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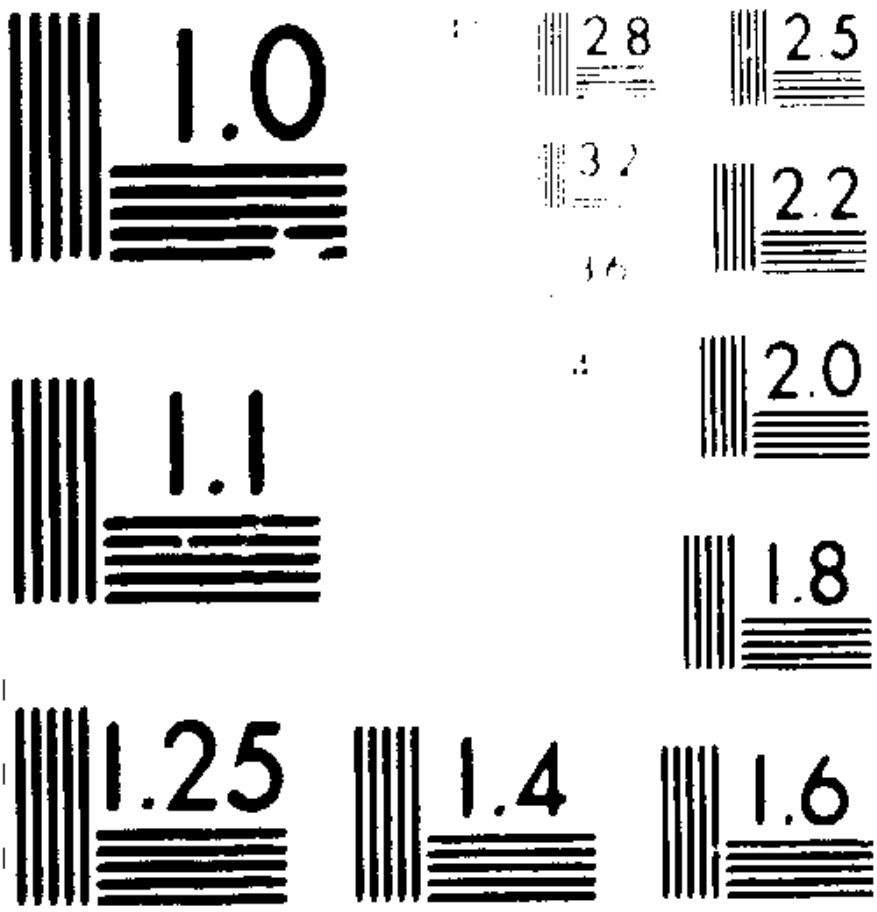

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April 1980

R1 ASSISTANCE TO TEKSTILNI KOMBINAT

DUNAV,

YUGOSLAVIA

SI/YUG/78/801

Terminal report prepared by

S.NAGAOKA

expert of the United Nations Industrial Development Organization

acting as Executing Agency for

the United Nations Development Programme

TABLE OF CONTENT

I SUMMARY

I was selected to work at T.K. "DUNAV" , Yugoslavia as a member of experts under UNIDO programme.
I was expected to assist Dunav as atextured synthetic fibers technologist.
I found the following:

trilobal polypropylene textured filaments are used as a carpet material.
round polypropylene textured filaments are not accepted as a carpet material because of poor quality.
round polypropylene staple fibers are used as a carpet material.
polyamide 6 filaments are well received as new material.
filaments are very profitable but staple fibers are not so.

Dunav had already produced round textured polypropylene filaments and staple fibers.
Dunav have a technology to produce round polypropylene filaments and staple fibers.
But Dunav had not "Know How" to produce trilobal filaments and polyamide 6 filaments.
So nowadays Dunav could not produce textured filaments and produced only staple fibers.
Newly constructed filament machine "Barmag line" did not begin to produce because of many problems, especially low productivity.
I often had conferences with Dunav top members and discussed about these problems and improvement methods. As the result of conferences. I mainly concentrated on the production of trilobal textured filaments of polypropylene and polyamide 6 by the existing machine. All works concerning the project were carried out throught Mr.AČANSKI and his line who is the director of production departments.
As the result, all recommendations for process, equipments and managements were carried out without difficulties.

In order to get the best improvements, Ioften obtained many technological data and process "Know How" from the biggest synthetic fibers manufacturing company in Japan "Toray" where I have been engaged in working.
These informations from Toray were very useful and practical for removing problems and taking actions.
Now Dunav began to produce the most profitable trilobal polyamide 6 textured filaments by the existing machine and has "Know How" of trilobal polyamide6 and polypropylene textured filaments.
Meanwhile Barmag line has been continued to test polypropylene filaments instead of polyamide 6 by Barmag and Dunav engineers and began to produce trilobal polypropylene textured filaments.
It is important that Dunav hereafter produces filaments of good quality.
So I have provided möre than lo recommendations to get better quality and higher quantity in the future.
This implies process and equipments improvements for polyamide 6 and polypropylene and laboratory manuals and quality control methods for polyamide 6 filaments.

II INTRODUCTION

Dunav was established in 1945 with the aim of processing hemp, jute into finished products as textile and packing material. Dunav is situated at Čelarevo, the small city is 28 km far from NOVI SAD and is about lookm northwest of Belgrad.
Dunav has expanded into processing of sisal and coir fibers during the corse of its developments.
Now Dunav produces the following :

- synthetic fibers and filaments, semiheckled
- spinning materials, flocked products,
- sissal, jute and oakum products,
- raffia and polypropylene and polyetilene ropes,
- technical textile fabrics and wrappings,

Except synthetic filaments and staple fibers, Dunav has a long history and a lot of "Know How".
And Dunav intended to produce synthetic filaments and staple fibers for the developments in the future.
As lst step, polypropylene split film process was introduced at the level of 8oo ton/year in 197o.
As 2nd step, polypropylene and polyamide 6 filaments and staple fibers processes were introduced from Reifenhäuser West German and Mackie England respectively in 1975.
The production capacity is looo ton/year for filaments and 7oo ton/year for staple fibers.
As 3rd step, Dunav constructed a new machine for polypropylene and polyamide 6 filaments from Barmag West German in 1979.
But Barmag line did not produce on schedule because Barmag could not achieve the guaranted figures.
When Barmag line begins to produce, the production capacity of Dunav will be 25oo ton/year for filaments.
The market of filaments for carpet materials requests trilobal polypropylene textured filaments or polyamide 6 filaments.
But Dunav had not "Know How" to produce trilobal polypropylene filaments and polyamide 6 filaments.

Though Dunav had produced round polypropylene textured filaments and staple fibers and filaments are profitable, Dunav had to stop the production of filaments.
All products are delivered to domestic customers.
Dunav has a strong wish to produce filaments of good quality for a carpet material and to sell them to foreign customers as well as domestic customers.
When I came to Dunav, the urgent problem was to produce trilobal filaments especially trilobal polyamide 6 filaments.
Dunav is expecting to expand synthetic filaments and staple fibers after urgent problems are removed. For these enviroument, a long range future plans are not fixed clearly.

1 ORGANIZATION OF DUNAV

Dunav consists of three big departments and one supplementary department with total of 1500 employees under general director Mr. LUKIĆ.

- DUNAV
  - Production department
  - Sales department
  - Management department
  - motel supermarket department

Production department is the biggest with 1200 employees under director Mr. AČANSKI and consists of four divisions.

- Production dept.
  - Synthetic division
  - Plastic division
  - Hemp and sisal division
  - Maintenance division

Synthetic division consists of five sections under manager Mr. KECMAN.

- Synthetic div.
  - Staple and filament sec. by Reifenhäuser, Mackie
  - Filament sect. by Barmag
  - Space dye sect.
  - Twisting sect.
  - Flock sect.

2 OUTLINE OF MACHINE

Dunav has three lines to produce synthetic staples and filaments namely Mackie line and Reifenhäuser line and Barmag line.

a. Mackie line is the equipment to produce staple fibers.

Extruder
Spinning machine
Drawing machine
Heat setting machine
Crimping machine
Cutting machine
Bailing machine

b. Reifenhäuser line is the equipment to produce filaments.

Extruder
Spinning machine
Take up machine
Texturizing machine
Twisting machine
Rewinding machine
Cutting machine

c. Barmag line is newly constructed equipment to produce filaments.

Extruder
Spinning machine
Texturizing machine
Twisting machine
Cylindrical knitting machine
Space dye machine
REwind machine

III FINDINGS

I have been briefed by Mr. Oshio who works at Toray Industrial Inc, Japan and is one of my colleages and had already been on mission to Dunav for one month period. Besides I have a lot of meetings with top members of Dunav to know real states of Dunav and Market conditions of carpet materials for two weeks after my assignment.
AS the result of these examinations, I majorly concentrated to improve quatity and productivity of Reifenhäuser line and to produce trilobal filaments by the line.
So this findings consist of four items namely market conditions in Yugoslavia, examination results of Dunav, improvements of Reifenhäuser line and production of polyamide 6 filaments.

1. Market conditions in Yugoslavia

Market conditions for carpet materials in Yugoslavia are the followings.
A lot of polypropylene textured filaments and staple fibers are used as carpet materials and polyamide 6 textured filaments are well received as a new material.
Trilobal polypropylene textured filaments are used but round polypropylene textured filaments are not used as a carpet material because of poor quality.
But round polypropylene staple fibers are used as a carpet materials.
Textured filaments are very profitable but staple fibers are not so.

2. Examination results of Dunav

A State of process

a Mackie line

This line has produced round polypropylene staple fibers.
Yarn breakings and machine troubles are sometimes observed but not so.
The productivity of this line is the best in three lines.
The quality is comparatively good.
Actual rate of the operation is estimated at 90%.

b Reifenhäuser line

This line produced round polypropylene filaments.
The productivity of spinning machine was low due to a lot of troubles, for example polymer leakage from the extruder and "extruder stop" and due to bad operation conditions.
Many twin yarns were observed in wound drums.
The productivity of this texturizing machine was also low because of yarn breakings.
Yarn breakings were due to twin yarns of spinning machine.
Actual rate of the operationwas estimated at 70%.
Another big problem of this line was this line has produced round polypropylene filaments and the filaments were cut into staple fibers.

c Barmag line

This line is the equipment for polyamide 6 and polypropylene filaments.
This line was newly constructed but did not produce filaments on schedules.
Barmag engineers have continued to produce polyamide 6 trilobal filaments as the gurantee test.
But there were many yarn breakings.
Barmag could not acheive the gurantee figure for this line.

B Level of operation and maintenance

a Level of operation

Three shift system is adopted for the production of these three lines and about 18o workers are engaged.
Operators work hard and have the attitude to keep exactly indicated operation methods.
But they are often changed their post so they can not be skilled.
And they have little knowledge aimming at good quality or high productivity.

b Level of maintenance

Three shift system is also adopted for these three lines.
Five mechanicians and four electronicians are working in these lines.
Mechanicians are well skilled to maintain the machines but not so trained to improve machines.
They have a little attitude aiming to high productivity.
But electronicians are not so skilled except a excellent engineer.
They are not trained about actual machines namely are lack of on_the job training.
Production machines were sometimes stopped for a few hours or days because of production management namely lack of spare parts.

c Level of production management

The average quantity of productions was 7oo ton/year for Reifenhäuser line and is 6oo ton/year for Mackie line.
These figures mean 7o % of Reifenhäuser line capacity and 9o % of Mackie line capacity.

The average ratio of running cost and fixed cost is estimated respectively about 50%.
If Dunav could produce till maximum capacity of Reifenhäuser, the cost will be reduced to 85% of the present cost.
To obtain better quality and higher quantity, it is in need to approach systematically improvements of process and equipments.
But total systematically approchments seem to be not enough in general.
Some of engineers and managers often change operation conditions to see only quality data and yarn breakings without the examination of true reasons.
They are unskilled to examine facts and true reasons.
If they would be skilled to observe facts of process and equipments and to think true reasons from facts and to make plans removing troubles from true reasons and to test the plans and to feed back the results, they can get better quality and higher quantity.

3 Improvement of Reifenhäuser line

A Decrease of machine troubles

For improvements of actual rate of the operation, it was important to decrease machine troubles of the spinning machine especially polymer leakage and extruder stop.

a polymer leakage

state: Polymer leakage at the point of the extruder arrised from too high pressure in the extruder for a week or two weeks. Then they stopped the spinning machine and changed the filter and seal packing of the point. They could not produce about one or half day for the maintenance.

reason: The specification of the filter was too fine.
The strength of the seal packing was weak for the polymer pressure because of aluminum. The polymer pressure inside the extruder raised rapidly and seal packing was deformed and the polymer leaked from the point.

action: took off the filter.
changed the material of the seal packing from aluminum to bronze.

b extruder stop

state: When the extruder worked normally, the extruder stopped suddenly. Operators could start up the extruder again without any actions.
But a lot of waste occurred by this troubles.

reason: The temperature of the extruder cylinder was not optimum.
The upper limit of the motor driving extruder was a little low.

action: changed the temperature of the cylinder to optimum condition

cylinder	AMOCO polypropylene	BASF polyamide
1-1	260 °C	210 °C
1-2	270	230
1-3	270	250
1-4	270	255
1-5	270	260
1-6	270	260

changed upper limit of the motor from 17 amp to 18 amp.

result: The problem of polymer leakage is removed perpectly. The problem of "extruder stop" is removed for AMOCO polypropylene and Basf polyamide 6.
When Dunav uses another materials, Dunav had better test optimum operation conditions.

B Decrease of yarn breakings

For improvements of the productivity, it is important to decrease yarn breakings of the texturizing machine.

state: Many yarn breakings were occured at the position of 2, 3, 4 goddet rollers and texturizing nozzles. There wre a lot of twin yarns at the point of yarn breakings.

reason: The operation conditions were not optimum. Pack filters were too fine and pack bolts were too small.

So many polymer leakages were occured from packs especially in the case of color chips and the surfaces of spinnerets were very dirty because of polymer leakages.
The attachment guides for finishing oil wre not good.
Drum forms of undrawn yarn were not cylindrical.
There were too many unnecessarily guides in the machines.

action: changed operatiön conditions the followings as the result of many tests for AMOCO polypropylene.

spinning condition

extruder temperature	26o-27o °C
extruder pressure	13o bar
difil temperature	28o °C
finishing oil revolution	8-1o rpm
cooling air pressure	5-1o mmAq

texturizing condition

drawing velocity	12oo m/min
draw ratio	3.5-3.8
temperature goddet 2	9o °C
goddet 3	11o °C
goddet 4	115 °C
nozzle temperature	16o °C
pressure	6.5 bar

changed the specification of the pack filter and bolt size.
changed guides for finishing oil.
changed guides positions and decreased many guides.

result: Yarn breakings are extremely decreased.
The productivity raised approximately 5o %
from 7oo ton/year to looo ton/year.
The waste are decreased also approximately
from 12 % to 8 %.

4 Production of polyamide 6 textured filaments

The above mentioned improvements are also useful and practical for the production of polyamide 6 textured filaments. So we could try to test two important points. one point was to decide the specification of trilobal spinnerets for polyamide 6.
Another point was to decide the optimum operation condition for the spinning and texturizing process.

A Specification of trilobal spinnerets

When Icame to Dunav, Dunav had already ordered trilobal spinnerets for polyamide 6 textured filaments.
I examined the specification of the spinnerets and found the specification was not good, especially demensions of holes were too fine for polyamide 6 textured filaments according to Toray "Know How".
I recommended the optimum specification of the trilobal spinnerets for polyamide 6 textured filaments.
When Dunav recieved two type spinnerets, we tested them by Reifenhäuser machine.
Recommended spinnerets showed good results. Now Dunav has produced trilobal polyamide 6 textured filaments by the spinnerets.

B Optimum operation condition

We tested many operation conditions for polyamide 6 textured filaments and decided the following operation conditions for spinning and texturizing process according to the balance of quality and quantity.

spinning condition

extruder temperature	210-260 °C
extruder pressure	100 bar
difil temperature	270-275 °C
finishing oil revolution	8-10 rpm
cooling air pressure	5-10 mmAq

texturizing condition

drawing velocity	1100-1300 m/min
draw ratio	3.1-3.5
temperature goddet 2	80-90 °C
goddet 3	120 °C
goddet 4	125 °C
nozzle temperature	200 °C
pressure	6.5 bar

Now Dunav has produced trilobal polyamide 6 textured filaments by the conditions and the capacity is increased 1.5 times of the polypropylene namely 1500 ton/year.

IV RECOMENDATION

It is important that Dunav hereafter produces polyamide 6 and polypropylene filaments of good quality.
To get better quality and higher quantity, Dunav needs still more improvements of process and eqipments.
And Dunav needs also exact quality examinations of filaments to control the process.
The recomendations consist of improvements of process and equipments and the inspection manual and quality control methods for polyamide 6 textured filaments.
Dunav begin to investigate already some of recomendations.
After these recomendations will be carried out, better quality and higher quantity will be assured.

1 Improvements of process and equipments

A Ageing of filaments

Reason : Trilobal textured filaments are very strongly crimped.
The characters of filaments are gradually changing for a week.

Countermeasure :
Stay filaments for a week after filaments are textured.

B Air conditioning eqipments

Reason : Polyamide 6 is very sensitive for atmospheric moisture and temperature.
So the temperature and humidity in the room should be constant.

Countermeasure :
Air conditioning equipments should be provided for the spinning and texturizing room.

condition	temperature	18-22 °C
	humidity	42-48 %

C Cleaning equipments of spinnerets

Reason : Dunav uses a burnout equipment as a cleanning equipments of spinnerets.
To get high productivity, trilobal spinnerets must be perfectly cleanned. But trilobal spinnerets are not cleanned perfectly by a burn out eqipment.

Countermeasure :
A solt bath equipment should be provided for a cleanning method.

D Compressor

Reason : The pressure of texturizing nozzle should be constant to get good quality.
But when Reifenhäuser machine and Barmag machine work together especially to use suction guns, Dunav is short of compressed air.

Countermeasure :
Compressors should be provided,
pressure 8bar

E Dryer

Reason : Polyamide 6 chips are sensitive for moisture.
It is important to keep the moisture of chips till o.o2 % to get higher quantity.

Countermeasure :
Polyamide 6 chips should be dried before spinning process.
And dried chips should be transported by dry nitrogen.

2 Inspection manual and quality control methods for polyamide 6 textured filaments

To get good quality and control the process, it is important to measure exactly the character of filaments and analysis the data.
Polyamide 6 filaments are sensitive for moisture, so undermentioned quality control methods are advised.

required condition
temperature 18-22 °C
humidity 63-67 %

item	unit	sampling	measuring method
tenacity	g/d	2 times/day	see A
elongation	%	,,	see A
shrinkage in boilling watter	%	1 time/day	see B
crimp elongation after boiling	%	,,	see C
modification ratio		when operation conditions are changed	see D

A TENACITY AND ELONGATION

a Outline

A yarn specimen is placed in the clamps of a tensile testing machine, stretched or loaded until broken, and the breaking load and elongation are observed. Elongation at a maximum load is read from the load-elongation chart. Tenacity at break can be calculated from the denier determined in a separate test.

b Procedure

1 Reel a skein of 20 turns on the standard reel from a cheese and remove the skein from the reel and hang it on the skein holder.

2 Condition the skein without a tension in the standard atomosphere:63-67 humidity and 18-22 degree temperature: for 24 hours.

3 Cut a lower end of the conditioned skein with scissors and a bundle of the yarns is obtained.

4 Adjust the tensile testing machine as follows.

gauge length	25 cm
crosshead speed	30cm/min
chart speed	20cm/min
air pressure for oneumatic clamp	4.5 kg/cm^2

5 Take one yarn specimen from a bundle of the yarns and place it in the central part of the top clamp and close the top clamp. Place the free end in the lower clamp and attach a tensioning weight equal to 0.1 g/denier based on a nominal denier to the yarn below the lower clamp. Close the lower clamp and remove the tensioning weight.

6 Set the full scale load of tensile testing machine so that the estimated load to rupture the yarn falls between 3o and 8o percent of full scale.

7 Start the machine, observe and record the breaking load and elongation.
If the specimen breaks within 3 millimeter of either jaw, disregard the result and test another specimen.

8 Repeat the measurement 5 times for one cheese.

c Calculation method

1 Tenacity

Calculate the average breaking load. Calculate the average breaking tenacity in grams-force per denier using the equation as follows.

$$\text{breaking tenacity} = \frac{DT}{D} \text{ g/d}$$

where

DT : average breaking load in grams

D : average denier

2 Elongation

Read the elongation at maximum load from the load-elongation chart. Calculate the percent elongation on the basis of the nominal gauze length.

B SHRINKAGE IN BOILING WATER

a Outline

The yarn for testing is prepared in the form of a loop and the loop length is measured under a tensioning weight sufficient to strainghten but not to stretch the loop before and after exposure to boiling water. The change in length is expressed as a percentage of the length before exposure.

b Procedure

1 Cut the yarn specimen approximately 1 meter long from a cheese and join the both ends of the yarn specimen. Prepare it in the form of a loop and hang it on the skein holder.

2 Condition the prepared loop without a tension in the standard atmosphere.

3 Hang the conditioned loop on a hook at the top of the measuring scale and add the required tensioning weight to the bottom of the loop. A weight is 0.1 g/denier based on a nominal denier.
Measure the inside length of the loop to the nearest 1 millimeter, after placing the tensioning weight on the loop.
Record this length as the original loop length : Ll.
Remove the tensioning weight on the loop.

4 Take the loop hung on the hook and carefully put the loop into the gauze bag.
Then put this gauze bag into the basket of wire netting.

5 Bring the bath to boiling and immerse the basket in the bath. Continue boiling for 30 minutes.
Lift the basket from the bath and allow the loop to drain until dripping stops.

6 Dehydrate the gauze bag by using filter paper. Then remove the loop from the gauze bag and place it on a horizontal plane and dry it in the standard atmosphere for more than 4 hours.

7 Measure the loop length of the conditioned loop as described in 1 and record the value as the loop length :L2: after treatment.

8 Repeat the measurement 2 times for one cheese.

c Calculation method

Calculate the shrinkage of the test loop using the equation as follows.

$$\text{shrinkage in boiling water} = \frac{L1-L2}{L1} \times 100\ \%$$

where L1 : average original length of the loop
L2 : average length of the loop after treatment

C CRIMP ELONGATION AFTER BOILING

a Outline

The yarn for testing is prepared in the form of a skein and exposed to boiling water.
The yarn length is measured under two kinds of tensioning weights. The change in length is expressed as a percentage of the original length.

b Procedure

1 Reel a skein of 2o turns on the standard reel from a cheese. Take the skein on the reel and condition it in the standard atmosphere for 1 hour and carefully put it into a gauze bag. Then put this gauze bag in a basket of wire netting.

2 Bring the bath to boiling and immerse the basket in the bath. Continue boiling for 2o minutes. keep the basket immersed in the bath throughout the boiling period. Lift the basket from the bath and allow the skein to drain until dripping stops.

3 Dehydrate the gauze bag by using filter paper. Then remove the skein from the gauze bag and place it on a horizontal plane and dry it in the standard atomosphere for 12 hours.

4 Cut a lower end of the conditioned skein with scissors and a bundle of the yarns is obtained. Take one yarn specimen from the bundle of the yarns and tie a knot at one end of the yarn specimen.

5 Fix the knot of the yarn specimen on a clip hung the measuring scle. Apply the original tension to the yarn specimen by hanging a weight of 2mg/denier based on a nominal denier for 3o seconds. Then measure the yarn specimen 5o centimeter long and mark on the yarn specimen by using a stamp : L1 .

5 Remove the original tensioning weight on the yarn specimen and apply the rated tension to the yarn specimen by hanging a weigh of loo mg/denier based on a nominal denier for 3o seconds. Then measure the length of the marked yarn specimen : L2 and record the value as the yarn length of the rated tensioning weight.

7 Repeat the measurement 5 times for one cheese.

c Calculation method

Calculate the crimp elongation after boiling of the test yarn using the equation as follows.

$$\text{crimp elongation after boiling} = \frac{L2 - L1}{L1} \times 100\ \%$$

where

L1 : original length of the yarn

L2 : average length of the yarn under rated tensioning weight

D MODIFICATION RATIO OF YARN CROSS SECTION

a Outline

5 filaments for testing are prepared by cutting the filaments in a hole of a copperplate. The copperplate are placed under a microscope with a drawing apparatus.
Yarn cross sections of 5 filaments are sketched and the modification ratio of trilobal cross section is expressed as a ratio of radius of a circumscribed circle to radius of an inscribed circle.

b Procedure

1. Take the yarn 5o centimeter long from a cheese and separate 5 filaments from the yarn. Then wrap one end of 5 filaments in rayon staples and taper off the end of the staples.
2. Thread one end of 5 filaments wrapped in rayon staple through a hole of a copperplate and cut the yarn projected from both faces of the copperplate by razzor blades.
3. Place the copperplate on a stage of a microscope and bring to a focus of 4oo magnifications. Set ABBEs drawing apparatus on the microscope and sketch the trilobal cross sections of 5 filaments.
4. Circle a circumscribed circle and an inscribed circle on the trilobal cross section by a compass. Measure radii of the circumscribed circle and the inscribed circle by a scale.
   Repeat the measurement 5 times for one cheese.

c Calculation method

Calculate the modification ratio of yarn cross section using the equation as follows.

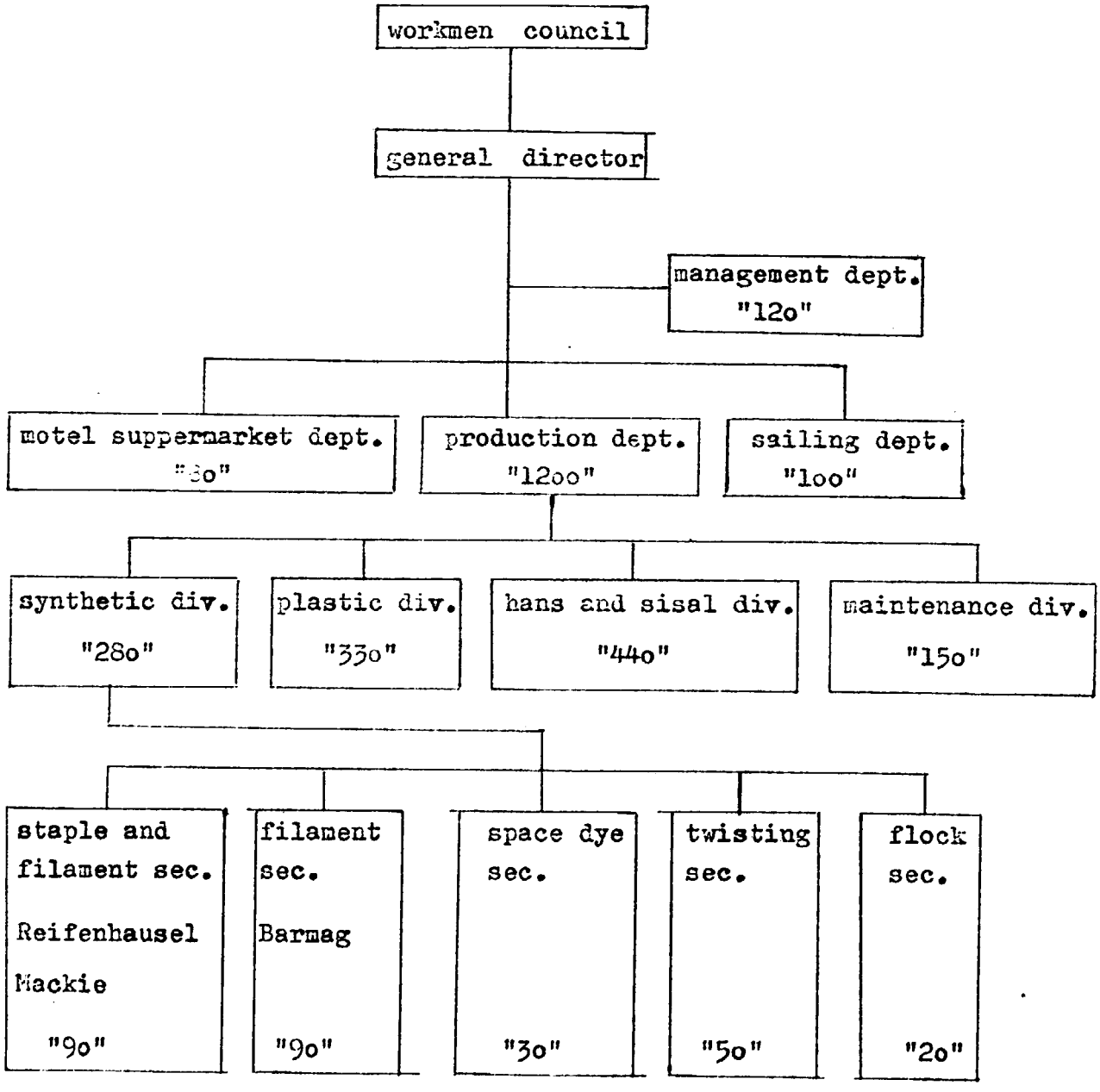
$$\text{modification ratio of yarn cross section} = \frac{R}{r}$$

where

R : radius of a circumscribed circle

r : radius of an inscribed circle

Organization of Dunav



" " means number of employees

SPECIFICATION OF EQUIPMENT

1 Mackie line

spinning	number of pack	3
	pack type	square type
	hole number	29000/pack
	hole diameter	0.7mm
	hole interval	1.4mm
	take up speed	max 15m/min
drawing	roller width	380mm
	drawing	1 stage
	tow denier	max 600,000denier
	speed	30m/min
heat setter	length	3,000mm/stage
		3stage
	wilth	500mm
crimper	width	250mm 150mm
	material of side plate	brass
	nip and stuffing load	air cylinder
	number of unit	1
cutter	type	gru-gru cutter
	number of unit	1
	machine supplier	Mackie

SPECIFICATION OF EQUIPMENT

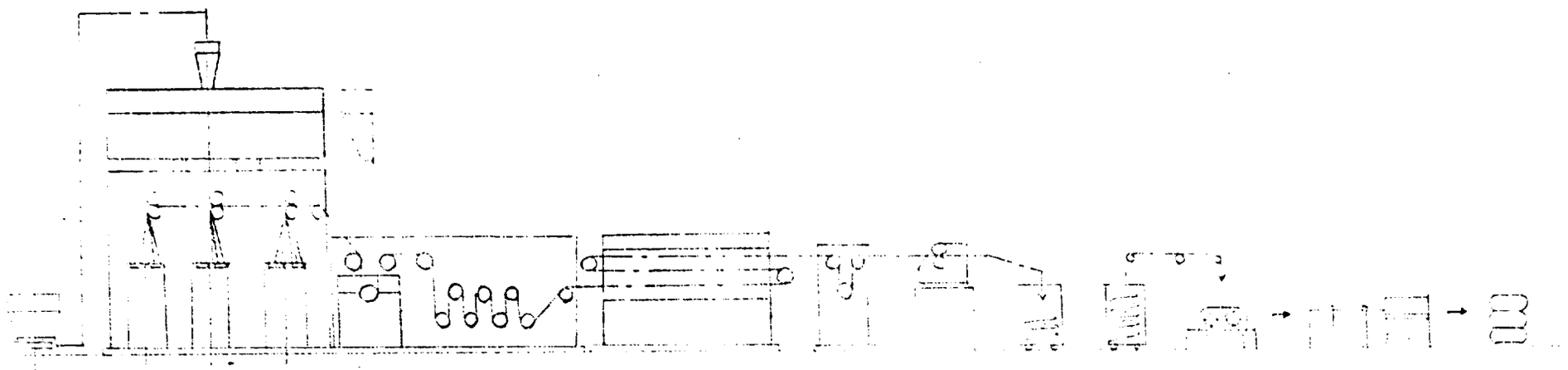
2 Reifenhauser line

spinning machine	extruder	diameter	120mm
		ratio L/D	25
		machine supplier	Reifenhauser
	spinning block	number of unit	2
		position	8
	gear pump	number of unit	32
		capacity	1.2--3cc/rev
	spinneret	number of spinneret	64
		type	8sp./position
		size	43mmD 9mmH
	chimmey	temperature	-18degree
		length	1800mm
		capacity	max500m3/min
	take up machine	number of position	8position
		guage	600mm
		oiling roller	2stage
		mschine supplier	IWKA
	winder	drum weight	16kg
		type	T178s
		machine supplier	IWKA
texturizing machine		number of unit	12
		speed	max1600m/min
		package	350mmD 330mmL
		drawing	1strech 1draw
		machine supplier	NEUMAG
after	twister	number of spinning	60sp
		machine supplier	Hacoba
	rewinder	number of unit	20sp
		type	T370
		machine supplier	GEORG SAHM
	cutter	number of unit	1unit
		machine supplier	Lummus

SPECIFICATION OF EQUIPMENT

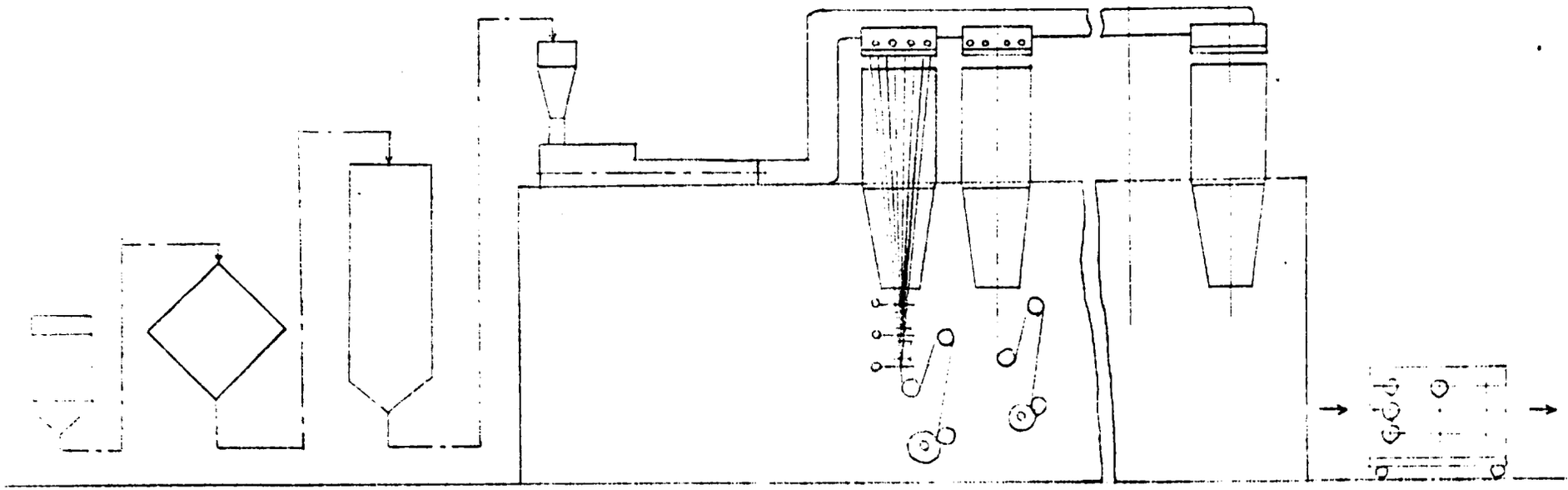
3 Barmag line

spinning machine	extruder	diameter	15oomm
		ratio L/D	3o
		machine supplier	Barmag
	spinning block	number of unit	3
		position	12
	gear pump	number of unit	24
		capacity	3cc/rev
	spinneret	number of spinneret	48
		type	4spinnert/pos
		size	1ɔommD 2ommD
	chimmey	temperature	
		lengtb	
		capacity	
	oiling roller	number of unit	48
		type	4unit/positio
texturizing		number of position	6
		speed	max16ɔom/min
		packag	6kg
		drawing	1draw
		texturizing	hot air nozzl
after treatment	twister	number of spinning	1oo
		machine supplier	HAMEL
	circle netter	number of unit	6
		machine supplier	Alfred Buck
	space dye	number of unit	1
		type	222.11-12oo
		machine supplier	EDUAD KUSTERS
	rewinder	number of unit	12
		machine supplier	HIRSCHBURGER MASHINEN

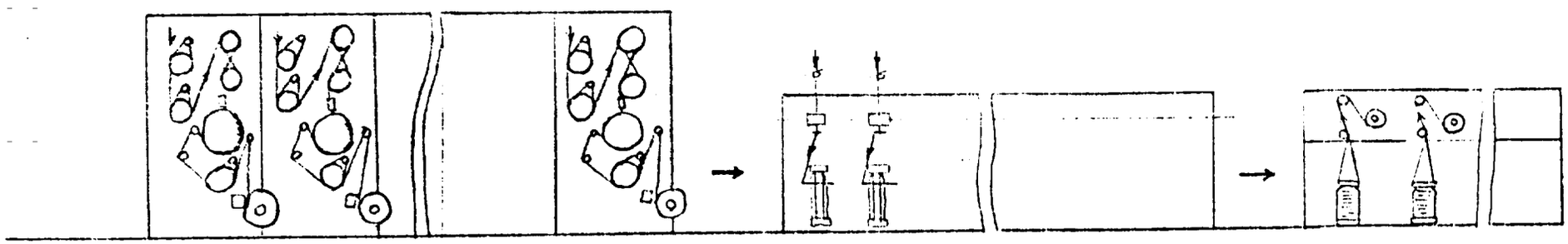


Chip coveyor | Spinning machine | Take up roller | Heat setter | Drawing Crimper roller | Cutter | Bailing machine

Mackie line

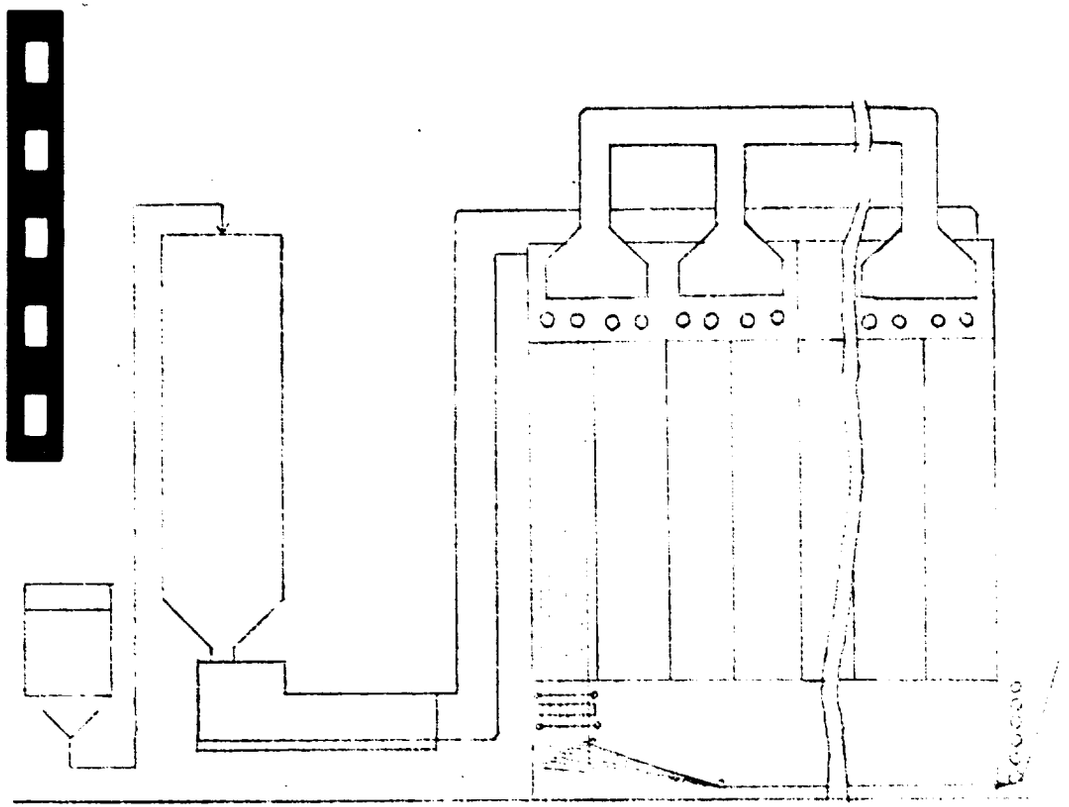


Chip conveyor | Dryer | Silo | Spinning and take up machine | Drum wagon

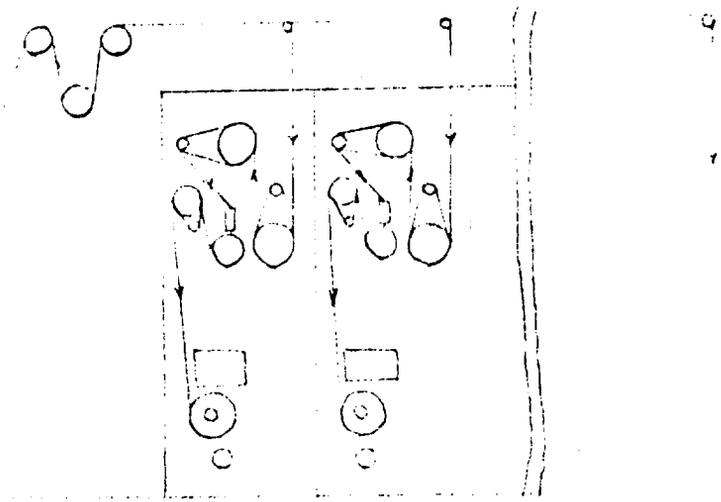


Texturizing machine | Twisting machine | Rewinding machine

Reifenhauser line



Chip conveyor Extruder Spinning machine



Texturizing machine

Barmag line