NEW HARDWARE AND SOFTWARE FOR THE CHROMACOM ELECTRONIC PAGE MAKE-UP SYSTEM

PROOF-RECORDER CPR 403 - HARDCOPY OUTPUT

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Abstract: Page-make-up systems increase their part of reproduction work from the original to the printing form. Less separation film material is necessary, the number of intermediate steps is reduced. But a total electronic system needs proof possibilities before preparing expensive printing forms. This is done by the proof-recorder CPR 403, which exposes photographic colour reflection material from digital data stored on magnetic disc. The printing conditions are adjustable. In addition new hard- and software packages for Chromacom-systems are described.

With the new peripheral unit of the HELL-page-make-up system - the Chromacom Proof Recorder CPR 403 - it will be possible for the first time to generate a colour-proof

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directly from digital picture information. This colour proof will be very similar to the final print by having a high resolution on a large recording size. The proof-recorder is a successful example for a high technology integration of laser's and "robotics" with an automatic computer-controlled process and it will increase the productivity of the complete page-make-up system.

Electronic page-make-up systems are adapting a constantly increased portion of work within the colour reproduction technic. This is because the number of intermediate steps and consequently consumption of film material from the original up to the final product can be reduced considerably. Further advantages against the conventional methods are the multiple possibilities of the software for the electronic picture-combination, -retouching and other-manipulations which are continuously improved and extended by new functions.

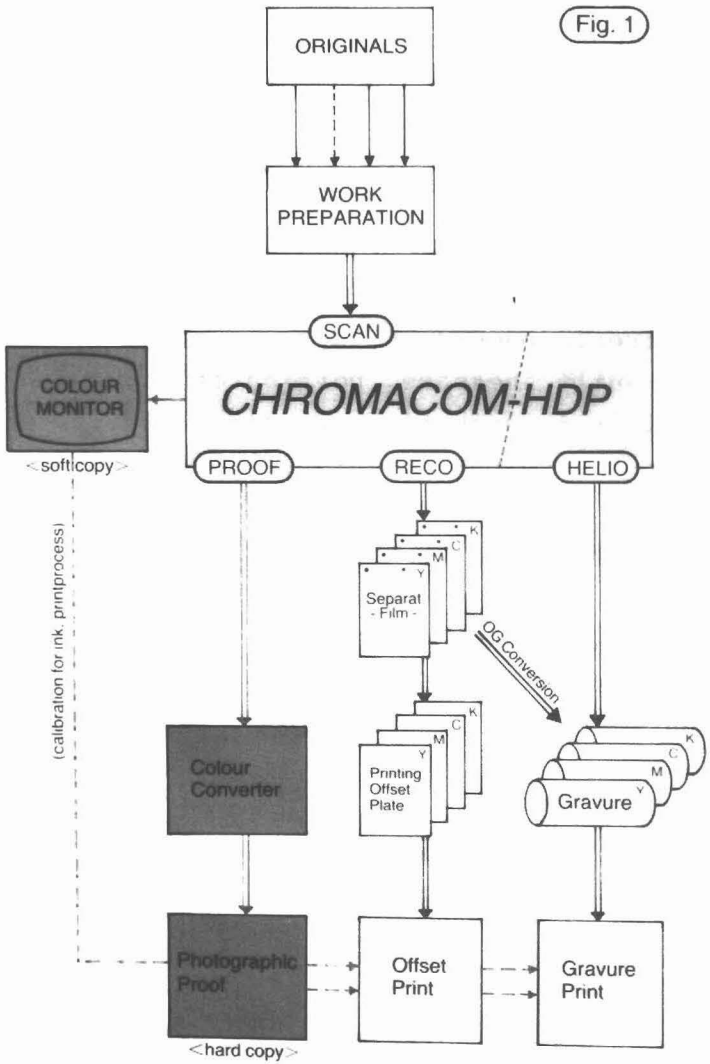


Fig. 1
ORIGINALS
WORK PREPARATION
SCAN
COLOUR MONITOR
CHROMACOM-HDP
<softcopy>
PROOF
RECO
HELIO
(calibration for ink, printprocess)
Separat - Film -
DG Conversion
Colour Converter
Printing Offset Plate
Gravure
Photographic Proof
Offset Print
Gravure Print
<hard copy>

Within the complete Chromacom-system (see Fig. 1) consisting of a scanning station - the digitizing input for the different originals, preferable by help of a work preparation stage - the Combiskop, final page processing station and recording station so far there is only a visual control of digitized pictures in form of a so-called "soft-copy". The expected print is simulated on a colour monitor, which is a necessity for an effective operation of the Combiskop, but with obvious limitations for the complete reproduction sequence:

a) the colour picture cannot be stored and handled directly (for instance for an internal or even an external customers approval of the reproduction work),

b) when displaying the total layout of larger formats, the geometric resolution is not comparable to the print - even not when using 512 x 512 picture elements or 2 times more for the monitor display,

c) no display in the final size, therefore the picture valuation can be changed by physiological effects depending on size and surroundings,

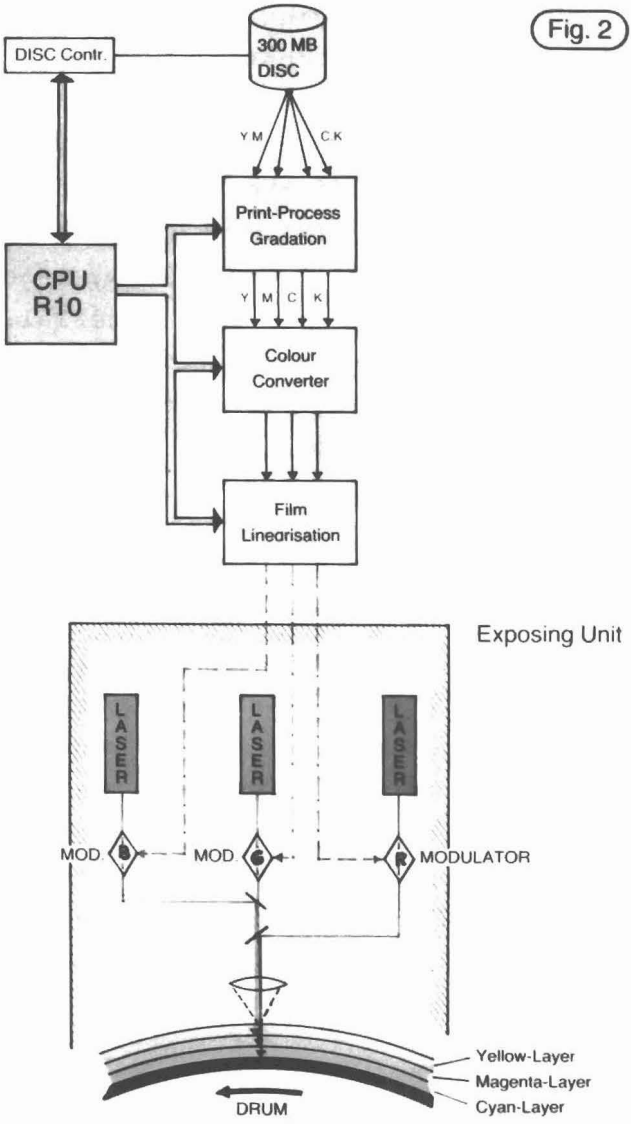
d) glance, brightness and other surface conditions of the printed paper cannot be simulated.

In order to get a hard-copy output with the a.m. conditions the control procedure used today, requires either the exposure of a colour-separation-set to generate a manual proof like Cromalin, Ciba, 3M transfer key, etc. or even the far more expensive procedure of producing printing forms for a subsequent press proof. With the proof-recorder it will be possible at least to carry out the first step - production of a pre-proof - automatically without recording colour separations.

For the exposure of colour pictures we use photographic colour reflection material, which is selected in regard to its colour- and surface conditions. The colour picture is recorded in a continuous-tone mode, without any screen structure. The colour calibration for the respective print result in gravure or offset will be programmed individually for all primary and mixed colours in a colour converter.

The function procedure of the CPR 403 can be seen on Fig. 2. The digitized colour separation data (Y, M, C, K) we get from a 300 MByte disc pack are passed through the following stages:

Fig. 2


DISC Contr.
300 MB DISC
Y M
C K
Print-Process Gradation
CPU R10
Y M C K
Colour Converter
Film Lineorisation
Exposing Unit
LASER
LASER
LASER
MOD.
MOD.
MODULATOR
Yellow-Layer
Magenta-Layer
Cyan-Layer
DRUM

1. A gradation stage for adapting to the respective printing gradation including engraving or copying gradation (for example dot-gain characteristic).

2. The colour converter provides the transformation of the gradation formed printing values (Y',M',C',K') to the proof densities of the yellow, magenta and cyan dyes of the film material. By digital means the respective printing inks, printing paper, photographic dyes and the theoretical principles of colour mixture - mainly substractive colour mixture for photographic materials and too for gravure, modified Neugebauer equations for offset printing - will be taken into account. Black separation signals are converted in respective R, G, B-signals, therefore the amount of UCR (= under color removal) has no influence on the proof - if there is no difference in the prints either. Calculated transformation tables are stored and can be called up by the Central Processing Unit (CPU).

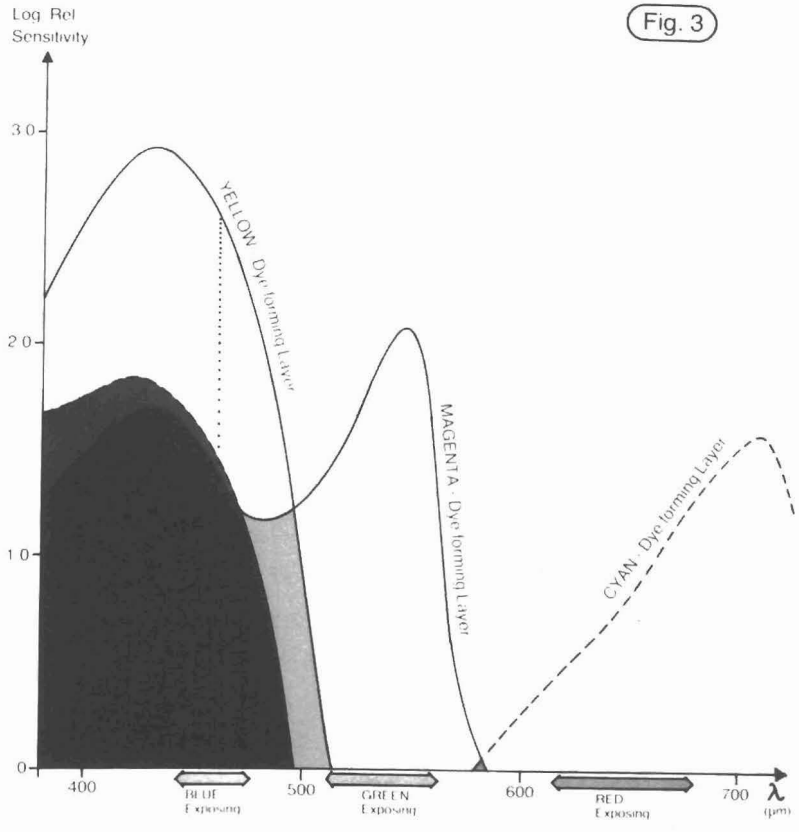
3. In the following three channel film linearization stage we get signals for the amount of red, green and blue laser light. Instabilities due to colour film

emulsion changes and colour processing are compensated. After having measured the automatically exposed colour control scales the adjustment of the film linearization will be done very fast and easy via the terminal/keyboard.

The hardware-control for the exposure will be performed with three single modulators within the recording unit. The recording unit also contains the HeNE and Ar^+-lasers which generate the required red, green and blue wavelengths. The output beams are combined by mirrors and beam splitters and finally expose simultaneously via a lens the colour film mounted on the rotating drum. For better laser light stability light control and feed back circuits are integrated. Pre-adjustments in order to get desired maximum light values - for different film material or recording resolutions in the range 80 L/cm up to 200 L/cm - could be made by micro-processor control. The adaption of the lens for different line widths is done in the same automatical way. Because of the simultaneous exposing of all three colours there is no register problem. The new direct laser beam recording reduces the rest of line structure in homogeneous areas, therefore the quality of the proofs is comparable to normal continuoustone photographic originals.

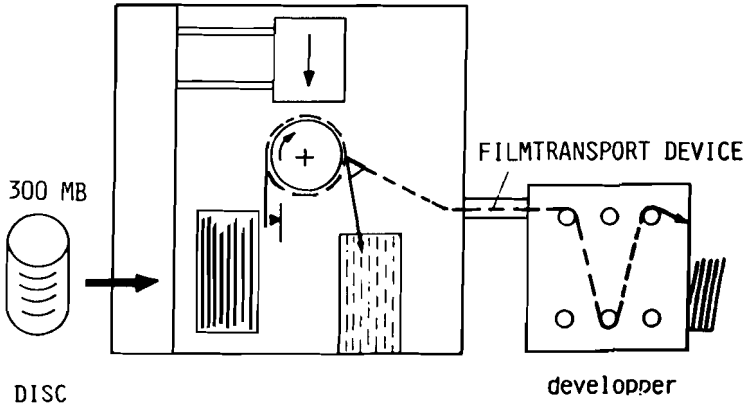
Advantages of laser light are - as well the high radiance for use of low sensitive colour film material - as the discrete spectral emission wavelength, helpful for a very selective stimulation of the yellow, magenta and cyan-dye forming layers.

Typical spectral sensitivity curves of a negative material are shown in Fig. 3, together with the optimal wavelength range for the red, green and blue laser output.



Typical Spektral Sensitivity
(NEGATIV - PAPER)

The whole proof station (see Fig. 4) consists of a 300 MByte disc drive, a R 10-minicomputer, a terminal with floppy disc drives, the colour recorder itself and an on-line colour film processor unit, that will be delivered by HELL directly. It is a day room unit with film loading cassette system for a capacity of max. 50 films from 300 x 400 mm^2 formats up to a usable size of 735 x 540 mm^2. Opening of the cassette, picking-up one single film, punching the register holes, mounting on the drum, recording, detaching and transporting the exposed film via a rubber-roller-system into the processor unit is done without any operator by microprocessor control. As an alternative a second cassette for picking up the exposed film can be used, if someone wants to use his own separate processor unit in a dark room.



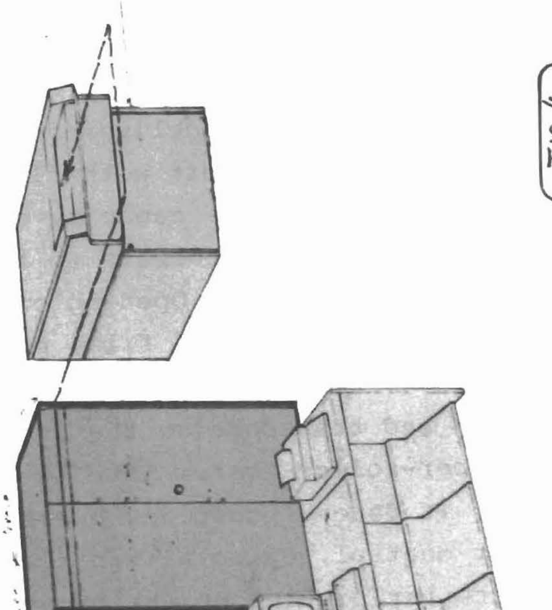


Fig. 4

For the negative colour reflection material we use at present, we get a dry proof after 15 min. processing time. The recording time for a DIN A4-size is about 4 min. (or 10 min. for the maximum format) at 120 lines/cm, that's our resolution for a 60 L/cm screen ruling. Other colour materials are in test or will be tested, especially new developments in the field of instant film and image transfer type material with considerably less complicated processing - even in shorter time-are of high interest.

A most important criterion for the selection of colour material is the colour gamut, that should cover the equivalent printing colour space. If the saturation of the single dyes in the proof material is sufficient, there is no problem to adjust the colour converter for getting equality between print and proof colours. In general a correspondence between dyes and printing inks is not required. A comparison for the primary and secondary colours of an offset print with standard European inks and two different proof materials is shown in a CIE chromaticity diagram (Fig. 5), but without the different brightness values. Similar research work was made some years ago by Mr Ward to compare a BURDA-ink colour space with the Kodak 37RC-material see ERA report May 1975). Later on similar colour metric comparision

between Cromalin-proofs and prints have been reported by GRI and TAGA.

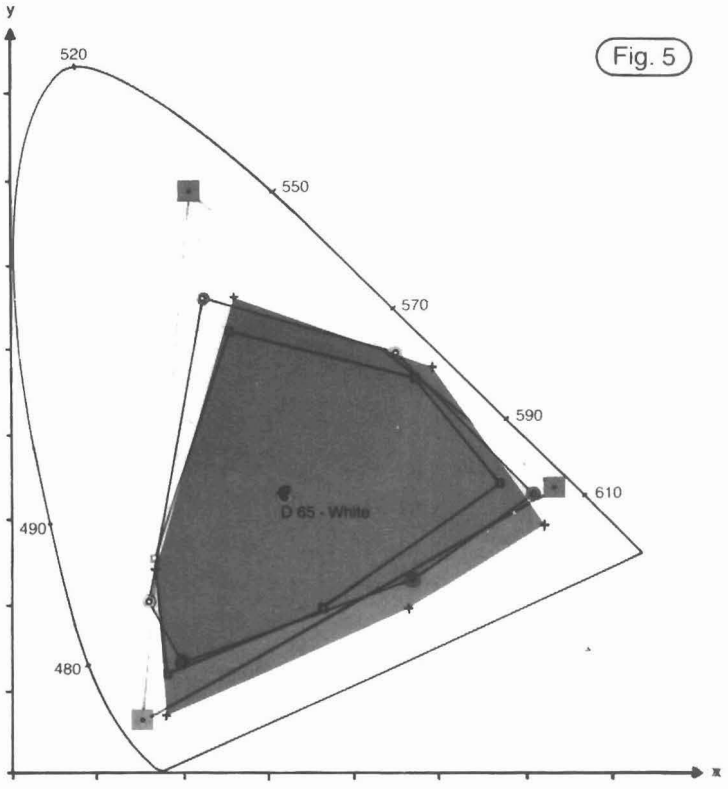


Fig. 5

CIE – x,y – Chromaticity diagram

PRINTING INKS (Offset: EURO-standard)

PROOF

PROOF

COLOUR MONITOR PHOSPHORS (special)

Referring to Fig. 5, you also can find the chromaticity coordinates for the phosphors of the colour monitor, HELL is using now in the "soft copy"-units Combiskop and Chromaskop: with these phosphors the printing colour gamut is covered sufficiently.

Because of the good continuoustone photographic quality of the proof another application - exceeding the actual proof production - could be the direct production of second originals, obligatory on the print process and with all electronic picture-correction, - manipulation and - combination possibilities of the Chromacom-system.

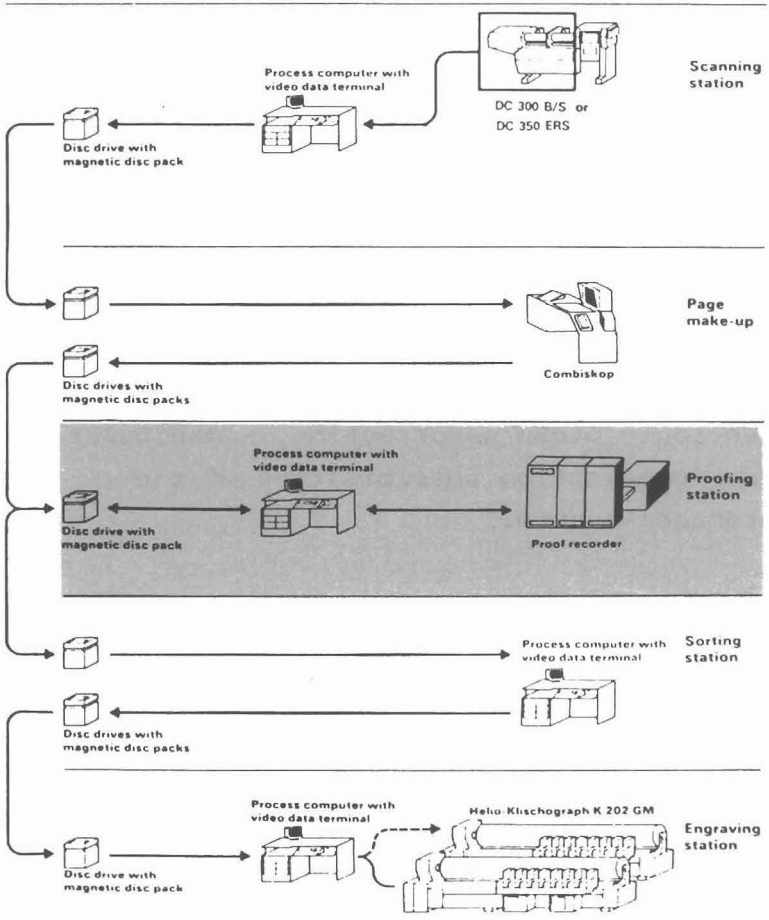
Also, recording on colour transparencies in order to get duplicates in nearly poster sizes is possible.

For the integration of the proof station into a HDP-system see Fig. 6: proofs can be recorded from a completed page as well as from just scanned single pictures. Dependent on the size, multiple recording of the same picture - also in circumference direction - could be programmed.

Particularly with an important innovation for the Chromacom system, the so-called integrated system, the proof recorder could be used in a much more profitable way. Within this new system

(6)

Gravure application



each of the different stations (Scan, Reco, Proof, Sort, Combiskop) can be combined with selectable disc drives or the new 6250 bpi magnetic tape stations. The inconvenient disc pack transport from station to station will then be avoided.

Furthermore HELL presents two new recorders for exposing continuoustone and screen separation films:

The CR 401 is a black/white-recorder for colour-separations with similar data as CPR 403, but an additional electronic screening and a new direct laser recording device with an excellent resolution.

The CR 402 records on large film formats (max. 1120 x 1285 mm^2) and is originated from the CP 340 S omitting the scan part. By help of a sorting station a final page film for the whole area of the printing form can be recorded to reduce imposition costs.

For further increasing productivity of the Chromacom-system we present an off-line work-preparation-unit, consisting of CPU, terminal with a function key board as in the Combiskop, digitizer and graphic colour display. With this "lay-out-programmer" a lot of parameters and commands for Scan, Reco and Combiskop-stations can be prepared and stored on floppy discs for later use in the different stations.

The important combination of pictures and text can be done in two ways:

a) getting the electronically generated text data out of a modified HELL-phototypesetting unit into the Chromacom-system.

b) scanning and digitizing paste make-ups by a new laser flatbed-unit (CN 420: with a resolution of up to 1000 lines/cm).