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TECHNO-ECONOMIC PROFILE

ON

SPECTACLE FRAMES

**PROJECT NO: UC/RAB/90/011
CONTRACT NO: 91/068P**

SEPTEMBER 1991

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TECHNO-ECONOMIC PROFILE ON SPECTACLE FRAMES

(PROJECT NO: UC/RAB/90/011

CONTRACT NO: 91/068P)

1.0 EXECUTIVE SUMMARY

Spectacle frames, although basically for holding lenses in front of the eyes for vision correction or protection, are also very much a fashion item. Fashion frames carry a price premium, but might be of short production runs, so that production must be geared to cope with this. To buffer this the production unit should market a number of 'standard' designs, free of the fashion label, to ensure long production runs.

Spectacle frame manufacture divides into two basic parts:

- a) Frames made mainly from plastics materials;
- b) Frames made of metal.

The machinery requirements, at most stages of production, are different for the two basic types. Consideration should be given, therefore, to starting manufacture in say plastic material and a second phase expansion, made by the introduction of a further production line for metal frames.

An initial production line, working on one 8 hour shift per day will produce between 100,000 and 150,000 frames per year, in plastics material and is estimated to cost US\$ 386,000. For metal frames, to produce between 100,000 and 150,000, a basic cost of US\$688,000. Both of these prices are for machinery installation, know-how, and training. This is exclusive of the building and other costs generated locally. For higher production a design team will have to be set up. Alternatively, use may be made of an existing design team, on a consultancy basis.

At full production of both types of frames a turnover of US\$10,500,000 is possible giving US\$4,050,000 gross profit. However with frame styles moving in and out of fashion it is important to have high 'mark-up' to cover risk factor.

2.0 PRODUCTION DEFINITION

2.1 Spectacle frames are a means of holding a pair of ophthalmic lenses in front of the eyes. They can also be used for sun filter lenses.

2.1.1 Basic Parts

Spectacles can be broken down into two main parts:

- a) A front, consisting of two shaped holes to take the lenses with a 'nose piece' between them;
- b) A pair of sides; each side has at one end half a hinge. This mates with the other half hinge which is attached to the front part. The other end of each side is normally bent to go over the ear thus helping to retain the complete frame on the wearer's face.

2.1.2 Materials

Materials must be selected that are suitable to come in contact with the human skin.

2.1.2.1 PLASTICS

A wide range of cellulose acetate sheet, in various colours and mottled effects, is available. This is a well tried material and inert to most wearers.

2.1.2.2 METAL

Although 'solid' gold in various carats is still used for one-offs, the majority of

metal frames produced now use, either rolled gold (a base metal surrounded with a very thin layer of gold alloy), or a base material which is electro-plated with another metal after forming into the required shape. Among suitable plating materials are gold, rhodium and chrome.

An alternative to metal finish is to spray the base metal with a suitable 'varnish'. This is then baked on. Many colours and effects can be made using this technique.

2.1.2.3 COMBINATIONS

Frames can be made using combinations of the two basic materials; for example, a plastics front with sides of metal.

2.2 Standards

From a quality point of view the new ISO standard 'Requirements and test methods for spectacle frames' should be followed (this as yet has no number). This will supersede other national standards. By way of example of a national standard DIN 5361 is included at Appendix A to describe the basic nomenclature.

3.0 TECHNOLOGY REVIEW

3.1 Review of the Options

The potential market is not limited to the number of people requiring sight correction. There is theoretically no limit to the number of pairs a person may buy. In practice there is a market level, but this can be influenced. It is the design and quality which play a major factor in the sales.

Taking an area population of say 24,000,000; 50% will at some time require glasses. A reasonable estimate of 1.2 pairs per person gives 14,400,000 pairs. Assuming a four year replacement cycle, we can estimate a 3,600,000 pairs per year potential market.

The market should be considered as 70% 'Standard' designs and 30% fashion.

3.2 Production Scale Ranges

Bearing in mind that plastics and metal frames are produced on different equipment, if both types are to be produced from day one, until volume sales are built up, utilisation of machinery is going to be very much under capacity.

Production of 100,000 - 150,000 frames per year is well within the capacity of the basic manufacturing line for plastics frames.

A basic metal frame line could alone produce around 250,000 frames a year, which would require high order book levels before production started.

It is possible to buy-in pre-made metal components and

assemble locally. This would reduce the initial outlay on equipment, but against this is the restriction on the scope for the design as it will then rely on a mixture of components already on existing frames being sold to the market.

3.3 Recommended Production Technology

Machinery may be bought 'piece meal', however there are companies offering complete production lines and the technical know-how to go with it. It is recommended that such a company is used for initial start-up.

Today many stages of production can be done on automatic machinery, their output, in many cases, is so high that on production figures being considered at present, initial investment in them would be difficult to justify.

Although some frame ranges, on the market, carry famous designers' names, the actual design should be left to experienced frame designers. This is because flair must be tempered with practical and anatomical requirements.

Initially 70% of production should be on long run styles (basic designs) and 30% 'fashion' frames.

3.3.1 Frame Manufacture (A) Plastics Frames

The raw material is sheet plastics (cellulose acetate). The sheet is cut into oblong blocks for fronts, and strips to form the sides.

The side material usually requires reinforcing and therefore, a metal core is inserted. The plastics strip is heated and the metal core is 'shot' into the softened material. The side

blank is then milled to shape. Some core wires incorporate the side joint, depending on design criteria; if not present a joint must be attached to the side pieces.

The front block may require extra thickness at certain points, such as the bridge and an additional piece of material is attached either by gluing or heat welding.

The front is formed in a series of milling operations. The first stage is to mill out the two holes. Then using these orifices as jig locators, the rest of the front is milled to shape. It is necessary to 'bow' the front to take up the curve of the lenses. Joints are inserted into the formed front.

The joint pieces must be protected during the barrelling process, and caps are moulded over the joints. Fronts and sides are placed in rotating barrels together with various media, to smooth and polish the plastics material to the required finish. This process takes many hours and barrels are run twenty four hours a day. Upon completion the capsules are removed from the joints and the sides screwed to the fronts.

Identification marks are printed on the inside faces of the sides or fronts. After final cleaning and checking the finished product is packed ready for shipment.

3.3.2 Metal Frames

Production of metal frames differs in many ways from the method employed for plastics frames.

The raw material, nickel, rolled gold, etc. come either in the form of drawn wire of circular cross section, or in "profile" wire.

Sides

The round wire is cut to length and passed through a swaging machine to reduce/alter it's profile. The pieces are then shaped in a stamping press, followed by grinding and polishing. After spot welding of the joint to the side, the ends are trimmed and the sides cleaned.

Eye Rims

The eye rims are also formed from wire. The wire is passed between shaped rollers to give it a "V" profile and at the same time curl it around to form the rim. A closing block is soldered at the rim opening and the rim pieces are "bowed" for lens curve take-up.

Bridges

Bridge pieces are coined (pressed) from cut lengths of wire. These are then trimmed followed by grinding and polishing.

Fronts

Two eye rims and a bridge piece are bought together in a jig and soldered. Pad arms (if required) are soldered to the front. The rim closing blocks can now be slit and screwed together. The sides are fitted to the front. The method varies according to the design. Normally this involves spot welding. The whole

assembly is barrel polished.

If plating finish is required, the frame is passed through the galvanization plant where various metal layers are deposited electrolytically.

Final assembly includes the mounting of plastics pads on the pad arms, followed by cleaning and packing.

3.3.3 Packaging

Packaging should not be too elaborate. The customer (final) does not normally see the packaging so this only adds to production cost and thus end price. Packaging should be supplied locally and would typically consist of each frame being inserted in a plastic bag which is then packed in a cardboard box (10 frames per box).

3.4 The Sources of Technology

3.4.1 Companies offering complete production lines and know-how:

F. W Haug GMBH & Co. KG
Haunauer Strasse 18
D-7530 Pforzheim
Germany
Tel: 07231 62023
Fax: 07231 66582 Plastics and metal lines

Seit Elettronica S.R.L.
Zona Industriale
31049 Valdobbiadene (TV)
Italy
Tel: 0423 975767
Fax: 0423 975785 Plastics and metal lines

Da Rin & Pinazza
32040 Domegge Di Cadore
Italy
Tel: 0435 72006
Fax: 0435 72405 Plastics line

3.4.2 Companies producing a wide range of
 machinery for frame manufacture:

Optimex
2 Rue General Ferrie
01105 Oyonnax Cedex
France
Tel: 74 77 51 86

Vaucher
5 Chemin De La Tuilerie
01103 Oyonnax Cedex
France
Tel: 74 77 00 12
Fax: 74 73 59 07

3.4.3. Company supplying barrel polishers and
 compound:

Emslie, Fallows Ltd.
14 Terminal Close
Shoeburyness
Essex SS3 9BN
UK
Tel: 03708 5644

3.4.4 Companies supplying components:

OBE-Werk
Postfach 20
D-7536 Ispringen bei Pforzheim
Germany
Tel: 07231 802-0
Fax: 07231 802156

Hinges, side wires,
screws and other
metal parts.

Comotec
La Doye
39400 Morez
France
Tel: 84 33 74 30
Fax: 84 33 15 56

Hinges, side wires,
pads, pad arms,
side tips.

3.4.5 Companies supplying raw materials:

Metal

Aspex International Ltd.
1 Bedford Road
London N2 9DB
UK
Tel: 081 444 2161
Fax: 081 883 3601

Wire; round and
profile in nickel
silver and rolled
gold.

Plastics

Mazzuchelli 1849 spa
Via S E P Mazzuchelli 7
21043 Castiglione Olona
Varese
Italy
Tel: 0331 826111
Fax: 0331 826213

3.4.6. Company offering frame design services:

Birch Designs Ltd.
Unit 2D Lakeside Industrial Estate
Brynmawr
Gwent NP3 4XN
UK
Tel: 0495 310305
Fax: 0495 311852

4.0 THE PRODUCTION PROCESS

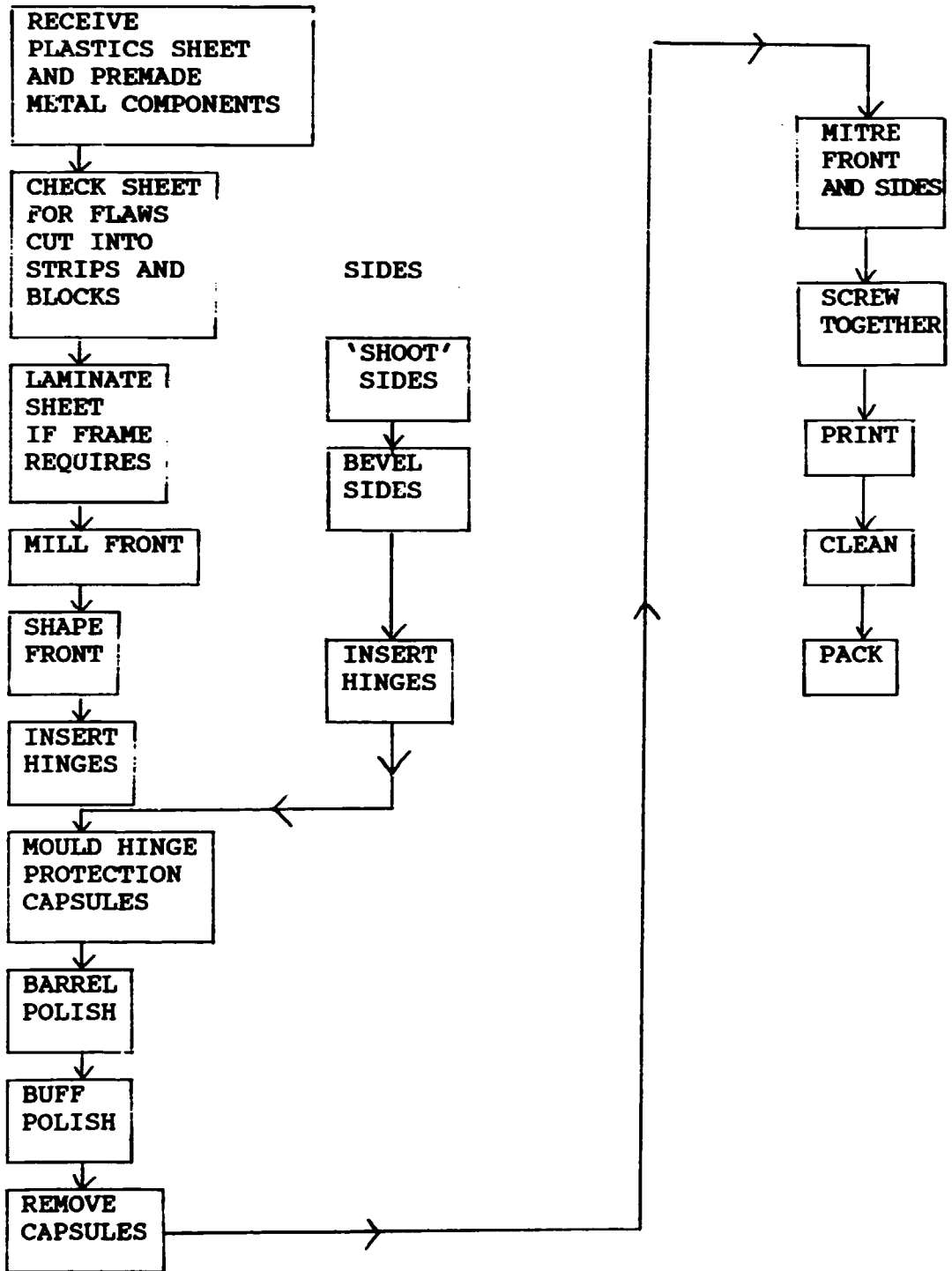
4.1 Description and Flowsheet for the Recommended Technology

The following description cover typical cases. Each frame, however, will require individual variations to the production.

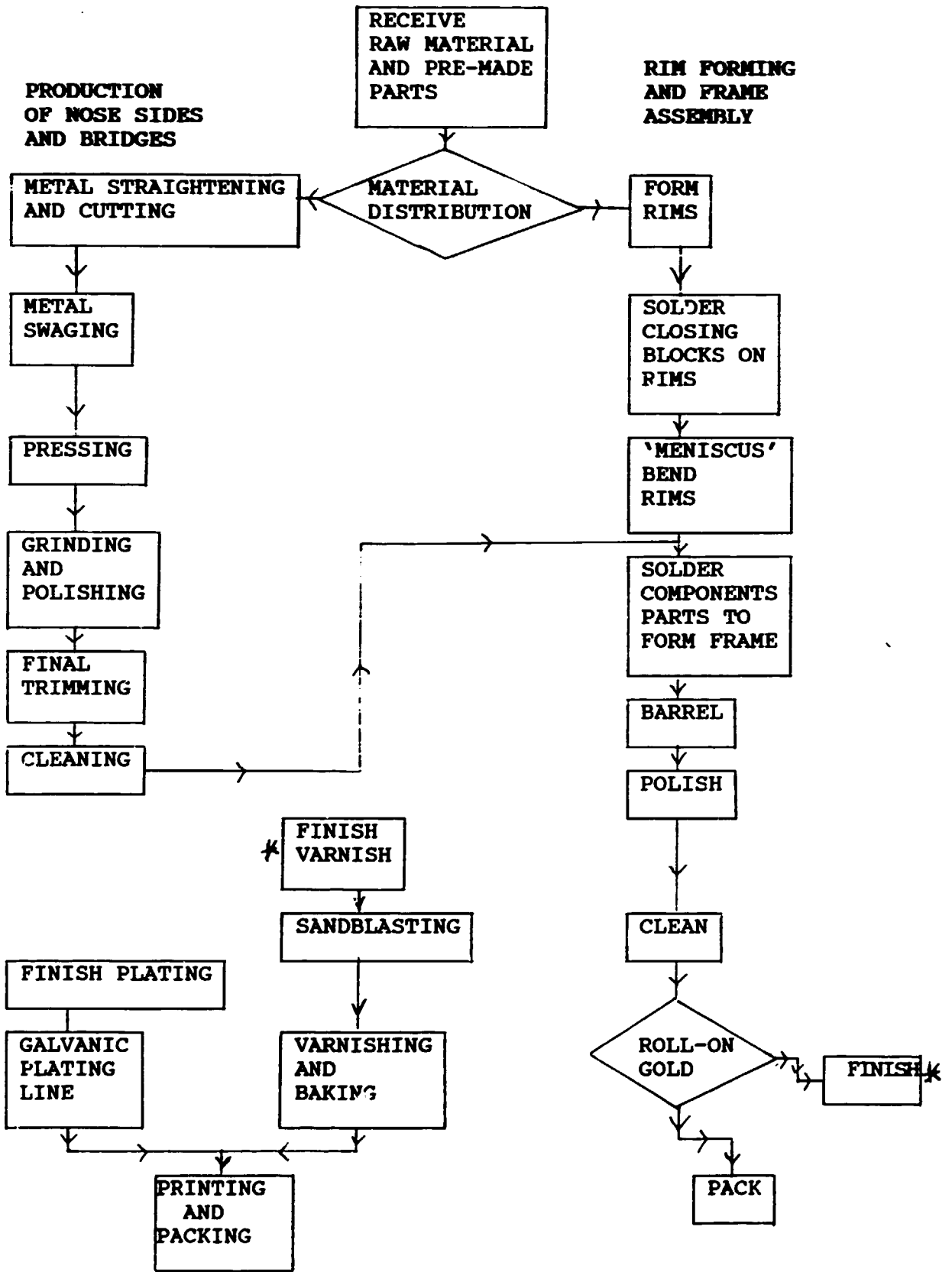
4.1.1 Plastics Frames

1. Receive plastics sheet and pre-made metal components. Inspect sheet for flaws; store horizontally.
2. Plane sheet to exact thickness required.
3. Cut into strips for sides and blocks for fronts.
4. Shoot reinforcing wire into side blank.
5. Insert hinges if not already on wire.
6. Mill front block; form 'eyes', the holding blank using eye holes, the rest of front is milled to shape.
7. Bow front to 'meniscus' shape of lenses.
8. Insert hinges.
9. Mould on hinge capsules to protect hinges during barrelling.
10. Barrel smooth and polish. Components placed in rotating drums together with wooden pegs and abrading and polishing compounds.
11. Buff parts on rotating mops.
12. Remove capsules.
13. Mitre front and sides to form contact surfaces.

FLOW CHART PLASTICS FRAMES



FLOW CHART METAL FRAMES



14. Screw sides to front.
15. Print frame details on side.
16. Clean frames in ultra-sonic cleaner.
17. Fit dummy lenses (if required). Lenses pre-cut on automatic unit.
18. Pack frames individually and bulk-up.

4.1.2 Metal Frames

1. Receive metal wire and pre-formed materials. Sides, bridged and noses.
2. Straighten wire and cut to length.
3. Swaging; wire formed to shape.
4. Pressing to give further shaping.
5. Grinding and polishing using vibrator unit.
6. Final trimming.
7. Cleaning and drying.
Rim forming and frame assembly.
8. Form rim from wire.
9. Solder on rim closing blocks.
10. Bend rims to take up meniscus lens shape.
11. Solder components together.
12. Tap closing blocks. Cut sided at joint, or screw sides to front.
13. Polish if metal need no further treatment.
14. Clean in ultra-sonic.

Metal frame finishing

15. Sandblast to obtain suitable surface to the metal.
- 16.a) Electro-plating; frame immersed in a number of baths and a current passed so that frame takes up some

- of the metal in solution.
- 16.b) Varnishing; frames are sprayed with 'varnish' and this is baked on in an oven.
17. Print frame details on side.
18. Pack frames in suitable containers.

4.2 Outline List of Machinery and Equipment

4.2.1 Plastics Frame Production

	US\$
1 sheet cutter	1800
1 sheet planer	12700
1 bevelling machine	6000
1 pantograph internal	6100
1 pantograph external	6100
1 pantograph tilting	6100
1 copy milling machine	15900
1 hinge inserting machine	13400
1 micro drilling machine	3180
1 capsules injecting machine	6100
1 capsules removing machine	1600
1 shining machine	4000
1 HF heater	8600
1 bending press	4900
2 double spindle buffing machines	6400
5 tumbling barrels	22500
1 semi automatic screw driving machine	5650
1 tampon printing machine	4600
1 temple tip bending machine with heater	4600
1 angle miller	3250
1 core shooting machine	19200
1 sheet laminator	17200
1 automatic lens shaping and bevelling machine	12600
1 water veil spray booth	6100

3 manual spray guns	450
1 drying oven	9900
1 trolley for oven	800
1 ultrasonic cleaning line	11800
1 rinse module	1400
1 solvent dryer	20400

4.2.2 Metal Frame Production

4.2.2.1 MACHINE FOR PRODUCTION OF SIDES, NOSES AND BRIDGES

1 automatic straightening and cutting machine	US\$ 4800
2 1-head manual swaging machines	10700
1 machine for pointing	4400
1 hydraulic press	30000
1 eccentric press	9500
1 circular vibrator 11 lt.	4100
1 circular vibrator 16 lt.	5300
1 trimming machine	4000
1 combined tanks cleaning and drying	21100

4.2.2.2 MACHINES FOR FRAME ASSEMBLY

1 rim forming machine with cam tracer	14000
4 closing blocks resistance soldering machines	6000
1 meniscus forming press	2800
1 bending press for sides and joints	3400
1 hinges resistance soldering machine	6900
2 soldering machines for noses	20800
2 soldering machines for bridges	20800
3 soldering machines for side joints	31800
2 soldering machines for nose pad supports	22000
1 soldering machine for spring hinges	9900
1 'V' cutting machine for closing blocks	4800

1 bench milling machine	1600
1 semi automatic screw driving machine	5600
1 tapping machine for closing blocks	800
1 milling machine for side joints	2900
2 double spindle buffing machines	6400
1 ultrasonic cleaning tank	11200
1 solvent dryer	18600
2 barrels	15800
1 side tip bending machine	4600
1 tampon printer	3400
1 lens shaper and bevelling machine	12700
3 micro air grinders	900
2 electric screw drivers	2400
1 template reproduction machine	1700
1 refrigerating unit for water cooling	7500

4.2.2.3 MACHINES FOR FINISHING METAL FRAMES

1 sand blasting booth	2800
1 complete electro-plating line	73000
1 water recycle system	19900
1 water veil spray booth	6500
3 manual spray guns	360
1 electrostatic spray gun	11100
1 drying oven	9000
1 trolley for drying oven	800

4.3 Budget Cost Estimate for Machinery ex Europe

Plastics machines	US\$ 268,000 (inclusive of 10% contingency)
Carriage and insurance	US\$ 26,800
Metal machines	US\$ 503,000 (inclusive of 10% contingency)
Carriage and insurance	US\$ 50,300

4.4 Budget Cost for Erection of Machinery

Cost of technicians from company supplying complete line.

Plastics line	US\$ 40,000
Metal line	US\$ 50,000

4.5 Site Requirements

The site should provide one level for the production area. There will be no very high floor loadings. There should also be an administration area, with showroom. Also provision should be made for an additional building to take a second phase for a metal frame production line.

4.6 Details of Building

A light industrial building is required with air conditioned production and administration areas. Plastics, for instance, are best stored and worked at 20°C with relative humidity of 45-55%.

4.7 Raw Materials Required

With the variety of frame styles, raw material requirements will be governed by the models in production or pending.

Sources of supply for the following must always be kept opened:

Plastics sheet

Metal wire
 Hinges
 Side wires
 Frame screws
 Trims
 Pre-made components (pad arms, bridges etc.)
 Solder
 Barrelling compounds and chips
 Galvanic chemicals
 Cleaning chemicals.

4.8 Raw Material Prices

As in 4.7 prices will vary with the requirement of the model. Prices of materials will often influence and modify the design at the planning stage.

Some typical current costs:

Plastics sheet from	US\$ 12.25 - 31.5	per kilo
(typically 100kg/1000 frames)		
Hinges for plastics frames	US\$ 287.00	per 1000 pairs
Side wires	US\$ 463.75	per 1000 pairs
Screws for above	US\$ 45.40	per 2000 pieces
Wire nickel silver 18%:		
Round 1.7mm	US\$ 33.25	per kilo
Profile 1.2 x 1.8 mm	US\$ 51.30	per kilo
Wire rolled gold 20/100:		
Round 1.5mm	US\$ 283.50	per kilo
Profile	US\$ 521.50	per kilo
Hinges for metal frames	US\$ 218.75	per 1000 pairs
Closing blocks	US\$ 201.25	per 1000 pairs

4.9 Utility Requirements

Electricity:-

40 KVA for plastics production

100 KVA for metal production

Air conditioning and lighting extra

A water supply must be provided at 250 ltr/hr plus domestic usage.

Compressed air - nominal requirement from small industrial compressor rated at 1500 ltr/min at 6 Bar

4.10 Normal Annual Maintenance

If complete line is bought, a maintenance contract should be sought at time of placing the order for the plant. General maintenance will be carried out by local staff. Allow 10-12% of overheads for maintenance.

4.11 Manpower Requirements

Production staff per 8 hour shift are:

General Manager	1
Financial Manager	1
Sales Manager	1
Administrative Manager	2
Production Engineer	1
Fitter	1

Plastics:

1 supervisor
10 operators at start-up
15 operators at full production

Metal:

1 supervisor
10 operators at start-up
22 operators at full production

Initial production (first 3 years) are based upon one 8 hour shift for both plastics and metal lines working 250 days/year.

General Manager - Should have a good track record of starting and building up a production unit and a sales force

Financial Manager - Minimum of 5 years' experience. Besides general accounting will be responsible for cost accounting of products. This is a very important aspect of job, as costs of models will vary greatly.

Sales Manager - Preferably with some experience in ophthalmic optics, to build up a local sales team; the size of team to reflect sales.

Administration - Two at start-up; both with experience and able to cover normal office duties plus sales from showroom if sales manager is not available.

Production Engineer - Key person; experience gained in a unit using a wide variety of machinery. Must be able to pass on knowledge to non skilled personnel.

Supervisor - To work under production manager. Should have had some appropriate formal training.

Fitter - For day to day maintenance. Must have had formal training plus experience.

Operators - At start-up, train 10 for plastics line and increase as production builds up. Fifteen will be required to work the line fully. Per shift for metal frames train 15 operators at start-up 22 will be required per shift in full production.

4.12 Pre-Production Costs

Training at suppliers works - 3 persons for two weeks plus know-how and ad hoc support for 1 year

Plastics line	\$ 51,200
Metal line	\$ 84,700

It is suggested that initial designs are brought in together with tooling. This would avoid local toolmaking facilities. Costs would depend on designs selected.

4.13 Initial Production Levels

With so many stages of production, initially there will have to be a work up period when it is suggested stocks of one or two models are built up then production can be increased depending on sales till capacity of plant reached. If second shift is then introduced, more barrelling machinery will have to be added as this process continues 24 hours a day.

Production per year	Plastics	Metal
Year 1	50,000	35,000
2	90,000	70,000
3	150,000	120,000

4.14 Construction Period

Design and Purchase Period	12 weeks
Buildings	16 weeks from clean site
Machinery delivery:	
- Plastics line	22 weeks

- Shipping	4 weeks
Installation	4 weeks
Production run-up	8 weeks
TOTAL OVERALL TIME	50 WORKING WEEKS

<u>Activity</u>	<u>Duration (weeks)</u>
Design/Purchase	----- 12 weeks
Machine delivery	----- 22 weeks
Shipping	-- 4 weeks
Installation	-- 4 weeks
Production/ Commissioning	---- 8 weeks
Buildings	----- 16 weeks

4.15 Environmental Aspects

There will be no great problems; however there should be care in the storage and handling of chemicals and their disposal.

5.0 PRODUCTION COSTS

These vary considerably due to (a) great variation in material costs according to design and (b) again depending on design, the number of production stages varies. The spread of production costs developed from an actual manufacturers cost is:

	<u>US\$</u>	<u>US\$</u>
	<u>MIN</u>	<u>MAX</u>
Plastic frames	7.9	17.0
Metal frames	12.0	32.5

6.0 INTERNATIONAL PRICE OF PRODUCTS

Quality frames sell to retailers from US\$ 20 to 100 or higher. With production controlled locally, it is easier to select the price range and produce accordingly. It can be seen that by changing specifications of materials, production costs can be varied greatly. Also design details add to production costs; for example if by slight modification of design a whole milling stage can be omitted, then the product may be aimed in a different price bracket.

By way of example the following calculations for turnover and gross profit are set out:

Plastic frames sell at US\$20 to 70.

Metal frames sell at US\$35 to 100.

Weighted Average selling price (weighted to take in to account greater rates of standard models)

Plastic frames US\$30.00

Metal frames US\$50.00

Manufacturing costs

Plastic frames US\$7.9 to 17

Metal frames US\$12 to 32.5

Taking worst case of manufacturing costs.

150,000 plastics frames @ US\$17	2,550,000
120,000 metal frames @ US\$32.5	3,900,000

	6,450,000

150,000 sell @ US\$30	4,500,000
120,000 sell @ US\$50	6,000,000

	10,500,000

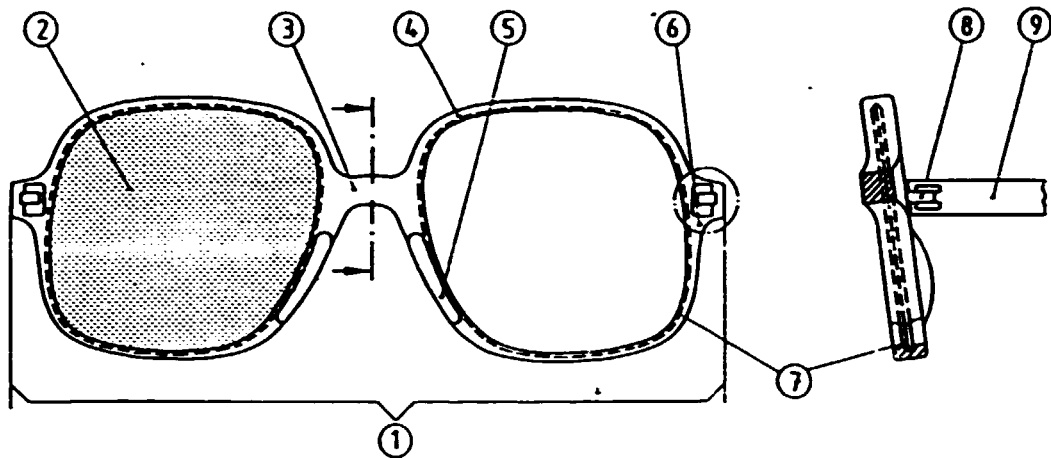
Therefore in third year, gross profit could be US\$ 4,050,000.

APPENDIX A

DIN 5361 - NOMENCLATURE

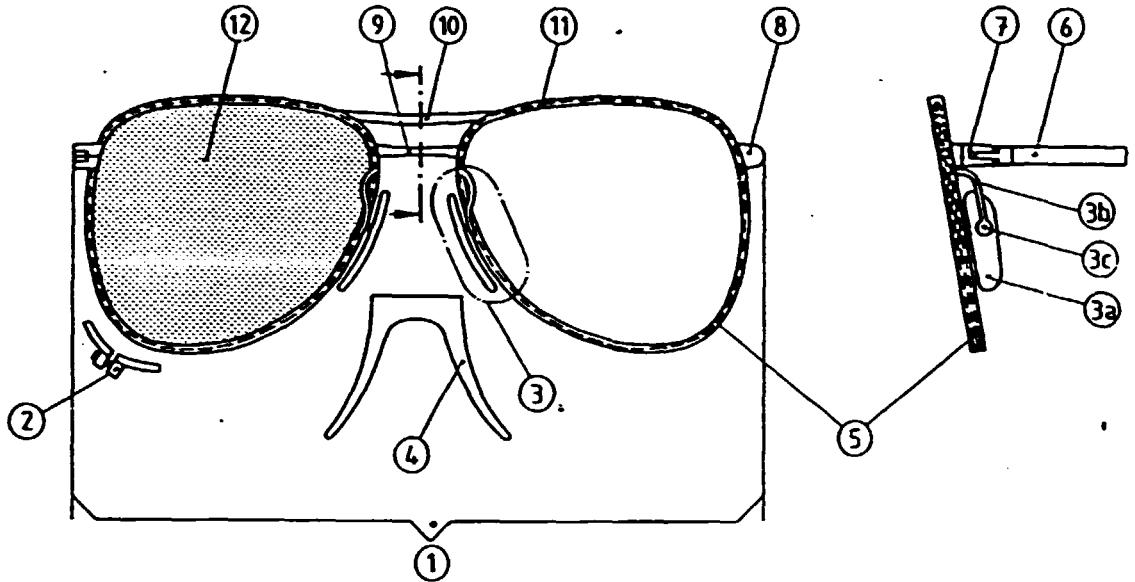
4 Benennungen

4.1 Kunststofffassungen

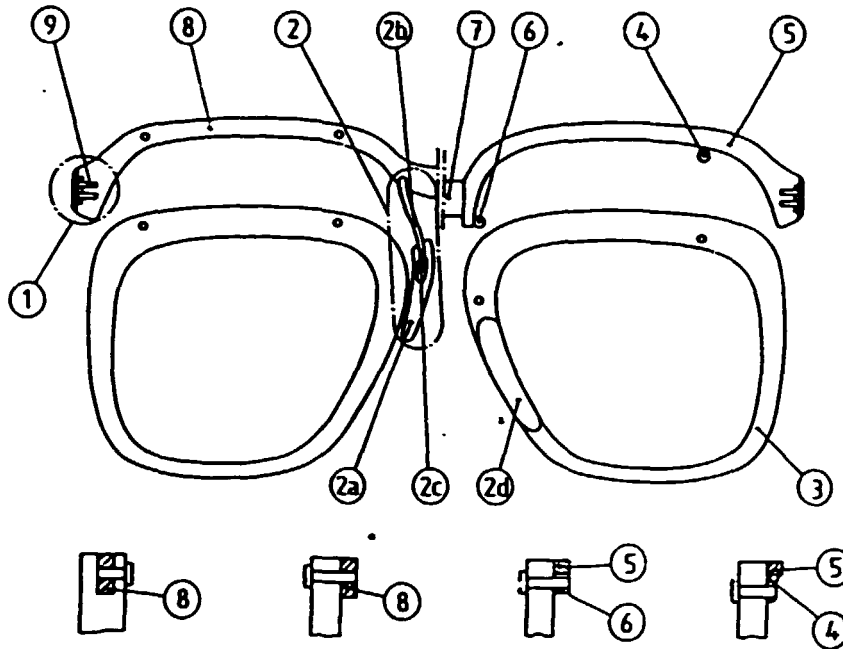


Lfd. Nr	deutsch	englisch	französisch	italienisch	spanisch
	Kunststoff-fassungen	<i>frames made of plastics</i>	<i>montures en matières plastiques</i>	<i>montature di materie plastiche</i>	<i>monturas de materia plástica</i>
1	Mittelteil	<i>front</i>	<i>face</i>	<i>frontale</i>	<i>frente</i>
2	Scheibenform	<i>lens shape</i>	<i>oeil</i>	<i>occhio</i>	<i>forma interior del aro</i>
3	Brücke	<i>bridge</i>	<i>pont</i>	<i>ponte</i>	<i>puente</i>
4	Rand	<i>rim</i>	<i>cercle</i>	<i>cerchio</i>	<i>aro</i>
5	Seitensteg	<i>pad</i>	<i>plaque collée</i>	<i>aletta</i>	<i>plaqueta pegada</i>
6	Backe	<i>lug</i>	<i>tenon</i>	<i>muso</i>	<i>talón</i>
7	Fassungsnut	<i>groove</i>	<i>drageoir</i>	<i>canalino</i>	<i>ranura</i>
8	Gelenk	<i>joint</i>	<i>charnière</i>	<i>cerniera</i>	<i>bisagra</i>
9	Bügel	<i>side</i>	<i>branche</i>	<i>asta</i>	<i>varilla</i>

4.2 Metallfassungen

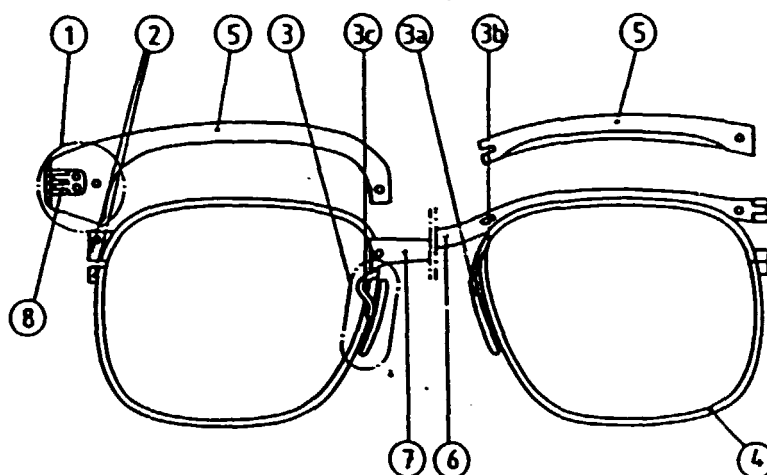


Lfd. Nr	deutsch	englisch	französisch	italienisch	spanisch
	Metallfassungen	metal frames	montures métal	montature di metallo	monturas de metal
1	Mittelteil	front	face	frontale	frente
2	Schließblock	block joint	bloc de fermeture	blocco di chiusura	bloque de cierre
3	Seitenstegpartie	pad and pad arm	jeu complet de la plaquette	settore placchetta	juego completo de la plaqueta
3 a	Seitenstegplättchen	pad	plaquette	placchetta	plaqueta
3 b	Seitenstegstütze	pad arm	bras de plaquette	porta-placchetta	brazo de plaqueta
3 c	Seitenstegbefestigung	stud	attache-plaquette	attacco placchetta	sujetador de plaqueta
4	Sattelsteg	saddle bridge	pont en forme de selle	ponte a sella	puente en forma de silla
5	Fassungsnut	groove	drageoir	canalino	ranura
6	Bügel	side	branche	asta	varilla
7	Gelenk	joint	charnière	cerniera	bisagra
8	Backe	end-piece	tenon	muso	talón
9	Brücke	bridge	pont	ponte	puente
10	Strebe	brace bar	pont supérieur	puntello	puntal
11	Rand	rim	cercle	cerchio	aro
12	Scheibenform	lens shape	ceil	occhio	forma interior del aro

4.3 Kombinierte Fassungen
Konstruktionsart A

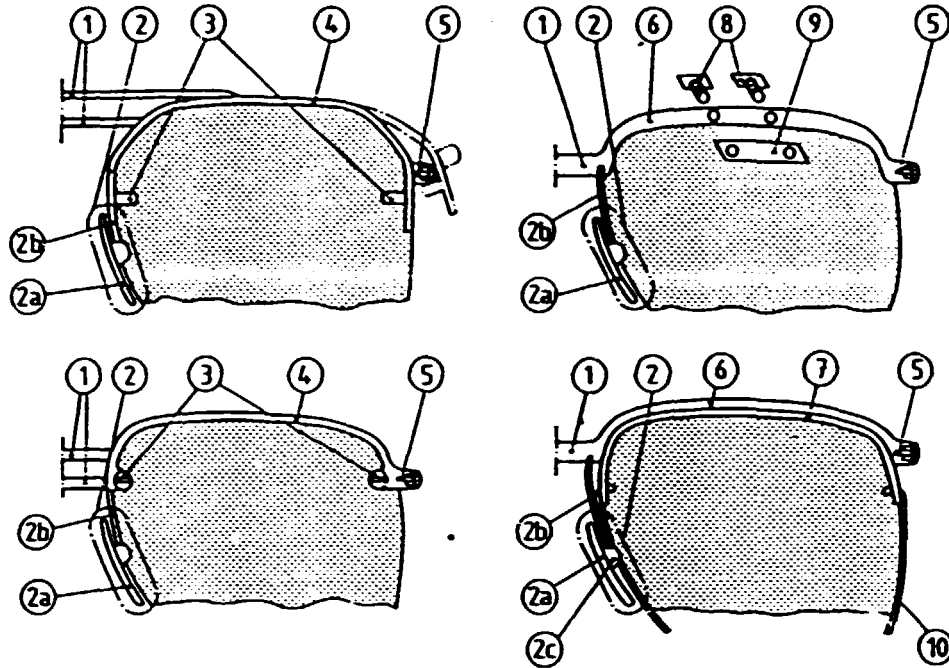
Lfd. Nr	deutsch	englisch	französisch	italienisch	spanisch
	kombinierte Fassung	<i>combination frames</i>	<i>montures combinées</i>	<i>montature combinata</i>	<i>monturas con combinación de metal y plástico</i>
1	Backe	<i>lug</i>	<i>tenon</i>	<i>muso</i>	<i>talón</i>
2	Seitenstegpartie	<i>pad and pad arm</i>	<i>jeu complet de la plaquette</i>	<i>settore placchetta</i>	<i>juego completo de la plaqueta</i>
2 a	Seitensteg- plättchen	<i>pad</i>	<i>plaquette</i>	<i>placchetta</i>	<i>plaqueta</i>
2 b	Seitenstegstütze	<i>pad arm</i>	<i>bras de plaquette</i>	<i>porta placchetta</i>	<i>brazo de plaqueta</i>
2 c	Seitensteg- befestigung	<i>stud</i>	<i>attache- plaquette</i>	<i>attacco placchetta</i>	<i>sujetador de plaqueta</i>
2 d	Seitensteg	<i>pad</i>	<i>plaquette collée</i>	<i>aletta *</i>	<i>plaqueta pegada</i>
3	Kunststoffrand	<i>rim</i>	<i>cercle</i>	<i>cerchio</i>	<i>aro</i>
4	Befestigungsör	<i>rim lug</i>	<i>oeilleteon-support</i>	<i>occhiello supporto</i>	<i>brida</i>
5	Halbbalken	<i>browbar</i>	<i>barrette</i>	<i>portante cerchio</i>	<i>barra-ceja</i>
6	Schraubhülse	<i>threaded rim lug</i>	<i>barillet</i>	<i>boccola</i>	<i>barrilete</i>
7	Brücke	<i>bridge</i>	<i>pont</i>	<i>ponte</i>	<i>puente</i>
8	Balken	<i>browbar</i>	<i>barre frontale</i>	<i>barra frontale portante</i>	<i>barra frontal ciliar</i>
9	Gelenk	<i>joint</i>	<i>chamière</i>	<i>cerniera</i>	<i>bisagra</i>

Konstruktionsart B



Lfd. Nr	deutsch	englisch	französisch	italienisch	spanisch
	kombinierte Fassung	<i>combination frames</i>	<i>montures combinées</i>	<i>montature combinata</i>	<i>monturas con combinación de metal y plástico</i>
1	Backe	<i>lug</i>	<i>tenon</i>	<i>muso</i>	<i>talón</i>
2	Schließblock	<i>block joint</i>	<i>bloc de fermeture</i>	<i>blocco di chiusura</i>	<i>bloque de cierre</i>
3	Seitenstegpartie	<i>pad and pad arm</i>	<i>jeu complet de la plaquette</i>	<i>settore placchetta</i>	<i>juego completo de la plaqueta</i>
3 a	Seitenstegplättchen	<i>pad</i>	<i>plaquette</i>	<i>placchetta</i>	<i>plaqueta</i>
3 b	Seitenstegstütze	<i>pad arm</i>	<i>bras de plaquette</i>	<i>porta placchetta</i>	<i>brazo de plaqueta</i>
3 c	Seitenstegbefestigung	<i>stud</i>	<i>attache-plaquette</i>	<i>artacco placchetta</i>	<i>sujetador de plaqueta</i>
4	Rand	<i>rim</i>	<i>cercle</i>	<i>cerchio</i>	<i>aro</i>
5	Kunststoffoberteil	<i>hood</i>	<i>garniture frontale</i>	<i>ciliare</i>	<i>bonete de plastico</i>
6	Balken	<i>browbar</i>	<i>barre frontale</i>	<i>barra frontale portante</i>	<i>barra frontal ciliar</i>
7	Brücke	<i>bridge</i>	<i>pont</i>	<i>ponte</i>	<i>puente</i>
8	Gelenk	<i>joint</i>	<i>charnière</i>	<i>cerniera</i>	<i>bisagra</i>

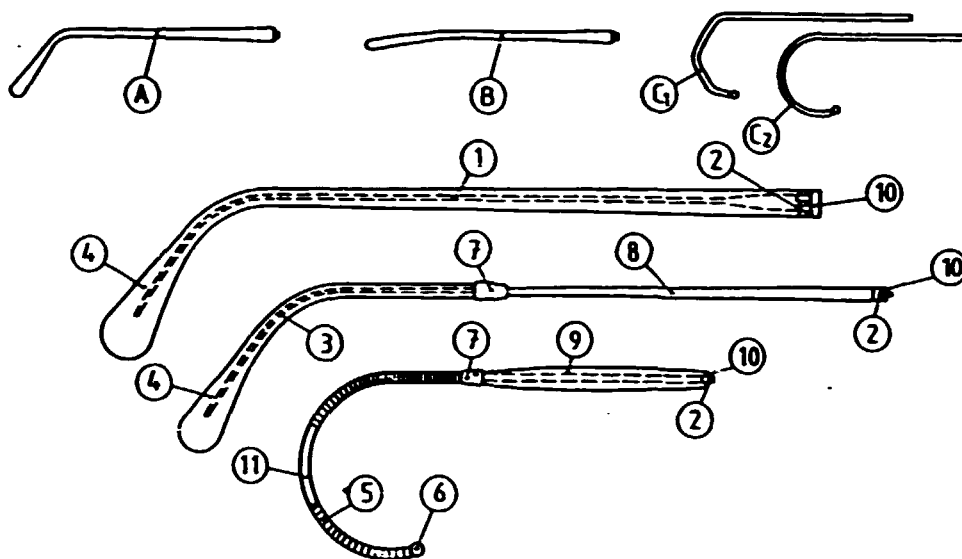
4.4 Fassungen für randlose Brillen



Lfd. Nr	deutsch	englisch	französisch	italienisch	spanisch
		Fassung für randlose Brillen	<i>rimless mount</i>	<i>châssis pour lunettes "glace"</i>	<i>chassis per occhiali a giorno</i>
1	Brücke	<i>bridge</i>	<i>pont</i>	<i>ponte</i>	<i>puente</i>
2	Seitenstegpartie	<i>pad and pad arm</i>	<i>jeu complet de la plaquette</i>	<i>settore placchetta</i>	<i>juego completo de la plaqueta</i>
2 a	Seitensteg- plättchen	<i>pad</i>	<i>plaquette</i>	<i>placchetta</i>	<i>plaqueta</i>
2 b	Seitenstegstütze	<i>pad arm</i>	<i>bras de plaquette</i>	<i>porta- placchetta</i>	<i>brazo de plaqueta</i>
2 c	Seitensteg- befestigung	<i>stud</i>	<i>attache- plaquette</i>	<i>attacco placchetta</i>	<i>sujetador de plaqueta</i>
3	Befestigungsöse	<i>strap</i>	<i>oeilleteon support</i>	<i>occhiello- supporto</i>	<i>brida</i>
4	Halbbalken	<i>browbar</i>	<i>barrette</i>	<i>portante cerchio</i>	<i>barra-ceja</i>
5	Gelenk	<i>joint</i>	<i>charnière</i>	<i>cerniera</i>	<i>bisagra</i>
6	Balken	<i>browbar</i>	<i>barre frontale</i>	<i>barra frontale portante</i>	<i>barra frontal</i>
7	Teilrand	<i>rim</i>	<i>demi-cercle</i>	<i>semicerchio</i>	<i>semiario</i>
8	Niet, Halteschraube	<i>assembly rivet or screw</i>	<i>rivet ou vis d'assemblage</i>	<i>rivetto o vite di fissaggio</i>	<i>tornillo o pemo de sujecion</i>
9	Gegenplatte	<i>counter-plate</i>	<i>contre-plaque</i>	<i>contro-placca</i>	<i>contraplaca</i>
10	Kunststoff-Faden	<i>plastics filament</i>	<i>bande en matière plastique</i>	<i>filo di materiale plastico</i>	<i>cinta en materia plastica</i>

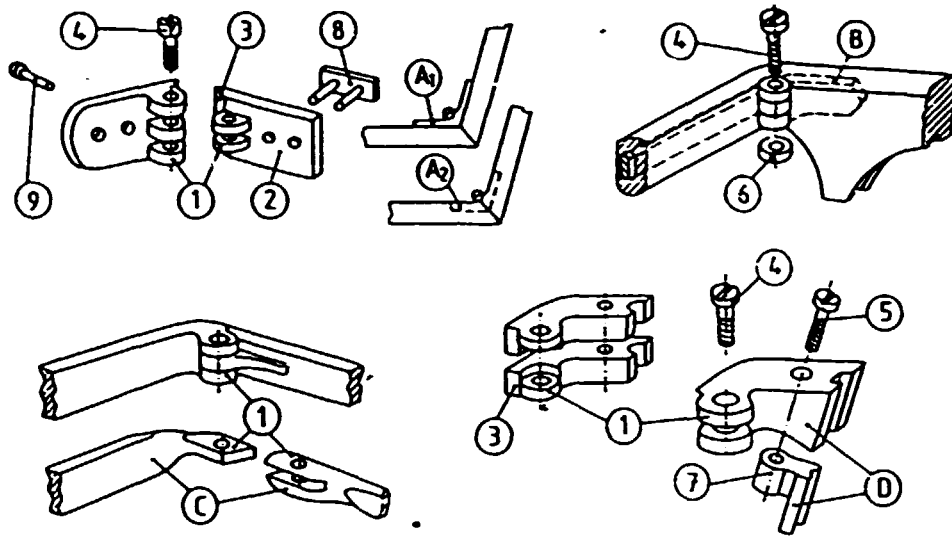
4.5 Einzelteile

4.5.1 Bügel



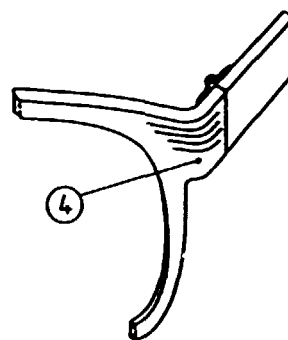
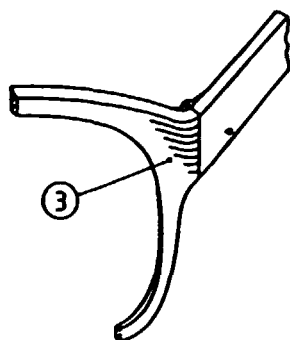
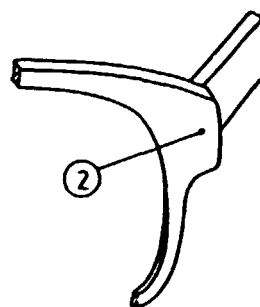
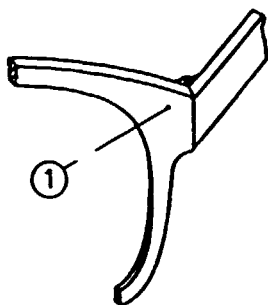
Lfd. Nr	deutsch	englisch	französisch	italienisch	spanisch
	Bügel	<i>side</i>	<i>branche</i>	<i>asta</i>	<i>varilla</i>
A	Golfbügel	<i>drop end side</i>	<i>branche type "golf"</i>	<i>asta "golf"</i>	<i>varilla "golf"</i>
B	Steckbügel	<i>straight side</i>	<i>branche type "droite"</i>	<i>asta diritta</i>	<i>varilla recta</i>
C ₁	anatomischer Gespinstbügel	<i>anatomic side</i>	<i>branche type "crochet anatomique"</i>	<i>asta anatomica</i>	<i>varilla de curya anatomica</i>
C ₂	Gespinstbügel	<i>curl side</i>	<i>branche type "crochet souple"</i>	<i>asta a riccio</i>	<i>varilla de curvada</i>
1	Bügeleinlage	<i>core</i>	<i>armature</i>	<i>anima</i>	<i>alma</i>
2	Gelenk	<i>half joint</i>	<i>charnière</i>	<i>cerniera</i>	<i>bisagra</i>
3	Bügelendstück	<i>drop end</i>	<i>embout</i>	<i>anima terminale</i>	<i>terminal</i>
4	Bügelende	<i>tip</i>	<i>spatule</i>	<i>terminale</i>	<i>espátula</i>
5	Gespinst	<i>spinning</i>	<i>cordage</i>	<i>riccio</i>	<i>bucle</i>
6	Abschlußkugel	<i>ball tip</i>	<i>boule terminale</i>	<i>sfera terminale</i>	<i>bola terminal</i>
7	Übergangshülse	<i>collet</i>	<i>virole</i>	<i>boccola di giunzione</i>	<i>casquillo o virola</i>
8	Bügelschaft	<i>butt</i>	<i>corps</i>	<i>corpo</i>	<i>cuerpo de la varilla</i>
9	Kunststoffüberzug	<i>half covered core side</i>	<i>manchon en matière plastique</i>	<i>manicotto di materiale plástico</i>	<i>cobertura en materia plástica</i>
10	Anschlagfläche	<i>knuckle</i>	<i>talon</i>	<i>tallone</i>	<i>extremo de tope</i>
11	Gespinstkern	<i>inner core</i>	<i>âme, armature</i>	<i>anima</i>	<i>alma</i>

4.5.2 Gelenke



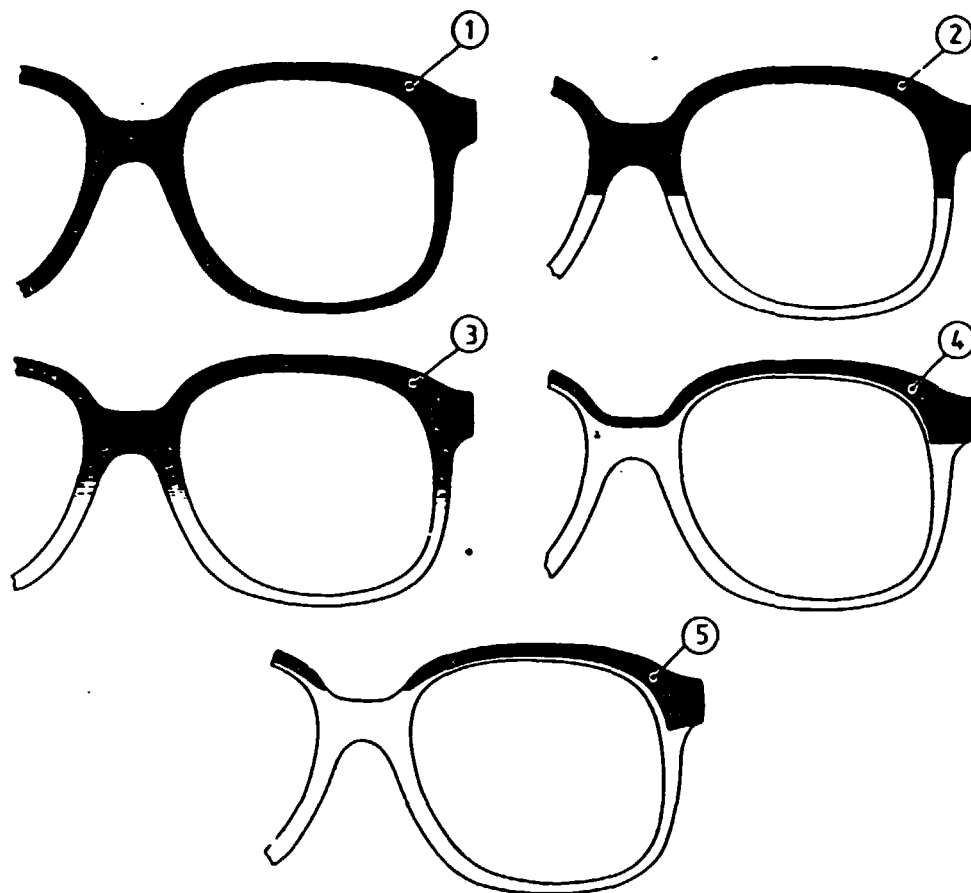
Lfd. Nr	deutsch	englisch	französisch	italienisch	spanisch
	Gelenke	<i>joints</i>	<i>charnières</i>	<i>cerniere</i>	<i>bisagras</i>
A ₁	aufgesetztes Gelenk	<i>surface joint</i>	<i>charnière appliquée</i>	<i>cerniera sovrapposta</i>	<i>bisagra sobrepuesta</i>
A ₂	versenktes Gelenk	<i>recessed joint</i>	<i>charnière noyée</i>	<i>cerniera incassata</i>	<i>bisagra empotrada</i>
B	verdecktes Gelenk	<i>concealed joint</i>	<i>charnière incorporée</i>	<i>cerniera annegata</i>	<i>bisagra incorporada</i>
C	Balken-Gelenk	<i>tenon joint</i>	<i>charnière tenante</i>	<i>cerniera a blocco</i>	<i>bisagra de barra</i>
D	Schließblock-Gelenk	<i>block joint</i>	<i>tenon rapporté</i>	<i>cerniera a blocco saldata</i>	<i>bisagra de bloque de cierre</i>
1	Gelenkauge	<i>charniere</i>	<i>chamon</i>	<i>tenone</i>	<i>gozne</i>
2	Gelenkplatte	<i>front plate</i>	<i>semelle</i>	<i>piattina</i>	<i>pala</i>
3	Anschlagfläche	<i>mitre</i>	<i>butée ou talon</i>	<i>battente</i>	<i>superficie de tope</i>
4	Gelenkschraube	<i>dowel screw</i>	<i>vis d'articulation</i>	<i>vite di cerniera</i>	<i>tornillo de bisagra</i>
5	Schließblock-schraube	<i>joint screw</i>	<i>vis de serrage</i>	<i>vite di chiusura</i>	<i>tornillo de cierre</i>
6	Gegenmutter	<i>locking nut</i>	<i>contre-écrou</i>	<i>controdado</i>	<i>tuercia</i>
7	Schraubhülse	<i>threaded barrel</i>	<i>barillet de jonction</i>	<i>boccola</i>	<i>barrilete de cierre</i>
8	Zierniet	<i>shield rivet</i>	<i>enjoliveur porte-rivet</i>	<i>perno doppio</i>	<i>perno doble o embellecedor</i>
9	Niet	<i>rivet</i>	<i>rivet</i>	<i>perno</i>	<i>perno</i>

4.5.3 Backenausführungen



Lfd. Nr	deutsch	englisch	französisch	italienisch	spanisch
	Backen- ausführungen	<i>end-piece types</i>	<i>types de tenons</i>	<i>tipi di cerniere</i>	<i>tipos de talones</i>
1	gerade Backe	<i>mitred lug</i>	<i>tenon droit</i>	<i>muso diritto</i>	<i>talón ajustado</i>
2	überstehende Backe	<i>overhang lug</i>	<i>tenon débordant</i>	<i>muso a battente</i>	<i>talón sin ajuste</i>
3	zurückgebogene Backe	<i>radiused lug</i>	<i>tenon roulé</i>	<i>muso piegato</i>	<i>talón cubierto</i>
4	Bogenbacke	<i>swept back lug</i>	<i>tenon coudé</i>	<i>muso curvato</i>	<i>talón curvado</i>

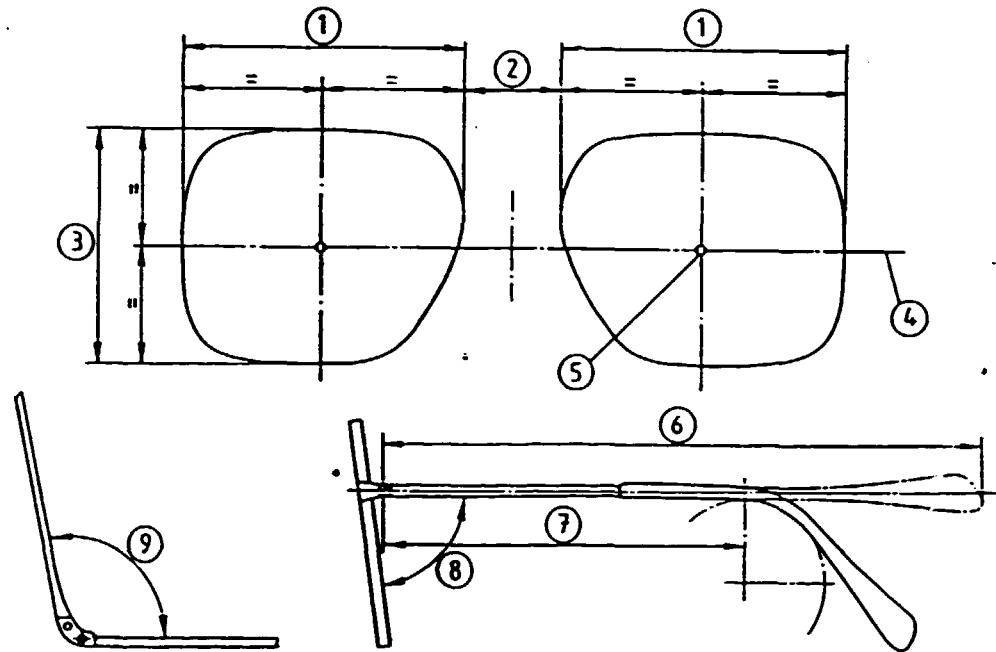
4.5.4 Kaschierungsausführungen



Lfd. Nr.	deutsch	englisch	französisch	italienisch	spanisch
	Kaschierungsausführungen	<i>types of lamination</i>	<i>types de placage</i>	<i>tipi di sfumature</i>	<i>tipos de chapeado</i>
1	ganz kaschiert	<i>fully laminated</i>	<i>monture entièrement plaquée</i>	<i>senza sfumatura</i>	<i>bicolor caché</i>
2	halbkaschiert ohne Übergang	<i>two-tone</i>	<i>monture 1/2 plaquée sans transition</i>	<i>netta sfumatura</i>	<i>medio caché o bicolor degradado</i>
3	halbkaschiert verlaufender Übergang	<i>graduated two-tone</i>	<i>monture 1/2 plaquée dégradée</i>	<i>sfumatura degradante</i>	<i>bicolor degradado</i>
4	kaschierte Oberlinie	<i>front with continuous browline</i>	<i>monture à ligne supérieure plaquée</i>	<i>sfumatura filetto</i>	<i>barra ciliar caché</i>
5	Augenbrauenkaschierung	<i>two-tone clear bridge</i>	<i>monture à sourcils plaqués</i>	<i>sfumatura sopracciglio</i>	<i>montura con cejas</i>

Anhang A

A.1 Maßsystem nach DIN 58 200



Lfd. Nr.	deutsch	englisch	französisch	italienisch	spanisch
	Maßsystem	<i>measuring system</i>	<i>système de mesure</i>	<i>sistema di misurazione</i>	<i>sistema de medición</i>
1	Scheibenhöhe	<i>horizontal boxed lens size</i>	<i>calibre nominal</i>	<i>calibro nominale</i>	<i>calibre nominal</i>
2	Brückenweite	<i>minimum between lenses</i>	<i>nez nominal</i>	<i>larghezza ponte</i>	<i>distancia mínima entre los lentes</i>
3	Scheibenhöhe	<i>vertical boxed lens size</i>	<i>hauteur du calibre</i>	<i>altezza del chierchio</i>	<i>altura del calibre</i>
4	Mittellinie	<i>datum line</i>	<i>ligne de mesure</i>	<i>linea mediana</i>	<i>línea de medición</i>
5	Formscheibendrehpunkt	<i>boxed centre</i>	<i>centre de "l'oeil"</i>	<i>centro dell'occhio</i>	<i>centro de rotación de la plantilla</i>
6	Bügelänge	<i>total length</i>	<i>longueur totale</i>	<i>lunghezza totale</i>	<i>longitud total</i>
7	Teillänge bis Bug	<i>length to bend</i>	<i>longueur au coude</i>	<i>lunghezza tempiale</i>	<i>longitud hasta la curva</i>
8	Inklinationswinkel	<i>angle of side</i>	<i>inclinaison</i>	<i>inclinazione</i>	<i>inclinación</i>
9	Öffnungswinkel	<i>let back of side</i>	<i>ouverture</i>	<i>apertura</i>	<i>abertura</i>

APPENDIX B - 1

1CM = 1M

Add on metal
production

GOODS IN GOODS OUT STORE	
PLASTIC PRODUCTION	METAL →
OFFICES AND SHOW ROOM	CAR PARK

APPENDIX B-2

1CM = 1M

