THE CONVERTED GRAVURE (HALFTONE GRAVURE CONVERSION)

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Abstract: a) The utilization of Helio Klischographs in the offset-gravure conversion process. How the idea originated. The first tests with the Hell Klischograph 193 which were the basis of Benito Sciarretta's patent.

b) Development of the system with the HK 202. Technological improvements in optical reading heads and modifications to the electronic parts.

c) Evolution of mat films for reading on Helio Klischographs.

d) Economic and practical advantages offered by these systems based on the experience of a major printing company serving the European market.

e) Prospects for development of the system.

Once upon a time .....

It will come as no surprise if, years from now, people recall how once upon a time rotogravure was carried out with continuous tone film. The more incredulous will ask for details but only a handful of elderly technicians will be able to supply them. Nowadays rotogravure is obtained from offset using a conversion process.

How the idea was born!

I am a firm believer in the old adage that necessity is the mother of invention. In our case, we had to reprint a book in offset and the original were no longer in esistence. All we had were a few copies of the original book printed in offset with a clearly visible screen and one of the first Hell scanners. A few tests convinced us of the possibility of using the prints as originals by scanning them with the optical reading head slightly out of focus and increasing the detail contrast to compensate. The result were acceptable and the work was completed.

A few years later several conversion systems were being developed using conventional etching, i.e. with pigment paper, and it became increasingly clear that electronic engraving would very soon be less competitive than conventional engraving. We had only Helioklischographs (unfortunately we were technically too advanced) and we were aware that in a short space of time we would price ourselves out of the market. Our pre-print costs would rapidly become too high compared with the competition and there was the added risk that quality would somehow suffer.

The Hell Company and the other users of Helioklischographs were unanimous in their belief that conversion would never be possible with electronic engraving and this opinion was publicly voiced at the Annual Technical Meeting of the European Rotogravure Association in Hamburg in 1978. It was during this period that I remembered what had previously been achieved with scanners and considered the possibility of exploiting the same principle. After all, the basic technological concept of the two machines is very similar - the transformation of light energy into mechanical energy instead of into light energy. The optical components in the two machines are almost identical, the computer output could be transformed in

the electronic component of the writing head and contrast detail could be used to remove out of focus effect that was the cause of low-intensity dots around the detail.

Once the basic idea was clear it became necessary to create the most favourable conditions. Continuous tone films exposed on opaque material give average reflected densities between 0.25 and 1.45 and the Hell Company's studies with the HK 193 had shown that these were just the densities which offered the best reproducibility. It was therefore essential to obtain similar density figures with screened film. Tests were made with 54, 60, 70 and 80 lines/cm., with variations of 5° in the screen angle and with dot percentage varying between 3 and 98 per cent. The curve plotted and the results obtained were as follows:

- the optical reading head would be sufficiently out of focus at 1/4 turns, assuming 0 to be its position when in focus.
- printing is not possible with a dot percentage inferior to 8 per cent.
- maximum dot percentage should be between 95 and 97 (100% being used for text and line drawings).
- any screen angle could be applied.

The two reproductions shown in the previous page were obtained by enlarging an eight point text 33 times. The photo on the left shows an obvious defect resulting from imperfect focussing of the Helio; the photo on the right is perfect both for reading and writing.

The first results were sufficiently good to convince Ilte to apply for a patent; that was on 22nd September 1978. In the same period the first works were being printed using offset colour separation.

The patent was ceded to the Hell Company so that it could be developed and improved, particularly that part which involved electronics, with special emphasis on the new Helioklischiographs (HK 200/1/2) which were to replace the old HK 193.

How the system was developed with the HK 202

Following Ilte's experience, the Hell Company carried out tests with the Helio Klischograph 202. The principal discovery was that if the screen was increased to 90 - 100 - 120 lines/cm. it was no longer necessary to use the reading head out of focus, providing the diaphragm of the optical head could scan at least two 50% screen dots diagonally. The size of the photo-diode made it impossible to change the diameter of the diaphragm. However, with less than two screen dots the information was insufficient for the optical head to compare with the flat tint and this caused moiré on the printing cylinders. The only way to avoid this was to use the scanning head out of focus.

Two years later the Hell Company changed the light ray and the diaphragm of the optical head and managed to create a reading system in focus. The main problem with this new type of head was that it could operate only with a 70 lines/cm. screen and the angle had to be identical for all the pages to be engraved. Obviously

this was far too limiting, even though the results were superior to any previously obtained.

For over a year now the Hell Company has been supplying the final automatic system of in-focus reading heads with automatic insertion of the electronic transforming component in the engraving head. The quality achieved by these new heads is markedly superior to any type of conventional engraving using continuous tone film.

While the machines were being developed the procedures of light-sensitive material were keeping abreast of the new demands: the opal film, that before was in continuous tone, became lith film which, because of its particular nature, could be transformed into daylight material. The whole procedure was made simpler. Wastage was cut to a minimum, the less-complicated process no longer required highly-skilled staff and production costs generally were being reduced.

An important additional factor was that with the new material the scanning head of the Helio Klischograph could read the lower percentages normally used in offset, i.e. down to 2%. The minimum percentages previously permissible had been 5-6%.

In addition, it became considerably easier to calculate the electronic conversion scale. The most practical way of doing this is by using quadrant diagrams and the essential stages are as follows.

The first stage is to establish the correlation between the dimension of the cell and the relative printed result. To do this a scale of 25 steps is engraved on a cylinder using an electronic linear scale (see fig. 1).

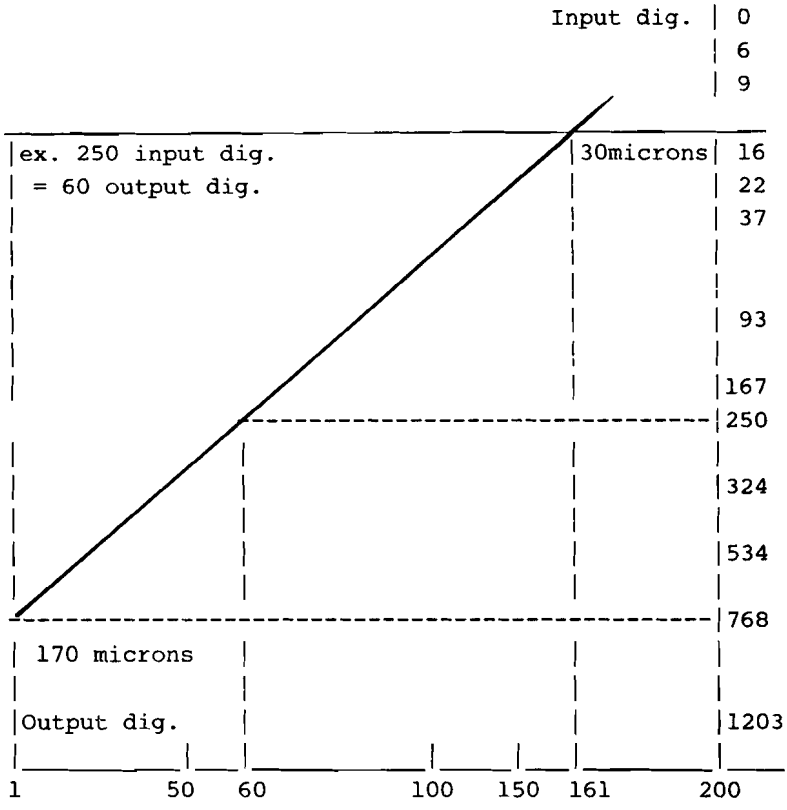


Fig. 1. Graph of linear conversion between digital input and digital output.

The starting point is considered to be the diagonal between 30 microns for the minimum dot and 170 microns for the maximum dot. These values are obtained by feeding the right calibration between engraving head and its amplifier.

At this point it is possible to measure the cell diagonals and the printing density and find the correlation between digital input, cell dimensions and printing density.

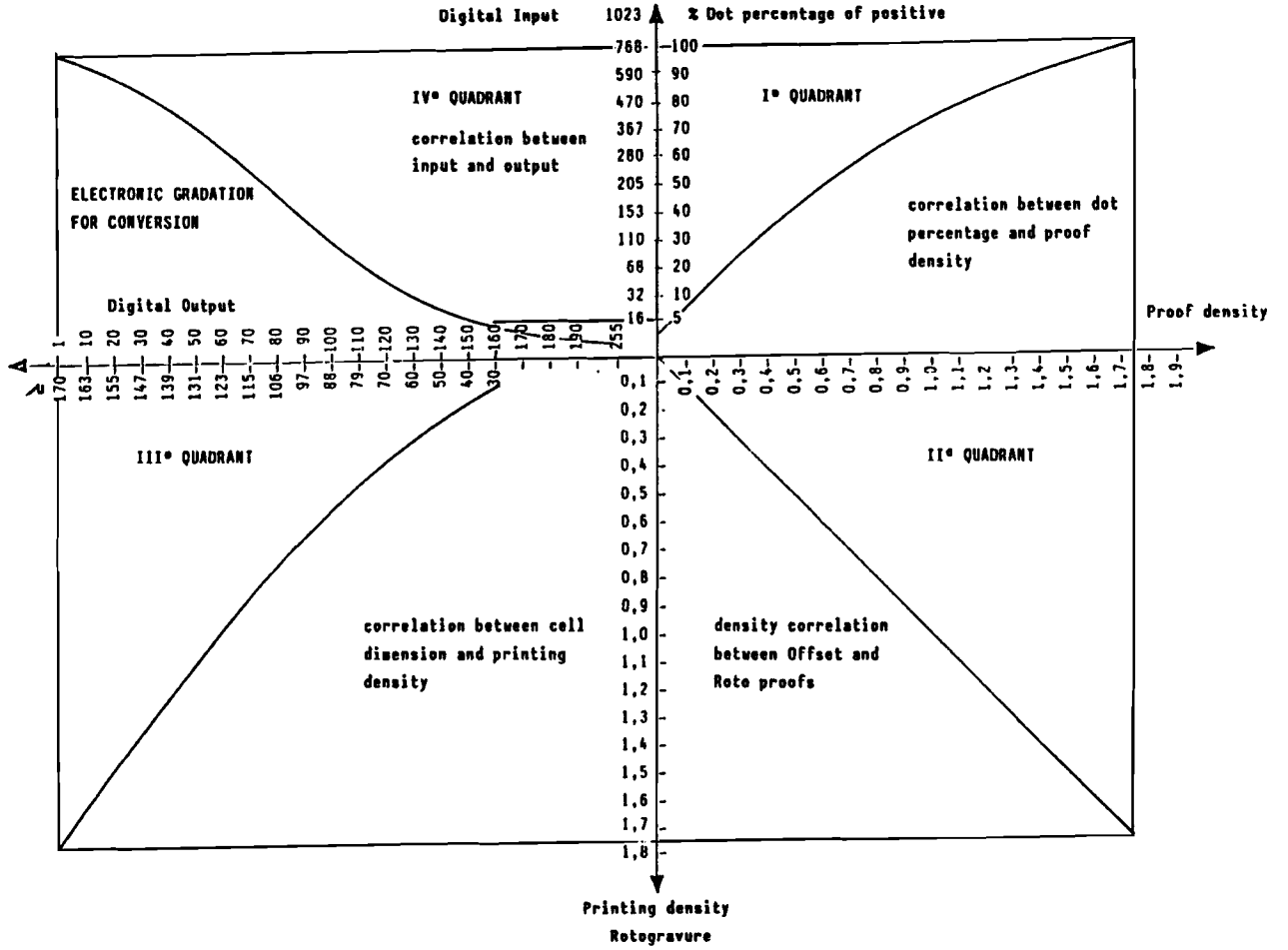
It is now necessary to transform into rotogravure a

screened scale which corresponds to the type of separation we want to print. Using the scanner, an electronic scale is produced with numerous well-defined steps (e.g. 3 - 5 - 10 - 15 - ... - 80 - 85 - 90 - 95 - 100 per cent); this scale is printed with the proofing or reproofing system to be used in production (offset plate or a system such as Cromalin) and the corresponding densities are measured.

By comparing the result with that previously obtained with rotogravure it is possible to calculate the precise value of the digital exactly the same printing density as the film in the offset process.

By plotting the curves of the various results obtained, with four quadrants it is possible to deduce instantly from an examination of the original to be produced the dot percentage necessary to obtain a given colour density in rotogravure, and to check it with a pre-proof. Or how to adjust the scale of the Helio Klischograph to obtain the best results.

The diagrams on the following page illustrate how the corresponding figures can be obtained from actual results.


Digital Input
1023
% Dot percentage of positive
768
590
470
367
280
205
153
110
68
32
16
100
90
80
70
60
50
40
30
20
10
5
IV° QUADRANT
correlation between input and output
I° QUADRANT
ELECTRONIC GRADATION FOR CONVERSION
correlation between dot percentage and proof density
Digital Output
Proof density
1
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
255
0,1
0,2
0,3
0,4
0,5
0,6
0,7
0,8
0,9
1,0
1,1
1,2
1,3
1,4
1,5
1,6
1,7
1,8
1,9
III° QUADRANT
II° QUADRANT
correlation between cell dimension and printing density
density correlation between Offset and Rote proofs
Printing density
Rotogravure

Economic and practical advantages offered by conversion

Let us compare the economic aspects of the offset and rotogravure printing systems in the two major stages of preparation and printing.

Preparation:

Without a shadow of doubt offset offers considerable advantages in this stage:

- production materials can cost as much as 50% less;

- the colour transparencies making up the page can be separated, proofed and retouched individually before being mounted;

- if retouching is necessary it is carried out after the separation has been proofed, thus limiting intervention to a minimum. (I would remind you that in continuous tone separation this stage is generally left to the individual judgment of a technician without the aid of a proof).

The possibility of proofing finished pages cheaply means the avoidance of unpleasant surprises and costly machine stoppage;
- half-tone can be inserted into the screened film during any phase of the procedure, including the preparation of the opalines, and re-makes of the pages or the affected colours are rarely necessary. With continuous tone re-makes are generally essential and often call for considerable re-adaptation.
- wastage during preparative stages is almost negligible and treatment time is very limited when using line or lith films for dot formation.

Numerous other small phases contribute to render offset preparation more economical, not least dry-etching, an

automatic programmed retouching system distributed by Agfa Gevaert. This avoids manual intervention when carrying out colour corrections on the films.

Comparative studio between the two systems of preparation has shown that the offset system costs about one third of the rotogravure system.

Printing:

The cost of preparing offset plates or rotogravure cylinders is normally included in printing costs. This is also true of paper. Machine speeds of the most advanced offset and rotogravure presses differ only by a few thousand revolutions per hour. It follows, therefore, that the advantage of one system over the other depends solely on the run and/or the number of pages the publication contains.

If we consider the number of pages possible for an offset product to be 32 or 64, a run of over 500,000 copies is necessary to compensate the extra costs involved in conventional rotogravure, since printing is the only stage where rotogravure offers advantages.

These advantages are:
- 4.5% less wastage compared with the 8% for offset
- slighltly higher speed
- the possibility of using cheaper paper
- use of the same printing form for millions of copies.
- etc. etc.

In addition rotogravure is a less complex system which needs few controls and production quality is more consistent.

The figures given previously are based on the number of pages contained in the standard UNI A4 format obtainable in offset. Most machines are capable of printing up to 32 pages and a few of the latest models

can print to 64 pages. In rotogravure 80 pages are normally possible and it is at this point that costs are rapidly reduced. However, a large part of the market is composed of 32 and 64 pages publications, many of which have runs under 500,000. The only hope of rendering rotogravure competitive is to reduce pre-print costs to bring them into line with offset. This can be achieved by using the offset system for preparation and than converting it to rotogravure, by producing the highest possible quality at the lowest possible price. This must surely be the aim of any company.

In synthesis, here are the principal advantages:
1. The unification of reproduction systems at the most economic and reliable levels.
2. Considerably lower production costs.
3. Improved quality and quality control with pre-proof systems prior to cylinder engraving.
4. The possibility of using partial or complete colour separations for the offset printing of low-run, pubblicity off-prints.
5. Greater exploitation of electronic separation and integrated systems (as well as improved use of memory).
6. More efficient utilization of productive capacity, particularly with the use of daylight film and automatic methods of premounting and final mounting directly onto the mat film (the retoucher can carry out phases normally executed by photographers or mounters).

Other advantages may be obtained but these are dependent upon how the system is handled by individual companies.

Future prospects for the system

I am convinced that within a short space of time developments in conversion systems will involve rotogravure at a worldwide level. Continuous tone film will disappear because its production will no longer be

profitable. Consumption of light-sensitive material generally will considerably decrease, with the elimination of the various photographic stages using continuous tone material and the tendency to eliminate one of the two photographic stages involved in engraving. The film utilized for separation will be used directly on the Helioklischograph. This will be possible as soon as the integrated systems are able to produce a satisfactory chemical proof. At this point it is not difficult to foresee a time when a chemical proof will be obtained and engraving carried out straight from the data recordered on magnetic tape.

From this we can deduce that the eccessive development of a system can sometimes lead to its becoming obsolete.

I do hope that I have been neither two optimistic nor too pessimistic and, above all, I hope that I haven't bored you.

Thank you very much for your attention.