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The state of the art in digital engraving

The engraving of packaging gravure printing cylinders has undergone dramatic changes in the past few years. Film originals have more or less become obsolete, and engraving from data has become standard practice. The latest engravers take full account of this trend, and have become pure "recorders". At the same time, a large proportion of the functionality of the engraver has been passed to front-end devices. A range of new developments has allowed the productivity of the HelioKlischographs and the quality of the gravure cylinders to be increased considerably.

Hardware and software

The latest generation of HelioKlischographs combine the proverbial reliability of these machines with cutting-edge technology. They are controlled by the Windows NT operating system on standard PCs. Peripherals such as external storage media or networks are also based on standards like optical disk or (Fast-) Ethernet. In addition to the PC, which acts as an operating station, an operating display on the engraving carriage also assists in setting up the machine. All the machine-specific electronic components are constantly monitored, and status reports are stored in log files. The service center can perform remote diagnosis and software updates via modem. All these features serve to simplify operation and maintenance.

Input now almost entirely digital

Nearly all new jobs are now engraved without film. It is only when processing follow-up jobs that film still comes into play as a data medium. As a consequence of this, the HelioKlischograph K500 has been designed as a pure output machine. Where films still need to be scanned, large-format scanners equipped with a facility for electronic descreening are used. The scanned data is then treated in exactly the same way as data created directly on an electronic production system.

Data is transferred to the engraver by data medium or online via a network. The network method is becoming more and more popular. Instead of the large number of data media required in the past, a central engraving server is now used. In the same way as for the hardware and software, a standard is also used for the engraving data format. And just as PostScript and PDF have become established as output formats for imagesetters, so the TIFF format has become the standard engraving data format in gravure printing. The advantage for the user is clear – he is not confined to one manufacturer and has flexibility in his choice of production equipment.

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Complete form processing

The advent of direct engraving from digital data also had another important repercussion. A large proportion of functionality, such as repeating and copying of single repeats to create the complete form, is being moved from the engraver to the front-end system. This benefits the user greatly, since it means that the process of assembling the cylinder layout is now under complete visual control. TIFF data is generated on the front-end system, and then engraved on the HelioKlischograph on a 1:1 basis. A high-performance proofing system, such as the HelioFormproof, which can be used for both in-house checking and communication with the customer, helps to enhance production reliability even further. The ROOM concept (Rip Once, Output Many) was already being used in gravure printing when it was still unheard of in the world of PostScript. It means that the complete form only has to be calculated once. The same screened data is used for proofing and then engraving. The fact that the front-end devices also use standard hardware components like Apple Mac and Windows NT PCs is also proof of the high degree of standardization which has been achieved.

Job preparation

The use of specialist job preparation software has considerably reduced makeready times for HelioKlischographs. All the engraving parameters can be defined in advance on upstream stations, which can be either Apple Macs or NT PCs. These parameters are then transferred to the HelioKlischograph using a parameter file called a job ticket. Depending on the configuration of the engraver, the setup process can be reduced to simply inserting the cylinder. And even this step can be eliminated in future, as we shall see in a moment. There are obvious advantages of this job preparation concept. As well as saving time on the HelioKlischograph, engraving expertise is also centralized. In practice, this means that only a few trained staff are required in the job preparation stage to control the engraving process and that the demands placed on the machine operator are considerably reduced. The job preparation process also assists in drawing up the machine usage plan, since precise engraving times for the individual cylinders are known in advance. Two further examples will demonstrate how the job preparation concept enhances production reliability. The gradations are now managed centrally in the job preparation process and transferred to the Helio in the job ticket. This reduces the risk of gradations with the same name but different content being located on different engravers. Comments can also be attached to the job tickets during the engraving job preparation phase, giving the Helio operator special instructions about an engraving job, for example.

Automated cylinder mounting

These days, hollow and axial cylinders are usually loaded using a pivot mount or jaw chuck. An elevating platform can be used to assist in clamping. In manual mode, the operator places the cylinder on the elevating platform. Height adjustment and cylinder clamping are then performed automatically. In fully-automatic mode, the elevating platform takes the strain off the crane, since the time-consuming process of precisely positioning the cylinder and clamping it into place is now performed inside the engraver. All the crane has to do is place the cylinder onto the elevating platform, and does not need to position it precisely. In fully-automatic mode, it is particularly useful to be able to check the dimensions of a cylinder. For this purpose, the K500 is equipped with cylinder measuring facilities. The actual dimensions of the cylinder are compared with the target dimensions contained in the job ticket.

Automatic Testcut

The geometry of an engraved cell largely depends on the “classic settings” for the engraving process – i.e. slide foot setting, vibration amplitude, engraving current for highlight and shadow, midtone correction, the amplitude of the image signal modulated onto the engraving frequency, and the ratio of the engraving frequency to the circumferential speed of the cylinder. Other factors also influence the result. These include the quality of the copper, the type of engraving head and the condition of the engraving stylus. In order minimize the effect of these external factors and to achieve reproducible cell geometry, the engraving control signal must be calibrated. This involves performing a test engraving run in which cells are engraved with prescribed cell geometries and then evaluated for purposes of calibration. In the past, this procedure used to be performed manually. It can now be fully automated using the CellGuard system. The benefit of this is that the Testcut becomes independent of the operator, which improves the reproducibility from one cylinder to another and reduces the operator's workload.

Faster engraving

Since the introduction of electromechanical engraving over 30 years ago, the engraving speed of these machines has barely changed. And yet engraving speed is the decisive element in the productivity of an engraver. Until 1998, an engraving speed of approximately 4000 cells per second was the standard. Only the HelioTwin method of engraving two cylinders in parallel on one machine bed was capable of ensuring a sustainable increase in the productivity of an engraver. Engraving from data also made it possible to introduce automatic fast crossfeed. This function examines the engraving data for white areas and automatically passes over the relevant lines in fast

crossfeed mode. In practice this achieves average time savings of 20 – 30 %.

Engraving can be performed in polar line or helical formation. While the polar line method delivers higher quality results, helical engraving delivers time savings of 20 – 30 %.

The performance of the engraving head itself was enhanced for the first time with the introduction of the HelioSprint system in 1998. HelioSprint almost doubled engraving output in one fell swoop. While most manufacturers are now claiming enhanced engraving output, only the HelioSprint system has proven its worth on a broad basis in day-to-day operation with over 500 installations. And this new engraving head not only offers enhanced engraving speed but also improved engraving quality.

Improved quality

Engraving quality depends on a whole range of factors. The first is the quality of the input data, which used to be in the form of film originals but is now digital data. The second is the calibration of the engraver, which involves a Testcut. Next come the physical properties of the engraving head, which transfers the information to the cylinder. And the final factor is the quality of the copper, which is very important. However, the engraving cylinder itself is only a means to an end, and when all is said and done the really important thing is the finished printed product. The print-specific features are taken into account in the engraving gradations.

Input data
When film was eliminated as a data medium, the disadvantages of this medium were also overcome. The main problem was the elimination of dust, which was a problematic factor. A series of error-prone process steps involving film were also eliminated – namely output, copy, stripping and bromide production. As problems have been overcome, it has become more and more important to prepare the digital data in a way that best serves the printing process. The creation of engraving data requires specialized, quality-determining processes, involving techniques known as anti-aliasing and digital filtering.

Testcut
The Testcut has already been placed into context above. In terms of engraving quality, it should be remembered that automatic Testcut systems like the CellGuard system make the engraving result independent of subjective influencing factors.

Engraving head

The physical features of the engraving tool include the quality of the stylus, the burr cutter and the slide foot. As long as the copper continues to be processed mechanically, the processing tool will be subject to wear and tear, even if it is as hard as diamonds, as it is in electromechanical engraving. So here it is just as important as ever before for the operator to keep a close eye on things! The physical features also include the transfer performance of the engraving head. In this area, the HelioSprint engraving head has features capable of sustaining enhanced engraving quality. During the engraving process with HelioSprint, edge cells are drawn towards the contour. In the direction of engraving, this effect is useful for both the entry cell and exit cell. Drawing the edge cells towards the contour in this way, a process known as cell shifting, creates smoother edges on the contours in print. This counteracts the saw tooth effect typical of gravure printing. The cell shifting effect is facilitated by the fact that the mechanical system of the engraving head is optimally adjusted to a newly developed engraving amplifier with integrated digital signal processing function. HelioSprint engravers can also deliver enhanced printing density thanks to their improved cell geometry, which permits a deeper cut than other engraving heads can achieve.

Copper

The quality of the copper is achieved by electroplating technology and mechanical surface treatment. In this area, a quality standard which provides an excellent basis for high-quality printing results has been reached.

Engraving gradations

The printed image created by a gravure printing cylinder is influenced by the printing ink used, the printing stock and the printing press itself. The printing performance also depends on the screen and the screen angling chosen. All these factors affect the transfer performance of the cylinder, and adjustments to take account of them are made by engraving gradation. Creating the gradation is equivalent to calibrating the transfer route from the cylinder to the printing stock. While the know-how behind creating gradations is straightforward, the creation process itself is relatively time-consuming because it encompasses the printing process. Many companies therefore keep their gradations a secret.

A new function – sequential engraving

Processing complete forms in conjunction with job tickets has enabled the introduction of sequential engraving. Sequential engraving involves performing several engravings in succession on one or two engraving cylinders in a single operation. Although the result of a sequential engraving operation can also be achieved through individual engraving operations,

sequential engraving combines the partial engravings, which means that the HelioKlischograph can operate unattended for a longer period of time.

Sequential engraving on one cylinder means that a cylinder can first be engraved with a fine screen for fine text and barcodes and then with a large screen for images. The advantage of this method is that it is not necessary to engrave the entire cylinder using a fine, time-consuming screen; a large proportion of the cylinder surface is passed over using fast crossfeed.

Sequential engraving on two cylinders allows two cylinders to be engraved automatically one after the other. This requires an engraver which can take two cylinders. The first cylinder is engraved and then the engraver automatically positions itself on the second cylinder and engraves that one too. This method is useful for performing lengthy engraving jobs during an unattended night shift.

Digital engraving – what's the outlook?

In the past few years, the development of packaging engraving has been dominated by the widespread introduction of filmless engraving. At the same time, the development of a series of new functions has sustainably enhanced the cost-efficiency, quality and ease-of-use of engravers. In the future there are two trends to watch.

Firstly, more and more solutions for specialist jobs will become available. At the moment, for example, the laser method is becoming increasingly popular for high-quality products like cigarettes or securities. A distinction is made between direct laser treatment and the laser ablation mask system.

Secondly, there is a trend towards fully-automated production, particularly in industrialized countries. The prerequisites for this are already in place – fully-automated electroplating lines, engraving from data, and automated engravers. The first fully-automated engraving projects have already reached the implementation stage at HELL Gravure Systems. These projects use different types of cylinder loading system. Depending on the application, cylinders will be loaded into the HelioKlischograph by ceiling crane, grip-arm robot or directly from a magazine.

The competitiveness of gravure printing, particularly vis-à-vis low-cost processes like flexographic printing, will largely be determined by printing form production. But the developments of the past few years and the emerging trends are well placed to secure the position of gravure printing in the production of high-quality printed matter.

Figure 1: The simple entry-level configuration for digital printing – layout station and engraver

Figure 2: Fully-automated engraving from data – the HelioKlischograph K500

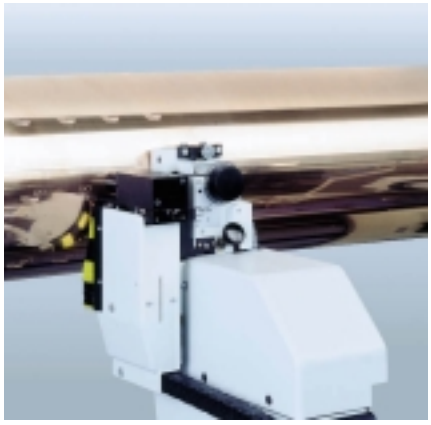

Figure 3: The CellGuard camera system and the HelioSprint high-performance engraving system

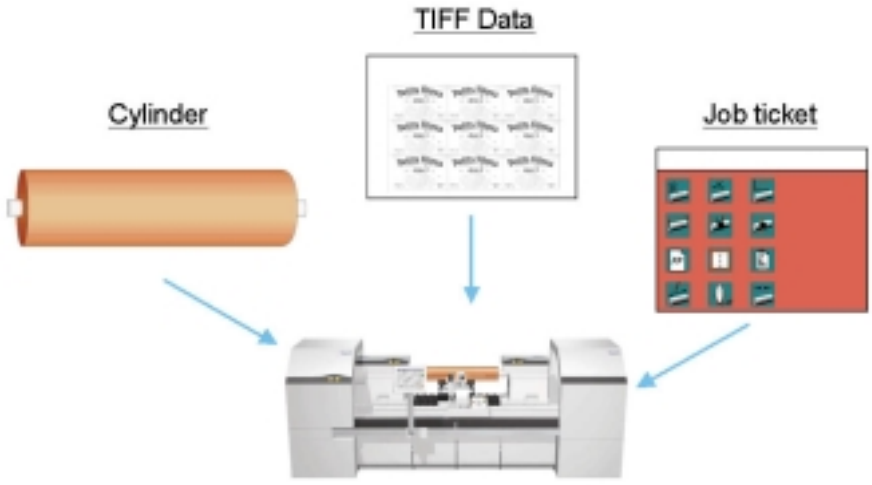

Figure 4: Controlling the engraver using job tickets cuts makeready times

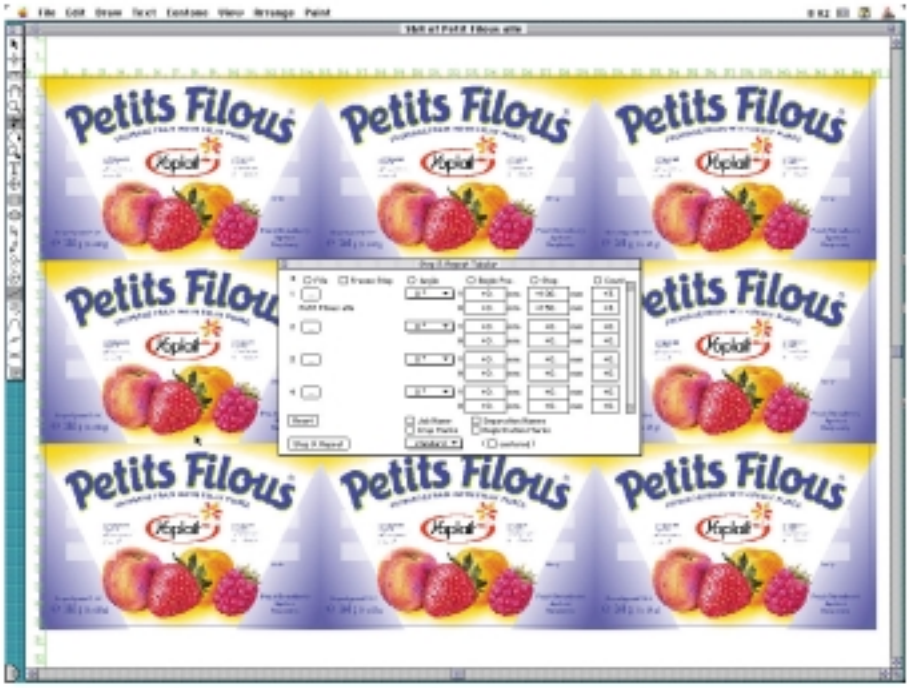

Figure 5: The cylinder layout can be assembled conveniently on the front-end device