Robert Rouveroy's technical article follows the development of camera movements, from the claw transport and register pin movement to the modern hollogon.

cinimages

by Robert Rouveroy C.S.C.

I've been involved with experimenting in forms of camera movements and other goodies. Most, if not all movements, have been developed or at least invented a long time ago, some in the 1890's. Most of them have been discarded for camera applications, because of inherent instability. Example, the Maltese Cross movement is still widely used in projectors, primarily 35mm, but has been rejected for camera applications. As of this moment, only four systems are widely used.

The claw transport and register pin movement, like in the Mitchell, is still the most favourite movement, due to its inherent stability and smoothness of operation. Then we have a second movement, the 'claw-only' movement, like in the Arri 35mm, the Auricon, Bolex, Beaulieu, and others. With the high tolerance limits of film stock that we have now, this is perfectly acceptable for most purposes. Maybe the Auricon movement has a slight edge, as it has a very long transport claw pin that partially fulfills the purpose of a registration pin. It stays in the sprockethole until the first beginning of exposure, before withdrawing. It also enters the next hole, before exposure has ended. Its principle has been widely copied and works very well. It does not have the incredible accuracy that the Mitchell has, but then nobody beats Mitchell anyway. That's something of a standard in the industry. The NFB have just overhauled two ancient Mitchells at high cost, an act of faith in the quality of their mechanisms.

The third movement is known in the trade as a "clapper gate". It has two vertical plates that compress together on either side of the film to physically lift the raw stock and impale its perforations on to register pins that are in a permanently fixed position. This gate provides great accuracy and was extensively used before the advent of sound. The mechanical noise level in frame transference is very high and thus its main contemporary use is in process photography cameras and laboratory printing mechanisms rather than sound studio shooting. "Going like the clappers" is an old industry term indicating haste and noise related to the cacophony of gate clatter. Bell & Howell, Acme and Oxberry manufacture these movements.

The fourth movement is the Imax, developed here in Canada: the "rolling loop" movement. The incredible speeds encountered by the filmstock running through the gate excluded the use of claws, so the designers dusted off a recent idea from Australia and incorporated it very successfully in their machine. The film is forced into a half curl, and at the precise moment is released through the gate and is then ingeniously clamped shut.

But, up till now, all camera movements can be compared to sewing machines. Whatever the degree of sophistication, all they do is stop the film, allow an exposure and initiate the next move to the next cycle. And here is the origin of all our troubles. The film has to move suddenly, sometimes exceed the speed of sound, and then has to come to a dead stop for the exposure, 24 times every second. Sync sound has to be recorded further along the film, after the start-stop movement has been smoothed out by rollers, flywheels, etc. The worst thing of all is that very early in the game, a standard of 24 frames was set. This makes it really incompatible with the 60 frames (30-30 interlaced) video standard in North America. By literally cheating outrageously, a semblance of compatibility is achived electronically, but it is always instantly clear if a program was taped or photographed.

Our friends in Europe have far less problems because the translation problems of film to video are minimal (25fr. to 50). Filmed inserts have often looked better than the video taped portion, for film in ordinary circumstances can record a great deal more information bits than magnetic video recording.

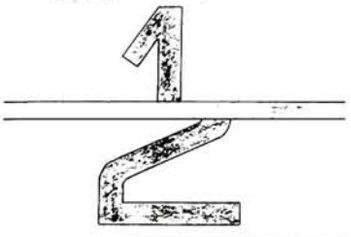
A fifth system is really not that new either. The basic idea is well known and consists of letting the film flow continuously through the gate and optically deform the image so it would "wipe" the image on the film. Very early systems used a solid polygon between the lens and the film, somewhat like the way most or all flatbed editing tables work. The results were identical: a comparatively shaky murky image. A funny history tidbit. The great Thomas Edison had pretty well sewn up all the patents on motion picture cameras and was making a great deal of money out of them, so he hired goons to bust up film producers who were using all kinds of imitations imported from France and Germany. So legend has it that two enterprising Frenchmen devised a polygon cameradrive, but Edison busted them anyway. An example of a polygon shot film is still preserved in Holland.

In 1966 or there-abouts, Beckman & Whitney came out with a very novel approach, sponsored by ABC, who needed a small sound on film camera to record the Vietnam war. It looked a bit like the Eclair ACL and had the film running continuously through the gate. The picture was "painted" on by a "rocking mirror" device. While it worked very well for a while, the

mechanical gearing between the drive sprocket and the rocking mirror quickly got worn down causing an unstable image. The ultimate demise of this highly original concept was attributed to the inability of the mirror to coincide the three primary colors on the image. The camera got in too late, just when we were changing over to colorfilm for TV use. It worked fine with black and white.However, the prisma, or polygon, drive is still used in many high speed cameras of all types. *

The inherent instability of the solid polygon (or rotating prism) becomes rapidly apparent when you buy a new editing table. For a few weeks, even months, the image is quite stable, but then it seems to deteriorate sharply.

solid ploygon wiping effect



hollogon dissolving effect

The rotating prism has to rotate slightly faster than the speed of the film passing through the gate. This means mechanical gearing and that rarely holds up for any length of time. Also, the position of the sides of the prism in regard to the filmplane makes the image go out of focus during the transition period, i.e. when one image is replaced with the other.

Enter the principle of the hollow polygon. A Dr. John Kudar patented an optical path light extender (US Patent No: 2.972.280). Very simply by cutting a large hole in a rotating prism and then putting the appropriate optics *inside* the prism, the problem was solved. The hollow polygon (or hollogon) is now mounted firmly on the film drive sprocket. So first of all, steady registration is achieved.

The (highly secret) optics inside the hollogon compensate firstly for the tracking aberation so there is no going in-and-out of focus at the moment of transition, and it does something more! It literally dissolves from one picture into the other (see diagram) so that there is no flicker **at all** at any speed from 0 to 1000 fps.

As there is far less mass to move, and no moving parts other than the hollogon and the filmdrive sprocket it is mounted on, and some guide rollers, the movement can withstand great accelerations and sudden stops and is extremely quiet.

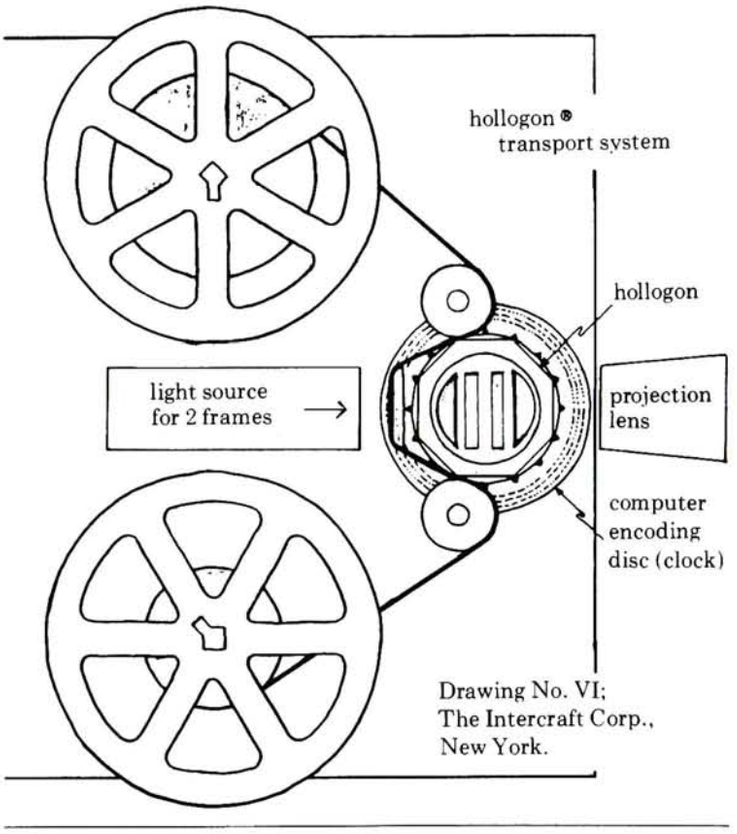
There is no shutter and no intermittent and the light going through always adds up to a theoretical 100%. Therefore a video camera "sees" the image at all times and the frames per second is quite immaterial. In effect, there are no translation problems any more. A film made for TV is usually cut slightly here and there to accomodate the commercials. With a Hollogon projector a 60-minute film can be stretched or compressed slightly to accomodate the time available. 10% stretch either way is quite acceptable to the eye.

But what about the sound?

* (If any reader has a good technical description of the inside of the B & W, I would be greatly obliged to hear from you; write me c/o **Cinema Canada**).

Well, Sony has come out with the answer. A compressor-expander unit attached to such a projector will electronically "chop-up" the signal and slow it down or speed it up without changing the pitch. It's called variable speech control (VSC) and was really invented by a blind Harvard student named Sanford Greenberg, back in 1960. He got tired listening to talking books as he could listen faster than they could speak. His idea didn't work out so well at first, and it was developed further by the Cambridge Research and Development Group. Then it got picked up by Murray Schiffman who owned a company called Data Technology. He got the idea how to restore pitch properly and the circuit was offered for licensing in 1971. Now Sony and Panasonic will market it very soon, probably in September. Quite cheap too; it'll probably add an extra $50.00 on your new cassette tape recorder.

So there you have it. Hollogon wedded with VSC will be the answer to CBC's biggest problem. Since they are drastically cutting back their commercial content, they are looking for one and two minute shorts to fill the time. This system would help them out considerably. I don't know if they have plans to do so, I never talked to them about it.



Drawing No. VI;
The Intercraft Corp.,
New York.

The same system could be used for tape to film transfers. Again, the picture is continuously "seen". Several projects are being perfected by the Intercraft Corporation in New York. Ulrich Fritzler gave a preliminary view at the SMPTE conference in November 1974 in Toronto.

The first machine you'll see using the hollow prism principle will be the new Magnasync/Moviola flatbed table. It will probably be on view by the time you read this. W. Carsen in Toronto hopes to have one soon. For those of you that have a late model of this editing machine, there will be available a replacement module with the hollow prism, for under $900.00. It is true that Steenbeck offered a variation of the hollogon for their editing tables as far back as 1969, but it would

have added an extra $3,000.00 to the purchase price. And it still flickered, somewhat!

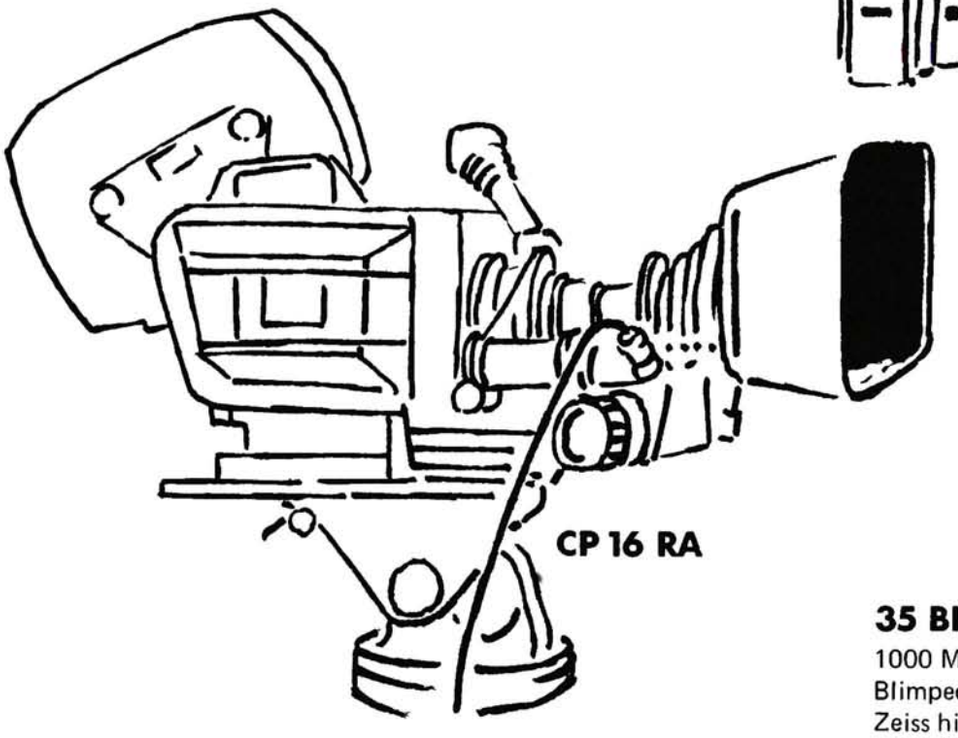
Gerry Quinney of Alex L. Clark Ltd. looks further ahead. He is closely involved in getting the Intercraft hollogon projector wedded to the Sondor Libra 16mm recorder/reproducer machine. This Sondor, developed in Switzerland has treated 16mm sprocketed tape the same as 1/4 inch tape. The treading is the same as a normal tape recorder, capstan and pinchweel and the large sprocket is not driven but keeps the whole thing in sync. This makes for highspeed forward and backward movement. With the Hollogon projector it will save costly minutes from your mixing time, and is a very quiet operation.

The hollogon principle as applied to cinematography still has to be further developed. However, there is no reason not to see it soon applied to (you guessed it!) super 8mm. The amateur market is so vast that practically *any* Super 8mm camera is more sophisticated than *any* 16mm or 35mm camera. Only in the amateur market is it financially possible to explore new possibilities in technology. Just lately I mucked about with a Bolex 8 Sound-on-Film camera of around $600.00 and I found that even with a two-buck microphone the sound quality was somewhat superior to 16mm optical sound.

But just for once, because of the uneasy marriage of TV standards and the current film standards, the hollogon principle might be first applied to 16mm TV projectors. At least, it would do away for a great part, with the incredible butchery perpetrated by TV film editors, who have to fit the programs into the appropriate time slots.

Just don't hold your breath! □

CAMERA RENTALS



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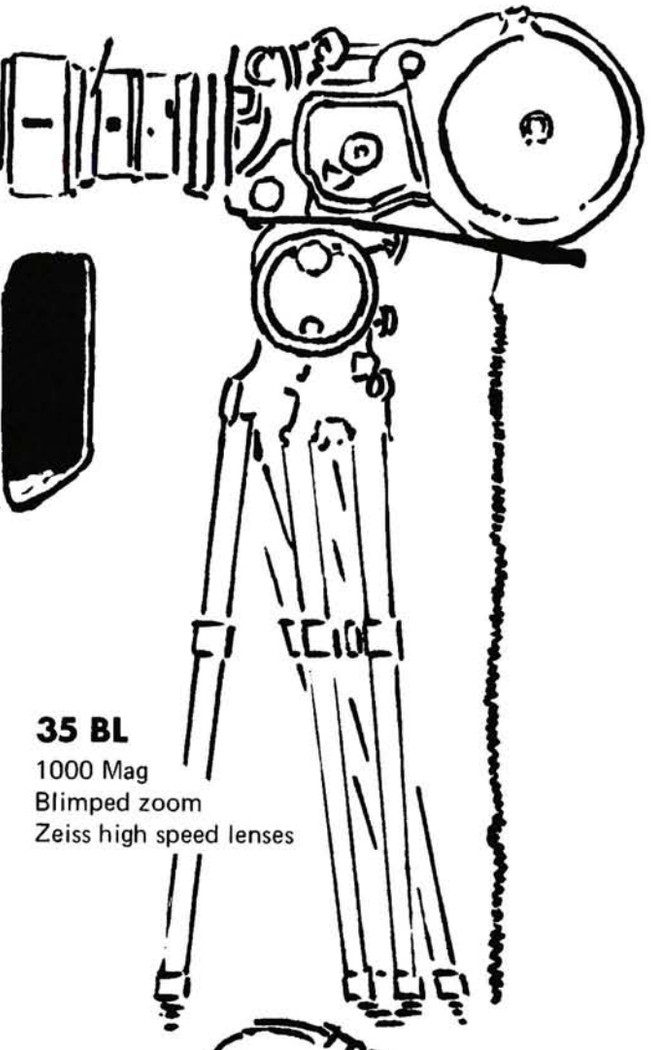

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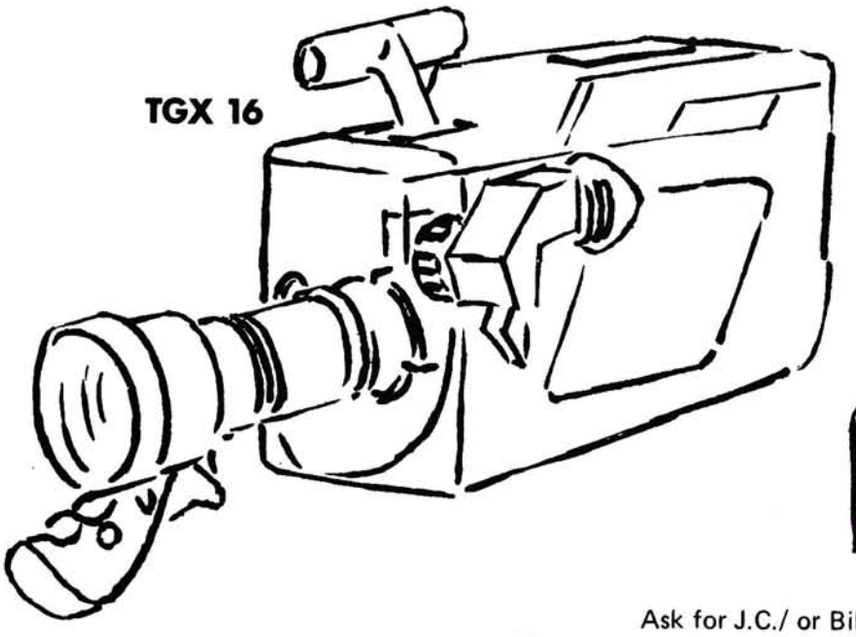

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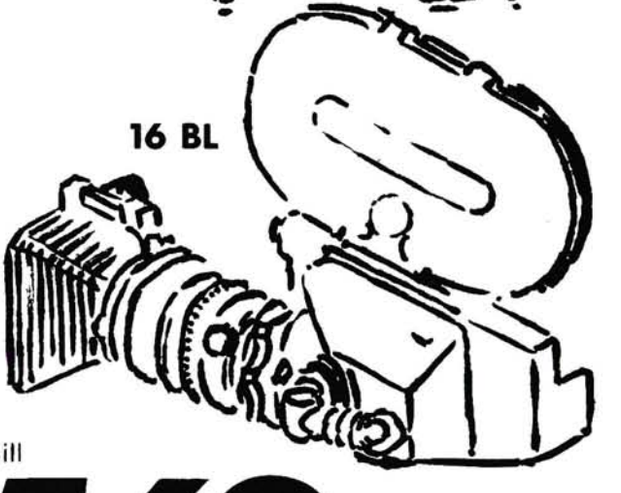

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