slide mount. The negatives were then printed onto 10x8 lith film that had been punched to Kodak standards. The difficulty in this system was to maintain the registration of the negatives as the negative carrier was placed in the enlarger, and some enlargers are tighter than others in this respect. The maintenance of registration at the 10x8 stage was no trouble as the peg bar could be simply taped to the base board of the enlarger. Other systems could have provided the same result just as accurately.

This second example is given to demonstrate that flexibility of approach is essential. The first example is however probably very close to a classis route for obtaining registered lith negatives and positives, and could be applied to any graphic content: graphs, flow diagrams, pie-charts, etc.

The rostrum itself can of course be used as a process camera, and registered black and white artwork used to generate 35 mm lith film that is shot finally from mounted slides. Many people think that this can only be applied to simple artwork such as titling and build-ups. Elsewhere the making of the artwork for a pie-chart has been described, however, the lith work done on a rostrum camera can be far more complex than that, and ultimately the artwork for in-camera matting is shot on the rostrum itself.

An example of where the preparation of the lith work on rostrum is particularly appropriate is where a logo is required to step back in perspective, and where this stepping needs to be matted into a background. See the example slide, "PARKSPARKS" which uses this effect. The preparation steps are as follows:

1. The logo "PARKSPARKS" was reduced onto 5x4 lith film in negative (white out of black) and contacted back to positive. And registered on cell.

2. The registered positive and negative was then lined up under the rostrum camera and the necessary zoom sequence plotted out, in terms of camera movements and artwork movements.

3. Using lith film in the camera, the positive and the negative were shot at each field size. Also at each field size, the film was rewound to the beginning and a multiple exposure using the negative only was built up. This multiple exposure was the key to the whole shot as it produced the mask to matte the stepped zoom into the background of the final transparency.

4. The lith film was then processed and mounted in register slide mounts, and the final assembly of the shot made on the rostrum using colour stock.

So again we have a system devised to achieve a certain task, and in this case it was far more appropriate to use the rostrum camera to generate the lith work. In other words; there are many ways to catch a monkey, and monkey catching is fast becoming a science.

CAMERA WORK

Before lith film artwork can be shot as colour slides, a palette of "inks" or colours must be made up. On rostrum cameras the dichroic filter box is normally used to make up these colours, however either coloured lighting gels, or additive tricolour filters can be used. Probably the least used method of making up a colour palette is with additive filters, but an understanding of this way of generating colour on film is very useful to realise the full possibilities of converting lith work into colour, and is something that should be experimented with just to prove the results.

Additive Synthesis of Colour

A set of tri-colour filters comprises of three filters of the primary colours - blue, green and red. The first test to make is to shoot the classic colour tri-foil and prove that it does actually work.

1. Cut a circle out of a piece of black opaque paper, and position this on top of the bottom-lit source of the rostrum, so that it is centred in the bottom two thirds of the frame.

2. Make an exposure bracket over a number of frames colouring the circle red with the red filter in front of the camera lens. Then rewind to the beginning of the series.

3. Position the circular mask in the top of the frame and offset to right, so as to overlap the series of red circles. Expose this in through the same exposure bracket with the green filter. Rewind to the start of the sequence.

4. Repeat the sequence with the mask moved to the left and with blue filter.

The resulting slides should show the classic additive colour trifoil - a red, green and blue circle, that overlap each other and in these overlaps generate the secondary colours, cyan, magenta, yellow and, where all three overlap, white. Two things should be noticed about these slides: one, that one colour exposure over another colour has produced a third colour, i.e. where red overlaps green there is yellow, and two, the more exposure or exposures the lighter the colour. This trifoil slide can immediately be used as a palette and the theory involved is used to generate colour graphic slides that only use lith film negatives:

1. From the trifoil test choose an exposure of green, and then expose a complete frame to green using this exposure.

2. Using any lith negative make a second exposure on the same frame, using the blue filter. The exposure chosen for this can match the green exposure and therefore the cyan of the trifoil test; if more exposure is used the colour will be lighter, if less it will be darker.

The slide produced will show cyan coloured lettering on a green background. More tests will be needed to make a more complete palette of the colours available. This involves making a large number of carefully logged double exposures using pairs of tricolour filters, and thus generating a selection of repeatable secondary colours. Another set of tests will involve exposing these secondary colours into each other to produce tertiary colours. In theory all colours can be generated as secondary colours, though the tertiary colour palette is limited by what has gone before. In practice these "secondary" colours are produced with either coloured gels or the dichroic head.

Shooting a Colour Palette with Colour gels

"LEE FILTER" lighting gels have become one of the industry's standard for this work.

Two distinct palettes or tests need to be shot for work with coloured gels - the first, literally, is just to check the exposure needed to reproduce a given saturation of colour. Gels should be tried in combination to make browns, olive greens and other more subtle colours. The second test is to generate a palette for making full colour slides from lith film negatives only. This is normally done by making up a piece of artwork with windows in it. A selection of commonly used gels is then taped behind the windows so that each window is coloured a different colour. This artwork is exposed into frames already exposed to plain colour. Again careful logging of exposures are necessary to ensure that repeatability can be maintained. These palette slides need very careful assessment before use; they tend to look like patchwork quilts and the choosing of colour combinations can be very confusing.

THE USE OF THE DICHROIC HEAD

The dichroic filters of the rostrum camera give the most easily accessible range of colours. Flesh tones, chocolate browns, earth browns, electric blues - all these and more are available with experimentation and careful logging of results. Again a series of tests are made and logged.

1. Line the camera up at about a 6 inch field size.

2. Select 150 cyan on the dichroic head. Shoot this through a spread of exposures, and include in the frame some kind of identification. This can be a strip of acetate with the filtration written on it.

3. Add 20 yellow to the cyan, change the filtration identification and shoot this through the spread of exposures.

4. Keep adding more yellow until the yellow is equal to the cyan - then start reducing the cyan. This needs eventually to go through all the main steps of filter combinations available, though not necessarily in one shoot.

The resulting palette of colours should present the possibility of making almost any colour that is needed. Adjustments in exposure will change the hue of the colours, a flesh colour is essentially an overexposed brown, while grey is underexposed white.

All these tests as described can be applied to any reversal colour stock and each will give varying results. The two most common stocks used at the present time are 5071 duplicating stock, and EPY tungsten stock. The main differences in these two stocks are the speed, 6ASA against 50ASA, and the rendition of the colours. This latter difference should be assessed empirically, however, it is normally accepted that EPY gives a clearer, more vibrant rendition of colours. The three stops difference in speed does in some ways make 5071 a more easily usable film, and the range of exposures on the rostrum are more suited to slow films. 5071 also has the advantage that transparency input can be easily combined with graphics. The equivalent stocks in sheet film are Kodak's 6118 and 6121. In roll film the choice is between stocks such as EPR and EPY.

SIMPLE COLOUR GRAPHIC SLIDES

There are two main routes for producing colour graphic slides from lith artwork. One involves using negatives only, and the other uses both positives and negatives. To make life complicated these two routes can be combined in one slide, and to compound this further manipulations can be applied during the shooting.

NEGATIVES ONLY

If the required colour combination of a particular slide can be generated by using colour double exposed onto colour, as in the palette described in the section on "shooting a colour palette from coloured gels", then the slide can be made using negatives only.

A slide with one element of graphics is very simple to shoot. Choose a background from the colour palette, and expose a frame to that colour, then roll back one frame, line up the negative, mask everything else to black and shoot the negative coloured with the appropriate colour and at the correct exposure. The next stage is the shooting of the negatives that have been "gelled-up". This means that a multicoloured piece of A/W is made up as one lith negative and that pieces of coloured gell are taped behind the appropriate elements of the negative. This should only be attempted with negatives of a reasonable size, and on artwork where there is adequate separation between the elements. A variation of this, is to make artwork up in two parts, one of which part that is intended to be exposed in white and consists of keylines and lettering, and the other part that is the colour blocks. The negative of the colour blocks can then be gelled-up, the assembly of the slide under the camera will consist of a triple exposure, one, the background, two, the gelled-up negative and three, the negative with the keylines, etc.

With careful consideration "positives" can also be used on their own. The term positive is used in parenthesis to mean a lith film piece of A/W where the object is black on a clear ground. Consider a slide where lettering is required in a dark green on a pale blue background. This cannot be achieved by using the negative only, because once the background is exposed to the pale blue it will be impossible to make the second exposure using a negative produce a colour that is darker than the background. However, using a positive of the lettering it is possible to expose the entire frame to green and then position the positive and make a second exposure with a blue gel. The positive will allow no exposure to degrade the original green exposure in the areas where it is opaque, therefore leaving the lettering or whatever green, while where the positive is clear the same combinations of colouring will occur as usual, thereby producing dark lettering on a pale ground.

TITLING

Titling of slides in its most simple form is also done using lith negatives. The slide is duplicated, the camera stepped back and a subsequent exposure made with a lith negative positioned correctly and exposed with white. This is referred to as "burning-in" white lettering. The simplest routine for titling 35 mm slides is to shoot the lettering onto

35 mm lith stock, mount these up and then double-expose these into the slides as they are being duplicated. Where titles are required in colour it is usual to make use of naturally dark areas of the original and to double expose coloured lith negatives into these areas. Trouble starts, however, where the titles must be put into light areas of the transparency and must be in colour. This will essentially involve matting the lettering into the transparency using both positives and negatives. Now, either the transparency must be the same size as the negatives and positives, or the negatives and positives must be the same size as the transparency. In the first instance the transparency is enlarged onto sheet film to a size appropriate for the lith artwork. The elements are then laid up on cell in register and the lettering is matted into the picture with a double exposure. This kind of technique can then of course be expanded to matting any form of graphics into any backgrounds that are pictorial. Graphs of production figures can be matted onto the appropriate factory backgrounds. Graphics themselves can of course be composed of elements of pictures, etc, etc. This kind of work does however rely on having access to a colour enlarger and while I would personally recommend that an A/V studio should have at least a 2 1/4 colour enlarger, this is not always seen as practical. The other approach is to size everything to 35 mm or 46 mm as appropriate and to then use mounted slides as the registration system.

This route to the end result means that two shoots must be made on the rostrum camera, the first shoot to reduce everything to the appropriate size and the second to assemble through multiple exposures the final slides. The Moroccan Landscape with zooms is an example of this kind of work, and a more detailed explanation of that particular shot is offered at the back of this manual. It is this way of working that is most closely derived from movie special effects.

In the first rostrum shoot all the material that is going to be needed for the final shoot is assembled and shot onto the appropriate film stock. Before starting this shoot great care must be taken to check that all the elements necessary for the final assembly are to hand, and the material must, in many cases, be more carefully prepared as there is considerably less latitude to manipulate elements between the two shoots and during the final shoot. Where lith film positives and negatives are going to be wanted in the final shoot it is well worth considering shooting all the line artwork first on negative stock and then on pos-pos stock, or conversely having artwork that is already in positive and negative form. On very complex shoots the appropriate stocks will have to be changed during the shoot, it is therefore worth masking the movement of the camera so that the feed magazines can be wound back and removed, and yet subsequently replaced with exactly the same frame in the gate of the camera. This technique might be necessary where colour artwork must be shot in register with line artwork, but artwork or camera movements need to be made between series of exposures. It is known as marking "the preferred sprocket". It is also used where "in camera mattes" need to be changed and subsequent exposures made on the same frames.

Very accurate mattes for matting objects into transparencies can also be shot on the rostrum, though the size of the original objects must necessarily be limited by the space available. The process essentially involves shooting a pack shot against black as one exposure and then shooting the same sho t back lit to make the mask. Obviously with small objects this presents few problems; the pack shot is set up on a sheet of glass above the bed of the camera and is shot with the camera's top lights and with a black background under the glass. The black ground is then removed the top lights switched off and the back light switched on. It is normally possible to shoot this mask shot on colour stock and obtain a dense enough black and clear enough white for this frame to be used straight out as a mask without having to contact it in register to lith. If however the object is too large for the standard bottom light source, minor, or perhaps major temporary alterations must be made to the camera. This can involve shooting through front silvered mirrors or extending the bottom lit source of the camera. In this context, it should be remembered that the wooden table top is only held on with screws and could be completely removed and replaced with opalled perspex. Most cameras can also be synched to flash units for those who prefer flash for pack shots. The final assembly of the shot is then very simple - the background is sandwiched with the mask in a registered slide mount, the pack shot mounted in another mount, and the two double exposed together onto duplicating stock.

THE ANIMATION TABLE

An animation table is a flat surface for moving artwork under the camera. The surface itself can normally be rotated on a turntable, which is in turn mounted on two sets of rails that permit linear movement in the horizonatal plain. Sometimes this complete assembly is mounted on another larger rotating turntable. The movements in the horizonatal plain are defined as East West, which is right to left across the camerabed; and North South, which is towards or away from the camera column. The specification of the table required is dependant on the kind of work that is going to be undertaken, and tables are made at various levels of complexity, flexibility, accuracy and at various sizes and prices. The larger more expensive tables are either designed as movie animation tables, or are so close in heritage that most movie rostrum cameramen would be totally familiar with them. The smaller tables tend to be designed to work primarily from back lit 35mm mounted slides. And to further complicate the cameraman's life all the functions of the camera and the animation table can now be computorised and driven with stepping motors. However, whatever table is used the main principals are the same. And perhaps the most important rule, as in all camerawork, is to develop a routine and stick to it.

Camera Routine

At all levels of rostrum camera work, the cameraman must develop routines that become automatic, however, this is particularly important where work with the animation table is concerned. A mental checklist and strict order of addressing the camera and table must be developed.

Pre-shoot checklist.

Lights: is the lighting correct; height, filters, polorizors.

Camera: Aperture on lens correct, correct filters.

Focus: Autofocus adjusted.

Control: Frame counter, zero. Pre set counter. Time expose, shutter, advance, forward or reverse.

And once the shoot is started always address the camera, the controls and the table in the same order. Always handle the artwork in the same way, and always make notes. Simple notes, such as frame numbers that have to be reached or rolled back to, can be written on pieces of sticky tape just by the console, more complex moves need to be entered in a log book, dope sheet, or storyboard.

Whatever sequence of actions is decided on, stick to it. For instance always move N.S. first, followed by E.W., followed by zoom, followed by rotation, and finally console switching or adjustment. The actual order of the sequence is unimportant, as long as the cameraman knows where the sequence ends, because that is the only place he can stop, FOR WHATEVER REASON. Do not let any interruption break sequence, or moves will be duplicated or missed out, or frames duplicated or missed out. These errors will usually show up at the end of a shoot, when frame counters, or movements are found to differ from the calculated results. First check the calculations, and if these prove to be correct, there is then no alternative but to reshoot. It is sometimes possible to identify the mistake and so minimise the reshoot, but it is foolhardy to think that the mistakes will not be noticeable on the light box, it is also easier to reshoot while everything is set up than having to start from scratch at a later date.

Peg-Bars

Most animation tables have a pair of travelling peg bars built into the work surface. These are moved by individual worm drives with their own crank handles and counters which can read to 1/1000 of an inch. These peg bars can be used in a static position or they can be used to achieve movements within the larger overal movement of the table, or oppossing movements involving each other. (Other peg bars can be taped to the surface, or a "floating" peg bar attached to the camera stand can also be used).

In slide making the most common "movement within the larger overal movement of the table" is where an object needs to be animated across a multiscreen panorama. The East West movement is used to make the multi-screen split, (see details in section on multiscreen work), and the moving peg bar and the North South movement are used to make the animation through each screen area. "Oppossing movements involving each other" might be used where a graphic device such as a logo can be made up of two parts and these two parts animated in from the edge of frame to form the completed logo in the cenre. This could be combined with zoom and rotation to give a spiralling effect.

While on the subject of peg bars, the artwork and the registration of artwork is obviously of primary importance in achieving complex moves of this nature. The size of artwork in relation to the amount of movement required is also very important.

MOVEMENTS

Not only can the peg bars be moved but so too can the entire table on its compound. It can move East West and North South, and may also be rotated on a turntable. Each movement is controlled by a calibrated wheel and a counter. The movements can be used separately or in combination. One important fact to note is that the ARTWORK MOVES, NOT THE CAMERA. To pan left to right across a picture, the picture is moved from the right to the left. This is inclined to become a ticky logic test when working out shoots involving movements.

Rotations

When using rotation, extreme care should be taken when positioning the artwork with respect to the centre of rotation of the table. Careful consideration of the problem will provide the solution. If an artwork is to be seen as spinning round its cenre, the centre of the artwork must be centred on the centre of rotation, and equally the centre of the rotation must be correctly aligned within the viewfinder, centred or not as the case may be.

Rotations may also be combined with East West and North South movements. Consider a subject that is required to tumble as it is moved across a multiscreen panorama. The East West movement is used in the normal way to make the multiscreen splits. The subject itself is set up away from the centre of rotation, but this centre is taken as the centre of the overall movement. Now if rotation alone were applied the subject would p a semicircle arc, and turn from vertical to horizontal and back to vertical. The semicircle can of course be straightened out by applying N.S. movement to the compound. In single screen work even move complex bounces and tumbles can be achieved.

Diagonal Moves

Diagonal moves can of course be made by combining E.W. and N.S. moves. This however, is very difficult to work especially under an open shutter. So diagonal moves are reduced to N.S. or E.W. by changing the whole orientation of the table to the camera. On some equipment the bottom rotation is used, and on the Forox SS the rotation of the camera head is used. So to do a shot using a diagonal move at 30^{o} to the horizontal of the picture, the entire compound (or camera head) is rotated to a 30^{o} setting and either N/S or E/W is used.

The bottom rotation is inevitably of heavier construction than the top rotation, and is intended to facilitate diagonal pans using only one movement instead of two, and not for rotation during the actual shooting. This also applies to the rotating camera head of the Forox SS.

The Pantograph Table

The pantograph Table is a plotting board attached to the base of camera; the animation table itself has an arm with a pointer on it, which used to indicate the animations table's centre position in relationship to the pantograph table. These positions can either be used to make up a blank sheet of paper, or to travel along a pre-designed path. Camera height readings are used to relate the points to any particular field size. The path followed by the table can of course be worked out on the table itself, with camera centres and field sizes plotted on it; this plot can then be transferred to the pantograph table, however, the plot must be placed upside down on the pantograph table.

Floating Peg Bar

A floating peg bar is a peg bar that is attached to the camera base but is flush to the top of the animation table. On more complex set-ups this peg bar will also have E.W. and N.S. movements. Not many slide cameras are fitted with this additional peg bar, but the principle of its use is important to understand. By having a peg bar tha t is static and independant of the movements of the animation table, it is possible to hold a mask in one position while other artwork is moved. The principle can of course be imitated without the use of the animation table; a line film positive can be taped with its peg bar to the surface of the backlit area, and so remain a constant mask while negatives are streaked, or rotated by hand. The positive can then be replaced by the negative and the masked area coloured in a second exposure, this coloured area will then be free of any of the streaking or rotation.

USES OF THE ANIMATION TABLE

The animation table is used in two distinct modes. The first could be defined as "step and shoot", the second as "movement during exposure". Many of the step and shoot techniques are just as easily accomplished without an animation table, and are only worth doing if the table gives very good accuracy and repeatability.

Most "movement during exposure"techniques are better achieved with an animation table, and indeed rotations and spirals are impossible without it.

Step and Shoot Techniques

Multiscreen splitting: (this is described in detail in the section on multiscreen work), here the accuracy of the E.W. and N.S. movements are relied on to make perfectly matched sets of panorama slides.

Step and Repeat movements: typically many exposures onto a single frame are made off one piece of artwork that is moved a small amount between each exposure. The camera might also be zoomed a set amount as well. The moves made can be drawn out as an overlay sheet which is used to line up the camera for each exposure, or the moves can be made by educated guesswork. When working the later way it is well worth using a pantograph plot so that the shot can be repeated or changed slightly. Step and Repeat movements need not be multiple exposures, but can of course be used to make individual slides for animation sequences. Further with careful consideration, step and repeat techniques can also be applied to multiscreen work, with multiscreen splitting movement added to the step and repeat.

Split Screen: Many images can be accurately and quickly multi-exposed onto a single frame. Any number of routes are available to achieve this.

Movement during Exposure Techniques

These in general are called names such as "whizzes", "zooms", "streaks" etc. The repeatability of these moves are difficult to organise, however, the use of the animation table will make them more successful. One of the least used tecniques of "movement during exposure" is the creating of graded colour background.
A straight edge mask is tracked across to reveal a plain colour during the exposure. The mask must move constantly or the final frame will be banded. Speed of movement and length of exposure will have to be juggled to obtain desired grading. In the extreme case the colours can be graded to black. To grade to white the frame is first exposed to a plain colour and then graded with white light on a second exposure.

Flip Box

Flip Boxes (sometimes called Flop Boxes) are devices for flipping artwork in 3 dimensions. They have two main used: One for producing lettering in perspective and the second for shooting the slides for spins. For simple one-off occasions the Flip box can be made up from card. Tape two card triangles to a base, and mount an Artwork card so that it can rotate on its centre using pins stuck through the tops of the two triangles. More substantial versions can be constructed out of aluminium sheet, and fitted with a protractor to produce more accurate amounts of rotation or spin. Artwork can be top or bottom lit. Depending on the dimensions of the box and the field size being shot it is sometimes necessary to use longer focal length lens than normal. Obviously when shooting artwork in 3 dimensions rather than two, greater depth of field will be required and exposure times will need to be extended so that the smallest apertures available can be used. Also, when working bottom lit great care must be taken to mask extraneous light during the exposure.

MULTI-SCREEN WORK

Before the advent of soft edge masks and pin registered camera the slides for multiscreen shows used to be cut out of large transparencies. A 10 x 8 tranie would literally be cut up with a scalpel and taped into a slide mount. The accuracy of the final projection was dependent on the skill of the man with the scalpel. Frequently the shows were rear projected onto screens that were divided up with mullians. Use was made of these mullions to loose the keystoning between screens, black tape was used to similar effect on front projected shows. People also started copying sections out of original slides, and out of this grew a need to have a system to line up the originals under the camera. Grids drawn as tracing overlays were used. People drew the grids more accurately and peg bars and punched cells were used to provide accuracy at the preparation end, and the chain was completed with the registered camera and slide mount. Soft edge masks for seamless panoramas have now become a readily available commodity and can be shot to work almost any format of projection.

Multiscreen work is now an established craft in terms of rostrum work, with two mainstreams of thought in terms of how to achieve it. Basically one side of the argument goes like this. "We are trying to make incredibly accurate still pictures, therefore the fewer moves made by the camera peg bar etc. the better and the more chance everything has of working". As much of the work as possible is done before rostrum camera work; in their ideal world the camera would remain locked at one size throughout the entire shoot and only the peg bars would be moved. The other extreme relies on the very good mechanical tolerances of the machinery available. Pictures are split up using the east west movements of the animation compound, Artwork of any size is out under the camera. The accuracy of the human eye, the camera reticle, and the animation compound are relied on. The sensible manner is to cull the best of both schools of thought and put together a system that is suited to the equipment available and to the level of craftmanship attainable.

Robin Prater and his team at Prater Audio Visual are probably the most "grid orientated" camera house in the country. Robin's systems have produced some of the most staggering examples of technical expertise in the recent years, and there are few companies that have pushed technical excellence in multiscreen work so far. Let me quote Robin about the Rostrum camera:

> "One must first dispel any illusion that it in itself is a creative innovator. It is merely a very accurate tool for slide making with the capability of exposing information onto film within a few tenth of a thousandth of a inch in relation to the sprocket holes in the film".

And in the same article he goes on to say:

> "First, note that the more preparation is completed away from the camera the more the camera can be used for actual shooting"....
> "Secondly when the artwork is under the camera the registration accuracy is limited by the accuracy of (a) the camera, (b) film dimension, (c) the registration slide mount, and (d) the slide projector. Whilst errors can occur in these, in my experience by far the greatest errors occur in the preparation work".

Robin's systems and indeed style of work reflect all these points.

On the equipment side P.A.V. has two Forox SS cameras, one of which can be used with the animation table. There are two process cameras, one with computorised controls for line work and one for sheet film colour work. There is a Durst 5x4 colour enlarger. An R6 colour processor completes the system. This substantial investment in hardware would be excessive for a smaller company, but there is little point in having a rostrum camera of the likes of a Forox SS without access to other process camera facilities.

Looking at Robin's approach to design is also of interest. Once the screen format has been decided (and there is very definitely no standard form in Robin's eyes), the design of the storyboard sheets and the rostrum camera grid are immediately started. Robin places enormous emphasis on production paper work which pays off handsomely when one looks at the ease with which the slides for 48 projector shows are handled. Each cut in a show is sketched onto specially printed card with the screen format, projector programming information, and graphic information. The completed storyboard, or stack of cards, then become the reference for the whole job and will finally carry even information about the magazine and slot number where any particular slide can be located. Many of PAV's shows have been 90% programmed from this paper-work before the slides are even loaded into the magazines. In the same way that the storyboard is the bible for the conceptual side of the work, the camera grid becomes the base from which all the projected material is built.

The gird itself is an accurate proportional drawing of the screen layout. This is drawn with both the full frame area and the projected area masked up in exact proportion. Other information includes centres, screen number and focusing marks. This grid is then taken to a process camera and film positives made at all the field sizes required for the shoot. These final grids are then stuck down on cell. Meanwhile the material is being sorted out and any process work is carried out. On jobs using large numbers of screens this often means enlarging colour material onto sheet duplicating stock. This might sound an expensive procedure but it comes impossible on the rostrum camera to get a small enough field size to shoot a large number of screens out of a small original; there is of course the advantage that images can be accurately sized against each other for matting into each other. A further advantage of this initial duping session is that the show cells can be stored, while the originals are returned to their owners.

When preparation is complete the rostrum camera shoot is started. The camera grid is put under the camera and centred and sized for the first screen area. The peg bars (PAV use peg bars on both top and bottom) are taped down. The grid is then taken off and replaced by the first cell. Everything that is on that screen and on that grid size is then shot. The grid is realigned for the adjacent screen area, and all the material for that area is shot. And so on until the shoot is then complete. Line-up slides for the projectors are also shot off the grid. Now provided that the grids themselves are accurate and the reflections are accurate the whole system should produce very accurate work.

The other school of thought relies for accuracy on the mechanical tolerance of the machinery used. The original material is lined up on cell against a rough grid that is usually a tracing. This grid and its associated peg bar are lined up parallel the east west movement of the animation table.

This is done by lining up the table's E.W. axis to the reticle of the camera; at a large field size the reticle is projected down and the table rotated until the table and movements are visually lined up. (The exact way to achieve this depends on the kind of table used). The field size is then reduced and the rough grid, and its peg bar, are lined up to the reticle therefore alighning grid, table E/W, and the reticle parallel to each other. If this is not done correctly the picture will be split in steps. Next the camera is sized and focused against the right hand screen area of the grid. The grid is then removed and replaced by a blank cell, onto which is stuck a tape "Flag". This flag is merely a triangle of sticky tape that is stuck onto the cell so that its point EXACTLY lines up with the projected area of the left hand side of the slide mount being used. The East/West counter is then zeroed and its hand wheel marked. The flag is then tracked across to the EXACT centre of the reticle, the reading taken and the hand wheel marked. The flag is then tracked to the right hand edge of the projected area, the reading taken and the wheel marked. The table is then returned to zero, and the flag cell replaced by the first transparency. The first area is shot, the table cranked across to the next reading and mark, the second area shot, and so on. The next picture is then split.

The splitting that has just been described is for the so called "ONE ON TWO" format of multiscreen work where the two outside screens butt join and the central screen area is centred on this butt join. Obviously the movements of the table can be worked out to accomodate other screen formats. One of the very interesting uses of this system is for splitting from mounted 35mm slides. A slide jig is used on the animation table and a reference slide is used instead of a flag. The North South movement of the table is used to accomodate sections from the top, middle or bottom of the slide.

Pros and Cons

1. Accuracy can be maintained with both systems. Some shows are impractical on either one or the other system, but in general simple format multiscreen work is better suited to the animation table, while complex jucta positions and mattings through different field sizes are better suited to grid work.

2. The investment in the animation table needs to be substantial in order to obtain the required accuracy. There is no need for this investment when working with grids.

3. Both systems require accurate pre-camera preparation. Careful selection of materials is important to each system. It is no good laying up 35mm tranies on 15 field cells. Check how much "flop" there is between cells. Use the small Kodak cell bar for small pieces of artwork.

4. There are minimum field sizes that can be used with either systems. Mostly it is considered to be about 17 milimetres With the grid system this requires extremely accurate placing of the grid cells under camera, a very good registration from cell to cell, and very little "flop" on the register pins. With the animation table system the East West movement must be very precise and accurate to very small tolerances. The accuracy of the lens mount should also be taken into account, as typically an extension tube or reversing ring will be needed, which tends to make the lens line up susceptible to movement. (When working with small field sizes it is well worth using reversing rings).

POSTERIZATIONS

Posterization is the process used to convert a tone original, black and white or colour, to a picture made of flat areas of tone or colours. The work itself derives from the flat colours and tones used in posters. The understanding of how posterization works is a good foundation for many further experiments in darkroom techniques.

Initially, the picture must be made into a number of separations. These separations can either be tone or colour. They are then used to print either tones or colours onto a single sheet of paper or piece of film. The choice of mechanical routes to this end are numerous and depend not only on the equipment available, but also on the end results envisaged.

Techniques for Posterization

The main types of posterization are:

1. Simple one part line conversion with single colour. (Black image and one colour).

2. Two colour line conversion using only one line negative or positive.

3. Two colour with bleed into each other using two densities of negative and positive.

4. Colour additions to original transparency.

5. Neon effects, glows and outlines.

6. As above, but with camera movements, or artwork movements.

7. Above with other artwork techniques.

All types are started in basically the same way. Take an original image and either contact enlarge this onto line film at 3 or more different densities or exposures. In the case of type '4', it must be a 'contact' to keep the line images the same size as the original. These line film negs and poses are then laid up on acetate cell, with a peg bar, in EXACT! register with each other.

1. Simple one part line conversion with single colour. (Black + one colour). Simply choose a very strong line image and shoot through a plain colour.

2. Two colour conversion with only one neg or pos. Expose the frame to a heavy saturation of colour, then re-expose as in 1. above. Where there was black in the second exposure the heavy colour of the first exposure will remain. Where there is colour in the second exposure, the colour of the first exposure will be degraded or changed. Which colours work with which is a matter for trial and error. The second colour can also be white to produce a colour and white image.

3. Two colours with Bleed to produce a third colour or black. Select a negative and a positive of different densities. Double expose one plus one colour into the other plus another colour: if the one black area does not overlap the other two strong colours will bleed together to produce the third colour area. If one does overlap the other, the overlap remains black.

4. Colour additions to areas of original transparency. First expose the original sandwiched with a line positive or negative. Double expose a colour into this with the matching positive or negative.

5. Neons, Glows, Outlines. To make an outline take a positive and negative of matching densities and shoot them sandwiched together but separated by a thin sheet of glass. It is sometimes necessary to use slightly different densities to obtain this effect. Result is fine white (or coloured) line image out of black.

   Neons and glows are essentially the same but with opalled film backing in the sandwich, to induce flare around the image. View with the lens stopped down as the aperture controls the amount of flaring.

6. Camera movements or artwork movements. Best used on technique 5. above, but can be combined with all the other. Make a series of exposures on the same frame but move the camera each time towards the artwork. This will produce a series of concentric images. If the artwork is moved as well, the images will be eccentric. The camera can of course be left still and the artwork moved either in a series of exposures or even during the exposure.

7. Other graphic techniques. Use tracing paper, pens , pencil or brushes to make other effects. Contact these tracing and use them as if they were ordinary one images. Particularly effective are simple line drawings contacted to negative and shot with a colour and fog filter. These drawings can of course be in register with the original shots and used in combination with the above techniques.

THE DIFFERENCE BETWEEN "ADDITIVE" AND "SUBTRACTIVE"

"Additive and subtractive" are terms applied to the two forms of colour synthesis.

To simulate the additive synthesis, visualise the effect of having three focusable and filtered lights, one Red, one Green and one Blue. Line these up on a screen so that they overlap each other, making the classic colour trifoil. Where red and blue overlap magenta is created; green and blue create cyan; red and green create yellow; and the overlap of all three colours creates white. So by adding together various amounts of the three primary colours, colours can be synthesised. The principle of additive synthesis is used in somecolour printing; in Rostrum camera work it is applied to producing coloured slides from B/W A/W either for graphics or posterizations, and can be used for complex colour correction work.

To simulate the subtractive synthesis, take a light box and three circular filters of equal value; one cyan, one magenta, and one yellow. Arrange these in the colour trifoil. The first immediate difference is that the additive trifoil is surrounded by black and gets lighter in the middle, while the subtractive synthesis is surrounded by white and gets darker in the middle. In subtractive synthesis filters subtract amounts of their complementary colour from the light source. A yellow filter appears yellow because it has subtracted equal amounts of cyan and magenta from the white light. An equal amount of yellow and magenta appears red because of the subtraction of cyan. Where all three filters overlap equally grey, or "neutral density", is created. The subtractive synthesis is used in colour correction of light sources on rostrum cameras. It is worth noting that neutral printing is present in any filter pack that is expressed in all three secondary colours, and this can be eliminated by equal amounts of all three filters until just two are left.

SOLARIZATION IN COLOUR

Solarization, the "SABATTIER EFFECT", involves fogging an image to light part way through the development. The undeveloped areas of the print are fogged and so reversed. The "MACKIE" line is the fine line that forms between the areas of fogged image and already developed image. In Black and White, Man Ray was the great exponent of this technique. There are many ways of achieveing this kind of result. Solarizing lith film, is very effective. The original is contacted onto lith film, and, half way through the development, fogged to approximately the same amount of white light as was used to make the contact exposure. Monocolour results can also be obtained by printing these onto colour stocks. However, the most interesting colour solarizations are obtained when working with colour papers.

Solarizing a Transparency, Using Pos/Neg Paper or Film

First make a test to obtain a satisfactory negative colour print. Look for a result where very deep shadows on the original transparency have printed to white, and greys have reversed to greys. Next set up a very low intensity white light that can be readily filtered to various colours. An anglepoise with a 15 watt bulb, and coloured lighting is ideal. The lower the wattage of the bulb the longer the fogging exposure can be, and therefore the easier it is to control. Make a negative print, and start to process this in the normal way. Half way through the process, switch on the filtered light for about 10 secs and at a distance of six feet. Continue the process as normal. Assess the dried print, against the negative print. The areas that were white in the negative print should not be fogged to the colour produced by the lamp. The image areas will also show some reversal of colour. Juggling the image exposure and fogging exposure and colour will now give control over the end result. Look for the Mackie line, the larger the print size, the finer this line will be in relation to the image. With a little patience it is possible to obtain intensely luminous colours that are unique to this process.

OFF-CENTRE ZOOMS

A zoom is a special effect created by camera movement up or down the column while a time exposure is being made. Although the artwork is not moving, the image being recorded on film is. When the camera zooms out (or up) images being photographed will move towards the optical centre of the frame; likewise when the camera zooms in (or down) images move away from the optical centre of the frame. The direction a zoom "tail" goes is controlled by placement of the artwork under the camera. Art composed near the bottom of the frame will leave a zoom tail going up (or north) as the camera zooms out, etc.

Standard zooms, as described above, are based on using a camera with the normal lens/aperture configuration when the optical centre of the lens is aligned with the optical centre of the aperture. Working like this when doing zoom effects has many limitations, but the camera operator can add much versatility to his camera by attaching a lens which can shift off-centre.

Nikkor makes the ideal lens; the 35mm PC or Perspective Control lens. This lens can shift up to 11mm of axis from its optical centre, and can rotate a full 360 degrees giving a shift in any direction once the lens is mounted on the camera. How this helps the camera operator is as follows:-

Using a PC lens, you are not limited to where you place the art within the frame and you can effect a zoom in any direction. For example, you can place a logo or other copy on the horizonatal centre line and have the zoom tail go down or up at any diagonal depending on the amount and direction of the lens shift off-centre. With a normal lens you would have to position the art near the edge of the frame, opposite the direction you want the zoom to go, i.e. start with your art near the bottom of the frame and zoom the camera up - the zoom tail will go up. If you wanted a slide with the copy on the centre line and the zoom tail going up, you would then have to dupe the first slide with the effect centred. This can only work with a black backround which adds yet another limitation along with the fact that the finished slide will be a dupe.

Using a PC lens, first shift the lens off-centre and rotate so that the lens is shifted off-centre, opposite the direction you would like the zoom tail to go in. Hint: use the knurled knob as a pointer to indicate direction of zoom tail. Once you have determined direction of lens shift, check the dot next to the small numbers on the lens ring closest to the mount. These numbers indicate the maximum distance in millimetres you can shift the lens without risking cropping the image. Once everything is all set up, then you can position your art and try a run through of your zoom with the camera viewer on to see if you care getting the effect you want.

Another big difference between shooting a zoom with a normal lens and shooting a zoom with a PC lens is that with a normal lens your art can be zoomed toward the centre of the frame but the image will never quite reach the centre. With a PC lens, your zooms cannot only reach the centre of the frame, but the image will go way past the centre line. Keep in mind you cannot zoom an image from one side of the frame to the other side and extend past the outside dimensions of that frame. For that you would have to incorporate linear movement of the art using a compound table.

SEAMLESS OR SOFT-EDGE MASKS

Seamless or soft edge masks are used to create panoramas using two or more projectors with the images overlapping to avoid the inherent line or seam between screens. The most common format uses three image area. Two are butted and the centre one overlaps each of the other two 50%. Once the desired masks are made, they are sandwiched in pin-registered mounts, such as Wess mounts. These masks are useful to achieve a soft edge around a photo-comp on one frame of a slide as well.

The first step of this process is to make a master negative from your art on panchromatic film. Panchromatic film is capable of rendering greys, needed to produce the soft edge effect. From that negative, we contract print the positive mask on orthochromatic film (not Kodalith), which has a clear base, enabling us to use it as a sandwich.

The negative stock to use is Panatomic-X processed in Microdol-X 1:3 at normal development. Exposure is 1 sec. @ F3.5 with 3 polarizers (or ND filters since we do not want good depth of field). The art is shot with the lens racked out to 1:1 position. Bracketing should be done with timer only.

The positive stock to use is Fine Grain Release Positive (5302) processed in Dektol 1:2- approx. 3 minutes. Exposure for contact printing in camera is 1/4 sec. @ F8 using bottom light, lens racket out to 1:1.

The following will explain how to create the artwork for use with the three image area, centre overlap projection format.

The camera should be set at a 12" field. You will need Flint black paper and white bond paper. For the left mask, position the white paper on the left and the black paper on the right, meeting at the reticle 2 east line.

For the right mask, white paper right, black paper left, meeting at the reticle 2 West line.

For the camera mask, white paper in the centre, bordered on the left and right with black paper. Divisions on 2 East and 2 West.

* Note: Paper must be lined up with lens in normal position, then the lens is racked out ot 1:1.

Treat each negative master as an in-camera matte. Install on the aperture and contact print with positive stock on the film plane.

For other application, the only mystery is the placement of the black and white artwork.

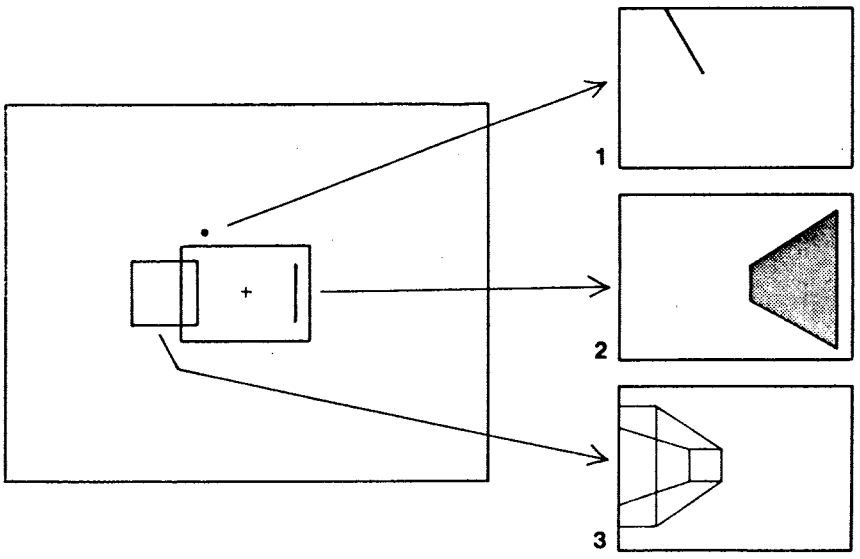
SLIT SCAN

A technique borrowed from the movie animators. Relies on Autofocus in one sense of the phrase. There are two distinct meanings of the phrase in a mechanical sense, and a third style of use that combines both mechanical definitions.

SLIT SCAN: a) If the shutter is open during the travel or zoom of a rostrum camera with autofocus; an object will appear to move away from the centre of frame, or towards the centre. Refer to drawing. During the Movement up the column the field size of the camera will change from small to large. In example 1, a dot will appear to move from outside the frame towards the centre (it will never reach it!) It will therefore appear as a single straight line on the photograph. In example 2, the line will produce a "sheet" or wall in perspective. Similarly the square will produce a tunnel effect. This is one definition of slit scan.

SLIT SCAN: b) Slit scan also means scanning the picture through a slit. The slit can be any shape but if one considers a straight slit that is moved across the artwork on a plain above the artwork, the artwork is scanned strip by strip. Simply this can be used to produce distortions not unlike a focal plain shutter, if the artwork is moved in another direction at the same time. (CAR WITH OVAL WHEELS).

The third mode of this is when the travelling slit is combined with the camera movements up and down the column. Distortions in perspective can be achieved this way.



GLOSSARY

ACETATE

A non inflammable material used as a base for films. Clear acetate sheets are used for graphic purposes. In dyed form they are used as colour films for light sources.

ADDITIVE PRINTING

Printing process employing the principle of the additive synthesis. Most early colour photographs were additive prints. Now used in certain makes of enlarger and manchine printers. The technology is now applied in a slightly derived form to make colours on colour graphics.

ADDITIVE SYNTHESIS

A method of producing full colour images my mixing light of the three primary colour wavelengths, blue, green and red. Mixed in equal proportions they produce white. Mixed in varying proportions they can produce all the colours of the spectrum.

AERIAL IMAGE

An optical system enabling the camera to photograph a back projected scene via. condensers set into the work surface of the rostrum camera. Art work on cells can also be photographed simultaneously. The lens on the projection system can be fitted with a compound to enable pans to be made. Much more use of the technology could be made in audio-visual and the principle is mainly applied to VIDEO MULTIPLEXERS, used to transfer Audio Visuals to Video.

ANOMORPHIC LENS

Lens able to compress a wide picture in one direction.

ANIMATION

The creation of the illusion of live motion using inanimate objects, such as two dimensional artwork.

ANIMATION TABLE

A flat surface for moving Artwork underneath the camera. The surface itself has a backlit area, fixed, or trackable, register system, and is mounted on a Compound Movement, to facilitate accurate movement in any direction of the horizontal plain.

ANIMATION CELLS

Acetate sheets that are punched to fit a standard peg bar system.

ANSI

American National Standards Institute. Have produced many standards, including a way of rating the speed of photographic paper and the aperture of a registered slide. The ANSI slide mount aperture corresponds to the Wess Item 1 approximately, and is 1.346 inches by .902 (34.1 x 22.9mm). The most commonly used apperture is the WESS Item 2 which is 1.370 inches by .920 (34.7 x 23.3mm), which is slightly larger. Care must be taken to make sure the right opening is specified in A/V work.

APERTURE

A variable opening in a lens that controls the amount of light reaching the film.

AUTO-FOCUS

A system which keeps the camera lens focused on the same place, i.e. the work surface, as the camera travels the greater length of the column.

BACKGROUND

The setting against which the action takes place, or the coloured base for top lit graphic on cell.

BACKGROUND PLATE

A term borrowed from the movie industry, meaning a low contrast print used for back projection, bi-packing, of aerial image work. Used in A/V to decide colour transparency enlargements used as background for graphic special effects.

BACKLASH

Stop in the control gear of an animation table, minimised by always starting from the same direction for any step and repeat moves.

COLOUR TEMPERATURE

Way of expressing the colour quality of a light source. The colour temperature is expressed in degrees Kelvin. Tungsten sources are 3200^{o}K.

COLOUR SEPARATION FILTERS

Filters used to separate a colour picture into three components parts, red, blue and green. These are also the filters used in the additive synthesis of colour and using double exposures any colour can be made up.

COMPOSITE

Image assembled as one final picture but made up of diverse elements.

COMPOUND MOVE

A shot requiring more than one animation table movement or camera movement.

COMPOUND

The works of a animation table that enable it to be moved accurately in any direction.

CONDENSERS

Two piano-convex condensers are used in aerial image systems.

CONTINUOUS TONE

Photographic image showing a graduation of grey tones.

COUNTER MATTE

A matte which is the opposite shape to another matte, it is one of a pair.

BACK-LIGHT

A light placed under the work surface, beneath oppalled glass, and filter trays. Used for copying transparencies, and graphic materials.

BACK PROJECTION

See Aerial image. Also refers to projection set ups where the image is projected onto the rear of special screen surfaces.

BATCH NUMBERS

Sets of serial numbers printed on packets of sensitive materials to indicate the production batch of emulsion with which they are coated. With duplicating stocks, filter recommendations are given which can be applied to facilitate the changing of batches.

BLEED

The area of artwork extending beyond the area which will be photographed by the camera.

BLEEDING

Background image showing through a superimposition due to an insufficient dense matte or inadequate exposure. Or unwanted material showing round the edge of a matte to misalignment of artwork or poor camera registration.

CAST

Overall bias towards one colour in a colour photograph or duplicate.

CELLS

Acetate sheets used as clear supports for Artwork. Usually punched to fit registration pegs.

CLEAR CORE

A opaque and clear film copy of Artwork were the clear area is contained within a black ground. Used to distinct between matte and counter mattes, or positives and negatives where it is not obvious which is which.

DENSITY

The relative opacity of developed photographic emulsion. Density is dependant on both exposure and development.

DEPTH OF FIELD

The distance above and below the Artwork plant where acceptable focus is maintained.

DIFFUSION

Reduction of the sharpness of image by the introduction of filters or diffusing material in front of the lens.

DICHROIC

Displaying two colours - one by transmitted light, one by relfected.

DICHROIC FILTERS

Filters made by surface coating glass, so that the desired colours are transmitted while the remaining is reflected. These filters are used in Dichroic light sources for colour balancing dupes.

DOPE SHEET

Camera instruction sheet, usually giving the order in which cells are used in any particular shot. Field sizes and other information will be included.

DOUBLE EXPOSURE

Two images photographed onto the same frame.

DROP SHADOW

A double exposure/matting technique where by offsetting the register of a matte and counter matte a black shadow image is created. Also used to describe the effect where a matte and counter matte have accidently been shot out of register.

EMULSION

Light sensitive material supported on a permanent base such as film.

EXPONENTIAL ZOOM

The subject size is increased or decreased at a constant rate throughout the travel of the camera. This is different from a logarithmic zoom where the field size is increased or decreased at a constant rate.

EXPOSURE FACTORS (see Filter Factors)

F STOPS

Number sequence indicating aperture setting on the lens barrel. Equivalent to the focal length of the lens divided by the effective diameter of the aperture, giving a scale constant for all lenses. Each setting progressively halves or doubles the brightness of the image.

FIELD SIZE

The area to be photographed. Usually expressed as the length of the longest side of the actual cropping on the artwork.

FILTER FACTOR

A number indicating the exposure compensation needed because of the abosorbtion of light by a filter. The same system is used to express the exposure compensation needed for any particular reproduction ratio using any particular lens. A similar system is used to express the speed of duplicating stocks and is included in the batch number information. The factor is applied by multiplying the original exposure time by the given number. i.e. a factor of 1.5 increased a 2 second exposure to 3 sec.

FLARE

Non image forming light producing a fault on the final slide. Most normally produced by incorrect procedure in copying, and rarely produced by reflections with the lens/camera system.

FLIP BOX (FLOP BOX)

Mechanical device for rotating artwork out of horizonatal plane.

FLOATING PEG BAR

Independant set of pegs flush to, but not attached to, an animation table.

FOGGING

Area or veil of density on a film that does not form part of the image. Caused by mishandling. Also used to cover the technique of changing the contrast of an emulsion by exposing it to a small amount of white light before making the copy exposure. Somethimes referred to as PRE-FOGGING or even FLASHING.

FOCAL PLANE

The Plane at which the image is brought into critical focus; it is the plane occupied by the film.

FOLLOW FOCUS

See Auto Focus.

FOLLOW FOCUS CAM

A cam cut to respond to the focusing curve of a specific lens. It is connected to the camera lens through a series of levers.

FRAMING

Selecting an area of the Artwork to be photographed by the camera.

GATE

Part of a camera or projector mechanism which holds the film during exposure or projection. In pin registered camera, the pins to locate the sprockets in relationship to the frame are part of the gate.

GEL

Coloured material (once gelatin) for colouring a light source or backlit artwork.

GRATICULE

The frame ontline engraved on the ground glass in the camera viewfinder. Can include any suitable framing or lining up information.

GRID

A very accurate overlay with camera line-up centres an field sizes. Usually used as the master to line-up the camera for multiscreen work but also to make line-up slides for projection. Specialist grids are made for specialist jobs such as complicated composites.

HARD EDGE MATTE

A matte with a clearly defined edge, i.e. sharp focus.

HALF TONE

System of producing or illussion of continuous tone with a black dot formation representing the image.

HI-CON

A black and white emulsion which has a clear base and very high contrast. Effectively a line film.

HEAT FILTER

Filter of heavy glass used to absorb heat radiation from a light beam. Pilkingtons Antisun glasses are examples.

INFRARED FILTER

Filter used in duplicating light sources to give a very sharp cutoff to the near infrared wavelengths. More effective than a heat-filter.

IRIS

A lens aperture which can be varied in size to limit the amount of light striking the film. The openings are calibrated in F. stops.

KELVIN

The unit of temperature measurement used for colour temperature.

KODALITH

Eastman Kodak brand name of lithographic film. Preferable to "Line" film for its high density.

LINE FILM

High contrast film which after correct development gives negatives of black and white only. Its blacks are not considered dense enough for many rostrum camera applications.

LITH FILM

An extreme form of line film, which produces very high contrast images but only when used with a special lith developer. Correctly developed is has blacks that are visually opaque, and for this reason is used extensively in Rostrum camera work.

LOGARITHMIC ZOOM

A zoom where the field size is changed in equal steps throughout the zoom. The change in the size of the subject will appear to accelerate as the field size is decreased.

MASKING

A technique where a cover is used to elimate or reduce the exposure in one area of film while permitting exposure in another. Masks are also shot onto lith stock for sandwiching with projection slides.

PAN

Linear movement of artwork in the horizontal plane under the camera.

PANCROMATIC

Of a photographic emulsion, sensitive to all colours of the visible spectrum.

PANORAMA

A set of precisely cropped and projected slides that when projected with the correct alignment form a panoramic image.

PANTOGRAPH

A device which indicates the position of an animation table in relationship to the camera lens axis.

PEG BAR

A strip of metal with pins used registering cells carrying Artwork.

P.C. LENS

A perspective correction lens, used in conjunction with its own focusing cam to create offcentre zooms.

PLATEN

A sheet of glass used to hold artwork flat under the camera. Some animation tables have hinged platens built into them.

POSITIVE

A photographic image where the total distribution matches that of the original subject. Frequently used to discribe a matte or a mask where the image is made up of black on a clear ground (opposite of "clear core").

MATTING

A technique for making composite pictures where two (or more) images are alternatively exposed onto the same frame. The technique uses a pair of pin registered film images, one positive and one negative, which precisely separate the two images.

MARRY UP

Join together, or line-up, the elements of a composite picture.

MULTIPLE EXPOSURE

The film is run through the gate of the camera several times and on each occassion a new element is added.

NEGATIVE FILM

A film that records an image with reversed tones. Subject high lights appear dark, and shadows appear light. With colour negative stocks not only are the tones reversed but the colours are rendered in hues of the complimentary colour.

NEGATIVE IMAGE

A copy of any Artwork where the total distribution is reversed from the original.

OPTICAL EFFECT

Any effect on the rostrum camera where the subject is recorded other than by conventional photography.

OPAQUE

(Liquid or Photo). Dense red pigment that is water soluble, and used to paint out unwanted areas of film.

ORTHOCHROMATIC

Of a photographic emulsion, insensitive to red light, sensitive to blue and green. Most process films are othochromatic.

RACK OVER VIEWFINDER

A camera viewfinder where the whole camera body is moved across to bring the graticule into line with the lens.

REGISTER

Exact alignment of discreet images with the view of being able to re-assemble them as one complete image.

REGISTRATION PINS

Pins which form part of the camera gate or slide mount and which are engaged in the film performations to hold each successive frame in register during shooting or projection.

REGISTER PUNCH

A punch used to make the holes used in vary register systems.

REVERSAL STOCK

Film stock that records a positive version of the subject being photographed.

ROTASCOPE

Device used to project an image from a camera. It can show a graticule or film clip in the view finder or camera gate.

SHADOW BOARD

A shield with a hole in for the camera lens which repesents a uniform black surface to the artwork, this eliminating reflections and flares.

SHADOW BOX (or MATTE BOX)

A three sided box in which artwork can be placed at various levels to facilitate soft edge matteing.

SOFT EDGE MATTE

A matte that is shot out of focus; mattes that are used above the artwork plane so as to have soft edges.

SOFT EDGE MASKS

A set of projection masks used to disquise the joints between screen areas in multiscreen work.

STREAK

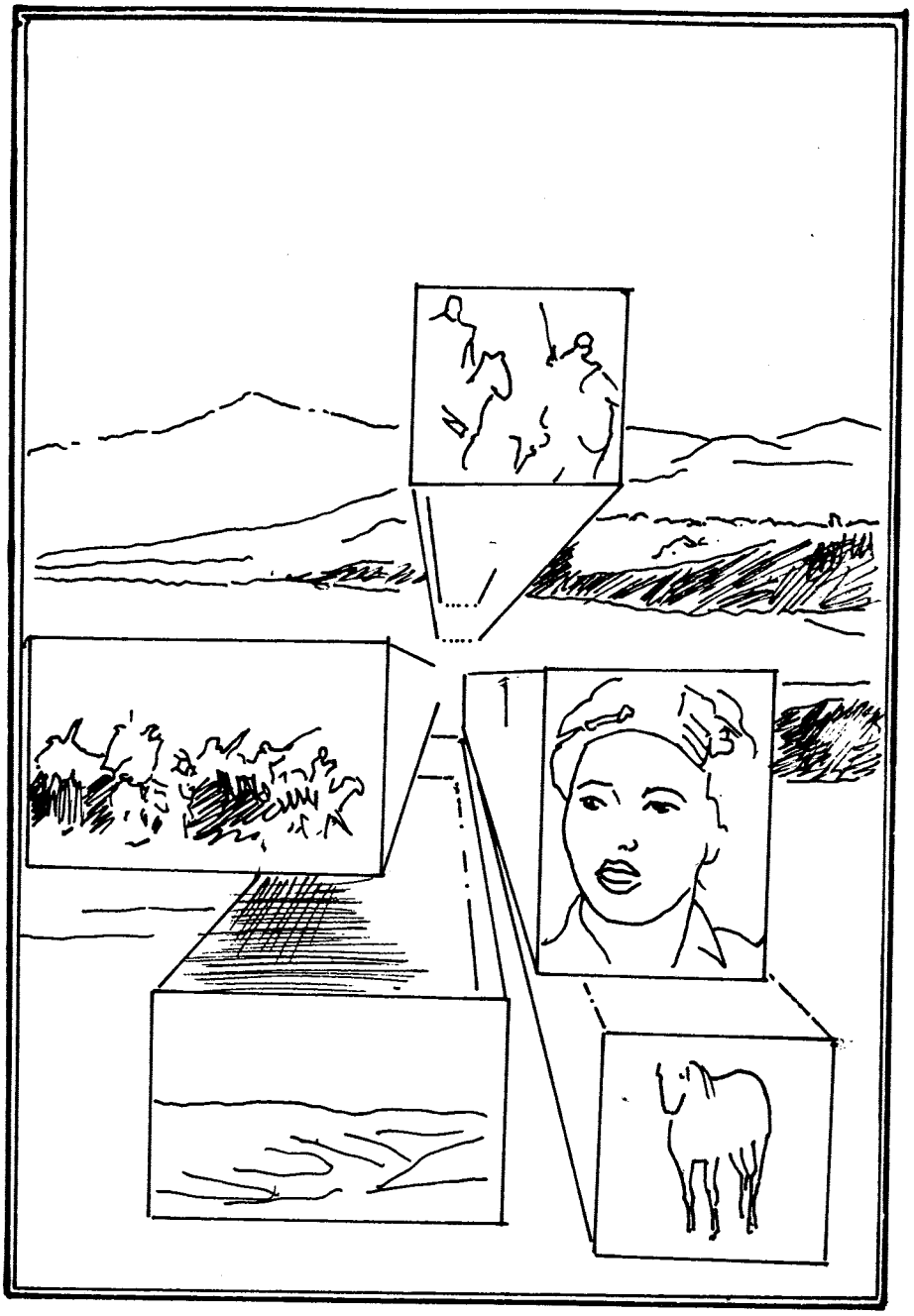
A single exposure where the artwork has been moved half way through the exposure.

TRI COLOUR FILTERS

A set of colour separation filters.

ZOOM

Progressive enlargements of the image as the camera is moved down the column.

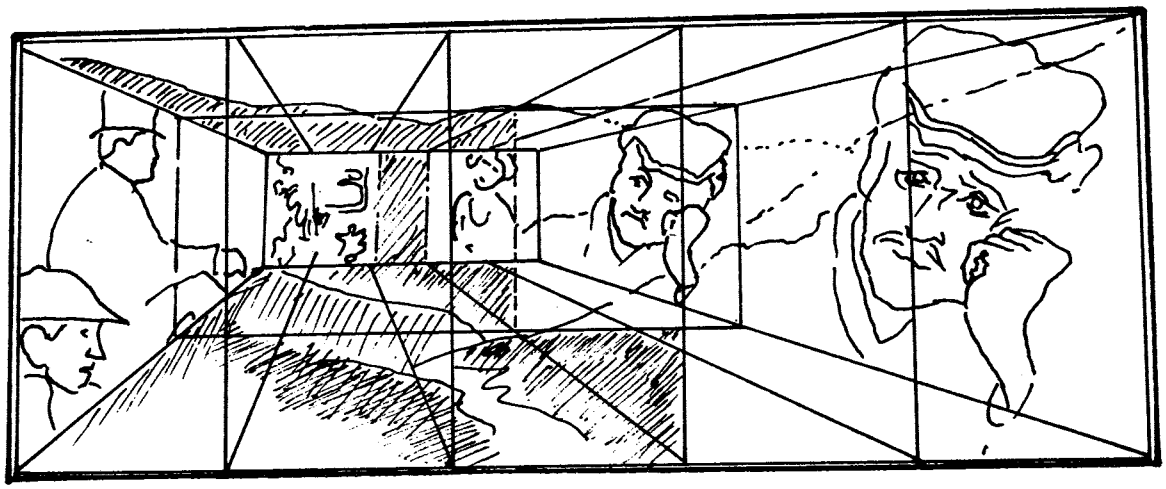


MOROCCAN LANDSCAPE WITH ZOOMS

Five insert transparencies and a background were selected. An S/S (same size) tracing was made with the boxes and cropping selected. The insert transparencies were stuck down on cell to match. A rubility mask for the boxes was cut against the tracing, and key lines drawn on a separate cell. These two Artworks were then contacted onto lith film and laid up in register on cell, against the tranies.

The first part of the Rostrum camera work was then shot. This consisted of making three basic shots (1) The masked transparencies, (2) the mask by itself and (3) the zoom of the keylines. As 1 and 2 were shot a tracing of the camera line-up was made so that all the zooms could be started from the same points. Each zoom was then started from the tracing outline.

The mask shot, 2 above, was then contacted twice at 35mm size onto lith. One of these was sandwiched with the background and one with the selected zoom. Then with registered mounts and the camera set to 1 to 1, the masked tranies were exposed into the counter masked zoom and background.



A HEAD OF OUR TIMES

The slide included shows one of the first complex build-ups of pictures on the screen, and actually involved seven of the ten projectors available. This show was made in the early days of making soft edge masks when there were no standard masks on the market, and because of this people tended to design screen formats that suited their designs rather than except a standard because it was available. The panoramas in fact are made up of only two slides; the two outside screens overlap by one third, and the third set of projectors is centred on this overlap but is not involved in the panoramas.

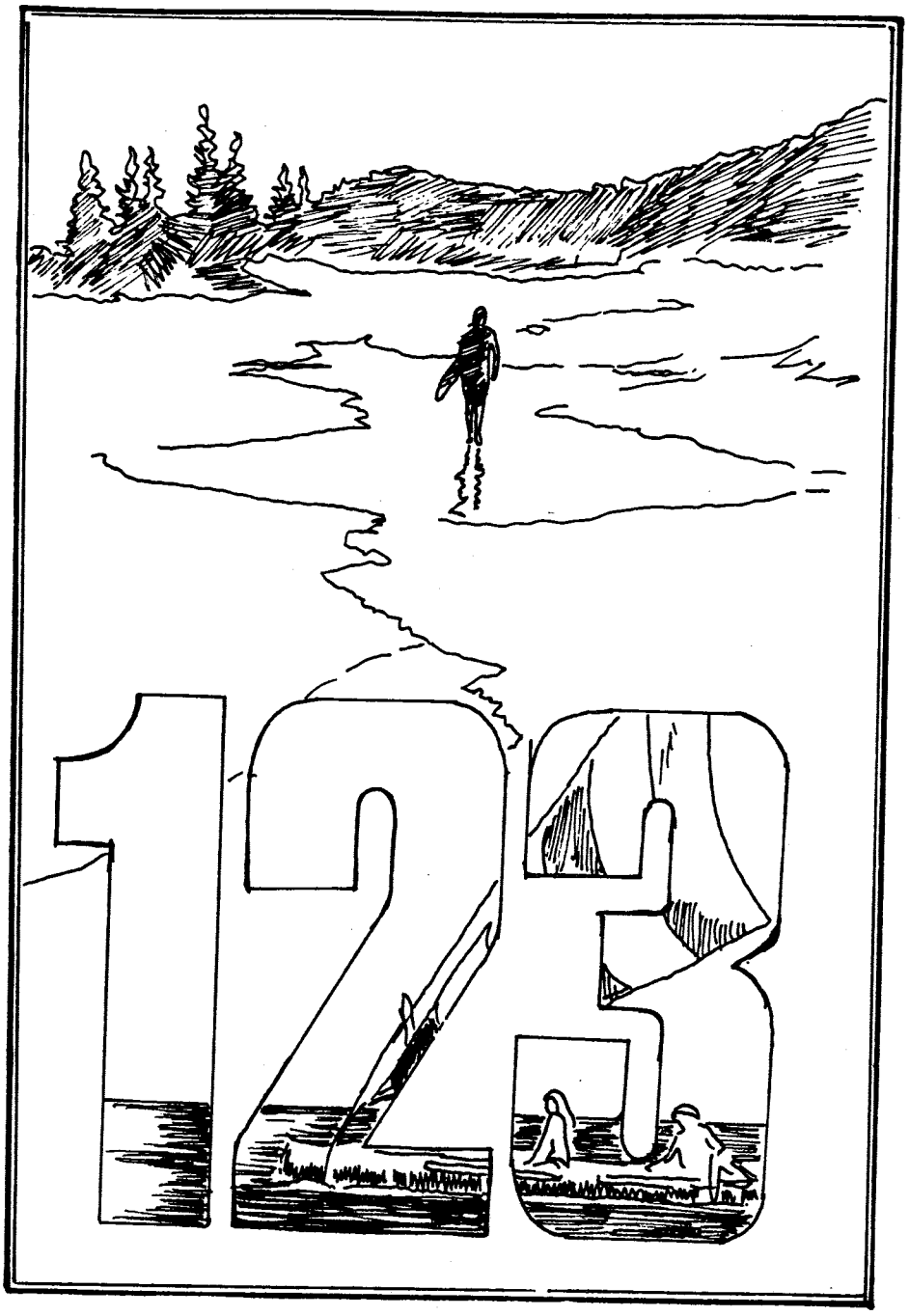
The shooting of the show revolved round the use of a series of tightly designed camera grids and layout grids. Each camera grid had a matching layout grid, and each pair of grids was sized so that it fitted inside the next size up, thus enabling the cropping of any picture to be dublicated at any of the three scales used in the overall design. In other words the cropping of the inserted pictures always exactly matched, but more importantly the original transparencies were only laid down on cell once and to change their scale was only a question of selecting the appropriate grid which put them in the right place in the frame and at the right scale.

Lith masks were cut at one grid size, each one appropriate to a particular "box" on the screen. The graphic grid lines were double exposed into the panoramas during the splitting.

Client: Electrosonic

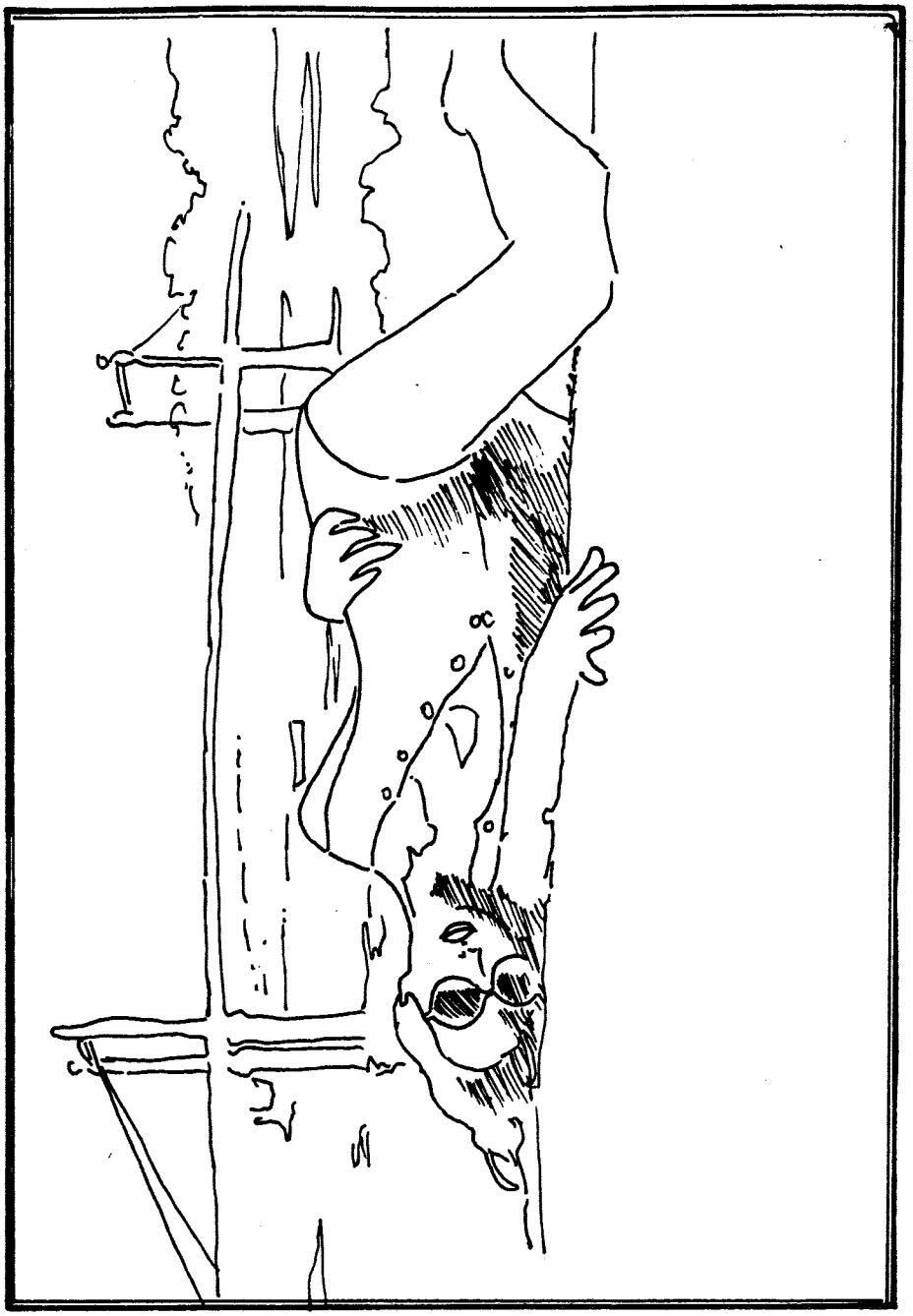
Designer: Tymn Lintell

Rostrum & Graphics: Antony Parks



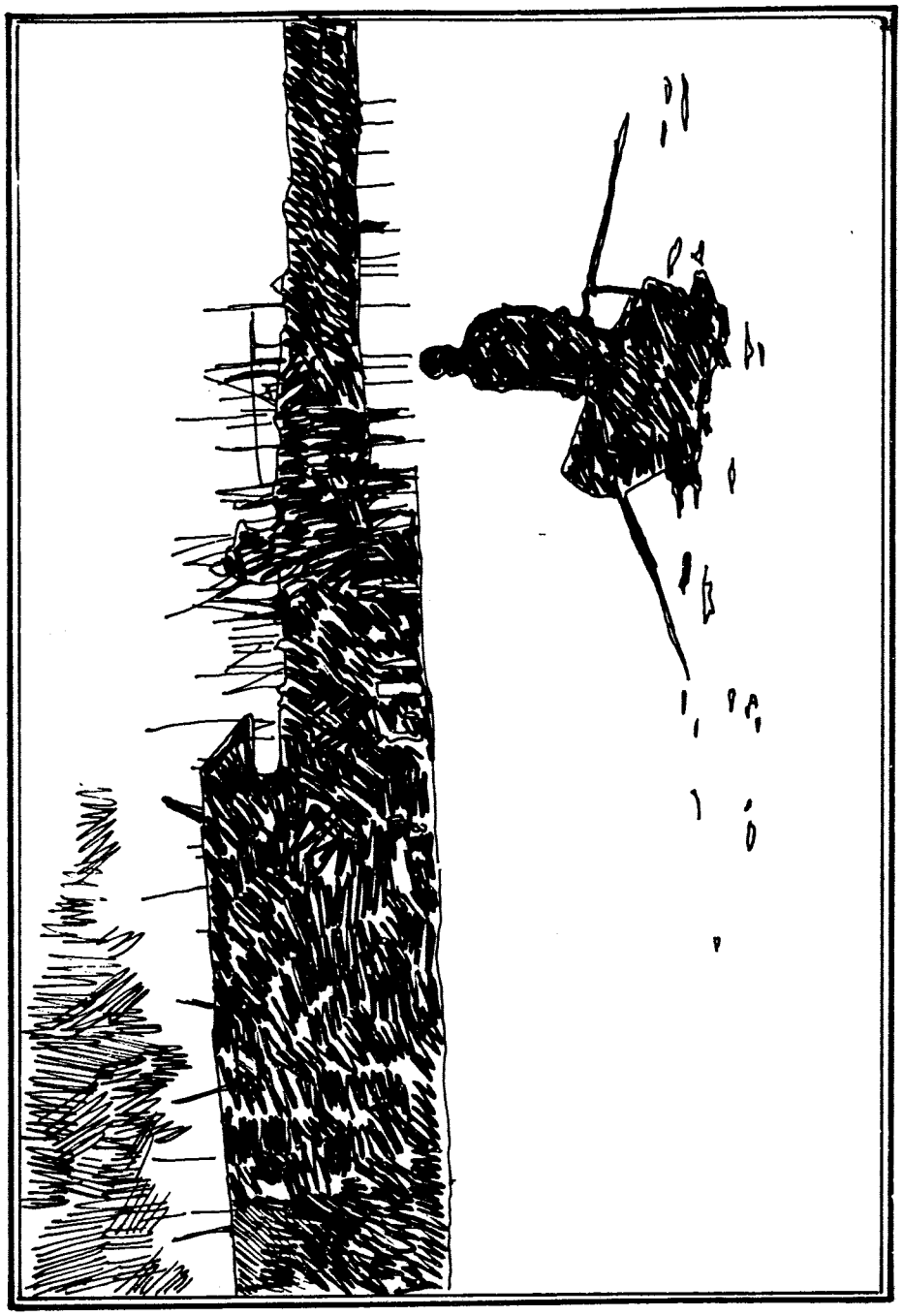
ONE, TWO, THREE

This picture shows the use of a simple in register double exposure using a matte and counter matte. The owo originals are 35mm; so the original "123" was reduced to about 20mm in overall length, onto lith film, and then contacted back to positive. This positive and negative were then laid up on cell in register and the two transparencies positioned on separate cells with appropriate cropping. The camera was lined up on the beach with the positive of the 123, and the peg bar taped down. The first part of the double exposure was made; the positive 123 and the beach shot were then replaced on the peg bar by the negative 123 and the sailing boat. The second part of the double exposure was then made.



GIRL IN FRONT OF THE BRIDGE

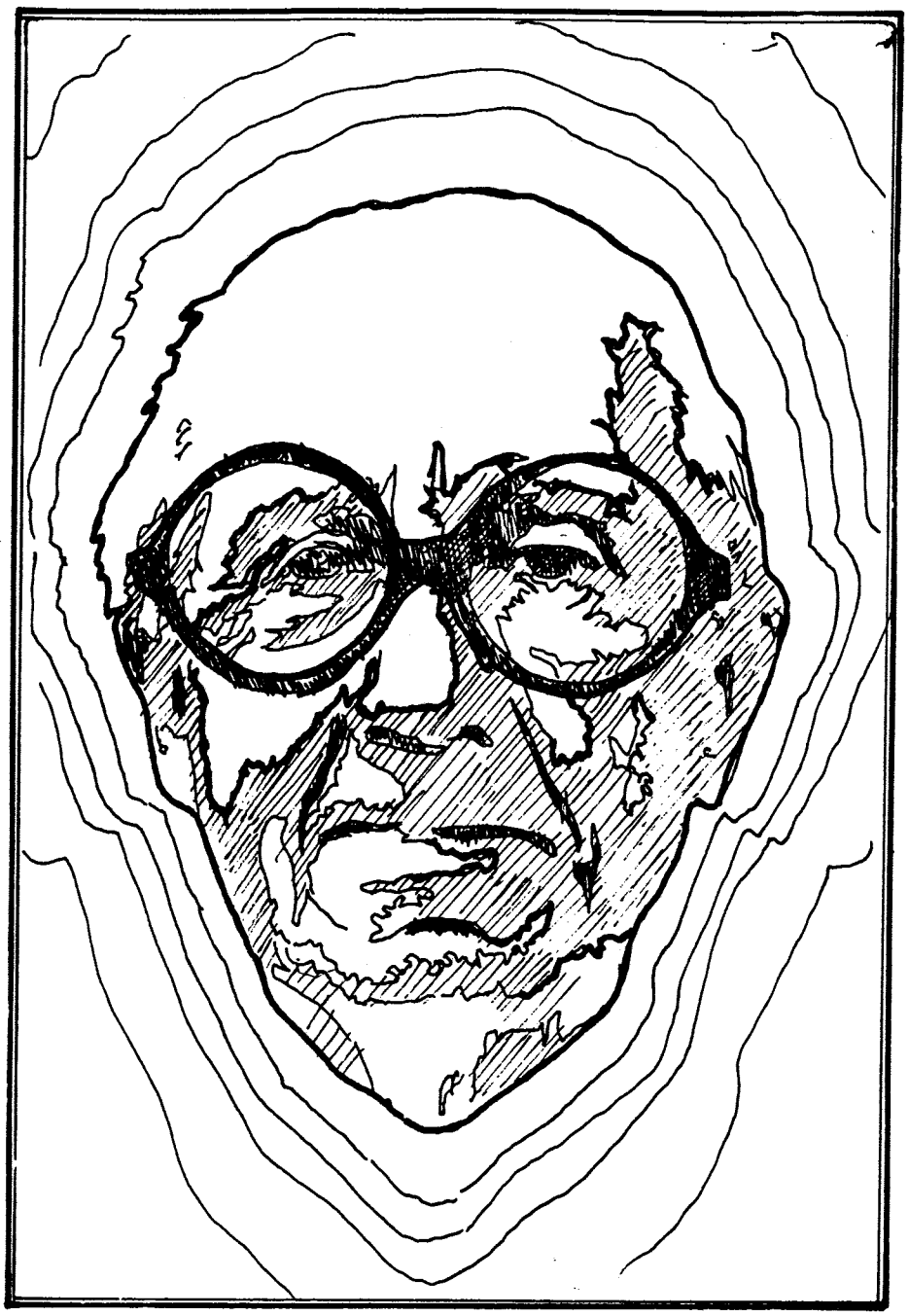
The two originals are 2¼'s; the girl was contacted onto lith film, and this negative was contacted back to pos. The rosrum shoot was then a double exposure. The first part was a three part sandwich: The bridge, the lady, and the lith positive of the lady. The second part was the negative of the lady and the lady. The exposure combination in the folio exaggerated the difference between the two parts of the picture, but with a bracket on the two exposures is almost impossible to loose the difference completely.



NEONED FISHERMAN

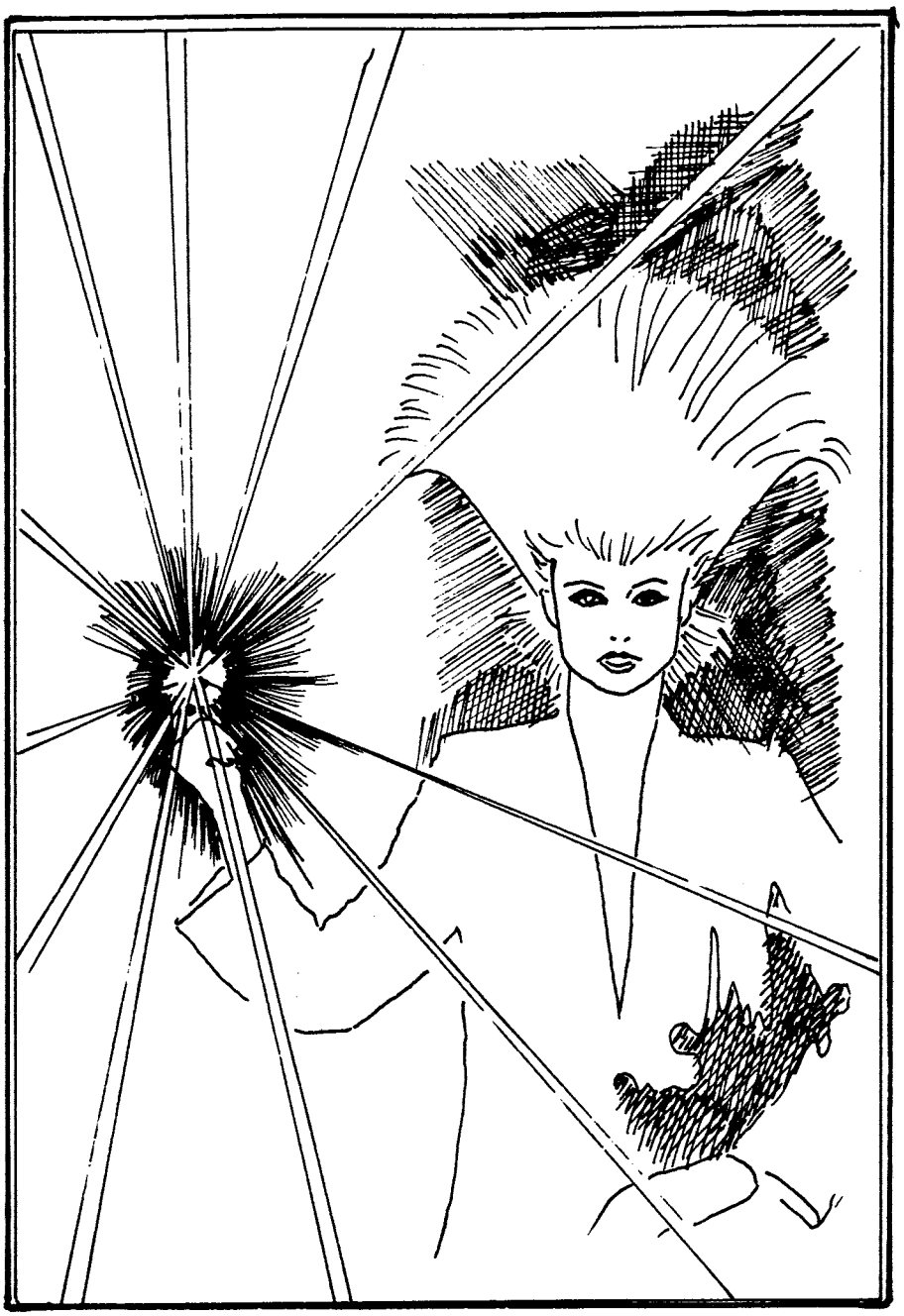
The original 35mm transparency was shot onto 35mm lith film. This was then processed and mounted in a register slide mount. The camera was then lined up on at 1 to 1 on a line up slide also in a registered slide mount. A positive lith was then shot from the mounted negative. This negative was also mounted in a registered mount. The two lith slides in separate mounts were then placed in the slide copying jig on with the positive on top, and separated by a piece of film backing. The camera, now loaded with 5071 and still at 1 to 1, was focused on the positive. The appropriate coloured gel was used to colour the shot.

POSTERIZED HEAD



The original for this shot was a 2¼ transparency. The first task was to eliminate unwanted background to the head and isolate it entirely. This was done by painting a mask with opaquing fluid on tracing paper using the light box. This mask was contacted to negative and then positive using sheet lith film. The transparency itself was then also contacted onto lith film at three different densities, these were again contacted back to positive. The whole lot were then laid up on cells using the transparency as a guide. The first part of the rostrum camera work was the poserization of the face itself. The negative of the tracing mask was common to all three exposures (one for each colour), however, in the shot included not all of the six negs and poses were used. A very dense negative that had only recorded the very densest areas of the original was used to colour the glasses and eyes. The highlights were coloured with the high light positive, and the mid tones used the combination of high light negative and mid tone positive. Some small areas were left black by hand dodging with black card. The repeating neoned outline was put in using the positive and negative mask during a manual zoom. The uneven spacing was where the camera came off autofocus and the sizing went slightly wrong (it was decided this was acceptable). Very similar techniques can be applied to any form of graphics.

CIBACHROME ADVERT



The original is a very carefully worked out studio shot of a girl holding a ping pong ball. The glow of the ball and the light traces were added on the rostrum camera. The original transparency was lined up under the camera to the chosen cropping. The main layout of the picture was then plotted onto the Forox craticle chart. The position of each ray of light was also worked out. The exposure of the tranparency was then made. The glowing ball was simply a hole in a black card shot through film backing to flare it. A tapered card slit was used to make the rays of light, again this was flared with film backing, and coloured with gels in front of the lens. The ball and each ray were exposed in after careful reference to the line-up chart.

Client: CIBACROME

Photographer: Hanna Browne

Art Direction: Adventure

Rostrum: Antony Parks