

SETTING CHROMA-KEY FREE WITH SCENE-SYNC

By REG KING

New equipment that can be installed in 15 minutes and brought into use in about 30 seconds frees television cameras from the locked-off situation all studios have been hindered by when using Chroma-Key

It is not often that one can invent something, then discover that it will do more than you originally intended. That, however, is what happened with Scene-Sync.

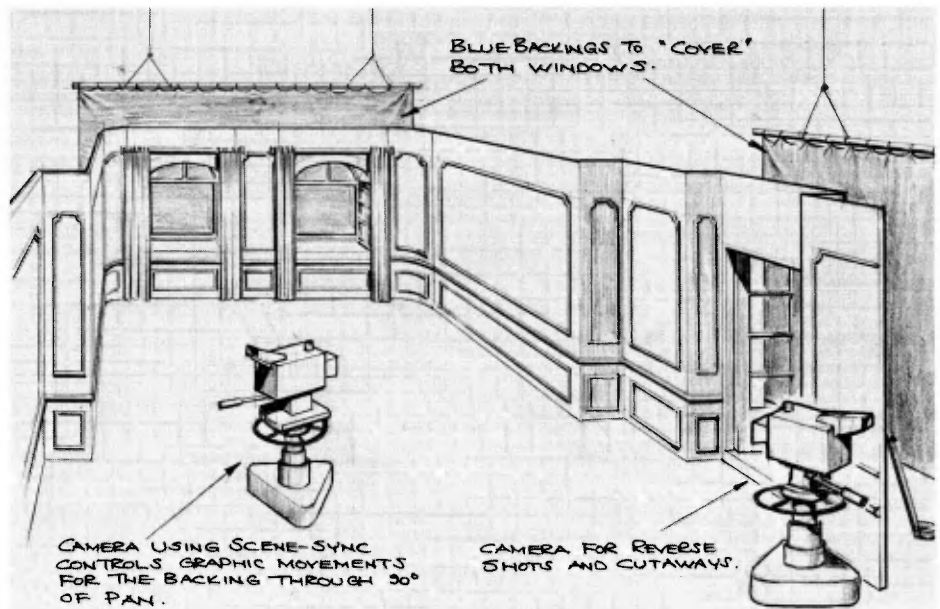
The original idea was to free television cameras from the locked off situation that all studios experience when using Chroma-key. Our aim was to produce easily-installed equipment that would make Chroma-key a more useful facility by virtue of the fact that normal scenes could be shot panning on normal movements of the actor about the set using small photographs or drawings as backings.

This equipment has been produced and it works well: installed in 15 minutes and brought into use in about 30 seconds, with no additional time necessary for lining up. Frequently setting up is faster than with a background from a slide because you have more freedom of adjustment. The other intention we had for Scene-Sync was to use it with 15-inch x 12-inch backings behind a studio set with windows to save the high cost of large painted cloths. This too has worked well.

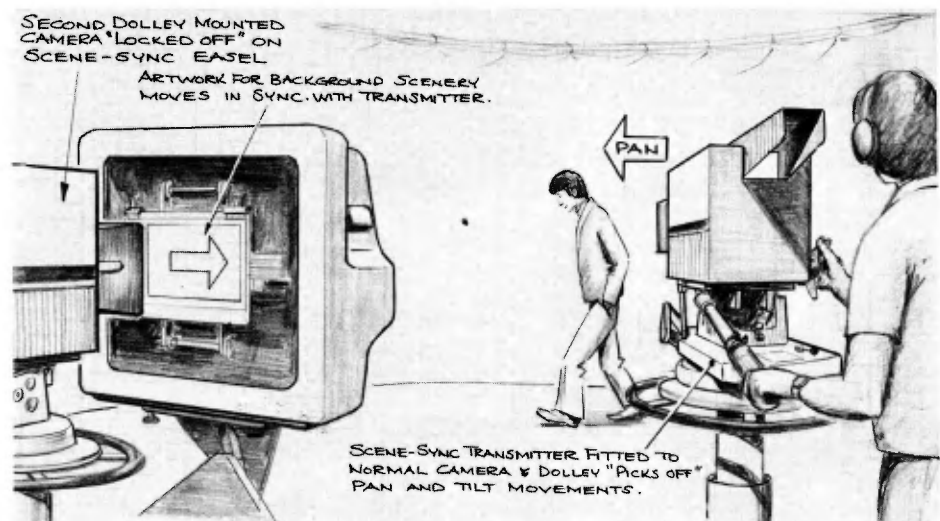
THE BASIC SCENE-SYNC

The hardware is basic and does not consist of any computers or mysteries. A flat metal box is fitted beneath the pan/tilt head on the dolly or crane before rehearsals start. Two potentiometers within the box "tell" an electronics unit what the camera is doing. The electronics unit then drives a specially designed Easel Unit. This easel is the trick. At the outset our problem was to synchronise the two images from two different cameras. The obvious solution would seem to be to master and slave the cameras.

In 1971, aided by the BBC in London,



"Hotel Suite" set with two windows. The camera, using Scene-Sync, can dolly and crane freely. (BELOW) As the foreground camera (right) pans, the background graphic moves on the easel in front of the camera (left). The Scene-Sync hardware is basic and does not consist of any computers or technical mysteries.



Production Designer Peter LePage waits patiently on the blue set, as the camera is lined up to match the second camera on the set, seen in the background (LEFT). The master camera is not a special master-to-slave system, but a normal manual head with pick-off arrangements. The graphic or artwork is in front of the second locked-off studio camera allocated to the background.



we did try some experiments with a master and slave camera set up. For several reasons that arrangement was not right. That gave us the idea for a new approach with more specific prerequisites for the design. One was that this new system could be brought in and out of operation in less than one minute. Also the cameraman should not have to part with the pan/tilt head with which he was thoroughly familiar, namely the Vinten MK III head, of which there are many thousands in use throughout the World.

The master head must have the same "feel" to it as if he were working on a normal "shoot". To meet this requirement the master camera is not a special master-to-slave system, but a normal manual head with pick-off arrangements. The graphic or artwork is in front of the second locked-off studio camera allocated to the background. As the master camera pans left, the artwork moves right, and vice versa. The same applies to tilting movements: as the camera pans up, the artwork moves down. A control is provided, for adjustment, so setting up is simply a matter of panning the master camera continuously, then watching a floor monitor and turning the dial of the control until the two images move at the same speed across the monitor screen. This takes only a few seconds.

So now we have a device that can save a lot on set building costs for short scenes, commercials, dance routines, even locations. A 15-inch x 12-inch picture can be given depth by the use of blue flats or shaped blue cutouts. These enable actors to move right into the "set", exit through doors, go behind columns, jump out of windows, even though they are all on the artwork. Normal set dressing and furniture can be added to the scene by placing the items onto the blue set in the correct position relative to the scene in the graphic.

SCENE-SYNC FOR BACKINGS

The 15-inch x 12-inch format can also provide a backing picture for a box set. For example, imagine a set with windows in two of its walls. Normally this would require two large painted cloths, and no matter how well they were painted it would still look as though they were just a few feet beyond the window; with this equipment no such problem exists. In fact, a view through a window can appear to be at infinity. Let me explain how this aspect of the equipment was discovered.

After the initial launching of the equipment in 1977 I started trying out some ideas. One was in response to a question put to me during a demonstration, "Does the artwork move when you crab and

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The Scene-Sync transmitter is mounted onto a Chapman NIKE crane. (BELOW) The cameraman's P.O.V. Indicator enables him to center the potentiometer within the transmitter. Two potentiometers within the flat metal box shown here "tell" an electronics unit what the camera is doing. The electronics unit then drives a specially designed Easel Unit.



Peter LePage (center) and Reg King (right) see the result of the line-up on the floor monitor during playback. Scene-Sync is designed to save considerably on set building costs for short scenes, commercials, dance routines and even locations. A 15-inch by 12-inch picture can be given depth by the use of blue flats or shaped blue cut-outs, enabling actors to move right into the "set".



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crane?" I had to answer, "No—only when you pan and tilt." I felt that this "smart alec" had caught me out; naturally my reaction was "What can I do about it?"

DOLLEY MOVEMENTS

So I tested the theory I had for the "backings" applications (in any case, to have added crab and crane pick-offs to our system would have infringed a U.S. patent). The tests proved that what at first appeared to be a shortcoming was, in fact, an advantage.

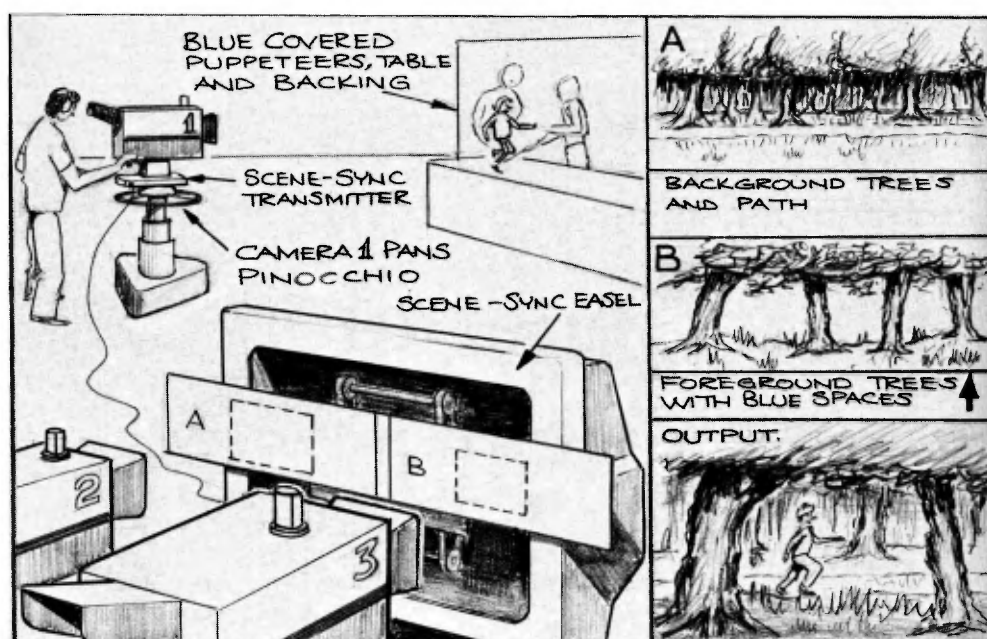
Because the distant scenery, when added by Chroma-key to be seen beyond the windows of a set, is supposed to be some distance away, there is no apparent movement of the scenery on the screen when crabbing sideways or craning up and down.

Try this effect. Stand away from the window in a room with a distant view visible. Now move your head to the left and right to simulate a crabbing movement. Notice that the distant scenery does not move with the windows. It is one of those effects that we all know about but have no reason to think about. In this instance, however, the effect adds the realism of distance to the photographic reality of the artwork, and this, coupled with pan and tilt on Scene Sync, provides the backings.

When this was tried on a programme at the ATV studios near London, the result on the screen was incredible. John Cooper, the director of the play, wanted a view of the Grand Canal in Venice to be seen from the windows of a reconstruction of a hotel suite in the studio in England. There were windows in two walls of the set and the camera had to both crab and crane during a scene lasting eight minutes.

The still photographer provided a series of still shots from an appropriate position overlooking the real canal in Ven-

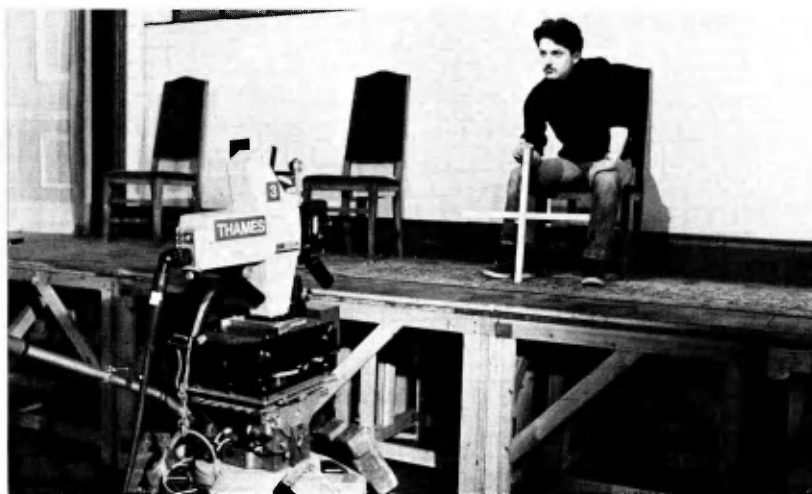
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Pinocchio (picked up by Camera 1) is overlaid onto Graphic A (Camera 2). Foreground trees (Graphic B, Camera 3) are overlaid onto other two. Camera 3 is "tighter" than 2, so "B" moves faster than "A". (BELOW) Puppeteers, completely covered in blue and working against blue backing operate the "life-size" Pinocchio puppet.



(LEFT) The Scene-Sync transmitter is mounted onto a Chapman NIKE crane. (RIGHT) Here an assistant holds the one-third-scale white cross "stand-in" in front of the camera on the slave head. Peter LePage had the normal size set elevated to obtain the low level viewpoints required for the "toy" characters.



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ice at the time the unit was there for the exterior locations. These stills were then joined together to provide a panoramic view 15 inches long.

A little juggling of the two cameras on the day of shooting placed the "scenery" beyond the windows with blue backings. Once set, the view stayed in the correct position throughout the scene. The close-ups and midshots were shot on a third camera to miss the windows. No difficulty was experienced in this respect. So real was the recording that a TV director I met later admitted he thought the scene had been shot in the actual hotel room in Venice.

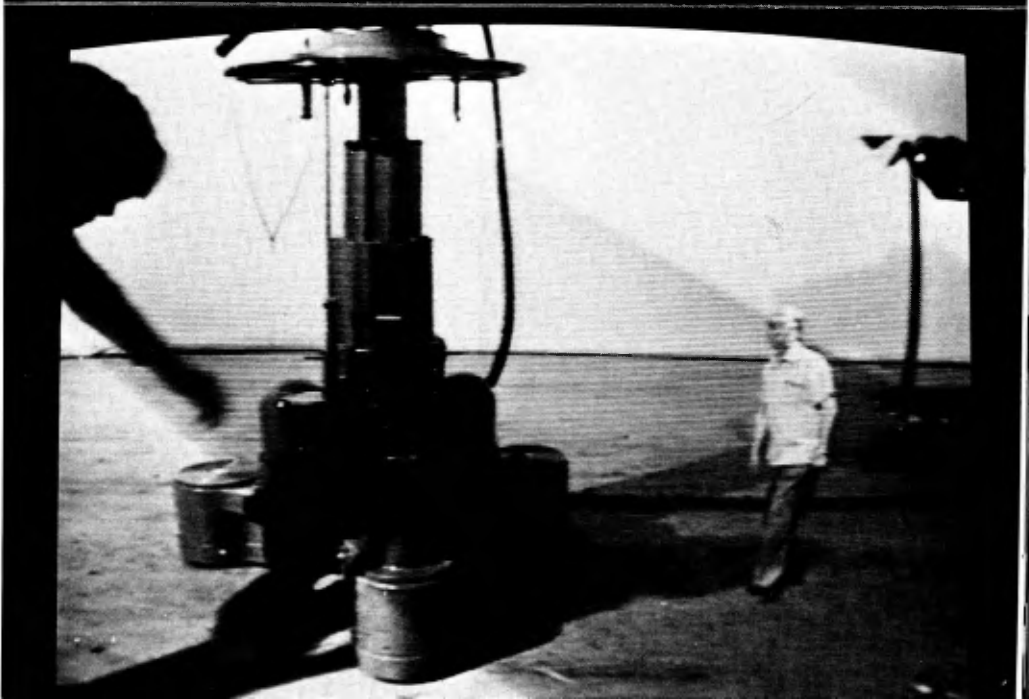
The effect of distance is really amazing, as the camera moves across the floor, whether left or right, up and down or in and out. I felt that this was quite a bonus, yet cost nothing.

FLYING OBJECTS

Encouraged by the result of this show I started to investigate camera movements a little further. Now there was something that we television folk had never had, or only with considerable financial outlay, and that was realistic shots of flying objects such as planes, space craft, the good old magic carpet and all the other fantasy objects that forever are required to be seen airborne in anything from Sci-Fi to Arabian Nights.

For example, some time ago a series

Photographs off the television monitor showing first test of the slave camera. The tiny figure is on the blue set and overlaid by Chroma-Key. Notice the pan down and pan right from the top picture to the one below. A total pan of 90 degrees will be available.



made by the BBC in the London Studios told the story of R.F.C. fliers in France during World War I. The atmosphere created in each episode was, as always with the BBC, totally realistic. For the aerial battles, radio-controlled, one-sixth scale models of the old planes "stood in" for the real thing with very convincing results, but when it came to the midshots where we see the crew in the plane the story was very different.

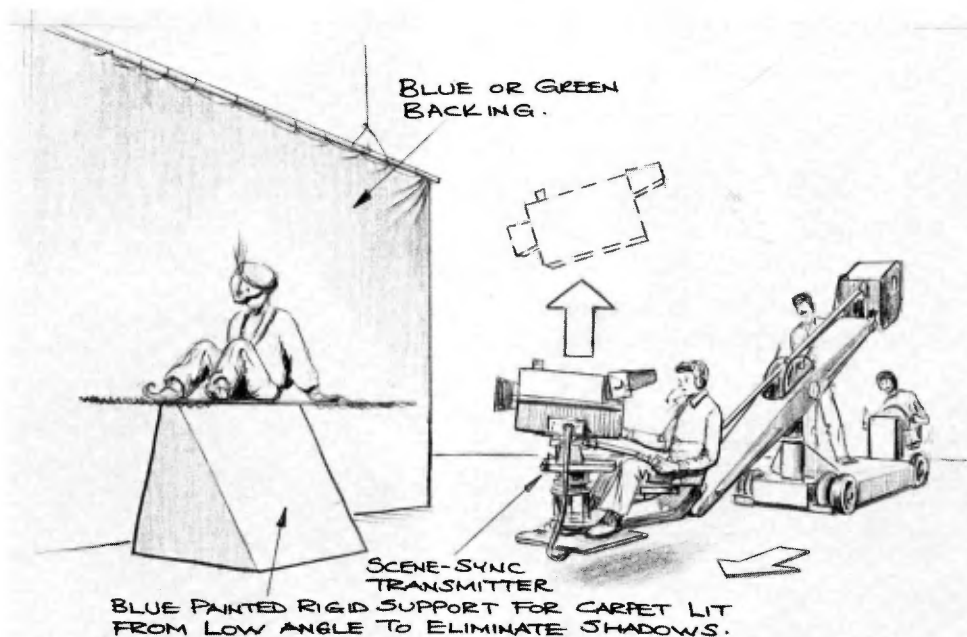
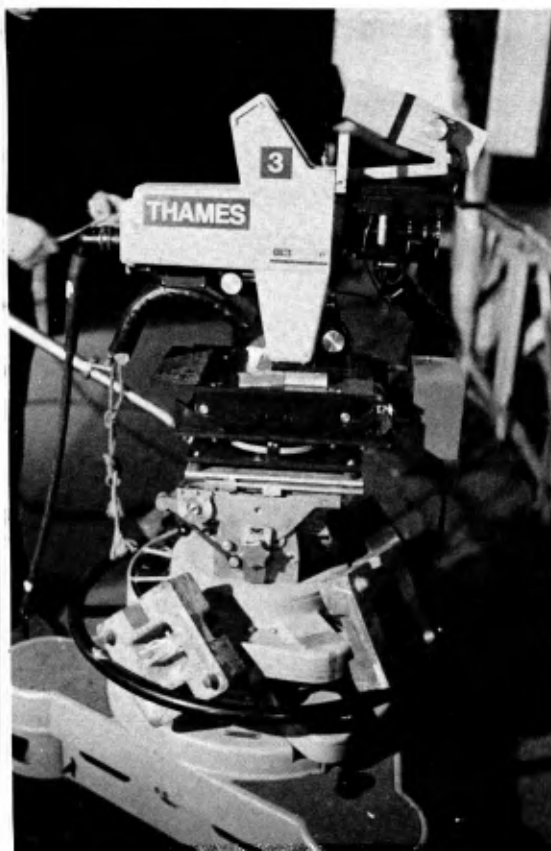
As front axial projection was very time-consuming and back projection was not in favour because of space and cost, the method used to record the airmen "flying" and "chatting" to each other was to hoist the whole plane up onto a tubular support in the middle of a field, then shoot it, low angle, with a wind machine and some coloured smoke. I was sure there must be a solution that would improve the realism of this very limiting and static-looking shot—and there is! I wanted to see the whole plane in shot with a real live crew, and it had to look as though it were actually airborne, complete with the "bumps" and "pockets". Furthermore, the ground had to be seen beneath the wheels. Now I could not, for an experiment that I was not 100% sure about, ask the BBC to lend me one of the large studios at their London Television Centre; it would require the rigging of the replica of a 1915 plane they had for the series.

They have, more than once, freely as—
Continued overleaf

The "background" camera mounted onto the prototype slave head which, for ease of lining up, was mounted onto a conventional television camera dolly. The production model slave will carry conventional studio cameras and will not require lightweight cameras to be used for such a shot.



Photographs from the monitor showing plane "manipulated" by craning the camera. The background for this test is a 6 x 8-inch color print. A film would be used for an actual production. Note how the horizon height varies as the camera pans down. (BELOW) Flying a magic carpet. Once set up, the perspective for the background to the carpet stays correct wherever the camera is placed.



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sisted with experiments in the past, but I felt this was a little too much to ask until I had tested the idea. So I built a one-sixth scale model of a biplane, complete with bracing wires (I wanted to see how they came out on Chroma-Key) and an ACTION MAN pilot, then added the test to an experimental session at the BBC.

It was important that my test, although in miniature, could be scaled up to work on a full-size plane. I felt certain that Scene Sync could eliminate completely the massive hydraulic rig normally used in the studio to handle "flying objects" with all the problems associated with disguising the rig, together with the gigantic BP screen or front axial projection screen required to cover the size of a plane.

Once again the set-up was very simple. By placing the plane at a fixed height, either using suspension cables or blue coloured pylons, in a studio with a stock blue cloth backing and blue painted floor, we could overlay the plane by Chroma-key onto a film of the countryside and clouds beyond. This, we know, has been done for years but it suffered from the same problem that all Chroma-key did before Scene-Sync arrived—no pan and tilt. With the Scene-Sync transmitter fitted beneath the camera mounted onto a camera crane we have complete mobility. The background camera is lined up onto a small BP screen about 19 inches by 12 inches, onto which is projected a picture from a projector that is "slaved" to the foreground camera pan/tilt movements on the crane.

For Tommy Steele's departure from a cellar, this blue staircase was built three times the size of a normal set. Peter Howell (center) the senior cameraman, kept a long tape measure handy. This, together with the two white crosses, kept the lining up time to a minimum.





Tommy Steele was required to climb a rope up a high stairwell. By conventional methods this would have meant building the staircase three times full size and would have been hazardous to the star. Here Steele is overlaid from the blue set onto small graphic attached to the Scene-Sync easel.

This presents a similar picture, for the background video camera, to that described earlier with the reverse movements, only this picture is a "movie". A little camera juggling places the plane in the correct position in relation to the background. Once set we can now create the uncanny effect of buoyancy as the boom of the crane is gently raised and lowered, with the cameraman panning up or down to hold the plane in shot. Scene-Sync controls the background picture and as we crane up and pan down the horizon rises, and vice versa. Then, by moving the crane in and out and swinging the boom slowly left and right, we achieve an air-to-air shot that could give you airsickness. If our "fliers" have to perform some dangerous bit of business, such as climbing out on the wing to repair a damaged aileron, or whatever, there will be no problems with the insurance; the studio floor is only about six feet away, yet the ground appears to be several thousand feet below because, as the studio floor is blue, we can be keyed to a view of the ground in a high angle shot.

Other aspects soon followed. Starting with a fairly tight shot of the cockpit then craning up as the lens is zoomed out,

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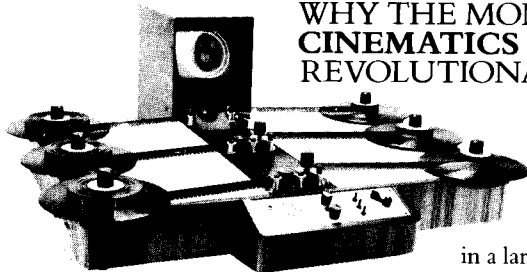


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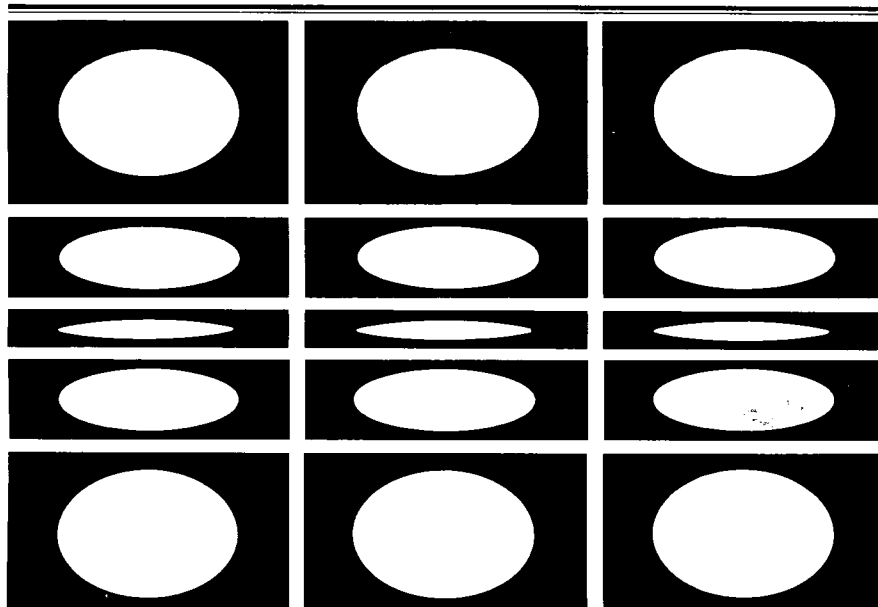
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with the far wing of the plane pulled down, sends my studio plane into a perfect "peel off" effect.

Remember that the plane does not change its position in the studio. It is the camera that moves on its dolly or crane. This opens the way for a wide range of effects. A miniature suspended on the blue set can be made to "fly past" the camera simply by dollying by and having the model backed by a wide angle still of clouds on the Scene-Sync Easel.

Placing a full-size replica or a miniature of a space craft on the blue set, overlaying it onto a 15-inch x 12-inch black card with pin holes backed up with a "pup", or even a 200w "dinkie inkie", creates a perfect "night sky" setting for a Sci-Fi situation.

The space craft, in the same way as the plane, is under the control of the camera crew who manipulate it with the ease that they normally manipulate the camera movements. To produce this result the crew have to move the camera in the opposite direction to the flying object. Strangely enough, this comes very naturally to them.

SLAVE CAMERA

Our early slave camera experiments in 1971 came to a halt because the special motor-driven head had to be used for the master (foreground) camera using the motors as generators. Now that we could pick off the pan and tilt movements from a normal manual head, it looked much more feasible to resurrect the slave camera. We had already built the small powered head to carry and manipulate the 16mm projector for the moving background effects, so modifications were made to the electronics to make them compatible with the "one-to-one" panning ratios required for the slave camera. An ENG camera was mounted onto the head because of the lightweight construction of the head. On the day of shooting, the head and camera were placed in correct relationship to the artist in the blue set. By making the necessary adjustments to scale, tiny figures could be followed in panning shots.

For the Thames Television Christmas production THE QUEST, the director, Robert Reed, wanted some shots showing the star, Tommy Steele, who plays a two-foot-high toy that has come to life, moving across a normal size set. Peter Le Page, the production designer, provided two white painted crosses, one exactly one-third the size of the other. These crosses were the "stand ins" during the lining up of the cameras. Very little time was consumed using this method. The Scene-Sync slave head was panned a

Continued on Page 1175

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few times until the two crosses moved together on the floor monitor, the same method of adjustment used on the basic Scene-Sync.

DOUBLE GRAPHICS

(This description of the use of double graphics has been contributed by Barry Letts, who has a very high reputation for producing first-rate television serials from the classics of adventure literature.)

I had used Chroma-key overlay many times when I was producing and directing DR. WHO, the longest-running sci-fi series on BBC Television. Three-foot maggots crawling across a living-room carpet, ten-ton caterpillars chewing up a space-city, were a welcome relief from the usual type of Bug-Eyed-Monster with an actor inside.

It was these "puppet" monsters, operated by puppeteers dressed entirely in blue and therefore invisible to the cameras, that gave me the idea of re-creating PINOCCHIO, with a real puppet playing the lead.

Scene-Sync made it possible for me to have a beautiful sequence where the puppet could be seen dancing through a forest with trees both upstage and downstage of Pinocchio. This is how Dave Jervis, our Effects Operator, solved it.

The puppet was on the blue set with its three blue costumed puppeteers. The image was overlaid onto a painting of the woodland scene with the path across the foreground. The second painting was prepared showing a few trees that were to appear downstage. The spaces between these downstage trees were filled with blue.

Both pieces of artwork were attached side by side to the Scene-Sync easel so that they would both respond to the movements of the master camera as it panned the puppet across the blue set.

Two cameras were lined up onto the Scene-Sync easel, one on each painting, a double Chroma-key overlay was used, the downstage trees being overlaid onto the puppet, who was already overlaid onto the trees to follow Pinocchio's dance.

The result was so satisfying, artistically and technically, that it has whetted my appetite and I am planning a much more ambitious project, using Scene-Sync to a far larger extent.

(My thanks to Barry for that description. R.K.)

CONCLUSION

So there it is. We now have access to completely new effects for video televi-

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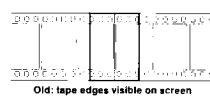


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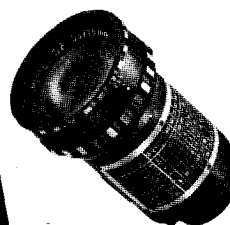
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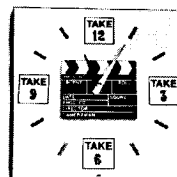
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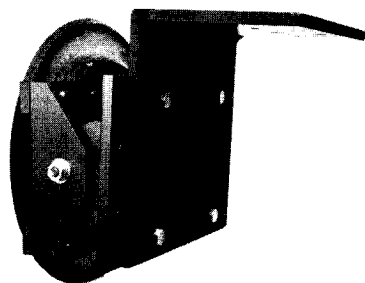


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sion. May I conclude this article by proposing a challenge to the video side of the industry, at the risk of being called audacious for doing so in the Journal published by the A.S.C.

The challenge is: can video television now come up with the kind of adventure production that has been the exclusive preserve of our worthy colleagues in the motion picture industry?

The kind of thing I have in mind is the action in such classics as IT'S A MAD, MAD WORLD and SUPERMAN, or the incredible Alter Ego dance by Gene Kelly in COVER GIRL.

Of course it will take some imagination!

Technical Summary

1. Pan and tilt on normal backgrounds;
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3. Moving backgrounds with pan and tilt for moving vehicles;
4. Flying objects in the studio;
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(ABOUT THE AUTHOR: REG KING became interested in television at an early age, when members of his family worked for John Logie Baird. He himself worked as a projectionist in both "portable" and conventional theaters. He trained as a design engineer and, since 1954, has worked for three companies, including Mole-Richardson, on the design and development of studio equipment for motion picture and television studios—mostly dollies, camera cranes, a microphone boom, a remote camera control, etc. He recently received the Royal Television Society Premium Award (1978/79) for the best presentation of new equipment.)

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