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Bogotà, Colombia, 20 November - 1 December 1972

PLASTICS ADD A NEW DIMENSION TO FURNITURE 1/

by

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SUMMARY

PLASTICS ADD A NEW DIMENSION TO FURNITURE

by

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Plastics furniture is of growing interest because labour costs are rising, timber prices are rapidly increasing, world supplies of high grade timbers is diminishing. Public interest in plastic furniture is increasing and modern styling and design are most economically expressed in plastic material.

A number of plastics are suitable for the manufacture of furniture. For example: glass reinforced unsaturated polyester resins, sheets of thermoplastics, polyurethane rigid foam and soft foam, polystyrene and polystyrene structural foam. Important aspects in the choice of plastics are: nature, shape and function of the furniture parts, size, wall thickness and type of surface, annual production and situation regarding material, labour and plant costs.

Material, processing methods and the way we live have at all times influenced our taste in style. In each age man has equipped himself from his technological resources and nowadays the trend is to plastics.

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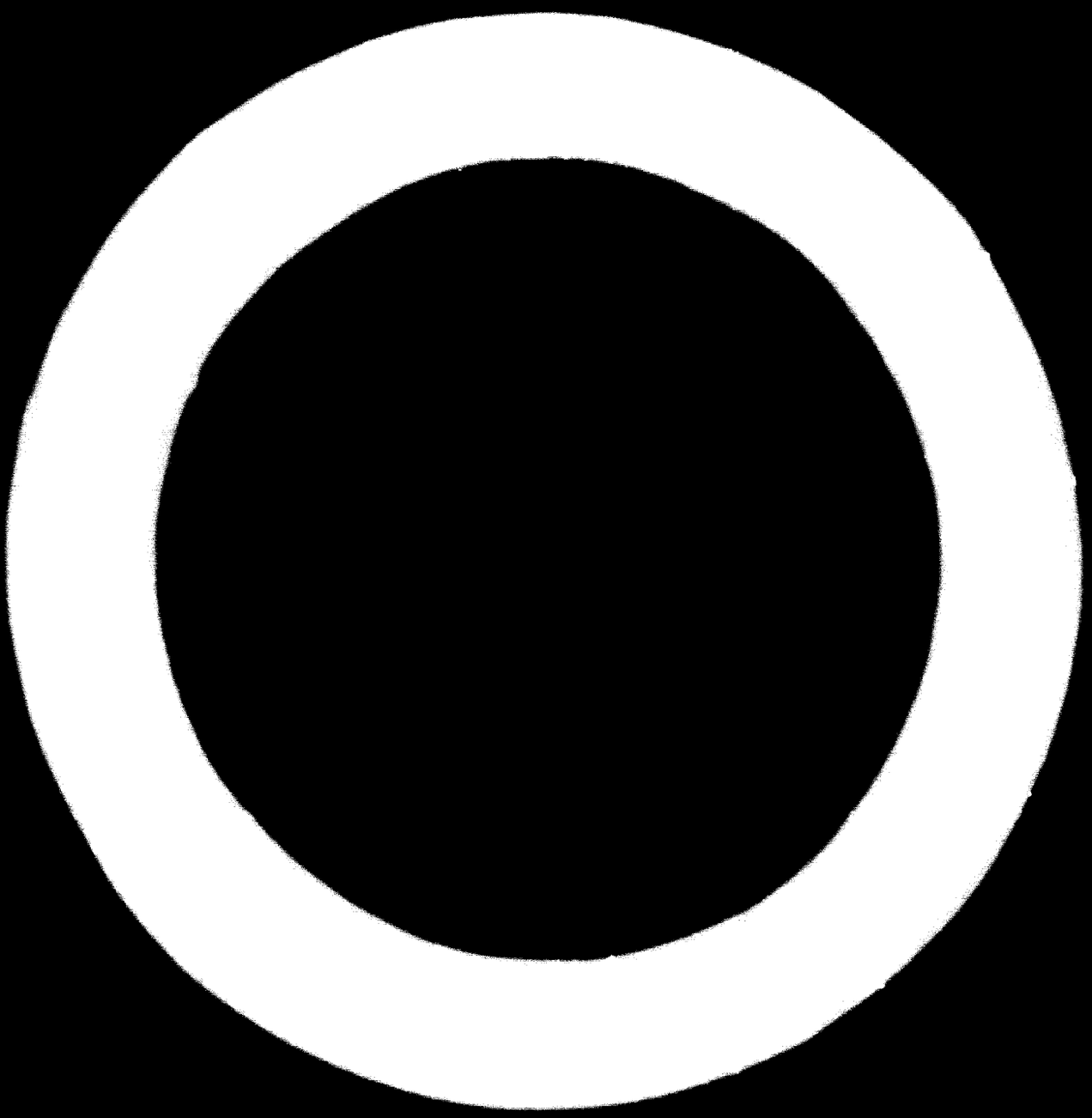


I. Plastics add a new dimension to furniture

The things people buy are the things they find attractive rather than because the articles concerned are made of wood or plastics or this, that, or the other material. But what are we going to find attractive in 1975, 1980 or indeed in the year 2000? What was once regarded as the only possible shape has given way to an astonishingly large number of different configurations.

No one argues any longer over absolute beauty; individualism is today's creed. A chair no longer requires 3 or 4 legs in order to be described as a chair. Now it is no longer the shape which counts - it is rather its suitability as a seat.

Available materials, processing methods, and the way we live have at all time influenced our taste in style. In each age man has equipped himself from his technological resources, and nowadays the trend is to plastic materials.

II. Market development (figure 1)

In 1968 already 56,000 to of plastic materials were processed by the furniture industry in the West German Republic. In 1975 this figure could well be 280,000 to and in 1980, 710,000 to.

These figures should not obscure the fact that as recently as 1970 in the furniture industry in the Federal Republic the share taken by plastics in a total turnover of 8000 million DM was only 5%. This just goes to prove that fabrication with plastics is today's big opportunity.

White glue, chipboard, melt adhesives and plastic top surfaces have made possible the mass production of furniture.

Manufacture in progressive factories is nowadays based on continuous operation. The precondition for this type of manufacture is however the simplest possible shape for furniture items, the box design with its plane surfaces. This holds for contract furniture just as much as for bedroom, living-room, nursery and kitchen items.

After years of box type furniture, a change of direction in styling may be expected in the 70's and I am most curious to know what the 1972 International Furniture Exhibition in Cologne will bring forth.

It is not attachment to the traditional, but a cool and austere attitude and the drive for simple uncomplicated surfaces which have brought so large a measure of success to what is described as period furniture.

Gentler, more flowing shapes and less severity of line are again in demand (figure 2). An appreciative section of the buying public already exists for this type of furniture.

III. Cost comparison

Such styles as these can be achieved without difficulty in plastics but not so readily in wood. On the other hand the volume cost of fabricated chipboard articles per m^3 is about DM 1300 to DM 1500 at the present time, while the corresponding cost in plastic is more than DM 2400. For price reasons therefore, it would be worth while to check very carefully whether synthetic materials and traditional materials could not be usefully combined.

Typical combinations already on the market include the add-on furniture range supplied by Melchersmann and certain chair types made by Kusch.

Melchersmann for very good reasons employ polystyrene moulded top and bottom cupboard sections with rounded corners (figure 3), the flat fronts and sides being made as before in chipboard. The polystyrene sections in a host of different ways (figure 4), for example as bed headboards or table-tops. It is undoubtedly correct not to separate the furniture fronts at the same time. Taste and stylistic sense do not change overnight; new shapes will be demanded soon again.

The second sample, the Kusch chairs (figure 5) e. g. model 3000, a combination of aluminium pressure die-castings with curved seat and back rest made from polystyrene structural foam, show in excellent manner a highly practical integration of conventional and modern materials in construction.

It is obvious that to begin with, some practical experience has to be gained before marketing nowadays such ingeniously contrived and technically advanced furniture combinations.

Nowadays the question is not whether wood or plastic is to be chosen but rather which design can be most efficiently constructed in which material; which part would be better made in wood, which in metal and which in plastics can be definitively predicted only by a costing prepared for each individual case. Just as the fabricator in wood knows his costs, the fabricator in plastics also knows how to proceed in his calculations.

As a rough and ready guide it may be said that the smoother the surface the more the comparison favours chipboard, while the more elaborate the shape the more definitely is the plastic material favoured.

IV. Fabrication

In this connection we are often asked who will produce the plastic furniture of the future. This question usually ignores the fact that in furniture manufacture a whole range of

plastics may be employed, and each of these plastics will in turn require a different processing technique (figure 6).

These are listed in the table shown in figure 6. The values given are approximate and are intended merely to indicate their order of magnitude. They also in no way represent the full extent of the various different machine and construction material possibilities. As a rough generalisation, its purpose is merely to indicate the inter-relationships which exist.

Every type of manufacture requires machines. The higher the degree of utilisation of these machines the more profitable is their operation. In the case of machines for plastic materials utilisation means round the clock operation, 6 days a week. With each individual plastics fabrication process, only a quite specific number of items can be produced per unit of time. If high output levels in the fabrication of plastics are demanded, high capital investments - though lower labour and material costs - have nearly always to be allowed for. A typical example of this is the injection moulding of polystyrene. Short runs usually involve high labour and material costs, but less capital outlay. This is again illustrated by deep drawing and by hand lay-up processes.

Whether to manufacture on the premises or to purchase outside is thus primarily a question of the quantity which can be produced against the numbers required, and naturally depends also on the capital which can be made available for the realisation of these ideas.

The profitability of a plastics processing machine also depends on the full utilisation of its production capacity. On a machine suitable for 20 kilos shot weight, 20 kilos mouldings should be made. Runs on smaller mouldings are

unprofitable. If a 20 kilos machine is installed this is a good reason for working out whether in the example of a cupboard being made on this machine, the drawers and drawer fronts should also be produced on the premises, or whether fabrication outside is preferable. On the sole consideration of operational capacity, for the injection moulding or foam injection moulding of the drawer cupboard, three machines of different size are required for the manufacture of the main body, drawers and drawer fronts. Drawers naturally require smaller machines which operate with smaller shot volume, and drawer fronts are still less in weight.

For a reliable prediction as to whether manufacture on the premises or purchase from an outside source is the more economical method, the weights of the mouldings to be made must be known in order to assess the plant which may be required.

Finally, a decision has to be made on the appearance the finished mouldings should have. The starting material and processing method are predetermined by the quantity to be made, and thus to some extent also the design.

The various plastic materials naturally differ in physical property values. Please pay special attention to the elasticity modulus listed in the last column of the table. For a given material and its appropriate processing method, the design has to take account of the mechanical and functional stresses to be expected in service.

A further point of a general character to be noted is that the processing of plastic materials must take place in a dust-free area. A shop in which woodworking operations are also being conducted is quite unsuitable; plastic processing requires its own shop.

In order to maintain maximum flexibility and to be able to respond quickly to market demands, it is advisable to have a workshop on the premises, which should be large enough to enable, at the very least, minor modifications to moulds to be carried out.

Trained personnel are essential for mould construction and for processing plastic materials. They should indeed have had several years' experience in the industry. If it has not been possible to recruit a suitable team, training courses are as a rule very expensive. Even with the best advice from one's supplier it is impossible to prevent mistakes occurring, in the absence of an experienced work team

In short, until a furniture manufacturer can enonomically utilise a plastics processing plant he should not consider producing his own requirements. At the present time there are plenty of plastics processors around who are equipped with suitable plant, and possess the experience required to be able to supply plastic mouldings of high quality in adequate quantity.

The best course at the present time would appear to be co-operation between the furniture manufacturer and the plastics moulder under a joint agreement.

Suppliers of the plastic starting materials are glad to give assistance in finding suitable partners.

And what is the long term outlook? If it is assumed that development is Europe will run parallel to development in the USA with perhaps a five year lag, the trend is then as follows: Furniture producers will commence with polyurethane foam casting processes and have their injection moulded polystyrene components made by an outside contracting firm.

The question as to which plastic and which processing method for the plastic should be adopted, for which type of furniture in the future, can only be answered for each individual case. The tendency would appear to be that for ordinary quantity production furniture and for contract business, injection moulded or foam injection moulded impact polystyrene with or without fibrous glass reinforcement will chiefly be used, and for high quality furniture, foam casting of urethane foams of suitable type will be used. For short runs, thermoforming of plastic sheet or moulding with fibrous glass reinforced polyester has to be considered.

One-off items or prototypes are best made by hand lay-up in glass reinforced unsaturated polyester resin. Here again a rough guide - for a requirement up to 3000 in number with a top limit of 10,000 of one model, polyurethane, as a rule, is the construction material to choose, above 3000 to far beyond 10,000 impact polystyrene.

Here we have some typical examples of plastic furniture. Period furniture (figure 7) reproduced in plastic materials was first made in America. This particular style described as Mediterranean style (figure 8) has not so far made any headway in Europe. On the other hand drawers made by injection moulding (figure 9) are representative of the earliest manufacture in plastic materials. A short time later these were supplemented by deep drawn articles (figure 10). A particularly individual plastics application was the extruded and subsequently thermoformed profile section (figure 11) which was employed as a facing for furniture units, contoured seats etc. (figure 12). The school desk with sides and top made from polystyrene structural foam and polyurethane coated tubular steel legs is a most ingenious design. By the end of 1971 the entire desk was injection moulded from polystyrene in one piece as a structural foam moulding (figure 13.).

Other interesting applications for HOSTYREN are a chair from Denmark (figure 14) or small storage units, the first use in Austria (figure 15). But it is not merely chairs and small furniture items which are being marketed in 1972, storage furniture panels have already made their appearance (figure 16). In this application both small and large cupboard structures are made from HOSTYREN structural foam (figure 17).

V. Conclusion

What then is the best procedure? Select items from your present selling range which appear to have good success prospects. Try to achieve similar items in plastics, produce the design, discuss it with Hoechst, even if at that stage you have finalised only part of your idea.

Advice on choice of material, processing method and mould design are the essential preliminaries for the economical production of functional plastic furniture.

Important aspects in the choice of a process are:-

1. Nature, shape and function of the furniture item
2. Size, wall thickness and type of surface
3. Number required per year
4. Situation regarding material, labour and plant costs.

Plastics furniture is of growing interest because:-

- Labour costs are rising
- Timber prices are rapidly increasing
- World supply of high grade timbers is diminishing
- Public interest in plastic furniture is increasing
- Modern styling and design are most economically expressed in plastic material.

In conclusion, there remains the question whether a world in which plastics provide the entire furniture environment is merely a pipe-dream. Certainly plastics will not dominate us but will help us to realise some of our aspirations. Plastics lend wings to our phantasies; modern process technology enables them to be realised, and phantasy realised will surely change our lives.

TYPE OF PLASTIC	PLASTICS CONSUMPTION IN 1000 TONS		
	1968	1975	1980
Phenolic Resin	20.0	25.0	30.0
Melamine Resin	1.5	7.0	20.0
Unsaturated Polyester Resins	1.5	15.0	40.0
Polyurethane Foam	0.1	75.0	250.0
Polyvinyl Chloride	30.0	50.5	100.0
Polystyrene	3.0	100.0	250.0
Acrylonitrile Butadiene Styrene (ABS)	0.1	5.0	10.0
Polyolefins	-	2.5	10.0
TOTAL :	56.2	280.0	710.0

Tabel 1 : BRD-Furniture Industry, Development of Plastics Consumption in the Seventies.

Abb. 6

Methods of Processing	Capital Investment: Machinery (DM)	Capital Investment: Mould (DM)	Attainable Parts Produced per Annum	Moulding Cycle in Sec. per Part and mm Wall Thickness	Suitable Rawmaterial	Density (g/ml)	approx. Price (Dollar/kg)	Modulus of Elasticity (kp/cm²)
Deep Drawing	10,000.-[1]	> 2,000.-[4]	160,000	120	Impact Resistant Polystyrene	1.04 - 1.06	0.94 - 1.50	24 - 28
	25,000.-[2]	> 4,000.-[4]	100,000	120 - 180	Acrylonitrile Butadiene Styrene (ABS)	1.03 - 1.12	1.88 - 2.50	26 - 28
	40,000.-[3]	> 6,000.-[4]	100,000	120 - 180	Polymethylmethacrylat	1.19	4.70	30
					Polyvinylchloride	1.30 - 1.35	1.25 - 1.88	15 - 20
					Polypropylene	0.91	1.25 - 1.88	12 - 14
Injektion Moulding	240,000.-[5]	50,000.-	320,000	10 - 20	Impact Polystyrene	1.04 - 1.05	0.39 - 0.47	24 - 28
	590,000.-[6]	100,000.-	120,000	10 - 20	Acrylonitrile Butadiene Styrene (ABS)	1.06 - 1.12	0.78 - 1.03	26 - 28
					Polyamide	1.12 - 1.15	1.36 - 1.65	17 - 29
					Polyolefins	0.91 - 0.96	0.50 - 0.79	10 - 14
					Acetal Copolimer[7]	1.54 - 1.61	1.97 - 2.12	65 - 90
					Polyamide[7]	1.23	1.40 - 1.86	35
					Polypropylene[7]	1.05	0.91 - 1.00	32
	150,000.-[8]	30,000.-	55,000	approx. 60[9]	Unsaturated Polyester[7] Resins	1.5 - 1.8	1.09 - 1.40	80 - 100
Injection Foaming	500,000.-[10]	50,000.-	110,000[11] 65,000[12]	10 - 15	Impact Resistant Polystyrene	0.5 - 0.9	0.48 - 0.56	10 - 20
					Acrylonitrile Butadiene Styrene (ABS)	0.7 - 1.0	0.98 - 1.12	13 - 22
Cast Foaming	25,000.- to 200,000.-	500.-[8] to 30,000.-[13]	100,000 - 150,000	180 - 300[9]	Polyurethane	0.3 - 0.8	0.94 - 1.55	20 - 60
Compression Moulding	100,000.-[10]	30,000.-	50,000 100,000*	60 - 120	Unsaturated Polyester[7] Resins	1.7 - 2.1	1.30 - 1.40	100
Handlay-up Moulding	1,000.-	> 1,000.-	-	2,500	Unsaturated Polyester[7] Resins	1.7 - 2.1	1.30 - 1.40	60 - 100

1) 0,5 m² Mould Surface
2) 1,0 m² Mould Surface
3) 2,0 m² Mould Surface
4) Mould for Epoxide Resins
5) 2 kg - Machine
6) 6 kg - Machine
7) Glass Fibre Reinforced Plastics
8) 3 kg - Special Machine
9) almost independent from wall thickness
10) 16 kg - Machine
11) 10mm wall thickness
12) 20mm wall thickness
13) Steel Mould

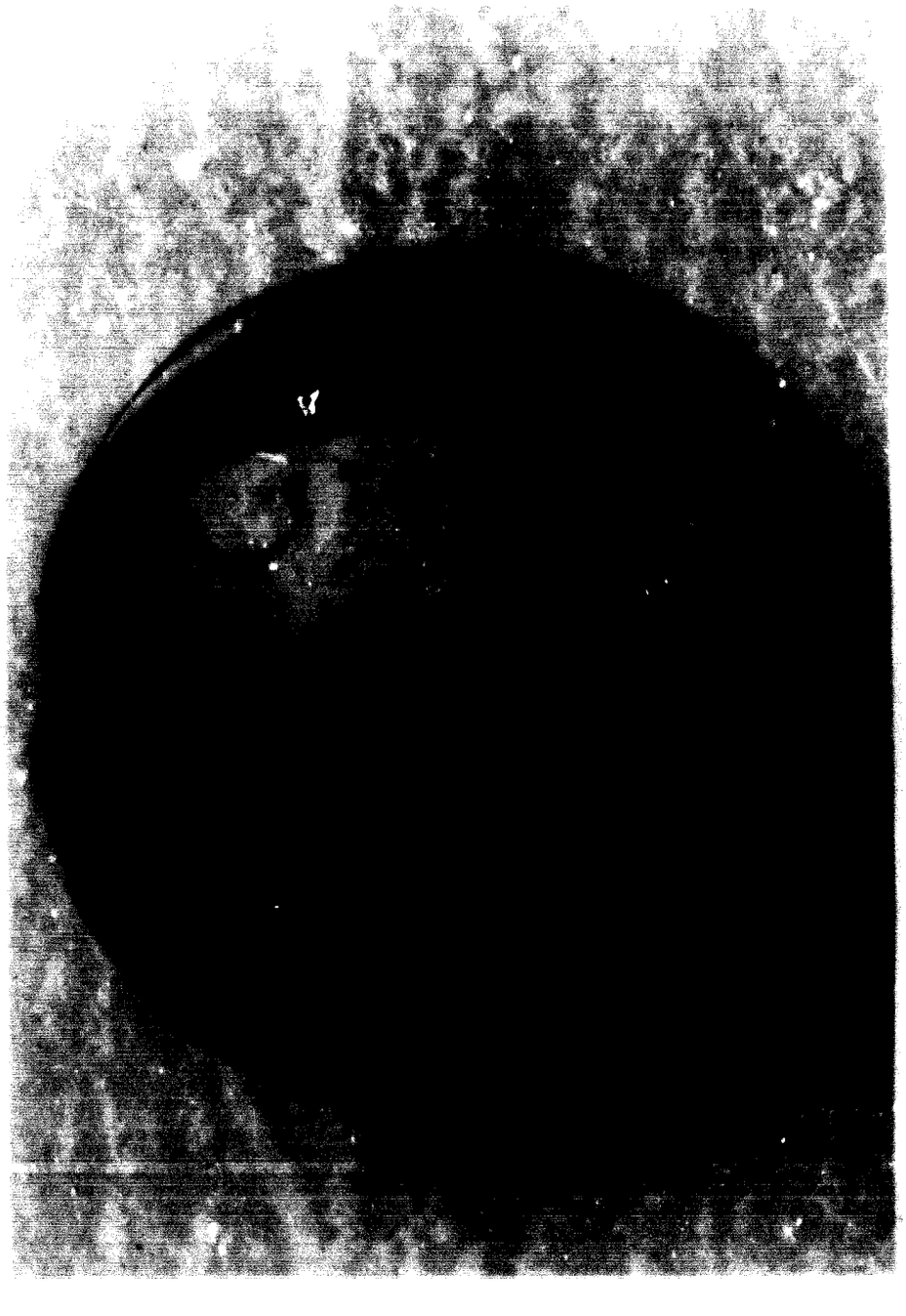


fig. 2: allround box
Source. PIN, Plastic International GmbH
Frankfurt / Main

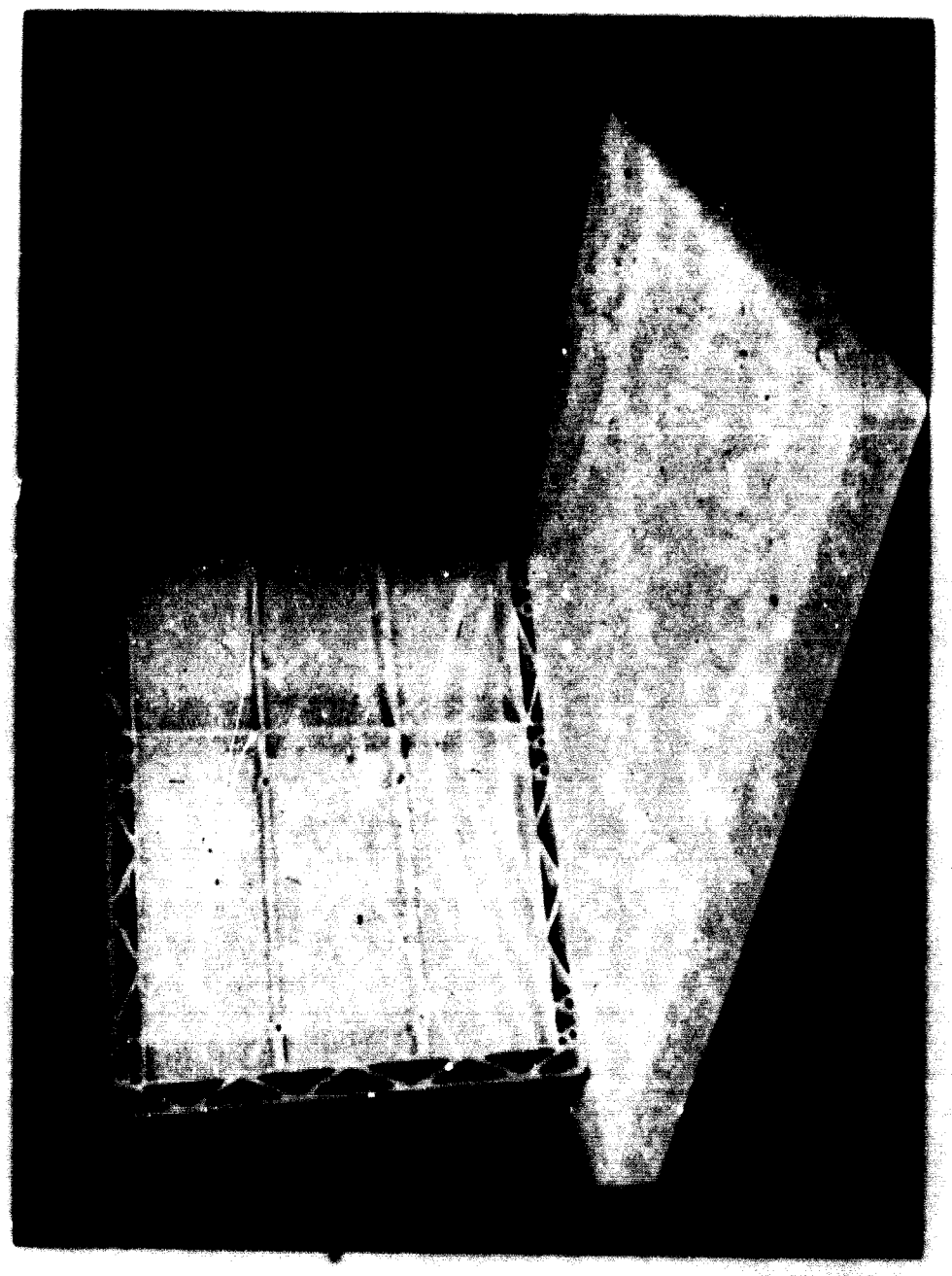


Fig. 3: top and bottom cupboard section from HOSTMEN S 4205
Hoerr, Reichsmann, Hille, FRG

Fig. 4: Bed head boards, table, tops, top and bottom cupboard sections with rounded corners from HOSTYREN S 4205
Hacora. Melcherwann, Melle, FRG

Fig. 5: Kusch chair e.g. model 3000, a combi
a combination of aluminium pressure die-castings with
curved seat and back - rest made from polystyrene structural
foam HOSTYREN S 4205

Messrs. Kusch & Co. Hallenberg

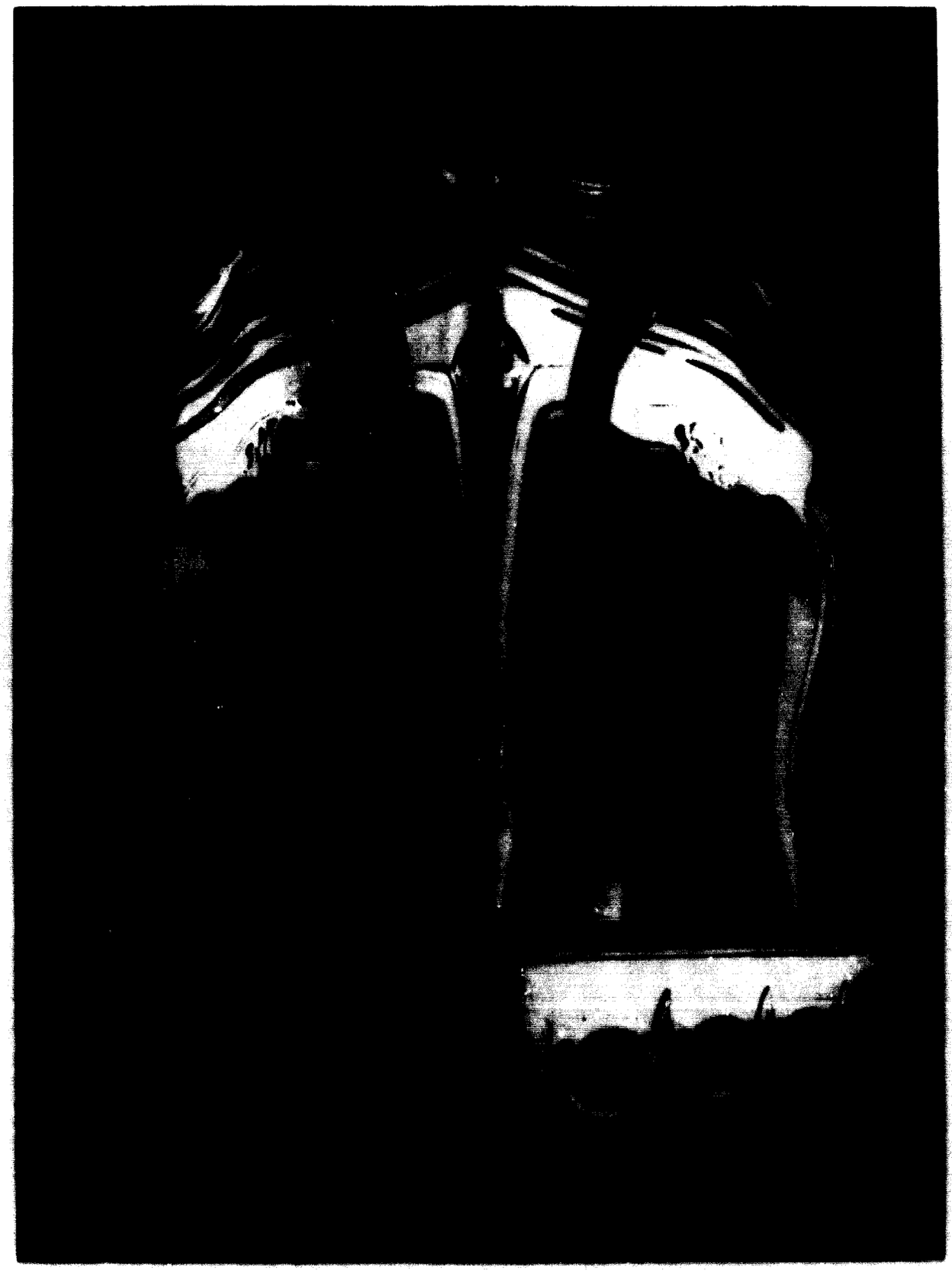


Fig. 7: Plastic furniture in Mediterranean style
Messrs. R. Angenendt DOPH, Dortmund, FRG

Fig. 8: Chair reproduced in plastic material
Messrs. Rudi Angenendt DGPH, Dortmund, FRG

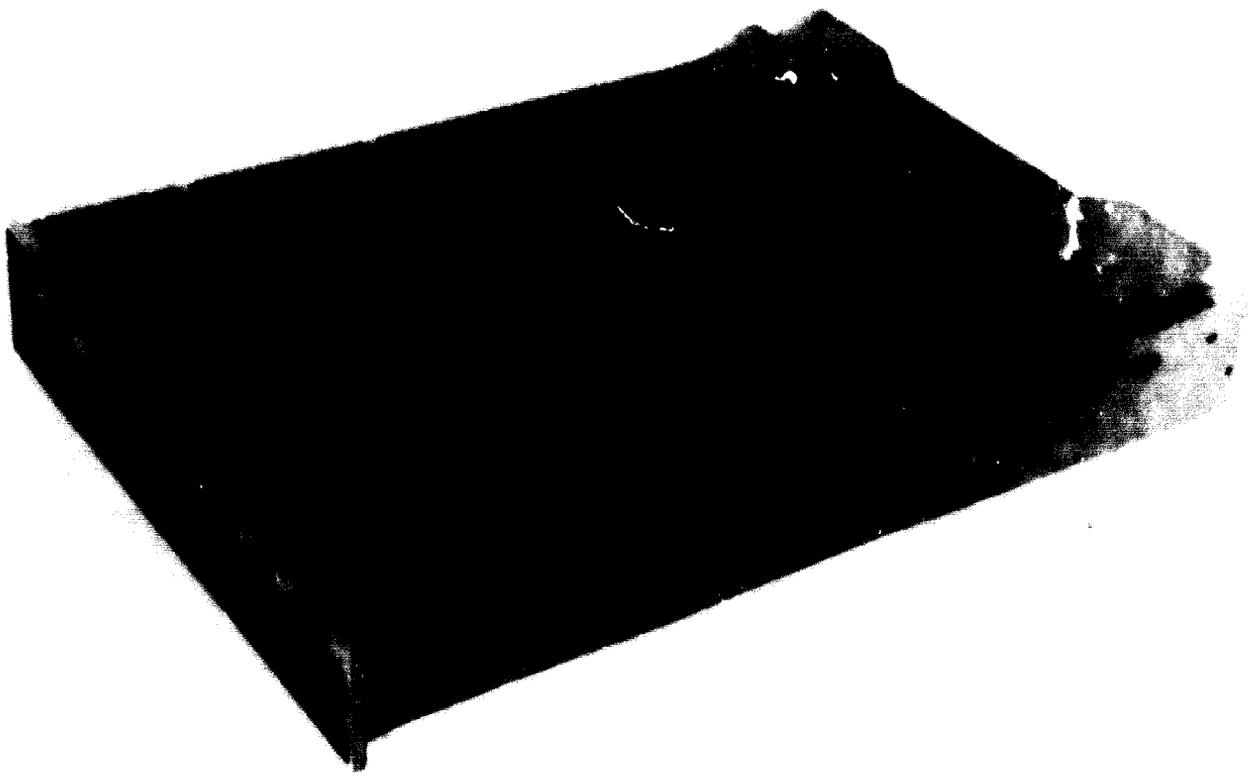


Fig. 9: hand drawer made by injection moulding from HOSTYREN S 4505 Nocore. YAMAHA - Plastic Möbiterchnik, FRG

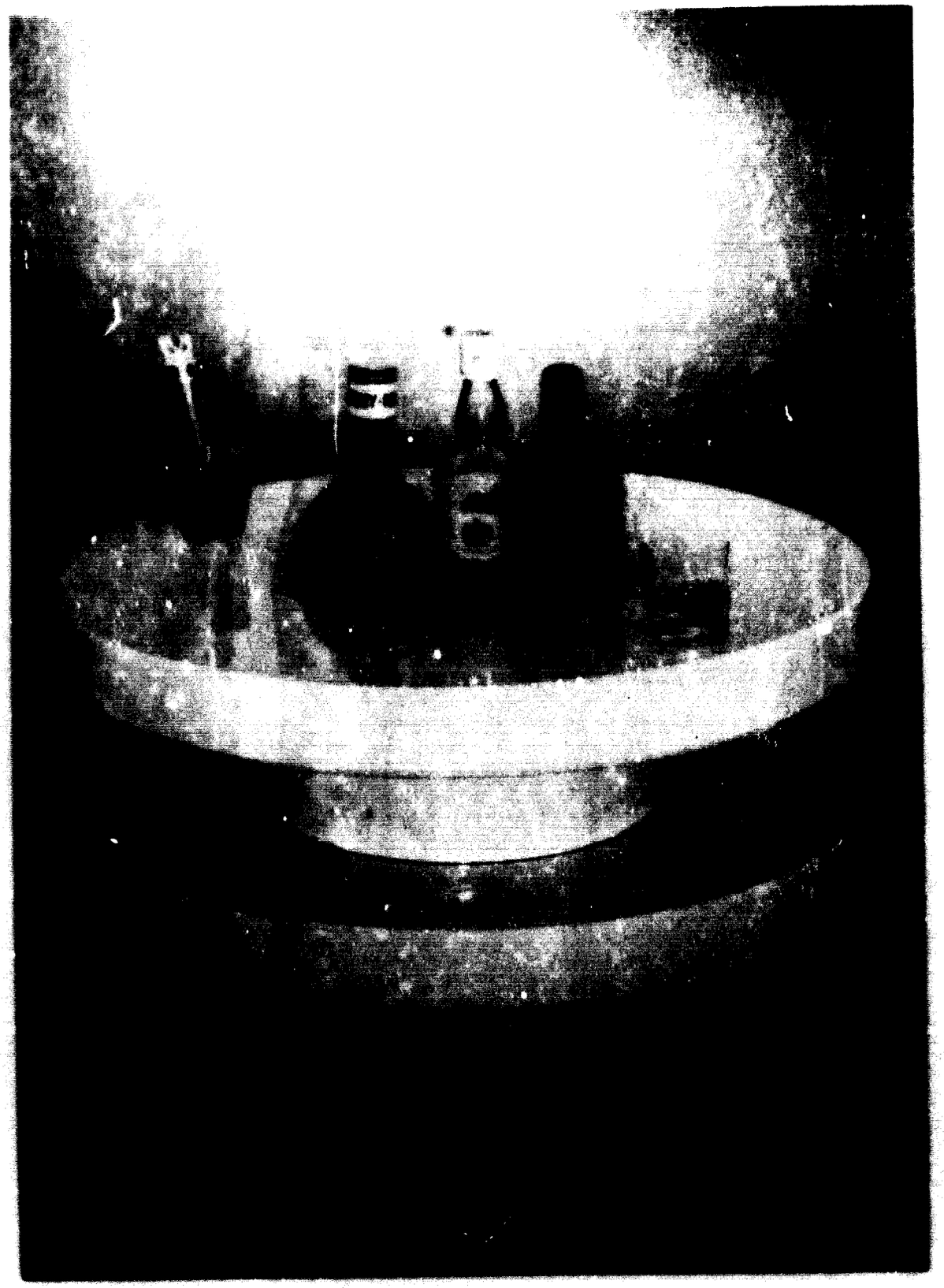


Fig. 10: TV-bar deep drawn article from HOSTYREN S 5401-sheets
Messrs. PIN, Frankfurt/Main, FRG

Fig. 11: Facing for furniture units from extruded and subsequently thermoformed profile section from HOSTYREN N 7000

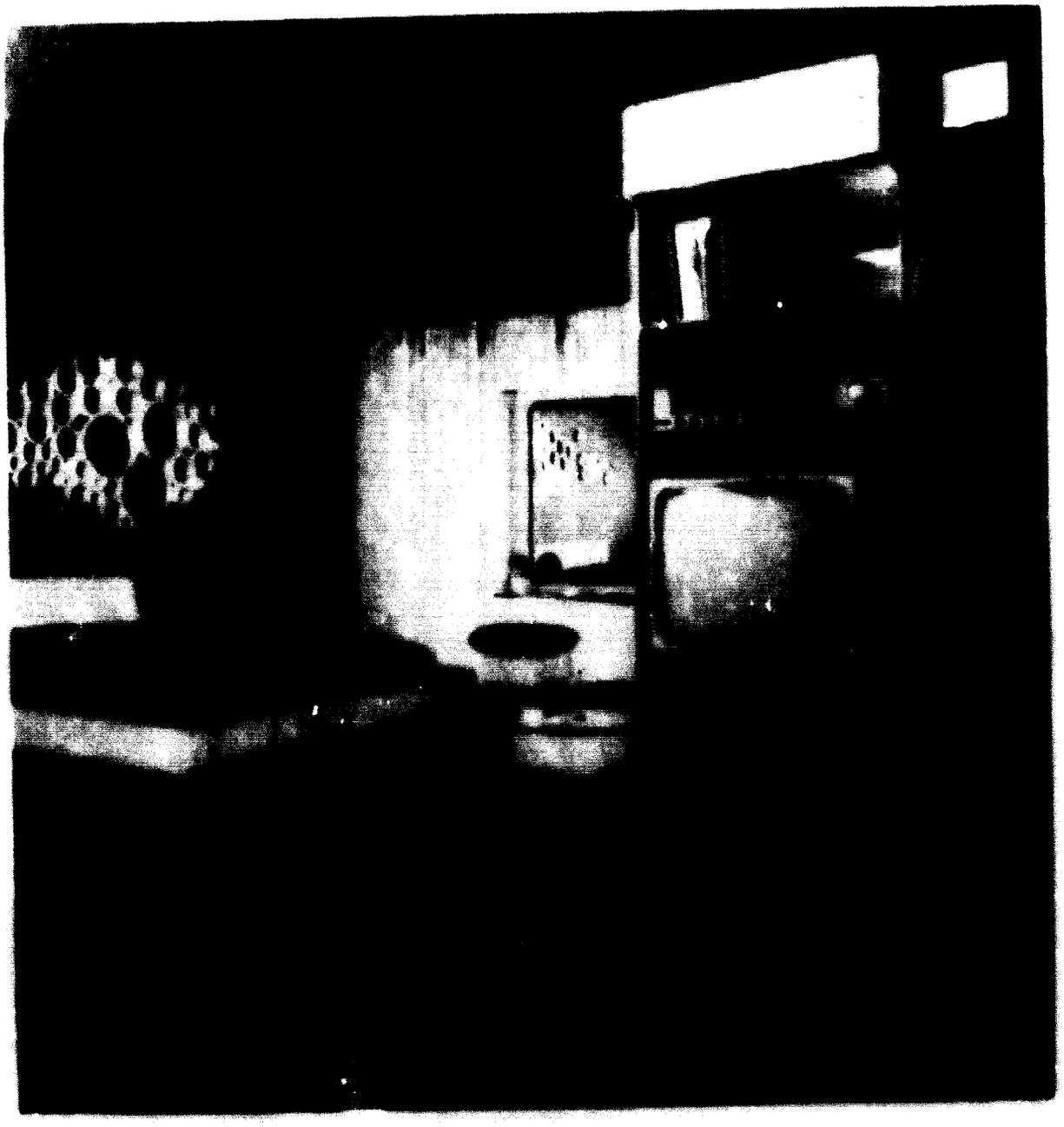


Fig. 12: Furniture facing from KOSTTREN N 7000

Fig. 13: School desk with body from polystyrene structural foam and polyurethane coated tabular steel legs.
Messrs. Flötotto Schulmöbelwerke, Gütersloh-Friedrichsdorf, FRG

Fig. 14: Chair from HOSTYREN S 4205
Messrs. Cado, Poul Cadovius KG, Metzkausen FRG

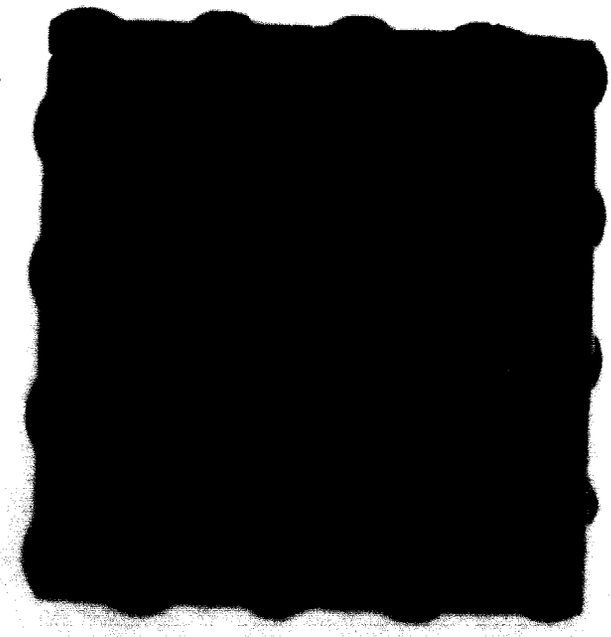
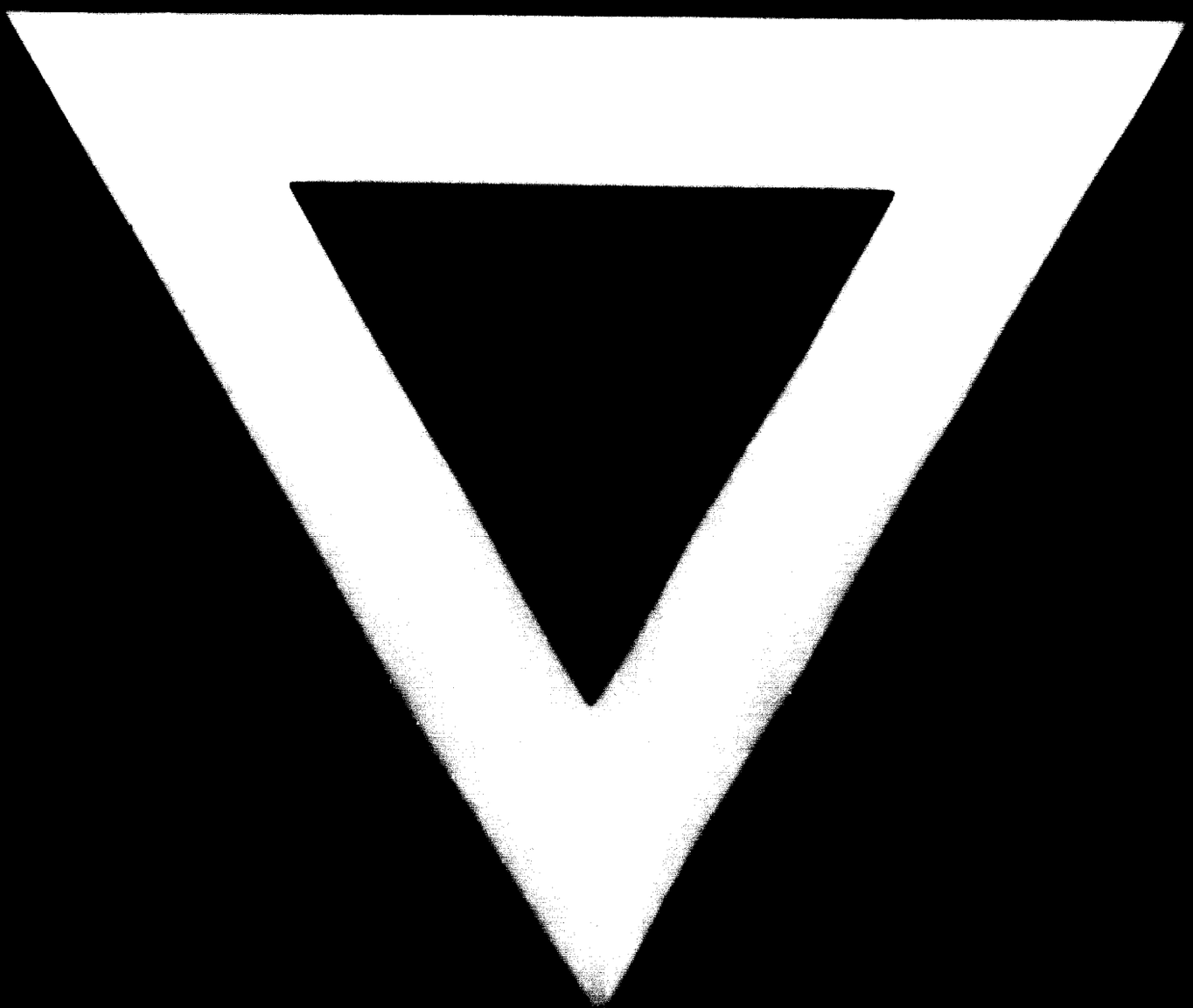


Fig. 15: Furniture panel from HOSVIRON B 4205
Source. ISOVOLTA, Wiener Neudorf, Austria

Fig. 16: Storage furniture from structural polystyrene foam. TOP TOP Gesellschaft für moderne Umweltgestaltung mbH, Rietberg, FRG

Fig. 17: Small cupboard from HOSTYREN structural foam
Messrs. Musterring International, Wiedenbrück, FRG



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