CAD PROCESSES

Javier Mira Peidro (*) Milagros Payá Sáez (**)
Ceramic Industries Research Association
(Asociación de Investigación de las Industrias Cerámicas)

SUMMARY:

Some of the characteristics that the tile exhibits, forming part of architectural tiling or acting as a base module for multiple combinations, allows it to benefit from the advantages of a CAD system.

This study attempts to show the present state of computerized graphic systems with applications for the ceramic paving and tiling sector.

Starting from the typical design process, the contribution that a CAD system can make to each stage of the process is examined, focussing principally on creation areas, the generation of photolithographs, and realistic representation of the finished piece.

(*) CAD Department, AICE
(**) Industrial Design, AICE

Both of the above teach in the AAOA School in Castellón, specialising in Ceramic Paving and Tiling Design.

INTRODUCTION

We can generally define design as the compromise that must exist between the function of an object and its appearance. Wucius Wong mentions some design characteristics: "In contrast to painting and sculpture, which are the realization of the personal vision and dreams of the artist, design deals with practical demands. (..) An industrial product must meet the needs of the consumer". It is not difficult to see that design includes all the activities that are involved in the creation process of an object, from the initial idea to the location of the product in its place of use.

At the time of industrial manufacture of a product, which will hopefully be accepted within a certain sector of the market, the need arises to give this product a shape, colour and finish that will be pleasing to the eye of the purchaser, and that will distinguish it from other products. If we combine this need with satisfactory technical characteristics and a suitable price, we will have produced a highly competitive article.

The optimum design process for obtaining sucessful products may be deduced. The following diagram shows this process divided into five blocks. Firstly, each one is described, analysing the contribution that a CAD system can make to it. Secondly, some images produced using a CAD system are shown. It should be mentioned that the enlargements of photolithographs were taken from negatives, since these give greater clarity than paper copies.

GENERAL DESIGN PROCESS

Definition of Problem	Market Research Characteristics of final product
Search for solutions	Analysis of existing solutions Technology Limits Application of creative methods Choice of alternatives
Project	Development (Outlines & sketches) Prototypes Prototype observations Modifications
Realization	Adaptations to plant Pre-series
Commercialization	Product launch Publicity

1-Definition of the problem

The first block summarizes the actions that must be undertaken in order to define the product profile. The first of these is observing the market with the aim of finding areas where supply is scarce or demand increased. It is also interesting at this stage to try out different market hypotheses, altering such variables as production costs, possible sales, or profit volume. This will allow us to define the final characteristics of the prooduct, as far as appearance and possible production costs are concerned.

The advantages of a computer in these studies can be deduced from the inherent characteristics of the machine: high computational speeds, diagrammatic presentation of data, etc.

2-Search for solutions

The second block includes all tasks involved in the creation of the product. This area is traditionally considered the domain of the designer. There are four distinguishable stages here:

1- Analysis of existing solutions. This consists of studying products that have been created in the relevant market, with the aim of forming a basis in the designer's mind that will serve as a point of reference and departure.

2- Technology Limits. The optimum product profile which we defined in the first block will be modified at this stage, since each company will have its own technical limitations. Viewing these limits objectively will allow us to make the most of available technology .

3- Application of Creative Methods. We must now start the search for an image that can be adapted to the final characteristics we wish to achieve. The application of a design method will act as a guide in this search; this basically consists of the methodical manipulation of an image. Each design team can create its own methods or make use of existing ones, using them as a flexible form that will yield a large number of solutions.

The use of a CAD design system considerably heightens the potency of these methods. The screen will act as the work surface, and the traditional pencils and brushes will be substituted by a cursor on the screen controlled by a graphic programme. Each point on the image will be defined by co-oordinates and a chain of numbers that correspond to each colour. This allows great ease of manipulation, since we are not working with physical elements such as pencil and paper, but with mathematical expessions that can be processed at high speeds by the computer.

We can observe the application of one of these methods in the adjoining slides. The process used is fundamentally based on the symmetry of the square. An isoceles triangle is taken as a generative module and the diagonals taken as axes.

The module is developed in two ways:

1- By rotation, taking the centre of the square as the centre of rotation. 2-By reflection, taking the diagonals of the square as axes.

This first manipulation resulted in two new modules, from which the one obtained by reflections was chosen.

This was combined with one of its variants and gave us an image of a 'damero' type tiled floor. Once again symmetries were applied, and scalings and copies of this image showed us what the final result could be. Finally a relief effect was generated onto the image using one of the graphic programme facilities.

4- Choice of alternatives. On seeing the results obtained on the screen, we can choose our definitive image.

3-Project

The project itself constitutes the third block. The idea chosen will be developed and a prototype constructed. To do this serigraph screens must be created. The results obtained from the application of CAD can be separated into colours and extracted from the system by means of a physical support such as a slide.

The work in the report was developed using this system. The device used to expose the film is capable of controlling 2732x4096 pixels. With the aim of optimizing this resolution virtual screens were used in the generation of the photolithographs. This basically involves working with an image of a larger size than the screen (4, 9 or 16 times larger). This notably increases resolution.

The slides obtained were enlarged using a reprographic camera, this provided the definitive photolithographs from which the serigraph screens were produced.

4-Realization

The fourth block involves the work carried out in the factory itself and adapting the production line to the new product.

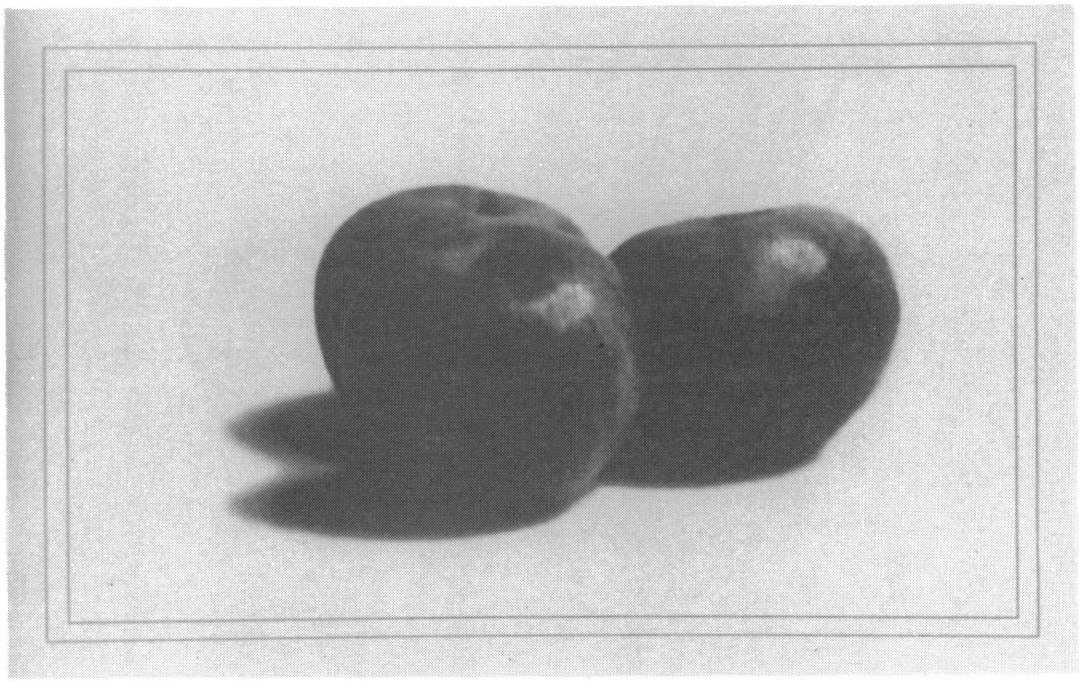
5-Commercialization

Finally there is the commercialization block that includes all product launching and publicity tasks. The latter can also benefit from the use of a CAD system. Modelling programmes allow for the creation of realistic images in which the designed piece can be placed in a three dimensional space. The resulting image can be shown to the potential buyer without the piece having been physically produced.

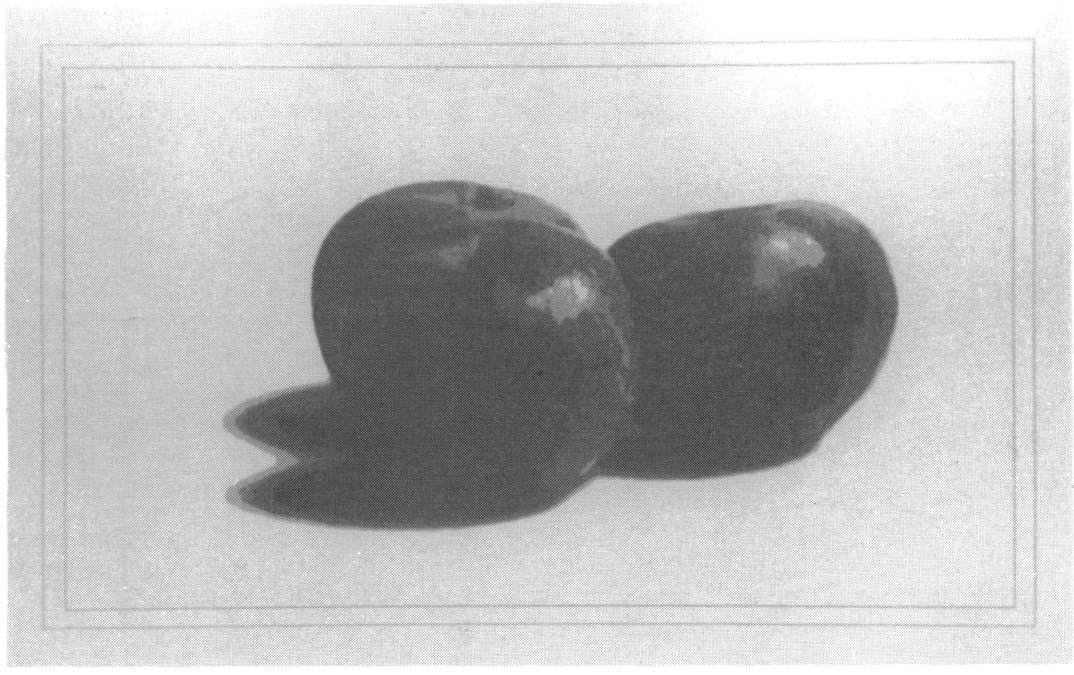
CONCLUSIONS

Some of the advantages that the computerization of the design process can bring to the ceramic sector are:

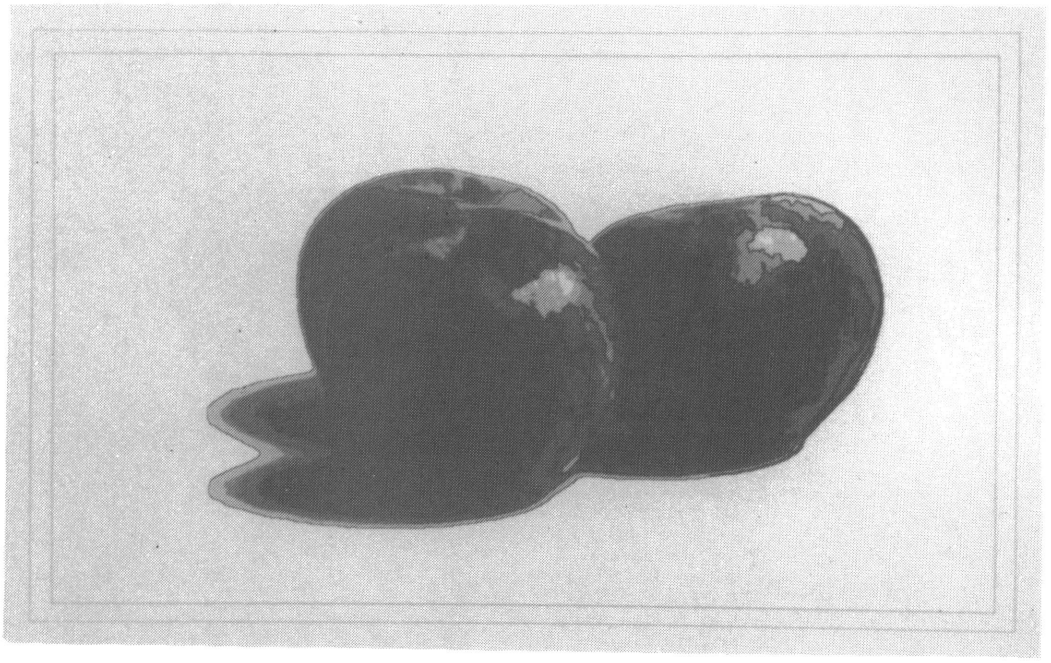
- More creation time, as routine tasks are carried out with speed.
- Reduction of the time spent in the creation of a design, which thus shortens the Idea-Project-Production-Commercialization cycle.
- Reduction of prototypes, since it is possible to visualise various aspects of the piece on screen, with the same end.
- Possibility of surveying the market before producing finished pieces.



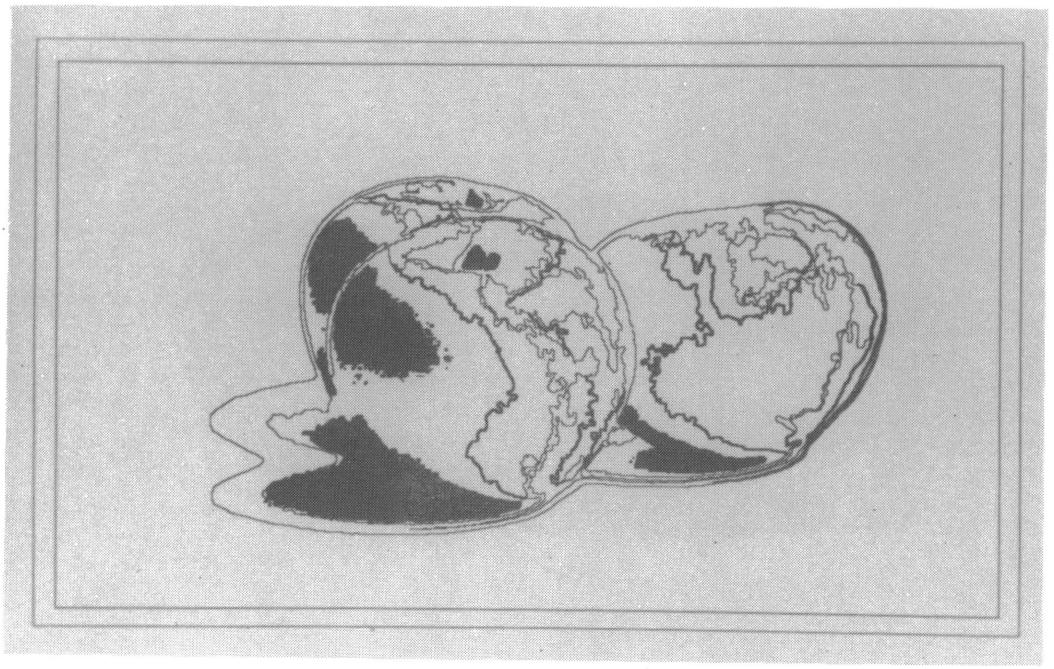
No. 1 - Image introduced onto the system using a 300 point/inch scanner.



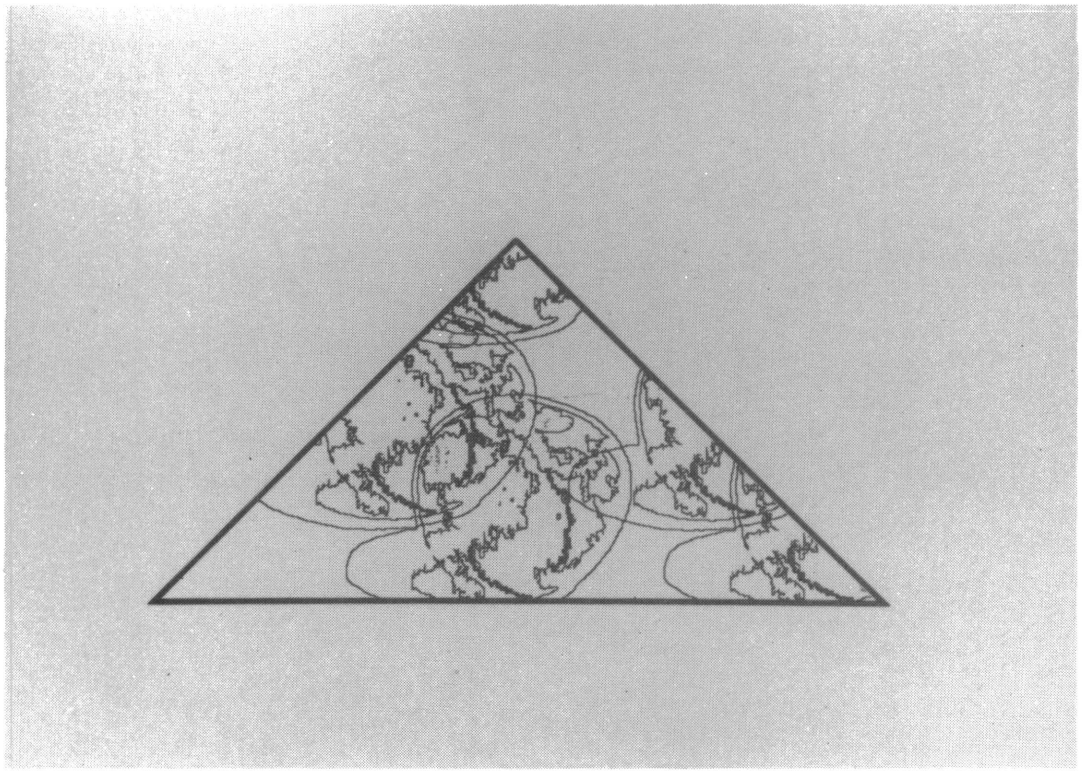
No. 2 - Subsequent view of image no. 1. This facility carries out a reduction in colours.



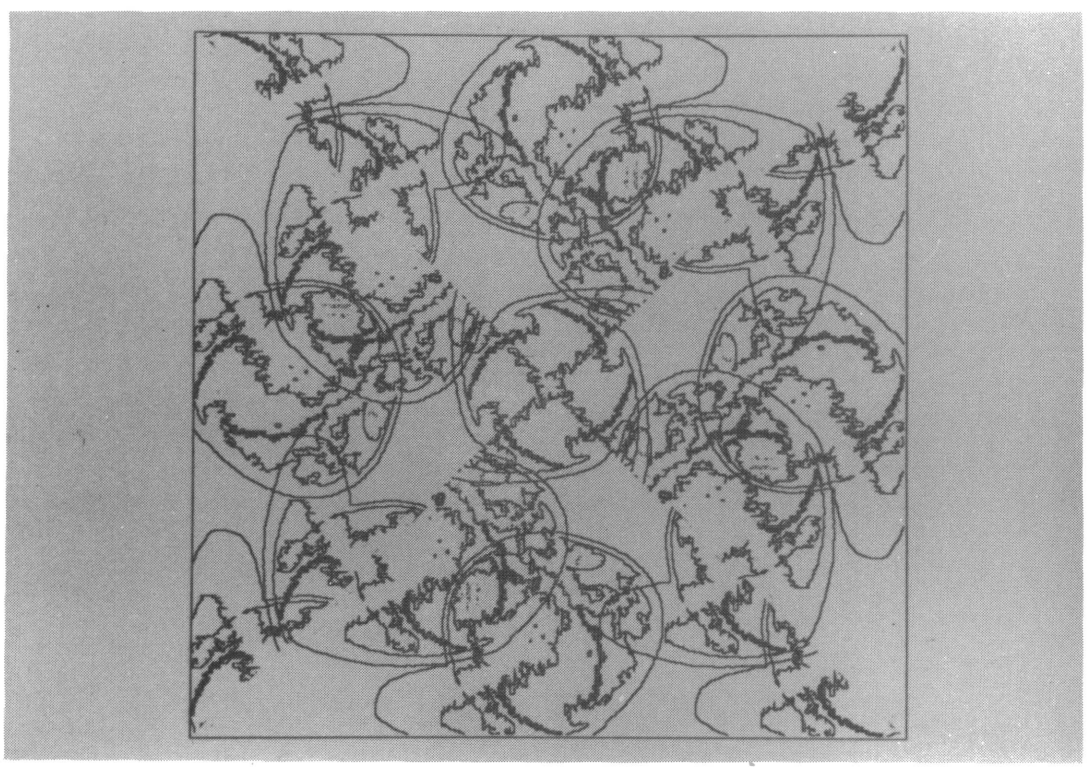
No. 3 - The volumes generated in the previous image are outlined in black.



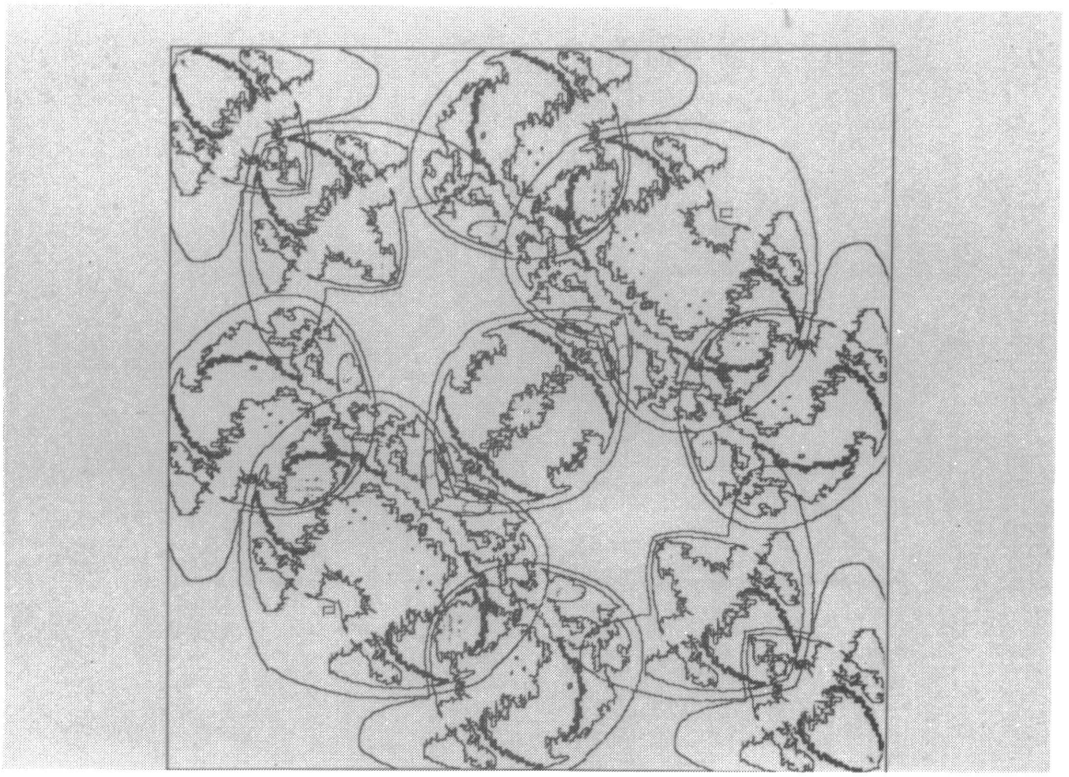
No. 4 - Elimination of all colours, except black.



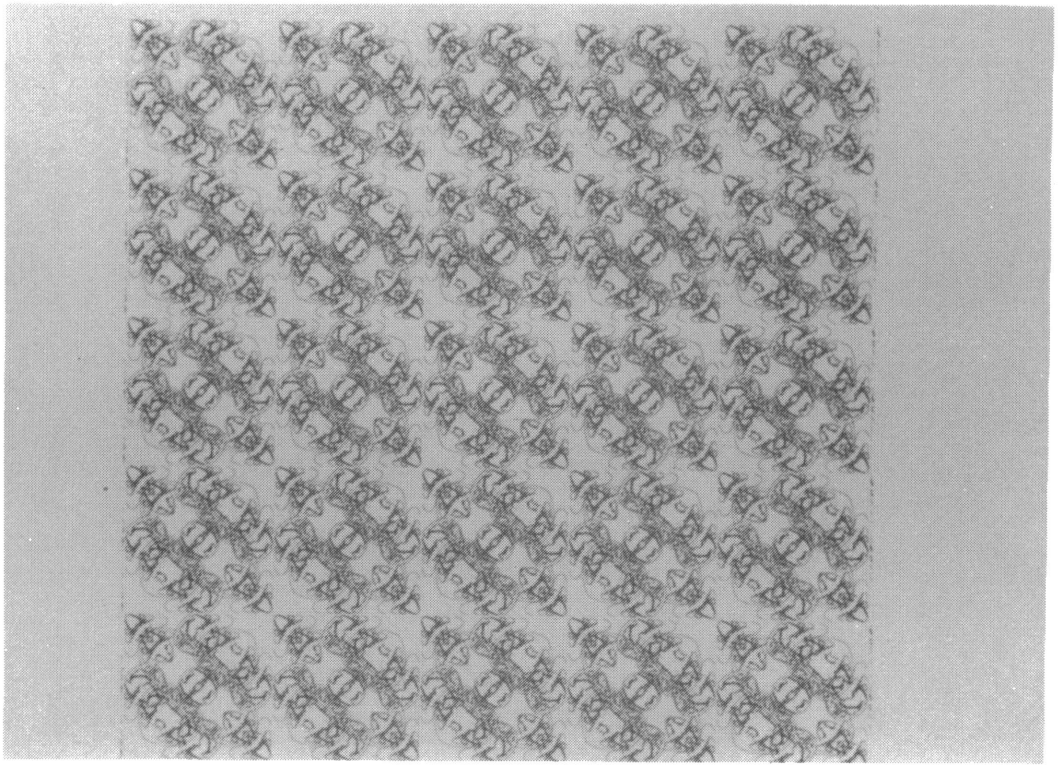
No. 5 - Composition of generating module.



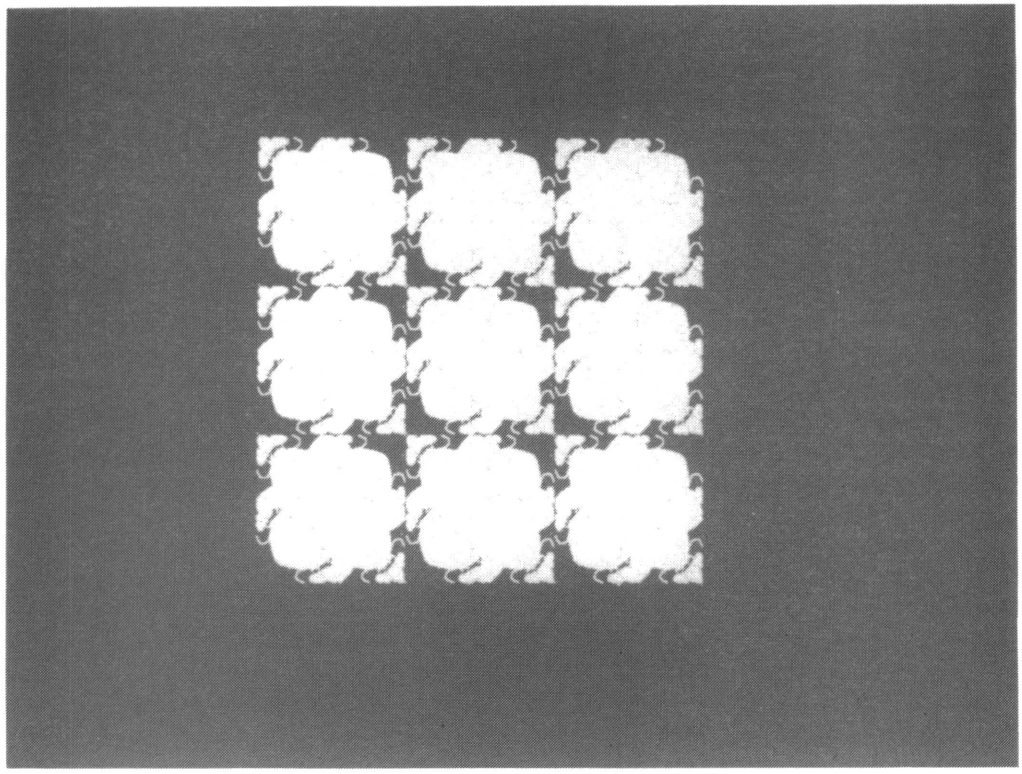
No. 6 - Development of module by rotation.



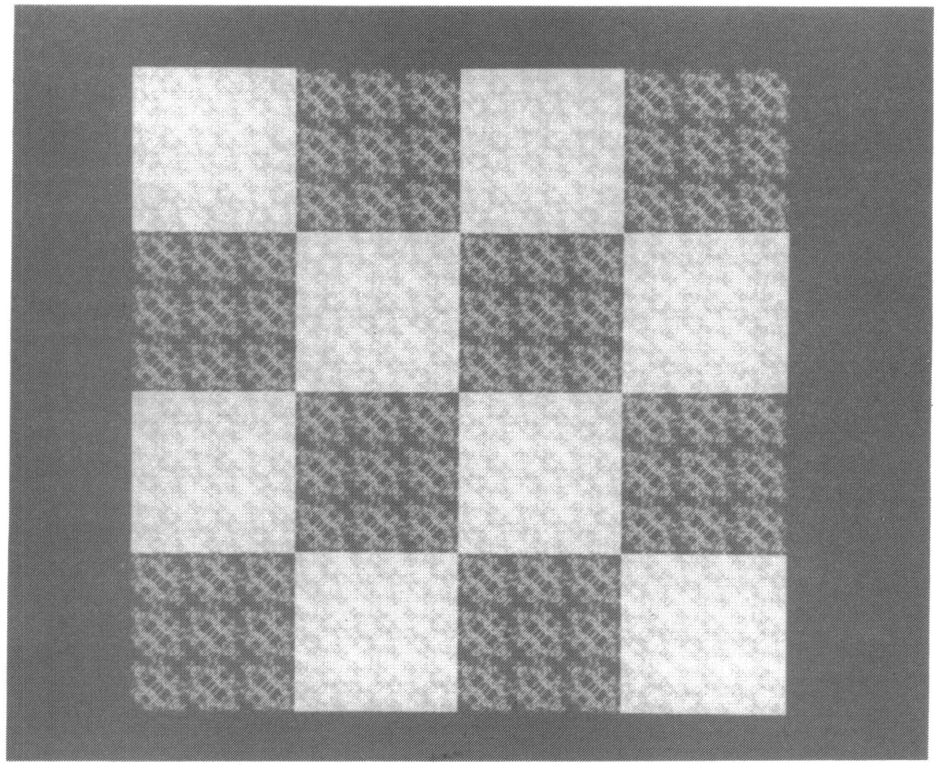
No. 7 - Development of module by reflection.



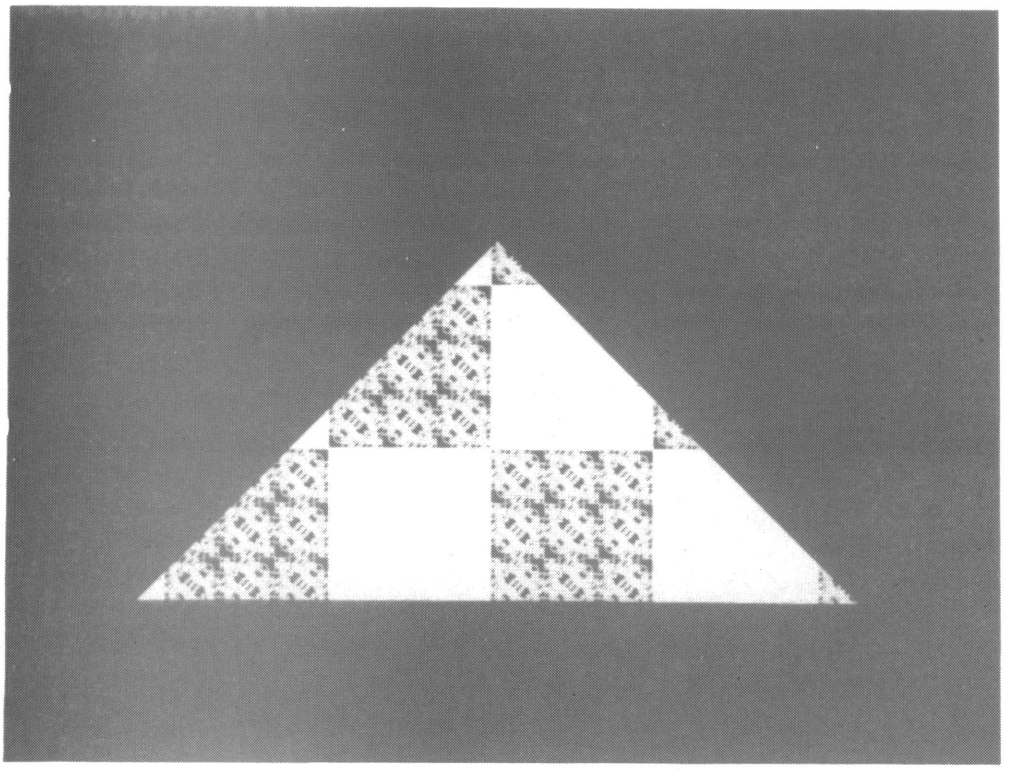
No. 8 - Reduction and duplication of the image.



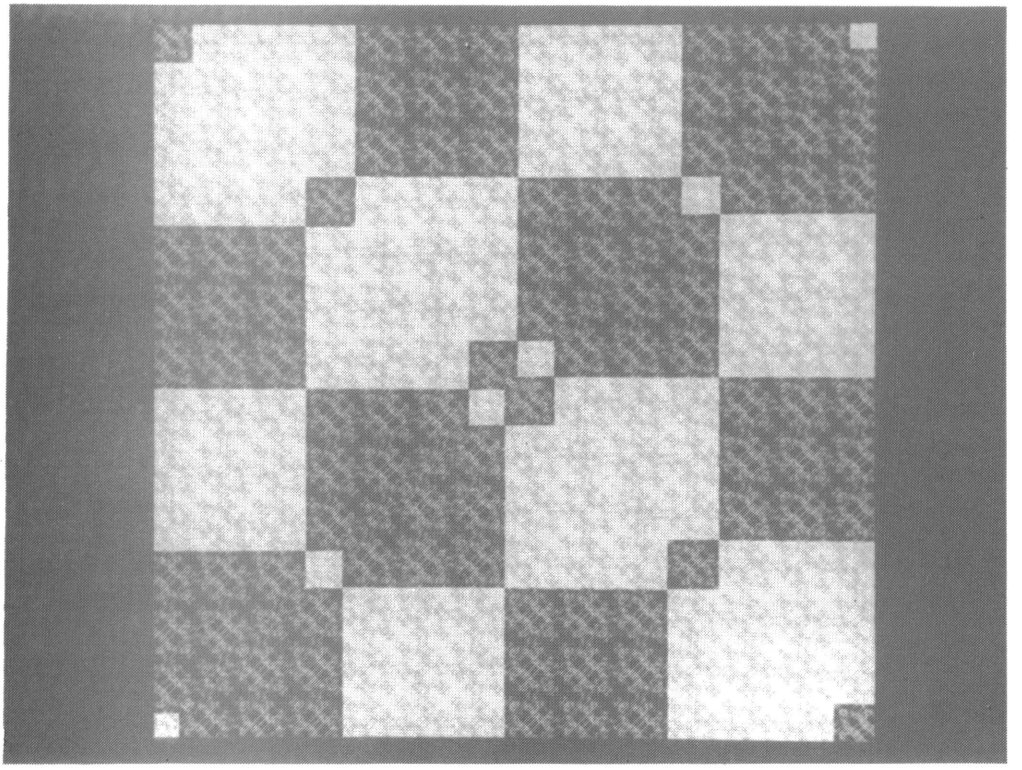
No. 9 - Change from pure black to white. Duplication



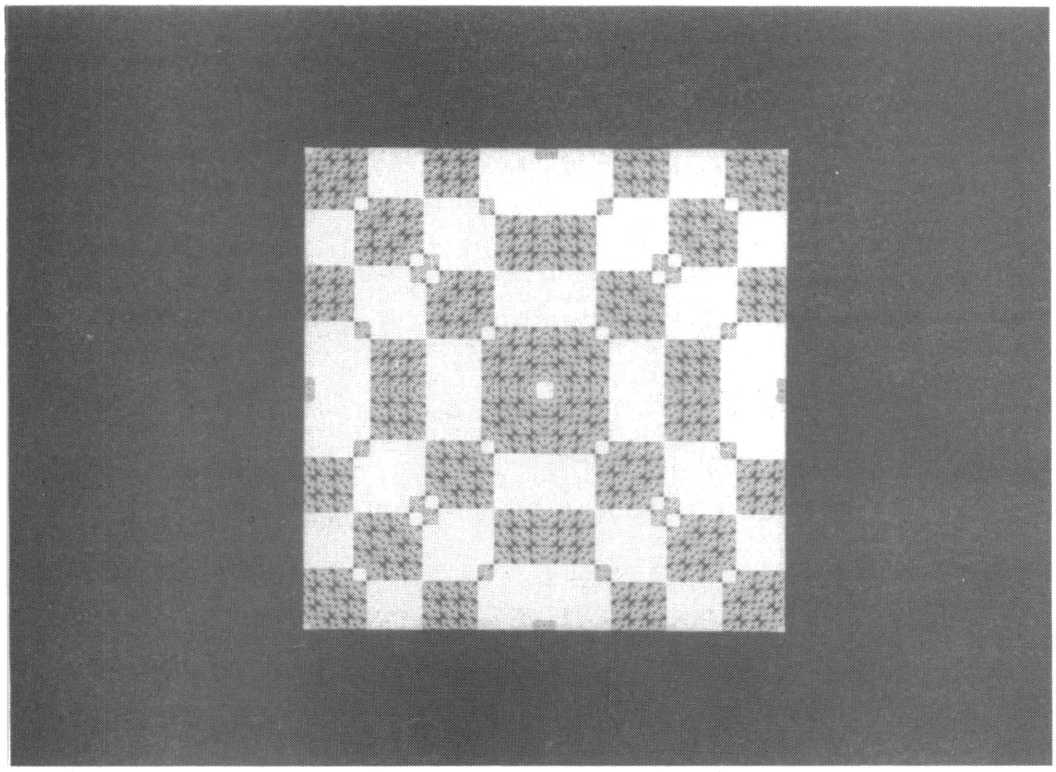
No. 10 - Damero composition



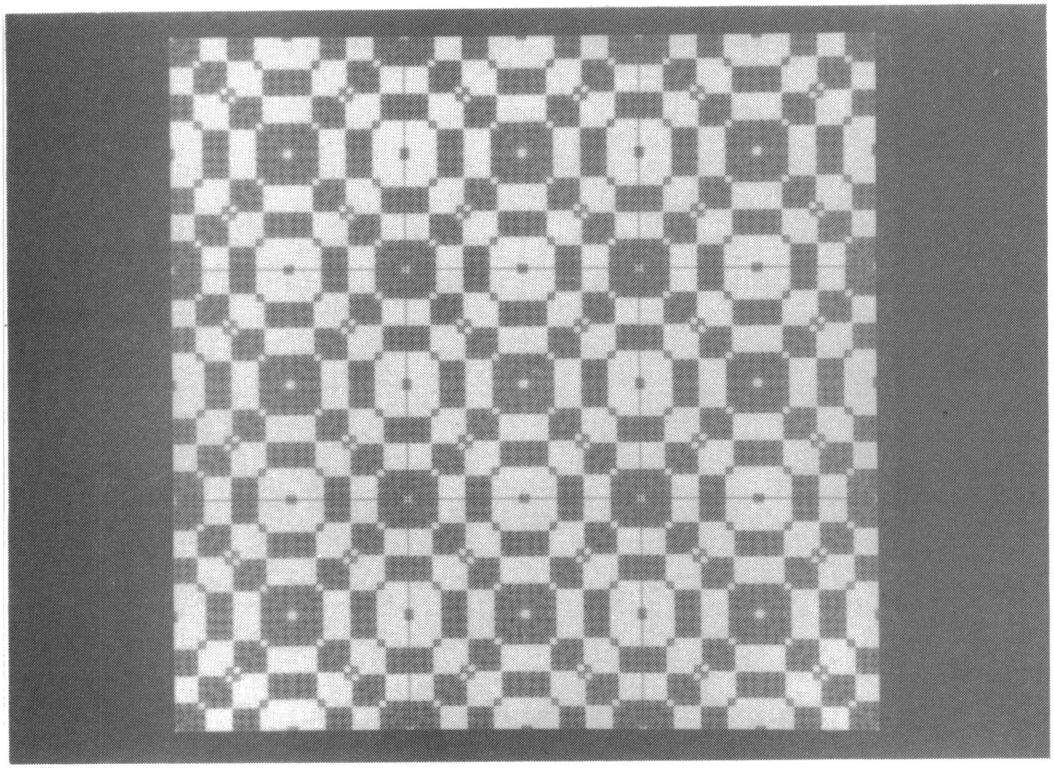
No. 11 - Creation of a new triangular module.



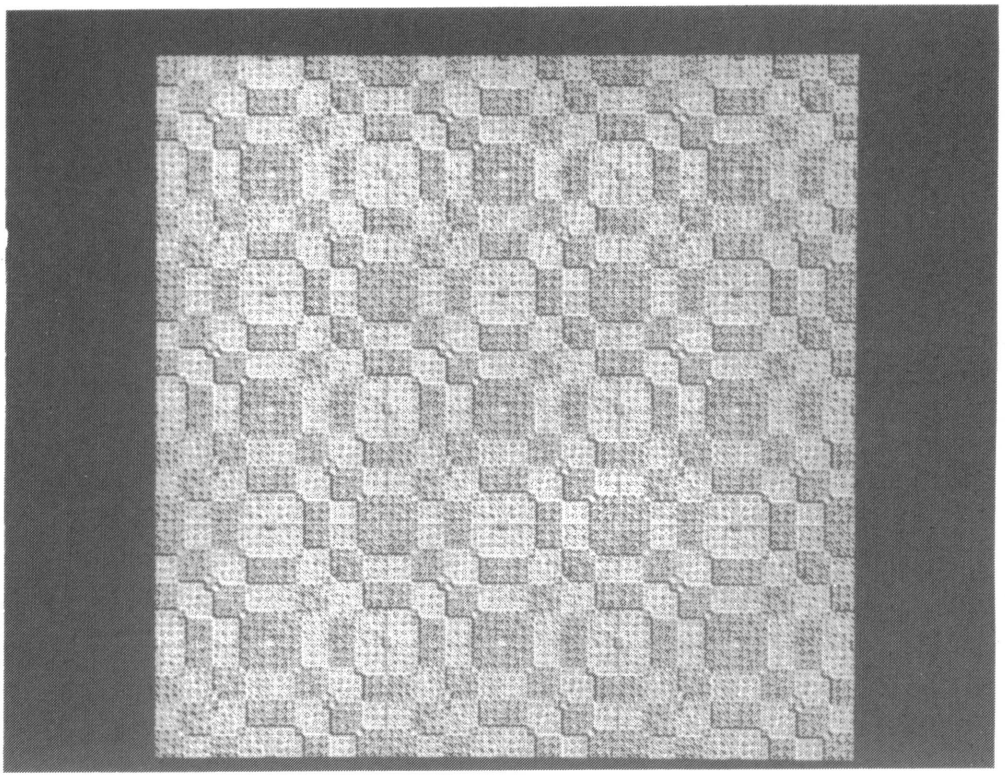
No. 12 - Development of module by reflection.



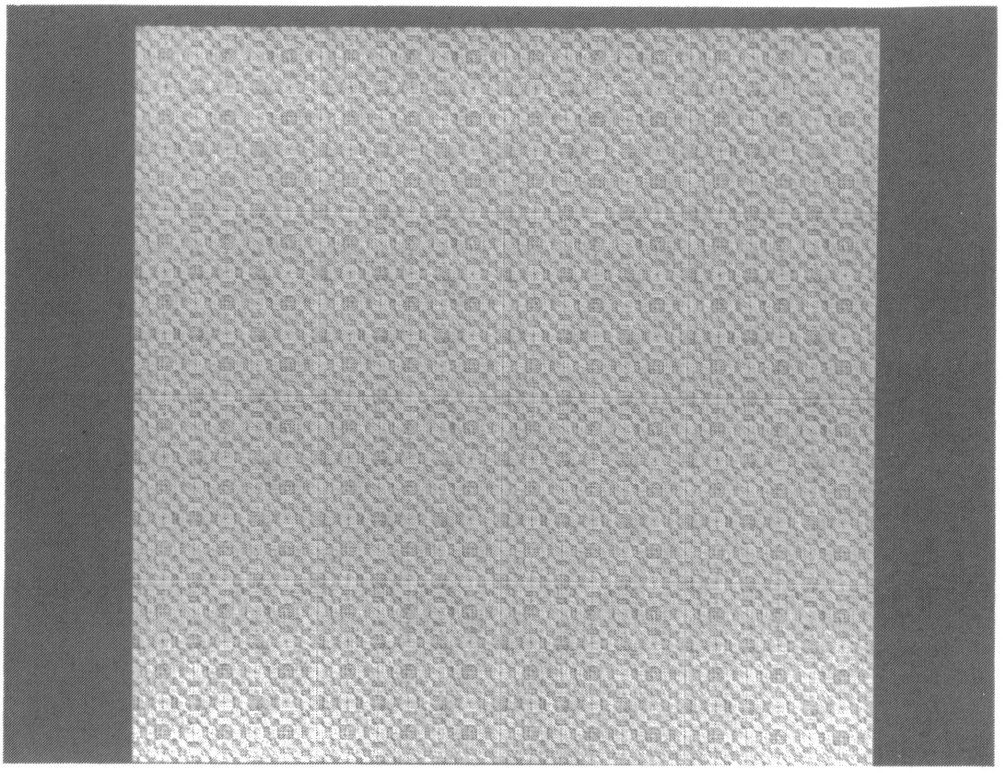
No. 13 - Reduction and duplication of image.



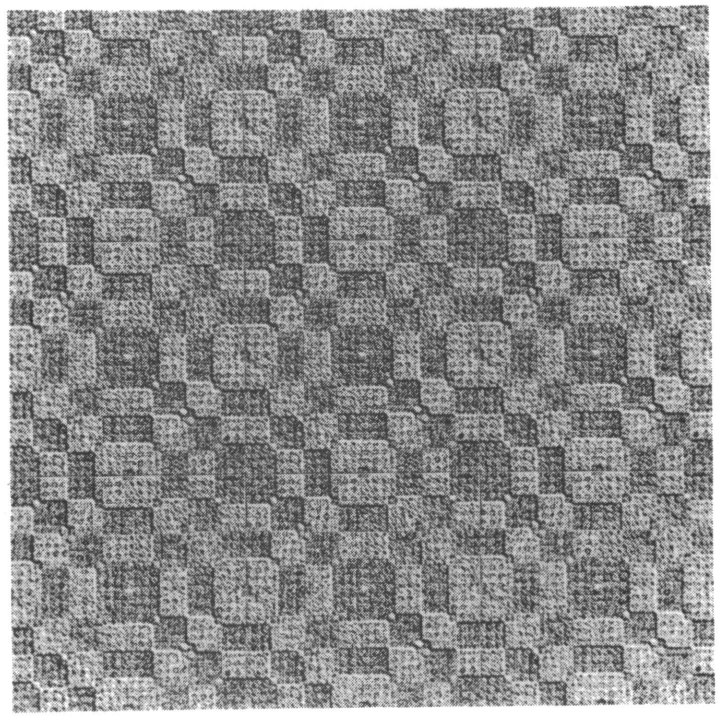
No. 14 - Reduction and duplication of image.



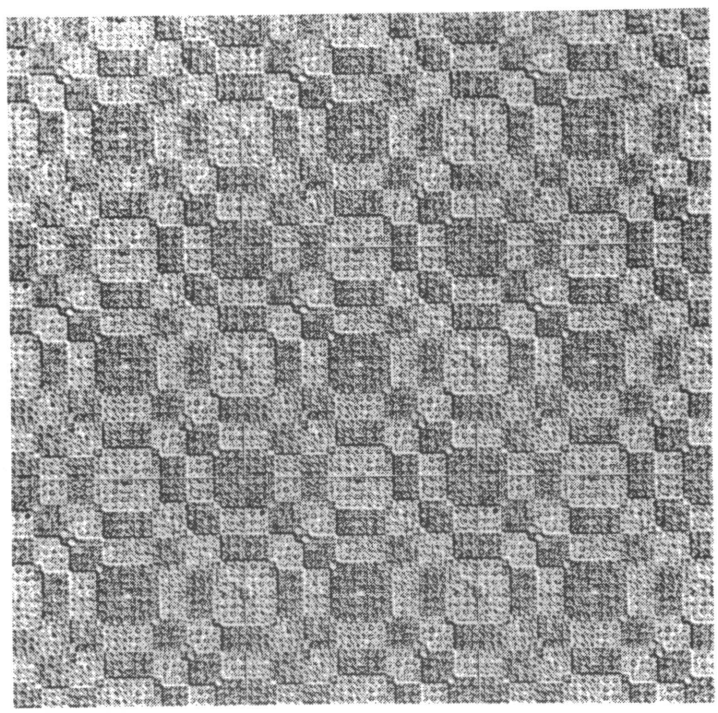
No. 15 - Relief effect



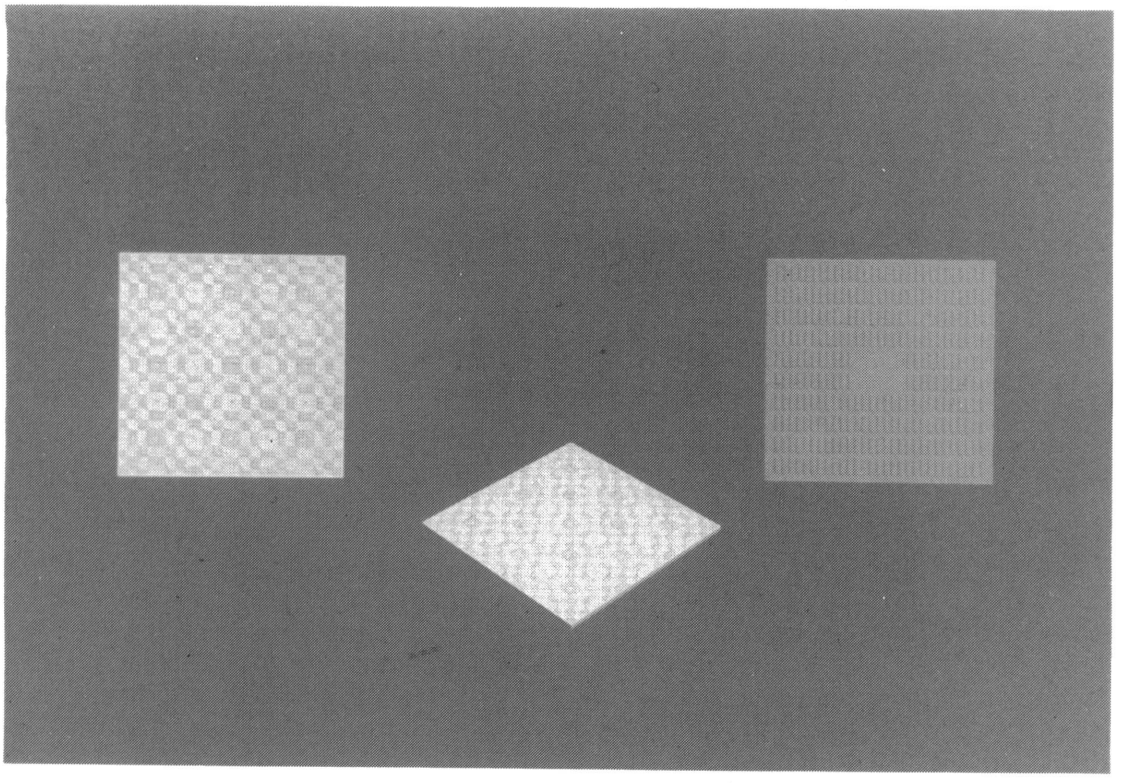
No. 16 - Reduction and duplication. Group of pieces.



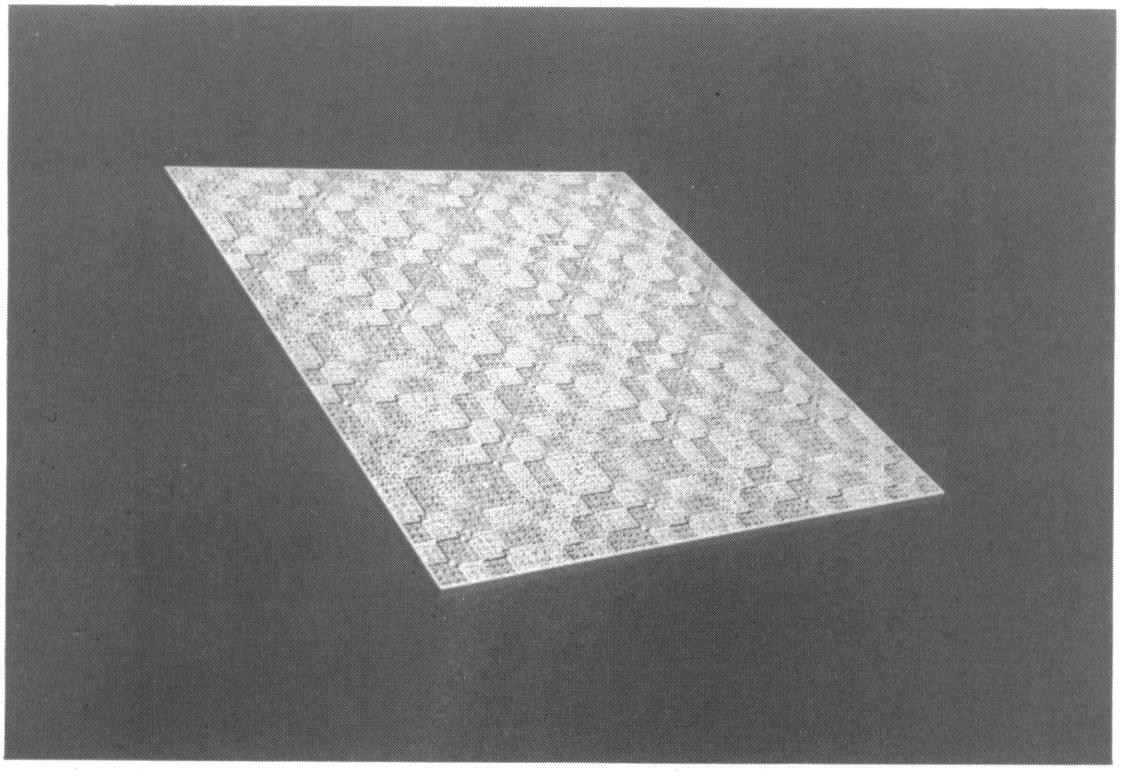
No. 17 - Colour test



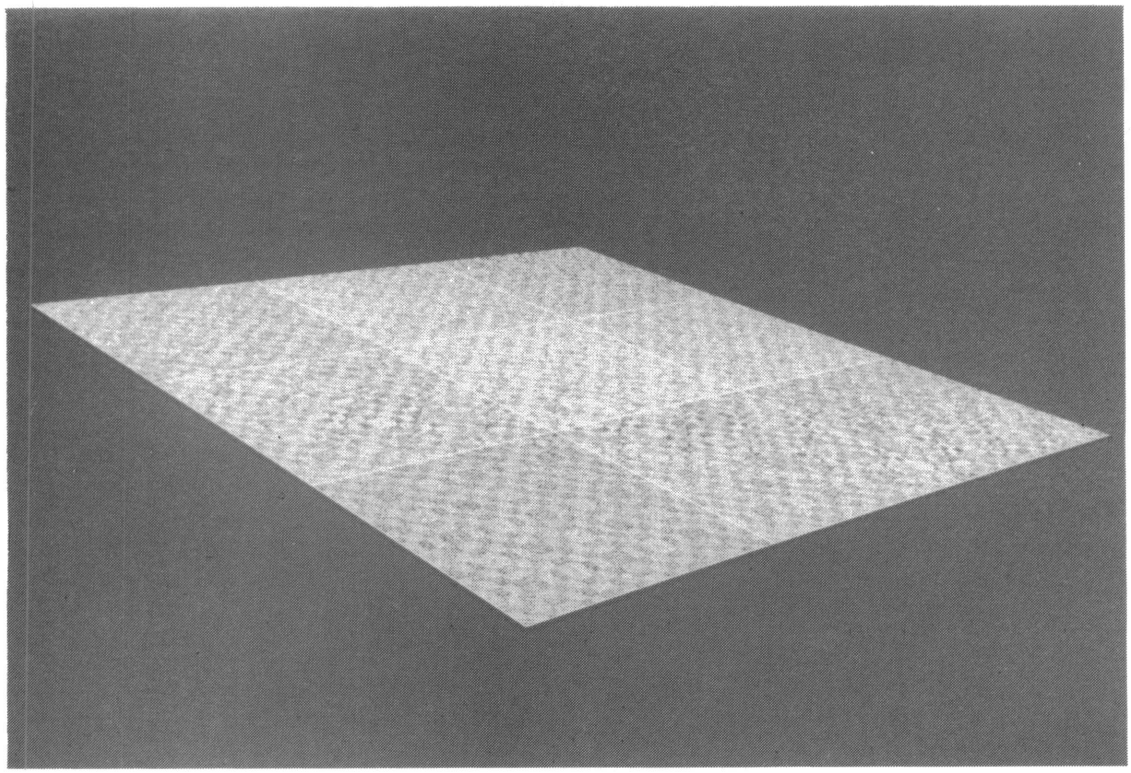
No. 18 - Colour test



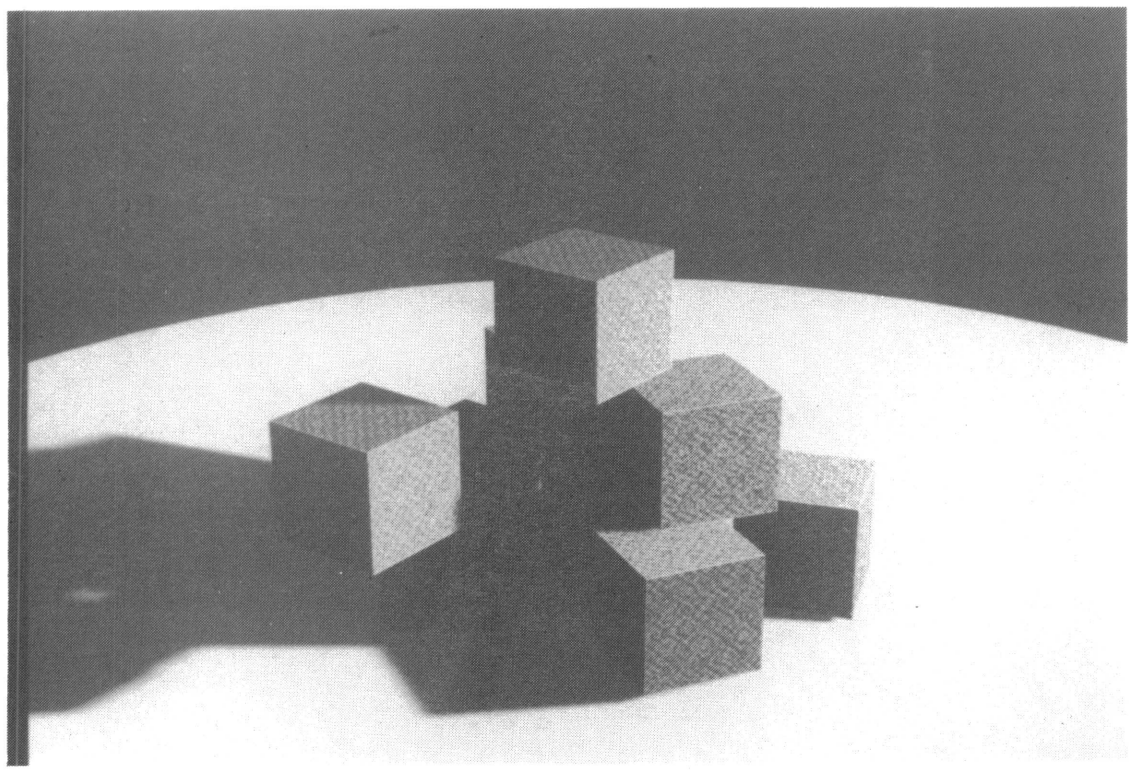
No. 19 - Front view, rear view and perspective.



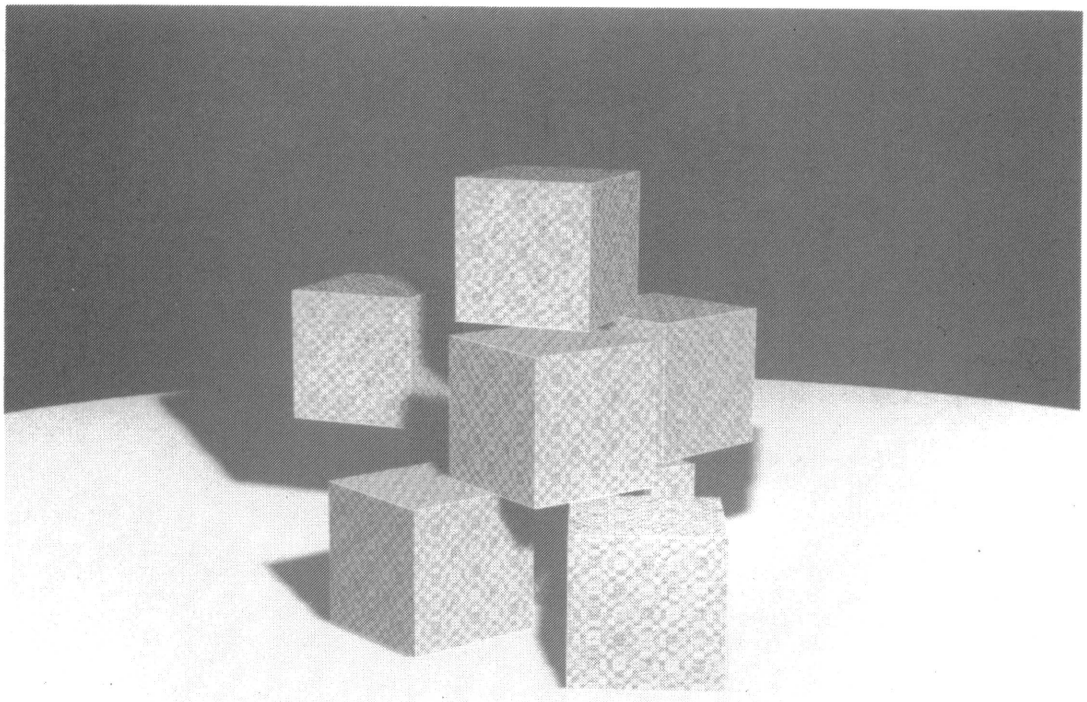
No. 20 - Perspective view of piece.



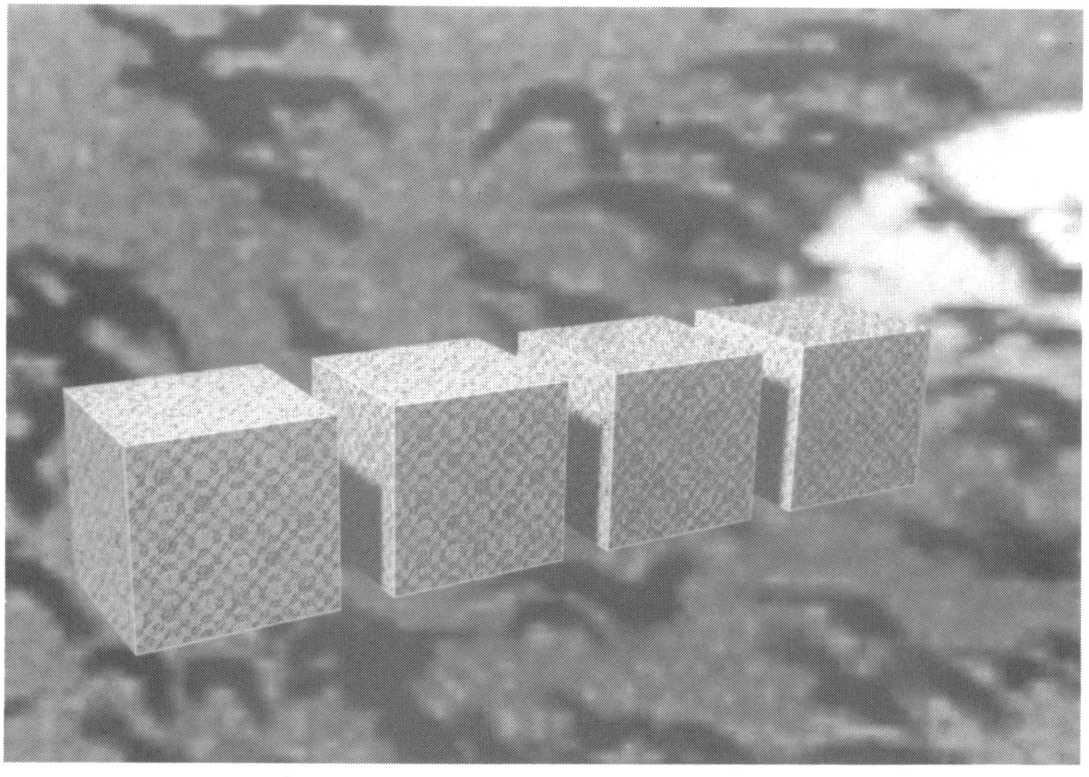
No. 21 - Group of nine pieces.



No. 22 - Image 1. View 1.



No. 23 - Image 1. View 2



No. 24 - Image 2.

Bibliography

- Applicaciones del diseño asistido por ordenador a los pavimientos y revestimientos cerámicos. C.Martinez Clar, J. Mira Peidro. Técnica Cerámica 170.
- CAD/CAM M.A. Vences Editorial Ingelek 1987
- Diseño Asistido por Computador Xavier Carol y Robert Juan Fundación BCD. 1985
- Diseño Industrial por Computador Rafael Ferré Masip Marcombo 1987
- CAD. Dibujo, diseño y gestión de datos E. Lee Kennedy Gustavo Gili. 1988
- Aplicaciones gráficas del ordenador. John Lewell Hermann Blume 1985
- Sistemas CAD/CAM/CAE Various Authors. Mundo Electrónico, Marcombo 1986
- Images de synthèse Michel Bret Dunod Informatique. 1988
- Simulación con ordenador L.L. McNitt Paraninfo 1986
- Introducción a la robótica I & II Pierre López and Jean Neuma Foule Arcadia S.A. 1987
- Gráficos con computador Ian O. Angell Paraninfo 1986.
- Informatica y Educación Javier Laborda Laia. 1986 Martin Minguella & Agustín Balaña. Fundación BCD 1985.
- Principles of Computer Aided Design Joe Rooney and Philip Steadman. Pitman Publishing. 1987
- Informática para usuarios avanzados Minsteria de Industria y Energía. 1988
- Fundamentos del Diseño bi y tridimensional Wucius Wong Gustavo Gili. 1986