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INTERNATIONAL TECHNOLOGICAL INFORMATION EXCHANGE MECHANISM,

TECHNOLOGIES FROM DEVELOPING COUNTRIES: INDIA, YUGOSLAVIA*

prepared by the UNIDO secretariat**

28

* Special issue for the Afro-Asian Industrial Co-operation Meeting within the framework of the IDDA and ECDC/TCDC, New Delhi, 17-21 November 1986.

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Preface

Developing countries have frequently expressed the need for information on technologies evolved or adapted by other developing countries. Such information will be of benefit to them in the appropriate choice of technologies by providing alternatives and also a basis for promoting the exchange of information and sharing of experience in this field.

To respond to this need, the UNIDO secretariat introduced the International Technological Information Exchange Mechanism (ITIEM), the ultimate goal of which is to promote and facilitate international exchange of commercially available technologies originating from developing countries. Within this mechanism, collection and dissemination of a special kind of technological information is organized through countries' focal points with the maximum use of already existing country systems and networks of technological information. At the same time the ITIEM should be looked upon as a complementary activity to INTIB and TIES, the two well-established informational systems serving the needs of developing countries.

The information collected from a national focal point is disseminated in the following way:

- sent to the focal points of other developing countries for dissemination among national entrepreneurs;
- sent to SIDFAs and JPOs for dissemination using UN channels;
- put into the INTIB database to answer developing countries' requests for specific technological information;
- published in the form of booklets, "Technologies from Developing Countries".

This particular booklet is prepared using technological and economic information received from Indian and Yugoslav focal points. Information on each particular technology is arranged in close correspondence with the following questionnaire:

I. Title of the technology with the underlined keywords.

II. Brief description of production process and final product.

III. Level of development and basic data including:

- production capacity;
- required equipment;
- raw materials required;
- plant site area;
- required manpower;
- energy consumption.

IV. Financial data including:

- investment costs;
- production costs.

V. What is proposed: a patent licence, know-how, joint venture etc.

VI. Contact addresses.

The questions are designed in such a way that the answers to them constitute a preliminary picture of the technology in question which can be bought or serve as a basis for co-operation. More detailed information can be received directly from a national focal point or from the owner of the technology.

Technology profiles by the
International Standard Industrial Classification (ISIC)

	ISIC classification	Title
	Food	
1.	ISIC 3122	Technology for manufacture of compounded nutritionally balanced animal feed
	Textile	
2.	ISIC 3213	Technology for making hoses
	Industrial chemicals	
3.	ISIC 3511	Technology for making ethylene from ethanol
4.	ISIC 3513	Technology for making synthetic dispersions
5.	ISIC 3513	Technology for making polyester tanks
6.	ISIC 3513	Technology for making 55 per cent divinylbenzene monomer
7.	ISIC 3513	Technology for manufacture of plasticizers
	Other chemical products	
8.	ISIC 3529	Technology for making bleaching clay
9.	ISIC 3529	Technology for making dispersion adhesives
10.	ISIC 3529	Technology for distillation plant and solvent extraction process
	Rubber industry	
11.	ISIC 3551	Technology for making cross-ply tyres
12.	ISIC 3551	Technology for making cross-ply tractor tyres
13.	ISIC 3551	Technology for making bicycle- and moped-tyres and tubes
14.	ISIC 3551	Technology for tyre retreading machinery and know-how for (a) hot capping and (b) precured retreading
15.	ISIC 3551	Technology for automotive tyre and tube manufacturing machinery

16.	ISIC 3551	Technology for making tubes for all sizes of automotive tyres
17.	ISIC 3559	Technology for manufacture of tread rubber (hot capping)
	Plastic industry	
18.	ISIC 3560	Thermoplastic product-making by injection and blow molding
	Pottery - China	
19.	ISIC 3610	Porcelain product-making by wet pressing
	Other mineral products	
20.	ISIC 3691	Technology for making grain refractory materials, exothermic and insulation powders and plates
21.	ISIC 3699	Steatite product making by dry pressing
	Fabricated metal products	
22.	ISIC 3813	Technology for design and manufacture of solid fuel, oil and gas fired boilers
23.	ISIC 3819	Technology for making welded link chains
24.	ISIC 3819	Technology for making springs for vehicles
	Non-electrical machinery	
25.	ISIC 3824	Technology for roller covering
26.	ISIC 3829	Technology for manufacturing community deepwell hand pumps
27.	ISIC 3829	Technology for making oscillation absorbers
28.	ISIC 3829	Technology for design and manufacture of ash handling equipment for fossil fuel fired boilers
29.	ISIC 3829	Technology for manufacture of pumps, electric motors and starters, renewable energy systems
30.	ISIC 3829	Technology for making earthmoving machines
	Electrical machinery, apparatus and appliances	
31.	ISIC 3839	Technology for making cables
	Transport equipment	
32.	ISIC 3843	Technology for making wagons

33. ISIC 3843 Technology for manufacture of commercial vehicles

Other manufacturing industries

34. ISIC 3909 Technology for making plastic coil slide fasteners

(1) I. Technology for manufacture of compounded nutritinally balanced animal feed (ISIC 3122)

II. (a) Proper selection of raw materials

(b) Laboratory analysis of all raw materials

(c) Raw-materials are put in a rocker seave which takes the material through elevator to storage bins, from where the material is passed through high-speed grinder, from where the grinded material is taken by elevator to vertical mixers where the various raw-materials are uniformly mixed and passed on to a container where molasses and stream are combined and converted to a pellet machine. The pellets are cooled in a vertical cooler and stored in bins before they are packed in an automatic filling machine.

(d) The finished product is in the form of mash/pellet and is tested before final dispatch.

III.	Production capacity:	100 tons per day
	Required equipment:	About 20 different machines are required
	Raw materials required:	Includes vitamins, minerals, animal proteins, veg. prot., brans, oil cakes etc.
	Plant side area:	Area required for the plant, gardens etc. is about 1 acre.
	Required manpower:	Approximate manpower required are 2 engineers, 8 technicians, 8 skilled workers and 30 unskilled workers.
	Energy consumption:	Connected power load is 200 KW.
IV.	Investment costs:	About US$ 165,000.

V. Know-how and also joint venture proposed.

VI. Contact address:

Bhandari Crosfields Limited
Bombay Agra Road
Manglia - 453 771
(Dist. Indore) M.P.
India

Telex: 0735 - 251 FEED IN
Phone: 39382/30569/36667
Cable: FEED - INDORE

(2) I Technology for making hoses (ISIC 3213)

II During the manufacture of three types of final products, fine ladies' stockings, men's and boys' socks, of dyed yarn and of polyamid raw yarn, identical technological processes are used: knitting, linking the toe, dyeing, ironing and thermosetting, quality control, labelling, adjusting and packing. The sequence of these phases differs according to the type of product:

1. Ladies'fine tights (panty hose), socks and up-to-knee stockings, manufactured of polyamid stretch yarn from 17 to 67 dtex.
2. Men's socks and knee socks, ladies'socks, up-to-knee stockings or thick tights of cotton, wool or acrylic blends with texturised polyamid filament yar and synthetic men's and ladies'socks and up-to-knee stockings of polyamid yarns.
3. Children's socks and knee socks and tights of cotton, wool and acrylic blends with polyamid yarn and stockings of pure cotton, wool, polyarcrylonitril or polyamid fibre.

III Total annual output of the plant is 15 million pair of hosiery goods provided that production is in two shifts (16 hours a day), 250 days a year, out of which:

Type	Daily capacity	Yearly capacity	Percentage of total production
1. Ladies' stockings	24000 pair	6000 000	40 per cent
2. Men's socks	30000	7500 000	50
3. Children's hoses	6000	1500 000	10
Total:	60000	15000 000	100

a) Required machinery - about 455 machines of different types.

b) Required amount of raw materials

Item	Quantity
- Synthetic PA yarn	250 000 kg
- Cotton yarn	13 000 kg
- Rubber yarn	188 500 kg
For dyeing of hoses and PA yarn in total yearly amount of 243,000 kg it is required:	
- Acid dyes 1,4 %	3 700 kg
- Auxiliaries	
washing agent 2%	4 900 kg
liogen P (levelling agent) 2%	4 900 kg
A.Sulphate (rinsing) 3%	7 300 kg
Nilofixan P (setting) 3%	7 300 kg
CH_3COOH 80% (acetic acid) 3%	7 300 kg
Ceranin HGS (softening) 3%	7 300 kg
Accessories	
- Knitting needles	995 000 pcs.per year
- Sinkers (hooks)	608 000 pcs.per year

c) Required area for the plant site

1. For the production of 15 000 000 pair of the hoses in two shifts (16 hours daily) it is necessary to have workshop space of 7 550 m^2. This surface does not include the space for power plant, offices and other common premises.

d) Required manpower

Degree of personnel education	The number of workers male	female	total
1. Unqualified	19	15	34
2. Semi-qualified	2	344	346
3. Lower education (elementary school)	-	-	-
4. Qualified workers (vocational school)	42	2	44
5. Secondary school	25	50	75
6. College degree	13	11	24
7. Highly skilled workers	57	-	57
8. University degree	7	3	10
Total:	105	425	590

e) Required utilities

- The total installed electric power in production plant 417 KW
- Required technological steam under the pressure of 3 200 kg/h
- Required quantity of industrial water 11 m^3/h
- Required quantity of compressed air under the pressure of 78 m^3/h

IV The construction cost of the plant with total area of 7 550 m^2 (without power plant and offices) is: 2 722 356 USA $
Import and assembly costs of the plant are 8 250 000 USA $
The total production expenses (the cost of yarn, packing material, accessories, amortization and other expenses saleries and taxes excluded, are 8 474 000 USA $ per year.

V Technology transfer extent: designing and engineering, selection and testing of materials, making of technical and economic projects, quality control of products and raw materials, education of personnel.

VI Contact address:
For more details, please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
Slobodana Penezića-Krcuna, 29-31
Yugoslavia

(3) I. Technology for making ethylene from ethanol (ISIC 3511)

II. Ethylene is produced by catalytic dehydration of 95% v/v ethanol (rectified spirit) either adiabatically or isothermically, depending on client's requirement and infrastructure.

In the adiabatic process rectified spirit vapour, mixed with steam, is passed at high temperature over a fixed catalyst bed in which near-total conversion to ethylene takes place. The product gases are quenched, scrubbed, compressed, refrigerated and dried to prduce 99% v/v ethylene gas as final product.

In the isothermal process, rectified spirit vapour is passed over the catalyst in a tubular reactor in which endothermic reaction heat is provided by condensing Dowtherm vapour. The purification process is the same as that used in adiabatic route.

III. Production capacity: Up to 4000 tons/year per train ethylene by isothermal route; and
up to 1000 tons/year per train ethylene by adiabatic route.

Required equipment: Basic engineering for all items of equipment will be furnished.

Raw materials required: (a) 95% v/v rectified spirit
(b) proprietary dehydration catalyst (imported)

Plant site area: 1000 m^2 roofless structure for a 4000 tons/year plant.

Required manpower: (excluding managerial, supervisory and maintenance staff)
One chemist per shift for quality control;
One operator per shift (chemistry background);
Two unskilled workmen per shift.

Energy consumption:

	Adiabatic	Isothermal
Steam	4.0 tons	1.5 tons
Fuel oil (10,000 kcal/kg)	90 litres	90 litres
Power (process only)	150 Kwh	260 Kwh

(indicative, depends on ethylene pressure at battery limit).

IV. Investment costs: For a 4000 tons/year plant within battery limits approximate investment would be as under:
US$ 1,250,000 by the isothermal route;
US$ 1,000,000 by the adiabatic route.

Production costs: This will depend on the input unit costs and hence cannot be estimated. However, the consumption of raw material alcohol per ton of product is 2.4 kl per ton of ethylene by either route.

V. What is proposed:

(a) Manufacturing licence for a fixed fee;
(b) Know-how and engineering package for a fixed fee;
(c) Training for client's technical personnel in India on plant operations, maintenance and quality control for a fixed fee;
(d) Start-up assistance and demonstration of performance guarantees on man-day reimbursement basis.

VI. Contact address:

Mr. U.B. Rao
General Manager (Operations)
Polychem Limited
7, Jamshedji Tata Road
Churchgate Reclamation
Bombay - 400 020
India

(4) I Technology for making synthetic dispersions (ISIC 3513)

II Synthetic dispersions are producted by polymerization in emulsion which includes as follows:
Preparation of raw materials (diseolution of protective colloids and iniciators,pre-emulsifying of monomers),charging reactors, stirring and heating mixture to the polymerization start;
Polymerization process by simultaneous adding monomers and water to the end of polymerization;
Cooling followed by mixing, plasticizing if it is necessary and filtering.
Products are polyvinylacetate and copolymer dispersions with technical characteristics:

- viscosity (Brookfield, 20°C, 50 rpm)	1 000 - 50 000 mPa s
- dry substance	40 - 60 %
- particles size	0,1 - 3 µm

Products are used as binders for production of dispersion paints, for production of dispersion adhesives and as binders and finishings for textile fabrics.

III Economical capacities of the plant for the production of synthetic dispersions are from 5 000 to 20 000 tons/year. Here is an outline of a plant with an annually production of 10 000 tons/year.

a) Required machinery and equipment - reactor for polymerization, condensers, containers, filters, pumps, heat station and measuring and control instruments - about 50 machines.

b) Required raw materials

The main raw materials are:
1. vinylacetate monomer
2. monomers of acrylic esters
3. di-butyl maleate
4. vinyl versatate
5. polyvinyl alcocol
6. hydroxyethyl cellulose
7. various emulgators
8. potassium persulfate
9. sodium carbonate
10. hydrogen peroxide
11. various plasticizers

c) Required area for plant site

Item	Area
1. Production hall	(18 x 20 x 15m) 150 m^2
2. Offices and laboratory,	
3. Stoke-house-closed and covered	(50 x 60 x 10m) 1300 m^2
4. Tank storage farm for liquid materials,	200 m^2
5. Area for gathering and treatment of waste waters,	300 m^2
6. Area for cooling towers,	
7. Covered area for storage of packing material and palettes	400 m^2
8. Courtyard and internal transporting system,	

d) Required manpower

Item	Job	No.
a) Production		
faculty education	technical manager	1
faculty education	technologist	1
secondary school	chief clerk	1
secondary school	foreman	4
schemical workers	manipulator	6
b) Store-house		
secondary school	storekeeper	1
qualified workers	workers in store-house	4
c) Laboratory		
faculty education	laboratory manager	1
secondary school	analyst	2
accustomed worker	dishwasher	1
d) other workers		

e) Required utilities

Item	Quantity
Electrical energy:	
- estimated consumption	75 kWh/lt of product
- voltage	220/380 V
- frequency	50 Hz
- installed power	630 KVA
Vapour:	
- consumption	0,1 t/lt of product
- pressure	1,5 bar
- temperature	105°C

IV Investment costs of construction of the synthetic dispersion making plant are estimated at $ US 9 000 000. Production costs are apporx. 140 $ US/ ton of dispersion.

V Know-how for production and marketing of synthetic dispersions is offered.

VI Contact address:
For more details, please contact:
The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
Slobodana Penezića-Krcuna, 29-31
Yugoslavia

(5) I Technology for making polyester tanks (ISIC 3513)

II Products are tanks with dished or flat bottom, in vertical or horizontal version, stable or transportable with various diameters and volumes that vary from 800 to 80 000 dm^3.
Polyester tanks are used in: chemical industry as storage, mixing and processing vessels for various chemicals; petrochemistry for storage and transport of mineral oils and other derivatives from refinery process; food industry for storage of liquid products as vegetable oils, milk, fruit juices, wine, must and vinegar; agriculture for storage of fertilizers, herbicides, fungicides, etc.
Manufacturing processes of tanks from glass reinforced polyester are started by mixing polyester resin and accelerator and adding catalyst to the obtained mixture. Parts are made of prepared mixture by its moulding and reinforcing with glass fibres. After welding of postpolymerization is achieved in postpolymerization oven.-

III According to the production scheme adopted, the polyester tank making plant is capable of producing 1 200 pieces per year. Tables 1-4 are based on the above scheme.

a) Table 1: Required machinery and equipment

Item	No.
Moulding and winding machine (big)	2
Moulding and winding machine(small)	4
Moulds (big)	5
Moulds (small)	10
Welding equipment	10
Postpolimerization oven(up to 110°C)	1
Testing device	1
Elevator and fork-lifts	

b) Table 2: Required amount of raw materials and utilities

Item	Quantity
Raw materials	
Resin	250 tons/year
Glass fibres	140 tons/year
Veil	20 tons/year
Acetone	20 tons/year
Styrene	3 tons/year
Catalyst	5 tons/year
Accelerant	3 tons/year
Other reinforcements according to requirements.	
Energy requirement	
Transformer 150 KVA	
Consumption 250 MWh/year	

c) Table 3: Required area for plant site

Area requirement	20 000 m^2
Buildings	
Production hall	3 000 m^2
Auxilliaries	1 000 m^2
Oven	100 m^2

d) Table 4: Required manpower

Item	No.
Faculty education	3 persons
Secondary-school education	5 persons
High-skilled workers	2 persons
Qualified workers	20 persons
Accustomed workers	15 persons

IV Investment costs of construction of the polyester making plant are estimed at $ US 730 000. Production costs are approx. $ US 1 000 000.

V Technology transfer extent: education of personnel, ready projects.

VI Contact address:

For more details,please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
Slobodana Penezića-Krcuna, 29-31
Yugoslavia

(6) I. Technology for making 55% divinylbenzene monomer (ISIC 3513)

II. Raw material Diethylbenzene in pure form is obtained by fractionation of the light polyethylbenzene stream which is available in any Ethylbenzene plant operating on the basis of Friedel Kraft's process of catalytic ethylation of benzene.

Purified diethylbenzene is cracked catalytically in the presence of steam and the crude divinylbenzene thus produced is purified by continuous vacuum fractionation in a series of distillation towers using polymerisation inhibitors. The final product conforms to the following specifications:

Component	WT. %
Divinylbenzene	53 - 55
Ethylvinylbenzene	40 - 43
Diethylbenzene	1 - 3
Heaviers	1 - 2

It is an extremely reactive monomer requiring inhibition with 1000 ppm p-tertiary butylcatechol and preferably refrigerated storage.

III. Production capacity: Up to 900 tons/year.

Required equipment: Basic engineering for all items of equipment will be furnished.

Raw materials required:
(a) Diethylbenzene of at least 98% by weight purity. Alternatively, light polyethylbenzene stream containing around 80% diethylbenzene which can be purified.
(b) Dehydrogenation Catalyst (proprietary) imported.
(c) Tertiary butylcatechol inhibitor.

Plant site area: 1000 m^2 roofless structure for a 200 tons/year plant.

Required manpower:
1 chemist per shift for quality control
3 operators per shift (chemistry background)
2 unskilled workmen per shift.

Energy consumption:

	Per tons of product (200 tons/year plant)
(a) Fuel oil	1100 litres
(b) Electric power	1000 Kwh
(c) Steam	60 tons

IV. **Investment costs:** Battery limit investment cost for a 200 tons/year plant is approx. US$ 800,000

Production costs: This will depend on the input unit costs and hence cannot be estimated. Raw material diethylbenzene (98%) requirement is 2.5 MT/ton of product.

V. **Proposals for:**

(a) Manufacturing licence for a fixed fee;
(b) Know-how and engineering package for a fixed fee;
(c) Training for clients' technical personnel in India on plant operations, maintenance and quality control for a fixed fee;
(d) Start-up assistance and demonstration of performance guarantees on man-day reimbursement basis.

VI. **Contact address:**

Mr. U. S. Rao
General Manager (Operations)
Polychem Limited
7, Jamshedji Tata Road
Churchgate Reclamation
Bombay - 400 020
India

(7) I. Technology for manufacture of plasticizers - (DOP, DIOP, DBP, DIDP, DTDP, BBP, TOTM, DOM, DBM etc.) (ISIC 3513)

PVC compounds - for shoes, cables, bottles, pipes etc.

II. (a) Plasticizers: It is basically an esterification reaction involving acid/anhydride and an alcohol to give the final ester which is purified to get product of the required specification.

(b) PVC compounds: Are obtained by mixing the raw materials, namely the resins, plasticizers and other additives.

III. Production capacity:

Required equipment:

Raw materials required:

Plant site area:

Company can take up turnkey projects or can given technical know-how and detailed engineering for the above-mentioned items. Will give detailed project report upon request.

Required manpower:

Energy consumption:

IV. Investment costs: Will depend on the capacity, location etc.
Production costs: and will vary from plant to plant.

V. Company could take up project on a turnkey basis or only supply know-how and detailed engineering. The question of a joint venture will be decided on a merit-to-merit basis.

VI. Contact address:

East Anglia Plastics (India) Ltd.
'D' Block, 6th floor
Shivsagar Estate, Worli,
Bombay 400 018
India

or

Calcutta office:
23, Camac Street
Calcutta 700 016
India

(8) I Technology for making bleaching clay (ISIC 3529)

II Highly active bleaching clays are specially activated adsorbents used for bleaching and refining of mineral and vegetable oils, fats, paraffins, etc.

Bleaching clays are produced by reaction of sulphuric acid and bentonitic clay. Mixture is boiled for definite period of time, salts and sulphuric acid are washed away. Cake is dried, milled and packed.

From the chemical point of view the bleaching clay is an aluminiumsilicate with montmorillonite as its basic component. The average chemical structure of the clay is as follows:

Ignition loss	6 to 9 per cent
SiO_2	68 to 74 per cent
Al_2O	13 to 20 per cent
Fe_2O	2 to 4 per cent
CoO	0,5 to 2 per cent
MgO	2 to 3 per cent
Alkalis	0,1 to 0,5 per cent

Bleaching clays look like fine powder of a light grey colour. Different grades are produced for special purposes, in the main, bleaching clays for the bleaching of all kinds of vegetable, mineral and trafo-oils. All types of bleaching clays are packed in guadruple natron paper bags ranging between 35 and 45 kilogrammes, depending on the type of product.

III An example of the plant which is capable of producing 7000 – 10.000 tons per year is given.

a) Required machinery and equipment

Equipment including mixers, reactors, filters driers, mills and packaging machine is needed for processes mentioned above. The number of the machines required is 16.

b) Required amount of raw materials and utilities

Item	Quantity
Clay	12 - 15 000 t/year
Steam	2 - 4 t/h
Sulphuric acid	5 - 7 000 t/year
Water	150 -200 m^3/h
Fuel	6 - $9x10^6$ kJ/h
Electricity	500 kW

c) Required area for plant site

Buildings	
Production unit	30 x 30 x 15 m
Raw material store	open space 30 x 30 m
Final product store	20 x 10 m
Steam production	20 x 20 m
Maintenance	10 x 15 m

d) Required manpower

Two engineers and 25 qualified workers are indispensable for performing the mentioned production processes.

IV Investment costs for the realization of the bleaching clay manufacturing plant would be 15 - 20 x 10^6 $ US. Operating costs would be 100 - 150 $ US per ton of bleaching clay.

V Technology transfer extent:

- preliminary research,
- preliminary laboratory research,
- preliminary research and analyze of market,
- planning and programming
- designing and engineering,
- selection and testing of materials,
- making of technical and economic projects,
- quality control of products and raw materials,
- advisory services,
- education of personnel,
- ready projects.

VI Contact address:

For more details, please contact:

The Yugoslav Center of Technical and Scientific Documentation

11000 Belgrade

Slobodana Penezića-Krcuna, 29-31

Yugoslavia

(9) I Technology for making dispersion adhesives (ISIC 3529)

II Products are dispersion adhesives with the following technical characteristics:

- viscosity (Brookfield, 20°C, 50 rpm) 1000 - 30000 m Pa s
- dry substance 30 - 70%
- pH 4 - 8

Products are used for various glueing of:

a) paper in cardboard-box industry, cigarette industry;
b) wood in woodworking industry;
c) various porous materials in building industry.

Production of dispersion adhesives which will be presented here includes two phases: 1. mixing emulsions, solvent, plasticizer, additives, fillers, resins and 2. homogenization of the mixture obtained.

III Economical production capacities are not limited. The plan for a dispersion adhesive manufacturing plant presented here is of a capacity of 5000 tons/year.

a) Required machinery and equipment - containers, filters, pumps, balances and dosage instruments, filling machines, lab equipment and control instruments - about 30 machines.

b) Required raw materials

Item	Quantity
Synthetic dispersions	4000 t/year
Di-butyl phthalate	300 t/year
Organic solutions (mostly toluol, ethyl acetate)	200 t/year
Inorganic fillers	150 t/year
Polyvinyl alcohol	10 t/year
Carboxymethyl cellulose	10 t/year
Methyl cellulose	5 t/year
Various resins	5 t/year

c) Required area for plant site

Item	m^2
1. Production hall	(15 x 20 x 15 m)
2. Offices and laboratory,	100 m^2
3. Store-house - closed and covered	(15 x 20 x 10 m)
4. Tank storage farm for liquid materials, ,	600 m^2
5. Area for waste water gathering and treatment,	100 m^2
6. Covered area for storage of packing material and paleters	
7. Courtyard and internal transporting system,	200 m^2

d) Required manpower

Qualification	Job	Workers
1. Production		
faculty education	technical manager	1
faculty education	technologist	1
secondary school	chief clerk	1
secondary school	foreman	2
schemical workers	manipulator	4
2. Store-house		
secondary school	storekeeper	1
qualified workers	workers in store-house	2
3. Laboratory		
secondary school	analyst	1

The above mentioned list doesn't include managing and administrative workers, maintenance personnel and others that depend on local conditions.

e) Required utilities

Electrical energy(data are given for production of 50 000 tons)	
- estimated consumption	25 kWh/lt of product
- voltage	220/380 V
- frequency	50 Hz
- installed power	250 KVA

IV Investment costs of construction of the dispersion adhesive making plant are estimated at $ US 5 000 000. Production costs are approx. 118 $ US/ton of the product.

V Know - how for production and marketing of dispersion adhesives is offered.

VI Contact address:

For more details, please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade, Slobodana Penezića-Krcuna, 29-31, Yugoslavia

(10) I. Technology for distillation plant and solvent extraction process (ISIC 3529)

II. Manufacture of essential oils:
1. Sandalwood oil
2. Ginger grass oil
3. Lemon grass oil
4. Tuberose oil
5. Jasmine oil
6. Vetivert oil
and
7. Chemicals (ferric chloride unhydras)

III. Production capacity: 32 to 50 kg per day.

Required equipment: Reactor, Condenser, Elaborator and Cooling system equipment.

Raw materials required:
1. Sandalwood powder
2. Ginger grass
3. Lemon grass
4. Tuberose flowers
5. Jasmine
6. Vetivert roots

Plant site area: 80x30 sq.ft.

Required manpower: 4 (managerial) and 6 (technical).

Energy consumption: Energy is required only for water circulation. Total 4 hp required.

IV. Investment costs: US$ 42,000 (if we used G.I. sheet reactor/condenser)
US$ 12,500 (if we used stainless steel reactor/condenser).

Production costs: Will vary from oil to oil.

V. Know-how and joint venture.

VI. Contact address:
Ms. S. Thangam (Chairman)
Mr. S. Natarajan (Managing Director)
M/S. Junoglobal Exporters (India)
Pvt Ltd.
11, C.N.K. Road, Chepauk
Madras-5
India

(11) I Technology for making cross-ply tyres (ISIC 3551)

II Tyres are an important construction component of vehicles and they have to correspond to all other vehicle parts. The production programme includes: passenger tyres, bus tyres, truck tyres and tyres for special vehicle (cranes).
Cross-ply tyres are manufactured as tube and tubeless type (TT and TL). Each tyre consists of a carcass, bead wire, tread and side walls. The carcass is made of textile cord, the cords of individual plies cross at angle. Passenger tyres cortain 4 do 6 cord plies, the other tyre types 8 to 14.
Technological process of cross-ply tyre production includes:

- raw material storing
- rubber compound mixing,
- semi-manufacture production (textile cord rubberizing, tread extrusion, sidewall calandering, making bead wire),
- building (making green tyres),
- curing,
- finishing and product control,
- storing products.

III High output production consisting of several process lines is proposed, the output of one line being 20.000 t tyre/year or 80 t/day. Daily output of different tyre types as follows: 1 000 truck and bus tyres, 1 500 light truck and special vehicle tyres, 2 000 passenger tyres.

a) Required machinery - mixers, rolling machines, cooling lines for mixtures, injectors, calenders, presses, compressors and the other machines and facilities.

b) Required amount of raw materials

Item	Quantity t/year
Natural caoutchouc	2 400
Synthetic caoutchouc	8 300
Softeners	500
Carbon black	4 700
Chemicals	1 300
Cords	2 200
Wire	600
	20 000

c) Plant site area - 14000 m^2 for production processes, raw material and final product storages;
4800 m^2 for annexes and energetic units.

d) Required manpower

A factory with only one process line together with five acompanying activites, employs about 560 persons. In a threeshift--work there should be employed 340 production workers: 60% highly skilled labour, 20% low skilled labour, 20% unskilled labour. Other activities such as maintenance, control and storing have to be done by 100 persons: 20 technicians, 70 highly skilled labour, 10 low skilled and unskilled labour.

e) Required utilities

Electricity - cca 10 MW
Energy consumption - 90000 KWh/day
Steam - 21 t/h, 30 bar, 250°C
Hot water - 7,5 t/h, 25 bar, 175°C
Compressed air - 3000 m^3/h, 10 bar.

IV Equipment costs /approx./ - US $ 14 million
Buildings and installations costs /approx./ - US $ 600/m^2.

V Marketing advisory activities; complete factory design; advising appropriate equipment and tools, raw material suppliers and supply of necessary instrument and laboratory equipment; organizing production and operative planning.

VI Contact address:

For more details please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
Slobodana Penezića - Krcuna, 29-31
Yugoslavia

(12) I Technology for making cross-ply tractors tyres (ISIC 3551)

II Tractor tyres are an important component of vehicles and they must correspond to all other vehicle parts. The production programme includes tyres for tractors (rear and front tyres), trailers and special vehicles.

The cross-ply tractor tyres are manufactured as tube type (TT).They consist of a carcass,bead wire,tread and sidewalls.The carcass is made of textile cord, the cords of individual plies cross at angle. The cord plies number depends on tyre carrying capacity.

Technological process of cross-ply tractors tyres production includes:

- raw material storing,
- rubber compound mixing,
- semi-manufacture production (textile cord rubberization, tread extrusion, sidewall calandering, bead wire making),
- building (making green tyres)
- curing
- finishing and control,
- storing.

III A high output production consisting of two process lines is proposed. The front and implement tyre production output amounts to 2.500 t/year or 10t/day. The rear tyre output amounts to 11.000 t/year or 44 t/tyres/day.

Daily output of several tyre types: 800 rear tractor tyres, 600 front tractor and implement tyres.

a) Required machinery - mixer, rolling machines, cooling line for mixtures, injectors for protector and other semi-products, calander for cord rubberizing and other calanders, curing presses, compressors, steam boiler and other machines and facilities.

b) Required amount of raw materials

Item	Quantity t/year
Natural caoutchouc	900
Synthetic caoutchouc	6 050
Softeners	1 100
Carbon black	3 700
Chemicals	800
Textile cord	750
Steel wire	200
	13 500

c) Plant site area - 13800 m^2 for production processes, raw material and final product storages;
4800 m^2 for annexes and energetic units.

d) Required manpower

A factory with two process line, together with five accompanying activities, employs about 500 persons. In a three-shiftwork there should be employed 300 production workers: 60% highly skilled labour, 20% low skilled labour, 20 % unskilled labour. Other activities such as maintenance, controlling and storing have to be done by another 90 persons: 15 technicians, 70 highly skilled labour, 5 low skilled and unskilled labour.

e) Required utilities

Electricity - cca 7 MW
Energy consumption - cca 60000 KWH/day
Steam - 14 t/h, 30 bar, 250°C
Hot water - 5 t/h, 25 bar, 175°C
Compressed air - 2000 m^3/h, 10 bar

IV Equipment costs /approx./ - US $ 15 million;
Buildings and installations costs /approx./ - US $ 600/m^2.

V Technology transfer extent: marketing advisory activities; complete factory design for cross-ply tractor tyres; advising appropriate equipment and tools, raw material suppliers and supply of necessary instrument and laboratory equipment; organizing production and operative planning.

VI Contact address:
For more details, please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
Slobodana Penezića-Krcuna, 29-31
Yugoslavia

(13) I Technology for making bicycle- and moped-tyres and tubes (ISIC 3551)

II The production programme includes several types of bicycle tyres which are divided into individual groups according to the vehicle which they are mounted to:

12" - 28" tyres and tubes for bicycle (203-635 mm)
16" - 19" tyres and tubes for moped, speed up to 50 km/h
16" - 19" tyres and tubes for moped, speed up to 100 km/h
17" - 18" tyres and tubes for motor-cycles, speed up to 150/h.

The above tyres consist of diagonal carcass of rayon or polyamide construction. The bicycle tyre coating is black, coloured or bicoloured, and black for mopeds and motor-cycles. It is extremely resistant to abrasion, atmospheric conditions and ozone influence and performs a good road holding. The basic compound of a high quality tube is butil rubber which has essential advantage in comparison to the natural rubber because od its low permeability and high durability.

a) Technological process of tyre production includes:
- raw material storing and preparation,
- blending,
- semi - manufacture preparation (cord rubberization, wire rubberization, wire welding, calandering, cord cutting and/or tearing)
- building
- curing
- control and packing.

b) Technological process of tube production includes:
- raw material storing and preparation,
- blending,
- straining,
- extruding,
- preparation of rubber-based valves,
- building-up-tubes,
- curing,
- control,
- completion and packing.

III Bicycle- and moped- tyres and tubes making plant with the two-shift work and the annual volume of production as follows:

Item	pcs	kg
bicycle - tyres	2.000.000	1.418.400
moped - tyres	500.000	832.500
bicycle - tubes	2.500.000	516.125
moped - tubes	500.000	143.500

a) Required machinery - about 100 machines of different types.

b) Required amount of raw materials and utilities

Item	Quantity
Caoutchouc (kg)	1.427.387
Fillers (kg)	794.015
Oils (kg)	165.159
S and accelerators (kg)	50.092
Other additives (kg)	189.742
Cords (m)	942.180
Wire cores (pcs)	5.540.000
Valves (bicycle) (pcs)	2.766.107
Valves (moped) (pcs)	526.040
Electricity 380 V, 50 Hz, 5600 KVA	
Steam 6000 kg/h	
Compressed air p=8 - 10 bar, 1200 m^3/h	
Cooling water T_{min}= 23°C, p = 3 -4 bar, 300 m^3/h	

c) Plant site area - 7200 m2 for production processes, raw material and final product storages,
2535 m^2 for annexes and energetic units,

d) Required manpower - 250: 200 in production process (30% women) and 50 in engineering, production-preparation, control and accompanying activities.

IV Equipment costs /approx./ US $ 11,5 million.
Production costs/approx./4 US $/kg of product.

V Know-how is proposed.

VI Contact address:

For more detail please contact:

The Yugoslav Center of Technical and Scientific Documentation

11000 Belgrade
Slobodana Penezića-Krcuna 29-31
Yugoslavia

(14) I. Technology for tyre retreading machinery along with know-how for
(a) Hot capping
(b) Precured retreading
(ISIC 3551)

II. (a) Tyre retreading machinery:
Machinery and assembly of machineries with required service connections like air and steam lines as per specification and know-how provided by us.

(b) Know-how:
Process of retreading by two methods, (a) the older antiquated method of hot capping still in vogue and (b) the state-of-the-art precured tyre retreading process.

Process (a) includes application of unvolcanized profiled green tread over the buffed tire casing using an adhesive for bonding. Later, the tyre is transferred is transferred to a matrix and vulcanized by stream under specific pressure.

Process (b) includes the application of pre-molded cured tread of a specific profile bonded over a buffed tyre casing and cured in an autoclave volcaniser at relatively low temperature.

The final product is the retreaded tyre.

II. Production capacity: Hot capping process
Standard 6 matrix operation - 1000 casings/month
Cold cure process - 1
Auto clave - 1000 casings/month

Required equipment:
(a) Tire buffer;
(b) Tire builder;
(c) Tire bonder (also known as vulcanizer);
(d) Air compressor : 35 cfm;
(e) Packaged boiler - 200 kgs/hr;
(f) Handling equipment.

Raw material required: Iron, steel, aluminium

Plant site area: 10,000 sq.ft

Required man power: 6 persons/1000 casings/month

Energy consumption: 30 KW

IV. Investment costs: US$ 42.000 for a plant to process 1000 tyre casings/month
Production costs: US$ 67,000

V. Know-how transfer (covered by royalty payment) is proposed.

VI. Contact Address:
Managing Director
Devon Machines (P) Ltd.
62-7, North Phase Industrial Estate
Ambattur
Madras-600 098
India

(15) I. **Technology for automotive tyre and tube manufacturing machinery**

Items of machinery:

(a) Banburies
(b) Mixing mills
(c) Extruders
(d) Fabric dipping and calendering line
(e) Tread and inner tuber extrusion line
(f) Fabric preparation equipment and tyre assembly machine
(g) Vulcanizing and finishing machinery

(ISIC 3551)

II. **Production of equipment to produce machinery for automotive tyre and tube manufacturing including instrumentation and electrical equipment.**

III. **Production capacity:** **Plant and machinery sufficient to manufacture one to two million two/three wheeler tyres and tubes per annum.**

Required equipment:
(a) machine tools
(b) airline and hydraulic line equipment
(c) iron and steel/non-ferrous

Plant site area: **5 acres**

Required manpower: **Approx. 100**

Energy consumption: **500 KW**

IV. **Investment costs:** **US$ 2.4 million**
Production costs: **US$ 3.25 million**

V. **Transfer of know-how (covered by royalty payment) is proposed.**

VI. **Contact address:**

Managing Director
Devon Machines (P) Ltd.
62-F, North Phase Industrial Estate
Ambattur
Madras-600 098
India

(16) I. Technology for making tubes for all sizes of automotive tyres. (ISIC 3551)

II. Rubber, natural or butyl is masticated in internal mixer with rubber chemicals, fillers, accelerators and other requisite ingredient as stated in the recipe and batched off in pipes, aged and then strained to remove impurities. The tubes extruded are cut to a required length valve fixed and spliced. The final product is the inner tube.

III. Production capacity: 1000 tubes per day

Required equipment:
(a) Internal mixer
(b) Mixing mills
(c) Extruding equipment (2 mills/ extruder/cooling line and booking area with powder dispersal system inside the tube
(d) Valve and splicing equipment
(e) Forming ring
(f) Molds
(g) Press
Service equipment
Boiler
Compressed air/vacuum
Chilling equipment

Rr materials required: Butyl/natural rubber, rubber chemicals as per recipe, valves, cores and cloth bags

Plant site area: 15,000 sq.ft.

Required manpower: 15 persons (10 minutes per tube)

Energy consumption: 500 KW

IV. Investment costs: US$ 1 million
Production costs: US$ 2 million

V. Transfer of know-how (covered by royalty payment) is proposed.

VI. Contact address:
Mr. K. George
Technical Director
MRF Limited
Madras-600 002
India

(17) I. Technology for manufacture of tread rubber (hot capping). (ISIC 3559)

II. Rubber along with chemicals, fillers, accelerators, anti-oxidants, curatives are mixed in a 2 stage process using an internal mixer called Banbury and then cracked in an open mill, fed into an extruder and extruded into a die to obtain a predetermined profile. Then cooled and packed in cartons.

III. Production capacity: 750 kg an hour (using a 6" screw schruder).

Required equipment:
(a) internal mixer with batch-off units
(b) mills
(c) extruder
(d) cushion gum calender
(e) conveyor line with cooling facility using local water
(f) booking with in-line weighing scales

Raw materials required:
(a) raw rubber (natural/synthetic)
(b) fillers/rubber chemicals etc.
(c) packing cartons with canstrap

Plant site area: 10,000 sq.ft

Required man power: 12 persons

Energy consumption: 400 KW

IV. Investment costs: US$ 330,000
Production costs: US$ 7.5 million

V. Transfer of know-how (covered by royalty payment) is proposed.

VI. Contact address:
Mr. K. George
Technical Director
MRF Limited
Madras-600 002
India

(18) I Thermoplastic product making by injection and blow moulding (ISIC 3560)

II Injection moulding and blow moulding of products from thermoplastic materials are carreid out after mixing resins and pigments. Moulded products are treated in order to obtain better surfaces and then printed where it is required.
Thermoplastic moulded products are used as various machine, electrical, motor, auto and electronic pieces, containers, and for electrical domestic appliances and other consumer goods.

III Here is an outline of a plant with a production capacity of 2 900 tons per year.

a) Required machinery - injection and blow moulding machines, printing machines, grinders, granulator, driers, silos, elevators, fork-lifts, equipment for maintenance, pneumatic and water cooling systems, moulds, air condition etc. - about 200 machines.

b) Required raw materials and utilities

Item	Quantity
Polyethylene - low density	650 tons/year
Polyethylene - high density	1 910 tons/year
Polycarbonate	196 tons/year
Polystyrene (+ Acrylonitrilstyrene)	60 tons/year
Polypropylene	220 tons/year
Total	3 111 tons/year
Installed electric power	3 000 KW

c) Required area for plant site

Buildings		8 000 m^2
Internal communication roads		4 000 m^2
Other superficies		3 000 m^2
	Total	15 000 m^2
Production hall, height 8m		1 800 m^2
Warehouse, height 8m		2 200 m^2
Covered courtyard, height 8m		2 200 m^2
Toilets, wardrobe and offices (according to local requirements)		800 m^2
Auxiliaries (laboratory, electric and mechanical workshops and stations: (compressor, transformer, water cooling, climatic, generator and fire-fighting equipment), height 5 m		1 000 m^2
	Total	8 000 m^2

d) Required manpower

Item	No.
faculty education	6 persons
secondary school education	16 persons
high skilled workers	18 persons
qualified workers	36 persons
accustomed workers	58 persons
Total	134 persons

IV Investment costs of construction of the thermoplastic product making plant are estimated at $ US 10 000 000. Production costs are approx. 3 600 000 $ US/year. Raw material costs are approx. 5 000 000 $ US/year.

V Technology transfer extent: Advisory services and education of personnel are offered.

VI Contact address:

For more details, please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
Slobodana Penezića-Krcuna, 29-31

Yugoslavia

(19) I **Porcelain product making by wet pressing** (ISIC 3610)

II Porcelain products are mostly used in the field of low voltage electric installation, as a basis for safety components of electric installation products, lamp screw caps, insulating supports and as a component part of other electric engineering installations. Porcelain products are distinguished for their mechanical and thermal resistance, insulating properties and ther resistance to chemicals.

Paste for wet pressing of porcelain products used as low voltage electric insulators is prepared by wet grinding of raw materials (25 per cent of alumina, 25 per cent of flint, 50 per cent of kaolins and clay) in ball mill in a charging procedure by adding electrolyte to reduce the permeability of water in slip. Ground paste slip is dispersed and dried in atomizer after cleaning on a fine vibrating sieve and in electromagnetic filter. Thus obtained granular mass is wet in the mixer to obtain the desired humidity (14 - 16 %) and plasticized. The porcelain paste thus obtained is shaped in a wet pressing procedure in metal moulds to make the porcelain product. Pressed products are then cleaned, by a machine or by hand, and if so required, they are soft treated and glazed. They are fired in the continuous tunnel kiln at temperatures from 1620 - 1650 K (SK - 12/13). Natural or liquid gas is the most suitable fuel for firing kilns.

III Annual output: 2,000 tons of porcelain products

(The annual output may be higher or lower than mentioned, depending on the utilization and possibilities of the type of atomizer used for the dispersion of the steatite mass).

a) Required machinery and equipment - ball mills, tanks with mixers, atomizer for dispersion of porcelain slip, silo, presses, continuous tunnel kiln, etc. - about 50 machines.

b) Required amount of raw materials

Item	%	annual quantities(t)
kaolins, clay	50 %	1,400
flint	25 %	700
alumina	25 %	700
		Total: 2,800 t

c) Required area for plant site

Required office space = 400 m^2

Required buildings

a) raw material stores : 600 m^2

b) preparation of paste: 1,200 m^2

c) pressing plant, tunnel klin, sorting: 2,000 m^2

d) warehouse: 300 m^2

d) Required manpower

a) Required labour: 75 semi-skilled workers, 13 skilled workers,

b) Operational personnel: 2 highly skilled workers, intermediate vocational training - 6 workers, advanced specialist's training - 2 workers, university-level training - 2.

e) Required utilities

Energy: voltage 220/380 V, total installed power: approx. 180 KW.

V Technology transfer extent: designing and engineering, selection and testing of materials, making of technical and economic projects, quality control of products and raw materials, education of personnel.

VI Contact address:

For more details, please contact:

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Yugoslavia

(20) I Technology for making grain refractory materials, exotermic and insulation powders and plates (ISIC 3691)

II Refractory materials are used for refractory linings of heat generators in ironworks, foundries and other industrial works. Formed exothermic and insulation products can be insulation plates with exothermic filling, asbestos-insulation plates and similar. Besides formed products, there are generally products in a form of mixed grain refractory raw materials which are despatched to users packed in bags with attached instructions for use and storage. The production procedure of refractory materials can be organized in three individual production lines:

1. Production of aluminium silicate grain products based upon SiO_2 and Al_2O_3 (TASM);
2. Production of alkali grain products based on MgO and Cr_2O_3 (TASM);
3. Production of exothermic and insulation products (TIP-TEM).

The production procedures of these three lines consist of following:

1. Preparation of aggregates (crushing, drying, milling, screening and classifying)
2. Preparation of bond clay (crushing, drying and screening)
3. Preparation of components as requested by the schedule
4. Mixing (wet and dry)
5. Packing in PE bags and twill material.
6. Possible forming if production of TI-plates (chilled castings) and drying of the same are in question.

III Production capacity

Production line	Capacity in ton/year
TASM	36.000
TBM	30.000
TIP-TEM	4.000
T o t a l:	70.000

a) Required machinery - about 150 machines of different types.

b) Required amount of raw materials
Total annual request of all raw materials (fireclay or refractory mortar, quartz conglommerate, magnesium, high aluminium raw materials, chromium, sinter-magnesium, chemical and hydraulic bonds and similar) is 75.000 t/year

c) Required area for plant site

Item	m^2
Production plants	6.000
Storage	10.000
Offices	500

d) Required manpower

Item	No.
University grade personnel	19
College grade personnel	6
Skilled workers (high-skilled)	34
Secondary school grade personnel	48
Skilled workers	123
Primary school grade personnel	4
Semi-skilled workers	76
Non-skilled workers	63

e) Required ucilities

Requested electrical power: 2.500.000 kwh/year

IV Estimation for investments - in US $ (investments in production)

1. Aluminium silicate grain refractory materials 5.000.000.-
2. Alkali grain refractory materials 3.000.000.-
3. Thermo-insulation and insulation materials 2.500.000.-

Production costs per on ton of production: cca US $ 150.00.-

V Technology transfer extent: marketing advisory activities, factory design, advising appropriate equipment and tools, organizing production and operative planing, quality control, training personnel.

VI Contact address:

For more details, please contact:

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Yugoslavia

(21) I Steatite product making by dry pressing (ISIC 3699)

II Steatite products are mostly used in electric engineering fields for lining thermostats, lamp screw caps, low and high voltage fuses, insulating supports and for various other insulating equipment and apparatus in electric installations.
Products are distinguished for exact dimensions and forms as well as smooth surface. By its technical specifications the material corresponds to DIN 40685, group 200, TyP KER 220 standards.

The paste for dry pressing of steatite products, used in the electric manufacturing industry, is prepared by wet grinding of raw materials (85 per cent tallow, 10 per cent clayish substance, 5 per cent solvents) in ball mill, worm procedure, by adding electrolyte to reduce the permeability of water in slip. Ground paste slip is dispersed and dried in atomizer after cleaning on a fine vibrating sieve and in electromagnetic filter. The obtained dried steatite paste granules are then directed in a charging mixer to the chaping requirements of individual products. Plasticiser is added if so required. Products are shaped from granulated paste by dry or semi-dry pressing in metal moulds on automatic pressing devices. Pressed products after possible further processing (drilling, thread cutting etc.) and cleaning are fired in a tunnel kiln at temperatures from 1620 to 1650 K (SK - 12/13) in continuous procedure. Natural or liquid gas is the most suitable fuel for firing kilns.

III Annual output: 3,000 tons of steatite products

(The annual output may be higher or lower than mentioned, depending on the utilization and possibilities of the type of atomizer used for the dispersion of the steatite mass).

a) Required machinery and equipment - ball mills, tanks with mixer, atomizers for dispersion of steatite slip, silos, presses, continuous tunnel kilns, etc. - about 60 machines.

b) Required amount of raw materials

Item	%	annual quantities (t)
tallow	85	3,570
clay	10	420
solvents	5	210
		Total: 4,200 t

c) Required area for plant site

Required office area: approx. 400 m^2

Required buildings

a) Raw material stores: 700 m^2
b) Preparation of paste: 1,700 m^2
c) Pressing plant, tunnel kilns(3) 2,000 m^2
d) Product sorting
e) Warehouse: 400 m^2

d) Required manpower

a) Required labour: semi-skilled workers - 110, skiled workers - 20;
b) Operational personnel: highly skilled workers - 3, intermediate vocational training - 8 workers, advanced specialist's training - 3 workers, university-level training-3.

e) Required utilities

Energy: voltage 220/380 V, total installed power - approx. 200 KW.

V Technology transfer extent: designing and engineering, selection and testing of materials, making of technical and economic projects, quality control of products and raw materials, education of personnel.

VI Contact address:

For more details, please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
Slobodana Penezića-Krcuna, 29-31
Yugoslavia

(22) I. Technology for design and manufacture of solid fuel boilers (1 ton/hr to 10 tons/hr. Steam and hot water output; oil and gas fired boilers (200 kgs/hr to 20 tons/hr) (ISIC 3813)

Boilers of smoke tube (packaged construction to BS - 2790 designs).

II. Process involves cutting (Oxy-Acetylene or Mechanical shear); rolling of circular shells; drilling of tube plates; fabrication by welding (manual or automatic) various parts with emphasis on class I welds of radiographic quality. Assembly of the welded parts, conducting tests on welded parts as per code (BS-2790/ASME/IBR).

Fitting of boiler accessories such as matching pumps for water; oil/gas/coal combustion equipment; valves and fittings; refractory and insulation jobs to suit.

III. Production capacity: Boiler manufacturing plant to produce minimum 50 and maximum 300 units per annum involving boiler plates of 250 tons to 1500 tons fabrication.

Machinery in initial stage of 250 tons include plate cutting/bending/welding/drilling/hand tools etc. - 30/40 machines of different types.

Plant area: Initial built-up 4,000 m^2 of shop area under cranes. Store/office and other covered areas approximately 1,000 m^2.

Initial manpower for production:

Engineers and technicians:	25
Administration:	15
Skilled and semiskilled workmen	80

Energy consumption: 250/300 KVA

IV. Investment costs: Around US$ 3 million
Production costs: Around US$ 2 million

V. Know-how. Additional facility of assisting plant design and set up, staff training.

VI. Contact address:

Hestler Boilers Pvt. Ltd.
55-56 Dalamal Chambers
Sir V. Thackersey Road
Bombay 400 020
India

Telex: 011-334 HBPL IN
Phone: 290335, 295569
Cable: HESTLER

(23) I. Technology for making welded link chains (ISIC 3819)

II. Production programme includes welded link chain, mild steel, alloy steel and stainless steel. The steels used are according to commonly used international specification. Steel after heat-treatment is fed into automatic cold forming machines which turn out as chains of the required dimensions in continuous length. These chains are then fed into another set of machine, other cut ends are welded together to complete the basic manufacturing operations. After welding, the chains are suitably heat-treated, calibrated for dimension, tested for strength and finished as per requirement of the customer.

Products: Welded link chain wire dia. 5 mm to 32 mm. Link dimension outside length from 15 mm to 150 mm depending upon wire dia.

III. Production capacity: Depending upon market possibilities, but a minimum volume of about 1000 M.T. per year to be considered.

Required equipment: Again depends on product-mix, but for production of about 1000 M.T. about 8 to 10 basic machines shall be required.

Raw materials required: For production of 1000 M.T. about 1100 M.T. steel will be required.

Plant site area: About 1000 sq.mtrs. of covered area shall be required for production process.

Required manpower: Depends on level of skills available, but following basic requirements should be noted:
5 Engineers
50 skilled workmen
15 unskilled workmen.

Energy consumption: Depends on product-mix.

IV. Investment costs: Approx. US$ 3 to 10 million, depending on product-mix.
Production costs: Depending on product-mix.

V. Know-how/joint venture is proposed.

VI. Contact address:
The Indian Link Chain Mfrs. Ltd.
Lal Bahadur Shastri Marg
Bhandup, Bombay-400 078
India

Phone: 582311/582312/586803
Cable: INLINCH BHANDUP

(24) I. Technology for making springs for vehicles. (ISIC 3819)

II. The production programme includes hot formed spiral springs, volute springs, malinated plate springs, leaf springs, stabilizer and torsional rods. All these products are made of hot forming steel grade per JUS C.B0 551, although other steel grades, corresponding to the applying standards in the customer's country for which springs are manufactured, may also be used. The material used is heated in appropriate furnace fired with propane/butane gas or heated electrically. The forming process is performed on the most modern machines, and quenching in the corresponding cooling fluid is the final forming operation. Products are shot blast with steel balls to stabilize their surface mechanically and to clean it from heat treatment effects. The shot blasting machines are provided in all process lines, and in the leaf spring production that side of the spring exposed to tension is usually subject to shot blasting.

Products:

a) Cilindrical spiral springs:

- Wire diameter d = 7 mm - 45 mm
- Mean coil diameter D = 30 mm - 320 mm
- Height, free H = 50 mm - 1000 mm

b) Volute springs:

- Thickness h = 6 - 15 mm
- Width b =70 - 200 mm

- Outer larger diameter D = 80 - 240 mm
- Outer smaller diameter d = 30 - 100 mm
- Spring height H = 100 - 350 mm

c) Leaf springs:

- Thickness h = 3,8 - 30 mm
- Width b = 40 - 150 mm

d) Stabilizer and torsional rods
Cross-section diameter d = 6 - 45 mm

III. Spring making plant with the volume of production 35.00 t spring yearly / about 1,300,000 pcs of springs/

a) Required machinery - about 510 machines of different types.

b) Required amount of raw materials and utilities
42000 t. of productional and 4000 t. of consumable materials.

Item	Quantity (t)
Hot forming steel	40,740
Brass - bronze	630
Plastics	210
Agents for anticorrosive protection (paint)	420
Crude oil	2,040
Propane - butan	1,360
Hardening oil	480
Oiling agent	80
Others	40

Plant site area - 14,000 m^2 for production processes, design, laboratories, etc.

Required manpower - 30 engineers and economists
30 technicians
270 qualified workers
45 unqualified workers

Energy consumption - 4 10^6 kwh

IV. Investment costs / approximately/ ≃ US$75 million

Production costs / approximately/ ≃ US$12 million

V. Turn-key contract is proposed.

VI. Contact address:

For more detail, please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
Slobodana Penezica - Kreuna 29-31
Yugoslavia

(25) I Technology for roller covering (ISIC 3824)

II The rubber coated metal rollers are component parts of several machines in paper,textile,wood,leather,concrete,chemical and metal industry as well as compound parts of several printing machines. These rollers operate as transport devices and the elasticity of their rubber coating gives some useful mechanical effects. The rubber layer provides good anti-corrosion and/or anti-abrasion metal roller protection. The roller sizes depend on machine sizes where the rollers are built in or on the product width (paper,tissue,metal sheets). Roller lengths 0,01 m to over 8 m, roller diameter 0,01 m to over 1 m.

Technological process of roller covering includes:

- preparation of rubber mixtures and semi-manufactures (calandered sheets),
- removing waste rubber from the rollers,
- metal surface degreasing and sand blasting,
- cement applying,
- covering with rubber mixture,
- curing,
- grinding,notching channels or boring holes into the rubber surface, balancing rollers,
- control and packing.

III The optimum production output amounts to 80.000 kg of rubber mixture yearly at one-shift-work. Due to the duration of a curing cycle a two-shift-work has to be taken into account at the curing process.

a) Required machinery - calender, scrapers, grinderstones, covering and curing equipment dynamic balancing machine, notching and boring tool, sand disintegrator and the other machines and facilities.

b) Required amount of raw materials

Item	Quantity t/year
Natural caoutchouc	8,5
Synthetic caoutchouc	31,0
Curing material	8,5
Preserving agents	0,8
Softeners	10,0
Carbon black	7,5
Fillers	24,0
Paint	2,5

c) Plant site area - about 1.500 m^2 for production processes and three business rooms of 80 m^2 each.

d) Required manpower

There would be necessary 30 production workers: 23 skilled and 7 unskilled labour. Managing production process (work control, quality control, operative technological work, and maintenance) requires 10 persons, 2 of high and 8 of secondary school qualification.

e) Required utilities

Energy consumption - 950 MWh/year
Steam - 800 t/year

V Technological transfer extent: factory design, technological process and equipment lay-out; equipment specification, advising appropriate offers, taking part in equipment installing; trial production; staff training.

VI Contact address:
For more details, please contact:
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Slobodana Penezića-Krcuna, 29-31
Yugoslavia

(26) I. Technology for manufacturing community deepwell hand pumps (India Mark II design) (ISIC 3829)

II. The final product is a hand operated submersible deepwell pump capable of drawing water from bore holes (minimum 4" dia) as well as open wells. Water can be raised from depth up to 80-90 metres. The average discharge is 800/1000 litres per hour and therefore the pump can serve a community of up to 500 for all their drinking water needs. The construction is sturdy, almost all steel, hot dip galvanized for protection from the elements. Over half a million of these pumps are already working successfully in lakes of Indian villages. Nearly 40,000 are also working in about 35 other countries, mainly in Africa. About 50% of the Indian stock of these pumps and nearly 100% of the foreign stock have been manufactured by our company.

The production programme in a developing country is proposed in a phased manner:

(a) the first phase envisages export of all sub-assemblies from India and only final assembly to be done locally;
(b) in the second phase some simpler operation can be undertaken locally. Galvanizing can also be done;
(c) in the final phase all welding can be done locally but it may still be necessary to get many of the components from India unless the production level is stabilized at around 1000 pumps per month (minimum) which would justify setting up of presses, shearing machines, lathes, milling machine and draw benches etc. to produce the components locally.

Essentially the product uses 6 mm HR plate, 4 mm HR sheet, 40x40x6 mm angle iron, 32 mm square bar, 6" and 1 1/4" B class welded pipe, 2 mm CRC sheet, 12 mm bright bar, cast iron cylinder, extruded brass liner and components manufactured from gun metal, steel, leather and rubber. The machinery required has been indicated in the paragraph above. Other treatments include electroplating and painting. GI pipe is used as a riser pipe with specially made couplers.

A set of special tools is needed for installation and maintenance. We will provide a detailed installation and maintenance manual.

III. Production capacity: Can start with minimum 500 pumps per month; to go up to 1000/1500.

Required equipment: As detailed under II. above. Additional good quality welding sets would be required. Also Electroplating and hot dip galvanizing plants.

Raw materials required: As detailed under II. above.

Plant site area: Approximately 5000 sq.ft. covered area; without basic machining operations which are planned to be sub-contracted.

	Required manpower:	About 75-100 persons at the level of 1000 pumps. This is also based on sub-contracting of the basic machining operations. The work force would include about 10 welders, 2 machinists, 2 galvanizers, 6 fitters and the rest unskilled helpers.
	Energy consumption:	Approximately 75 to 100 HP (excluding basic machines etc.)
IV.	Investment costs:	Will depend on availability of local facilities. In any case for phase one and two very little investment is required except any special jigs and fixtures for welding and inspection gauging equipment which would all have to be exported from India.
	Production costs:	Will depend on local facilities.

V. The company has no interest in a joint venture but is open to providing technical know-how either against lumpsum payment or combination of initial payment and royalty. Our personnel would be deputed to assist in the commissioning of production.

VI. Contact address:

INALSA Pvt. Ltd.
Surya Kiran
19, Kasturba Gandhi Marg
New Delhi - 110 001

Telex: 31-65063 INAL IN
Phone: 3314214, 2314215, 3314216
Cable: INALSA

(27) I Technology for making oscillation absorbers (ISIC 3829)

II Shock absorbers are primary used as vibration absorbers in road and rails motor vehicles of various types, in washing machines, seats and as supports of various uses.
Production programme of absorbers can cover following types (observing principle of activity): friction, gas, hydraulic single-pipe, hydraulic double-pipe, hydraulic absorbers Mc-Pherson system, lever hydraulic and hydropneumatic absorbers.
Metal parts of absorbers are mostly of steel, sintering iron and alloys and are manufactured by use of special thermal processes, treatment of sliding areas and surface protection. Rubber and plastic materials which are used for manufacture of some parts must possess requested characteristics, for example: sealing capability, corresponding resistance on dynamic loading, wearing and heating, oil and long life.

III All necessary data needed to establish a production unit capable to produce 600.000 absorbers per year is presented below. The production assortment includes absorbers from largest to smallest principal dimensions and various types.

a) Required machinery and equipment for pipe and small parts production lines, welding and sub-assemblies lines, absorber installation line, piston rod production line and press treatment line - about 80 machines of different types.

b) Required amount of raw materials and utilities

Item	Quantity per year/t
Steel rods of 8 - 25 mm	400
Steel pipes of various dia. and wall thickness with special quality conditions	680
Steel sheets and strips	130
Iron sintering parts	70
Parts manufactured from light non-ferrous metals	50
Parts made of rubber	40
Protection painting	580 kg
Special oil used for hydraulic absorbers	150.000 lit.
Thinner	
Neutral gas (nitrogen, argon, CO_2)	
Required energy	350 KW

c) Required area for plant site

Item	m^2
Management, economic-financial and technical area	200
Overhead area in production	40
Requested buildings	
Official building	200
Production plant building	1.350
Storage area	150
Power plant area	50

d) Required manpower

	No.
University grade personnal (mechanical engineer)	11
College grade, mechanical and economic profession)	5
Skilled metalworker	12
Semi-skilled metalworker	140

IV Investment costs /approximately/ in US $:

Buildings	198.000
Machinery pool	426.776
Interior transportation and storage	118.000
Power plant	40.000
Total investment:	4.782.776

V Technology transfer extent: laboratory researches, planning and programming, design, advising appropriate equipment and raw material, quality control, training personnel.

VI Contact address:

For more details, please contact:

The Yugoslav Center of Technical and Scientific Documentation
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Yugoslavia

(28) I. Technology for design and manufacture of ash handling equipment for fossil fuel fired boilers (ISIC 3829)

II. The process of manufacture including cast iron/alloy steel casting, machining, fabrication and final finishing etc. The manufactured equipment also requires rigorous quality control and testing at various stages of manufacture. The range of equipment assemblies includes:

- E-type material handling valves (extraction valves)
- Air electric segregating slide valves (branch isolating valves) vacuum breakers
- Ashflow valves
- Universal slide valves
- Knife gate valves
- Jalamix dust valves (Daniel's bowls)
- Flushing apparatus feed gate housings
- Clinker grinders
- Primary collectors
- Secondary collectors
- Three-cell collectors
- Hydromix dust conditioners
- Rotary feeders
- Hydroejectors (jet pumps)
- Hydrovactors (vacuum producers)
- Wetting heads
- Feeder ejector
- Vertical and horizontal ash slurry pumps
- Collector tanks
- Air separator tanks
- Air water converter tanks
- Fluidizing feeders metering cut off gates
- Air washers
- Aeration blocks
- Air slides
- Hydrobins
- Bottom ash hoppers
- Towers
- Cranes
- Indurite fittings and pipes
- EZY sleeve couplings
- Sluiceway liners
- Flushing/jetting nozzles
- Sequential control panels

III. Production capacity: 10,000 tonnes of ash handling equipment per annum.

Required equipment: Foundry plant and machinery; machine shop equipment, fabrication equipment and tools; and testing equipment.

Raw materials required: Cast iron; steel; stainless steel; nickel; chromium; manganese; furnace oil etc.

../..

	Plant site area:	**Plot area - 40,000 sq. meters.**
	Required manpower:	**Engineers and supervisors - 30** **Qualified workers - 250** **Unskilled workers - 70**
	Energy consumption:	**2×10^6 KWH per annum**
IV.	**Investment costs:**	**US$ 5 million**
	Production costs:	**US$ 15 million**

V. **Know-how/joint venture/turn-key project is proposed.**

VI. **Contact address:**

Mr. A.K. Pal
Vice President
The Indure Private Ltd.
Indure House, Greater Kailash-II
New Delhi - 110 048
India

Telex: 031-4283
Phone: 6411321, 6412358, 6412 9
Cable: INDURITE

(29) I. Technology for manufacture of
(a) Pumps for agricultural and irrigation applications
(b) Standard electric motors and starters
(c) Renewable energy systems including hot water systems and gasifiers based on wood and biomass.
(ISIC 3829)

II. (a) Manufacture of castings and fabricated parts;
(b) Machining of shafts, bodies, covers etc.;
(d) Making stacks of stampings, windings (for motors only);
(e) Assembly of components, testing, painting and punching.

III. Production capacity:

Required equipment:

Raw materials required:

Plant site area:

Depending on the selection of products, market and capacity required. Brief project report/ information can be made available upon specific request.

Required manpower:

Energy consumption:

IV. Investment costs:
Production costs:

As in point III. above.

V. Know-how transfer/patent licence is preferred.

VI. Contact address:

Dr. K. Kulkarni
Sr. Manager, Tech. Services
Jyoti Limited
P.O. Chemical Industries
Vadodara 390 003
Gujarat
India

(30) I. Technology for making Earthmoving Machines viz., Rear Dumpers from 25 T to 50 T capacity, Track shovels up to 4.5 m^3, front end loaders up to 6m^3, dozers up to 300 hp and scrapers. (ISIC 3829)

II. Earthmoving machines comprise of sub-assemblies viz., engine, transmission, final drive, hydraulic aggregates and structural elements. Manufacture of these machines requires a wide range of machine tools for machining, special gear cutting and hobbing machines, welding systems, a good metrology facility, jigs and fixtures etc.

III. Production capacity: *

Required equipment: *

Raw materials required: Castings, forgings, alloy steels for structural applications etc.

Plant site area: *

Required manpower: *

Energy consumption: *

* To be mutually discussed and project report to be prepared depending on the particular country's need.

IV. Investment costs: Depends on
Production costs: project report.

V. Collaboration for manufacturing is proposed.

VI. Contact address:

Director (R&D)
Bharat Earth Movers Limited
Unity Buildings, JC Road
Bangalore - 560 002
India

(31) I Technology for making cables (ISIC 3839)

II Drawn copper or aluminium wire for production of insulated wires or cables widely used for electrical purposes is invariably wet drawn on drawing machines from wire rods 8 to 10 mm ø up to 0,03 mm ø. The conducting portion of the cable is called conductor and it is made of a number of bare copper or aluminium wires, stranded or bunched. Then, we are extruding a plastic or rubber insulation coating on conductors. Round or sector shaped insulated cores are laid-up or twisted together in helical form to get a mulicore cable. Wire or metal tape (armour)is often applied over laid-up cores to protect cables against mechanical damage. Provision of an outer protective covering for cables is sheating and it is usually extruded over the irsulation at single-core cables or over the assembly of cores,resp., over armour at multicore cables.
Pinal products are: a) thermoplastic insulated wiring cables of nominal conductor cross-sections 0,5 up to 150 mm^2 with number of cords 2 up to 4 and PVC; b) thermoplastic polyethylene insulated power cables for voltage up to 1 kV of nominal conductor cross-sections 2,5 up to 500 mm^2 with number of cores 2 up to 4 acc.to DIN,VDE and BS specifcations.

III The production capacity of the plant will be reffered to total quantity of copper wire ø 8 mm being 2000 tones yearly.
The plant is designed for double-shift operation under the following schedules:8 hours/day 25 days/month 300 days/year

a) Required machinery and equipment - about 30 machines of different types.

b) Required row materials/year

Item	Quantity (to)
Copper wire rod 8 mm ø	2141
PVC for insulation	1637
PVC for sheathing	1200
PVC for filling	100
zinc-coated steel wire	601
zinc-coated steel tape	124

c) Required area for plant site
Building
50 m x 80 m = 4000 m^2
Storehouse
15 m x 80 m = 1200 m^2

d) Required manpower

4 Engineers (Managers: Production, Quality Control, Maintenance, Produc. Planning)
8 Technicians (Foreman: first and sec. shift)
1 High-qualified polisher
2 Qualified polishers
31 Skilled workers
10 Semi-skilled workers
4 Unskilled workers

e) Required utilities

Item	Quantity
Electric power installed	2800 kVa
Cooling water	136 m^3/h
Compressed air	3,35 Nm^3/mm
Drawing lubricant	1200 l/min
Protective steam	24 kg/h

IV FOB price of machinery and equipment .....(approx.) US $ 5,400,000.- Financial data about necessary investment for production will be given in the contract.

V Consulting kinds and offering cooperation:
- Planning and Engineering
- Choice and material testing and/or of equipment
- Technical projects execution
- Quality inspection of raw materials and products
- Consulting services
- Staff education

VI Contact address:

For more details, please contact:

The Yugoslav Center of Technical and Scientific Documentation
11000 Belgrade
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(32) I Technology for making wagons (ISIC 3843)

II Goods wagons, tank-wagons and special wagons serve for transportation of all shapes of goods (bulky, loose, granular liquid, gaseous and out of loading gauge).
Production may include all types of freight cars - open, covered, special cars and cisterns - 2 axle, 4 axle, 6 axle, 8 axle, 10 axle, 12 axle, 16 axle, 18 axle and 24 axle wagons which correspond to carrying capacity of 27 to 320 t and loading up to 20 t per axle.
Required raw materials and semiproducts from steel, metal and alloys are subjected to treatments such as sand blasting, cutting, forging, removing of shaving, lochmith's works, after which treated and formed parts with axles are mounted to subassemblies and assemblies. By mounting axles and bogies, the assembly of wagons is completed and the final operation is surface treatment of wagons by painting.

III For one-year volume of production of about 45000 t wagons which corresponds to production of about 1500 goods wagons (4 different types) it is necessary to provide as follows:
a) Required machinery and equipment
Total about 1200 different types of machines (equipment for cutting and separation, equipment for treatment by deformation, equipment for removing of shavings, equipment for welding, equipment for control, equipment for indoor and outdoor transportation, laboratory equipment etc.)
b) Required amount of raw materials and utilities
55000 t of productional and 5500 t of consumable materials,

Item	Quantity /t/
Steel	48.840
Steel castings	2.695
Electrodes for welding and building up	808,5
Wooden building material	1.347,5
Agents for anticorrosive protection (paint)	753,5
Others (pig iron, aluminium, copper and alloys, etc.	555,5
Crude oil	550
Oxygen	825
Propane-butane	825
CO_2	3.025
Coal-coke	165
Lubricants	55
Others	55
Electric power	6.106 kWh

c) Required area for plant site
4500 m^2 of business space and 25000 m^2 of production space.

d) Required manpower

Item	No.
Graduate engineers in different field of specialization	50
Engineers in different field of specialization	30
Technicians in different field of specialization	140
Graduate economists	8
Economists with advanced and secondary school	30
Graduate lawyer	2
High-qualified and qualified workers	750
Not thoroughly untrained and unqualified workers	90
Workers of other professions	90

IV Investment costs of a wagon plant are estimated of US $ 58 mill. Production costs are about 16.10^6 US dollars.

V Technology transfer extent: preliminary research and analyze of market, planning and programming, designing and engineering, selection and testing of materials, making of technical and economic projects, quality control of products and raw materials, advisory services, education of personnel, ready projects, estabilishment and equipping of productional lines.

VI Contact address:

For more details, please contact:

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(33) I. Technology for manufacture of commercial vehicles (ISIC 3843)

II. Casting, forging, metal cutting/machining, heat treatment, welding, fitting and assembly.

The company makes commercial vehicles - trucks and buses - with gross vehicle weights ranging from 4 to 16 tonnes. It also makes vehicles in 4-wheel drive and for special executions like dumpers, tippers, garbage removers, water sprinklers, fire fighters and the like.

III. Production capacity:

Required equipment:

Raw materials required:

Plant site area:

Required manpower:

Energy consumption:

All varying depending on the size of the project, product-mix, in-house manufacture and availability of infrastructural supporting facilities. The details would have to be worked out on a case to case basis.

IV. Investment costs:
Production costs:

Same applies as in III. above.

V. Technical collaboration arrangement for know-how and supply of CKD parts is proposed.

VI. Contact address:

Director (Exports)
Tata Engineering and Locomotive Co. Ltd.
Block 'A', Shivsagar Estate
Dr. Annie Besant Road
Worli
Bombay 400 018
India

Telex: 117-3716
117-3858
Phone: (022) 4921800

(34) I Technology for making plastic coil slide fasteners (ISIC 3909)

II The slide fasteners are manufactured for every possible useclothing, shoes, leather wear, sport and camping accessories, protective clothing, upholstery, industrial use and so on.
A plastic coil slide fastener consists of chain and slider.The chain consists of tape (cotton or polyamid) 10-18 x 0,3 - 0,7 mm and coil made of polyamid monofilament 0,5-0,9 mm. The coil is sewn to the tape. Slider body and pulls are made on Zn - alloy(JUS - C.J. 6.040).

The slide fastener can be made in separable or nonseparable form and in sizes: 4,5 and 7 mm coil width. The colors are defined by the color card, and the length by buyer. The lateral strength of the slide fastener is 30,40 and 50 daN/1", in dependence of the size.

Manufacturing processes in a plant of plastic coil slide fastener are coiling, sewing, dyeing, finishing and termofixing,completing,pressure casting + stamping, polishing, calibrating, slider assembling,surface treatment, repairing + servicing.

III The optimum annual output of the slide fastener making line is 8.000.000 m annually on a two shift basis.

a) Required machinery - about 70 machines of different types.

b) Required raw materials

Item	Quantity Annual Requirement
Cotton or polyamid tape	18,000.000 m
Polyamid monofilament	38.000 kg
Polyamid sewing thread	7.000 kg
Zn-Alloy GDZn Al 4 - Cu(JUS C.J 6.040)	65.000 kg
Brass tape	8.000 kg
Newsilver tape	3.900 kg
Al - tape	3.000 kg
Polyamid granulated for separable bottom stop	2.200 kg
Dyes, enamells, adjuvants	4.000 kg

c) Required area for plant site
A rough estimate of the area of offices is 150 m^2 and area of buildings for production is 1850 m^2.

d) Required manpower

Item	No.
1) Graduated mechanical engineer or engineer for economy	1
2) Mechanical engineer	1
Engineer for textile chemistry	1
Engineer for economy	1
Jurist	1
Electronics engineer	1
3) Constructional technician	2
Chemical technician	1
Textile technician	1
Technician for economy	3
Typist	1
4) Operators:	
- for dyeing	2
- banch lathes	25
- electricians	3
- fireman	1
- truck drivers	2
- crane / fork lift drivers	2
5) 175 helpers for various operations (predominantly women)	
Manpower -	total: 224

e) Required Utilities

1. Electric power

   Installed current 320 kW

   Simultaneity factor ca. 70%

2. Compressed air consumption at the pressure 600 kPa amounts 2,2 m/h
3. Steam consumption at the pressure 600 kPa amounts ca. 400 kg/h
4. Water consumption ca 16 m^2/h

IV 1. Costs of constructions

- Ground + buildings	ca. 930.000 $
- Machines + equipment	ca. 1,400.000 $
Total:	ca. 2,330.000 $

2. Production costs:

   Material, manpower, energy, transport, advisory fees amount in average 0,355 $ /m.

V

Complete know-how is proposed.

VI Contact address:

For more details, please contact:

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